ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 1825 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Yung-Lyul Lee, Seoul, KOREA, REPUBLIC OF;
Euee-S Jang, Seoul, KOREA, REPUBLIC OF;
Chung-Ku Lee, Incheon, KOREA, REPUBLIC OF;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.
**PART B - FEE(S) TRANSMITTAL**

Complete and send this form, together with applicable fee(s), to: Mail

Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

or Fax

(571) 273-885

**INSTRUCTIONS:** This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fee will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate “FEE ADDRESS” for maintenance fee notifications.

**CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)**

12726 7590 03/19/2015
Birch, Stewart, Kolasch & Birch, LLP
P.O. Box 747
Falls Church, VA 22040-0747

**APPLICATION NO.** 11/813,969
**FILING DATE** 07/13/2007
**FIRST NAMED INVENTOR** Yung-Lyu Lee
**ATTORNEY DOCKET NO.** 5200-0104PUS1
**CONFIRMATION NO.** 9254

**TITLE OF INVENTION:** Reference Frame Ordering For Multi-View Coding

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**EXAMINER** HODER, BRADLEY W
**ART UNIT** 2439
**CLASS/SUBCLASS** 375-240010

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
   - Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
   - "Fee Address" indication (or "Fee Address" Indication form PTO/SB/147; Rev 03-06 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list:
   1. Birch, Stewart, Kolasch & Birch, LLP
   2. (1) The names of up to 3 registered patent attorneys or agents or, alternatively,
   3. (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

   **(A) NAME OF ASSIGNEE:** HUMAX HOLDINGS CO., LTD.
   **(B) RESIDENCE: (CITY AND STATE OR COUNTRY)** Yongin-Si, Republic of Korea

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☑ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
   ☑ Issue Fee
   ☑ Publication Fee (No small entity discount permitted)
   ☑ Advance Order - # of Copies

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)
   ☐ A check is enclosed.
   ☑ Payment by credit card. Form PTO-2038 is attached.
   ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number __________ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)
   ☑ Applicant certifying micro entity status. See 37 CFR 1.29
   ☑ Applicant asserting small entity status. See 37 CFR 1.27
   ☑ Applicant changing to regular undiscounted fee status.

**NOTE:** Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

**NOTE:** If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

**NOTE:** Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

**AUTHORIZED SIGNATURE**

Authorized Signature ____________________________

**Typed or printed name** Esther H. Chong

Date APR 24 2015

Registration No. 40953
### Electronic Patent Application Fee Transmittal

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### Filing Fees for U.S. National Stage under 35 USC 371

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<td>Esther Hyeri Chong/Mary Mejia</td>
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The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.
NOTICE OF ALLOWANCE AND FEE(S) DUE

127226  7590  03/19/2015
Birch, Stewart, Kolasch & Birch, LLP
P.O. Box 747
Falls Church, VA 22040-0747

EXAMINER
HOLDER, BRADLEY W

ART UNIT 2439
PAPER NUMBER

APPLICATION NO. 11/813,969  FILING DATE 07/13/2007  FIRST NAMED INVENTOR Yung-Lyl Lee
ATTORNEY DOCKET NO. 5200-0104PUS1  CONFIRMATION NO. 9254

TITLE OF INVENTION: Reference Frame Ordering For Multi-View Coding

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THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

Page 1 of 3

PTOL-85 (Rev. 02/11)
PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail
Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax
(571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated below unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

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Birch, Stewart, Kolasch & Birch, LLP
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Falls Church, VA 22040-0747

APPLICATION NO. FILING DATE FIRST NAMED INVENTOR ATTORNEY DOCKET NO. CONFIRMATION NO.
11813,969 07/13/2007 Yung-Lyul Lee 5200-0104PUS1 9254

TITLE OF INVENTION: Reference Frame Ordering For Multi-View Coding

APPL. TYPE ENTITY STATUS ISSUE FEE DUE PUBLICATION FEE DUE PREV. PAID ISSUE FEE TOTAL FEE(S) DUE DATE DUE
nonprovisional UNDISCOUNTED $960 $0 $0 $960 06/19/2015

EXAMINER ART UNIT CLASS-SUBCLASS
HOLDER, BRADLEY W 2439 375-240010

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list
   (1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
   (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to
   2 registered patent attorneys or agents. If no name is listed, no name will be printed.

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)
   PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.
   (A) NAME OF ASSIGNEE
   (B) RESIDENCE: (CITY and STATE OR COUNTRY)

   Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
☐ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)
☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number ____________ (enclose a extra copy of this form).

5. Change in Entity Status (from status indicated above)
☐ Applicant certifying micro entity status. See 37 CFR 1.29
☐ Applicant asserting small entity status. See 37 CFR 1.27
☐ Applicant changing to regular undiscounted fee status.

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   NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status, as applicable.

   NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

   NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature ____________ Date ____________
Typed or printed name ____________ Registration No. ____________

Page 2 of 3

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance. Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.
OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number’s legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.
**Notice of Allowability**

<table>
<thead>
<tr>
<th>Application No.</th>
<th>11/813,969</th>
<th>Applicant(s)</th>
<th>LEE ET AL.</th>
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<tr>
<td>Examiner</td>
<td>BRADLEY HOLDER</td>
<td>Art Unit</td>
<td>2439</td>
</tr>
<tr>
<td>AIA (First Inventor to File) Status</td>
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**The MAILING DATE of this communication appears on the cover sheet with the correspondence address**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to 03/07/2014.
   - ☐ A declaration(s)/affidavit(s) under 37 CFR 1.130(b) was/were filed on_____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____: the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1,2,6-8 and 12-14. As a result of the allowed claim(s), you may be eligible to benefit from the Patent Prosecution Highway program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to PPHfeedback@uspto.gov.

4. ☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   - Certified copies:
     - a) ☑ All  b) ☐ Some  c) ☐ None of the:
       1. ☑ Certified copies of the priority documents have been received.
       2. ☐ Certified copies of the priority documents have been received in Application No. _____.
       3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE “MAILING DATE” of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ CORRECTED DRAWINGS (as “replacement sheets”) must be submitted.
   - Including changes required by the attached Examiner’s Amendment / Comment or in the Office action of Paper No./Mail Date _____.
   - Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner’s comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☑ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner’s Comment Regarding Requirement for Deposit of Biological Material
4. ☑ Interview Summary (PTO-413), Paper No./Mail Date 13 March 2015.
5. ☑ Examiner’s Amendment/Comment
6. ☐ Examiner’s Statement of Reasons for Allowance
7. ☐ Other _____.

/BRADLEY HOLDER/
Primary Examiner, Art Unit 2439

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U.S. Patent and Trademark Office
PTOL-37 (Rev. 08-13) Notice of Allowability Part of Paper No./Mail Date 20150314
AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

EXAMINER’S AMENDMENT

2. An examiner’s amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner’s amendment was given in a telephone interview with JUSTEN FAUTH on March 13, 2015.

The application has been amended as follows:

In the Claims:

Claim 1: (Currently Amended):

A method of setting an order of reference frames for multi-view coding performed by a plurality of processors, the method comprising:

selecting, by the plurality of processors, one or more first frames of a same kind that have a same-view relation with a current frame, the one or more first frames being
encoded or decoded prior to the current frame by a processor used to encode or
decode the current frame;

selecting, by the plurality of processors, one or more second frames of the same
type having an inter-view relation with a specific frame of the one or more first frames,
the specific frame being encoded or decoded immediately before the current frame by
the processor used to encode or decode the current frame; and

encoding or decoding, by the plurality of processors, the current frame by making
direct reference, with respect to any of the frames of the same kind as the current
frame, to the selected one or more first frames and the selected one or more second
frames,

where the current frame is one of a plurality of frames that are generated by a
plurality of cameras in a temporal order of an I frame, a first B frame, a second B frame,
and a P frame, the plurality of frames being encoded or decoded in an order of the I
frame, the P frame, the first B frame, and the second B frame about a time axis.

Claim 2: (Currently Amended):

The method of claim 1, wherein the one or more first frames of the same kind are
extracted in the reverse order of encoding or decoding.

Claim 5: (Currently Canceled):
Claim 6: (Currently Amended):

The method of claim 1, wherein the current frame is one of a plurality of frames that includes picture information input by a plurality of cameras, the picture information being generated as one of 1-D parallel data, 1-D arc data, and 2-D parallel data.

Claim 7: (Currently Amended):

A non-transitory recorded medium embodying a program of instructions executable by an encoding device or a decoding device having a plurality of processors for setting an order of reference frames for multi-view coding, the program readable by the encoding device or decoding device, the recorded medium for executing, via the plurality of processors, the instructions embodied on the recorded medium for performing the following steps:

selecting, by the plurality of processors, one or more first frames of a same kind that have a same-view relation with a current frame, the one or more first frames being encoded or decoded prior to the current frame by a processor used to encode or decode the current frame;

selecting, by the plurality of processors, one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames,
the specific frame being encoded or decoded immediately before the current frame by
the processor used to encode or decode the current frame; and

encoding or decoding, by the plurality of processors, the current frame by making
direct reference, with respect to any of the frames of the same kind as the current
frame, to the selected one or more first frames and the selected one or more second
frames,

where the current frame is one of a plurality of frames generated by a plurality of
cameras in a temporal order of an I frame, a first B frame, a second B frame, and a P
frame, the plurality of frames being encoded or decoded in an order of the I frame, the P
frame, the first B frame, and the second B frame about a time axis.

Claim 8: (Currently Amended):

The recorded medium of claim 7, wherein the one or more first frames of the
same kind are extracted in the reverse order of encoding or decoding.

Claim 11: (Currently Canceled):

Claim 12: (Currently Amended):
The recorded medium of claim 7, wherein the current frame is one of a plurality of frames that includes picture information input by a plurality of cameras, the picture information being generated as one of 1-D parallel data, 1-D arc data, and 2-D parallel data.

**Claim 13: (Currently Amended):**

The method of claim 1, wherein the encoding or decoding the current frame by making reference to the selected one or more first frames and the selected one or more second frames includes:

encoding or decoding the current frame by making direct reference to the selected one or more first frames and the selected one or more second frames.

**Claim 14: (Currently Amended):**

The recorded medium of claim 7, wherein the encoding or decoding the current frame by making reference to the selected one or more first frames and the selected one or more second frames includes:

encoding or decoding the current frame by making direct reference to the selected one or more first frames and the selected one or more second frames.
Reasons For Allowance

3. The following is an examiner’s statement of reasons for allowance:

Claims 1, 2, 6-8, 12-14 are considered allowable.

The instant invention is directed to a system and method for the setting of the order of reference frames for multi-view coding.

The closest prior art, as recited, Haskell et al. US Patent No. 6,055,012 and Liu US Patent Application Publication No. 2003/0169627, are also generally directed to various aspects of the setting of the order of reference frames for multi-view coding. However, Haskell et al. or Liu does not teach or suggest, either singularly or in combination, the particular combination of steps or elements as recited in the independent claims 1, 7. For example, none of the cited prior art teaches or suggests the steps of “setting an order of reference frames for multi-view coding, comprising: selecting, one or more first frames of a same kind that have a same-view relation with a current frame, the one or more first frames being encoded or decoded prior to the current frame by a processor used to encode or decode the current frame; selecting, one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames, the specific frame being encoded or decoded immediately before the current frame by the processor used to encode or decode the current frame; and encoding or decoding the current frame by making direct reference, with respect to any of the frames of the same kind as the current frame, to
the selected one or more first frames and the selected one or more second frames,
where the current frame is one of a plurality of frames that are generated by a plurality
of cameras in a temporal order of an I frame, a first B frame, a second B frame, and a P
frame, the plurality of frames being encoded or decoded in an order of the I frame, the P
frame, the first B frame, and the second B frame about a time axis.”

Therefore the claims of the instant application are allowable over the cited prior art.

Any comments considered necessary by applicant must be submitted no later
than the payment of the issue fee and, to avoid processing delays, should preferably
accompany the issue fee. Such submissions should be clearly labeled “Comments on
Statement of Reasons for Allowance.”

Conclusion

4. Any inquiry concerning this communication or earlier communications from the
examiner should be directed to BRADLEY HOLDER whose telephone number is 571-
270-3789. The examiner can normally be reached on Monday-Friday 10:00AM-7:00PM
EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s
supervisor, Luu Pham, can be reached on 571-270-5002. The fax phone number for
the organization where this application or proceeding is assigned is 571-273-8300.
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/BRADLEY HOLDER/
Primary Examiner, Art Unit 2439
All participants (applicant, applicant’s representative, PTO personnel):

(1) **BRADLEY HOLDER**.
(3) ____.
(2) **JUSTEN FAUTH**.
(4) ____.

Date of Interview: **13 March 2015**.

Type:  ☒ Telephonic  ☐ Video Conference
☐ Personal [copy given to: ☐ applicant  ☐ applicant’s representative]

Exhibit shown or demonstration conducted:  ☐ Yes  ☒ No.

If Yes, brief description: ________.

Issues Discussed  ☒101  ☒112  ☐102  ☒103  ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: **1, 2, 5-8 and 11-14**.

Identification of prior art discussed: ________.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc.)

**Proposed modifications to independent Claims 1, 7, modifications to dependent Claims 2, 6, 8, 12, 13, 14, and cancelation of Claims 5, 11 were discussed in order to bring the application into condition for allowance. An agreement was reached to amend Claims 1, 2, 6, 7, 8, 12, 13, 14 and cancel Claims 5, 11 in an Examiner’s Amendment.**

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**Applicant recodartion instructions**: It is not necessary for applicant to provide a separate record of the substance of interview.

**Examiner recodartion instructions**: Examiners must summarize the substance of any interview of record. A complete and proper recodartion of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recodartion including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/BRADLEY HOLDER/
Primary Examiner, Art Unit 2439
**Notice of References Cited**

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<td>US-6,056,012 A</td>
<td>04-2000</td>
<td>Haskell et al.</td>
<td>348/48</td>
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<td>US-2006/0023787 A1</td>
<td>02-2006</td>
<td>Cai et al.</td>
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<td>375/240.03</td>
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<td>US-7,035,453 B2</td>
<td>04-2006</td>
<td>Liu, Ping</td>
<td>382/154</td>
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<td>US-7,778,328 B2</td>
<td>08-2010</td>
<td>Vedula et al.</td>
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**FOREIGN PATENT DOCUMENTS**

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**NON-PATENT DOCUMENTS**

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<td>Matusik et al.</td>
<td>3D TV: a scalable system for real-time acquisition, transmission, and autostereoscopic display of dynamic scenes; Published in: Proceeding SIGGRAPH '04 ACM SIGGRAPH 2004 Papers; Pages 814-824; 2004; ACM Digital Library</td>
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*Notice of References Cited Part of Paper No. 20150314*
A general surface approach to the integration of a set of range views
... Second, the range views must be registered, e.g., the frame transformations between each pair of range views must be found. To model an object, a common reference frame in which all views can be transformed must be defined. Frame transformations consist of ...
Cited by 306 Related articles All 9 versions Cite Save

A robust subspace approach to layer extraction
Q. Ke, T. Kanade - Motion and Video Computing, 2002 - ..., 2002 - ieeexplore.ieee.org
... Figure 2. Layer extraction results. (a): reference frame; (b): color ... Handling occlusions in dense multi-view stereo. ... In CVPR01. [17] M. Lee, W. Chen, C. Lin, C. Gu, T. Markoc, S. Zabinsky, and R. Szelski. A layered video object coding system using sprite and affine motion model. ...
Cited by 46 Related articles All 17 versions Cite Save

A survey on image-based rendering—representation, sampling, and compression
C. Zhang, T. Chen - Signal Processing: Image Communication, 2004 - Elsevier...
... Format; RIS (for EndNote, Reference Manager, ProCite); BibTeX; Text; RefWorks Direct Export; Content; Citation Only; Citation and Abstract. ... In practice, even if we are capturing a dynamic scene, sampling on the time axis is often determined by the camera’s frame rate and the ...
Cited by 196 Related articles All 12 versions Cite Save More

Digital coding of waveforms: principles and applications to speech and video
... 1992 [Details] [BibTeX]; Hui Li, Peter Noll Hybrid Phase Trellis-Coded Modulation for ... Jürgens, Harald Klaus Speech Quality Assessment of Synthesized Speech Using Different Reference Systems ... [Details] [BibTeX]; Kai Uwe Barthel Entropy constrained fractal image coding 2. ITG ...
Cited by 3350 Related articles All 3 versions Cite Save More

Efficient compression of arbitrary multi-view video signals
JS. McVeigh - 1998 - cs.cmu.edu
... 28 Table 4.1: Optimal reference frames for View 0 in simulated multi-view signal depicted ... for coding schemes. ... 110 Table 5.2: Storage requirement comparison for coding schemes in ... for possible reference frames, a) prediction PSNR, b) total coded bits per ...
Cited by 12 Related articles All 11 versions Cite Save More

Approaches to H. 264-based stereoscopic video coding
S. Li, M. Yu, G. Jiang, T. Y. Choi ... - Multi-Agent Security and ..., 2004 - ieeexplore.ieee.org
... The CABAC overcomes this disadvantage by assigning a code to a sequence of symbols, so each symbol can be coded with a ... [4] Lukaes ME, "Predictive coding of multi ... [5] Park J, Yang KH, Iwadate Y, "Efficient representation and compression of Multi-view images", IEICE Trans ...
Cited by 27 Related articles All 3 versions Cite Save More

Extracting view-dependent depth maps from a collection of images
SB. Kang, R. Szelski - International Journal of Computer Vision, 2004 - Springer...
... computes the local depth map associated with each chosen reference frame independently. ... optimizes a set of self-consistent depth maps at multiple key-frames. ... Keywords: stereo correspondence, multi-view stereo, occlusions, view-dependent texture maps, view-dependent ...
Cited by 73 Related articles All 19 versions Cite Save More

Low bit-rate video streaming for face-to-face teleconference
... We force the entire face to be intra-coded, and added as a reference to the multi-reference frame database. ... Real-time multi-view face detection, tracking, pose estimation. ... Object-oriented analysis-synthesis coding (ooasc) based on the source model of moving flexible 36 objects. ...
Cited by 14 Related articles All 19 versions Cite Save More

MPEG-4 facial animation in video analysis and synthesis
P. Eisert - International Journal of Imaging Systems and ..., 2003 - Wiley Online Library...
... At low bit-rates, bit-rate savings of 33% are achieved, corresponding to coding gains of ... is not restricted to head-and-shoulder scenes but any video sequence can be coded efficiently if ... MAC in comparison to an H.264 codec running with one or two reference frames for prediction ...
Cited by 33 Related articles All 18 versions Cite Save More
3D TV: a scalable system for real-time acquisition, transmission, and autostereoscopic display of dynamic scenes
W Matusik, H Pfister - ACM Transactions on Graphics (TOG), 2004 - dl.acm.org
... the following contributions: Distributed architecture: In contrast to previous work in multi-view video we ... producers capture live, uncompressed video streams and encode them using standard MPEG coding. ... The maximum transmitted frame rate at full resolution is 12 frames per ...
Cited by 480  Related articles  All 28 versions  Cite  Save
A novel multi-view video coding scheme based on H. 264
G Li, Y He - ... Communications and Signal Processing, 2003 and ..., 2003 - ieeexplore.ieee.org
... compensated inter-view channel prediction and achieves the efficient compression of multi-view
video to ... In the following results, simulcast represents that stereo sequences will he coded by
encoders ... structure and there is no obvious increase of complexity in coding more than ...
Cited by 33 Related articles All 2 versions Cite Save

Multi-view video coding using reference picture selection for free-viewpoint video communication
H Kimata, M Kitahara, K Kamikura... - Picture Coding Symposium, 2004 - Citeseer
... We can easily understand that if the view 4 or view 6 is coded as Inter GOP, "Inter(4,6 ... Multi-view
video coding method that is capable of low-delay decoding a picture is proposed. ... It is
demonstrated its efficiency from independent coding over 1 dB in the low and medium bitrates. ...
Cited by 45 Related articles All 2 versions Cite Save More

Multi-view coding for image-based rendering using 3-D scene geometry
M Magnor, P Ramanathan... - Circuits and Systems for ..., 2003 - ieeexplore.ieee.org
... 7 depicts an image of the Mouse image set that is en- coded at different bit rates using the 8-bit
accurate geometry ... At 0.136 bpp overall coding bit rate and 40.1 d B PSNR ... MAGNOR et al.:
MULTI-VIEW CODING FOR IMAGE-BASED RENDERING USING 3-D SCENE GEOMETRY ...
Cited by 83 Related articles All 21 versions Cite Save

Coding approaches for end-to-end 3D TV systems
A Vetro, W Matusik, H Pfister, J Xin - Picture Coding Symposium, 2004 - Citeseer
... The coded video streams are then broadcast on separate channels over a transmission network ...
of pictures along the spatial direc- tion and using the multiple reference frame prediction of H ...
Additionally, some of the recent work on multi-view coding has been reviewed and the ...
Cited by 102 Related articles All 12 versions Cite Save

Stereo video coding based on frame estimation and interpolation
... To enable multi-view applications, MPEG-4 version 2 will include the capability to encode accurate
disparity ... Since the frames in the left view stream are coded with high resolution, we consider this
scheme is independent of the nature of the scene, hence suitable for coding a wide ...
Cited by 42 Related articles All 4 versions Cite Save

High-quality video interpolation using a layered representation
CL Zitnick, SB Kang, M Uyttendaele, S Winder, ... - ACM Transactions on ..., 2004 - dl.acm.org
... high-quality interpolated views at video rates (Section 3). We then present our multi-view stereo
reconstruction ... RGB data is converted to the YUV color-space and D is coded similarly to Y ... For
I-frame coding with alpha data, we use a quad-tree plus Huffman coding method to first ...
Cited by 1137 Related articles All 29 versions Cite Save

A multiview sequence CODEC with view scalability
... The MPEG-2 Multi-View Profile (MVP) was defined in 1996 as an amendment to the MPEG-2
standard ... which is referred to as a group of GOP, as a basic unit for coding and rate ... 5(a). The other
view sequences without I' frame are coded using disparity and motion vectors based ...
Cited by 53 Related articles All 4 versions Cite Save

Evaluation of face resolution for expression analysis
Y Tian - Computer Vision and Pattern Recognition Workshop, ..., 2004 - ieeexplore.ieee.org
... We would also like to thank J. Cohn at University of Pittsburgh to provide Cohn-Kanade AU-Coded
Face Expression Image Database. ... Real-time multi-view face detection, tracking, pose estimation,
alignment, and recognition. ... Coding facial expressions with gabor wavelets. ...
Cited by 141 Related articles All 8 versions Cite Save
Tracking and modeling non-rigid objects with rank constraints
L Torresani, DB Yang, EJ Alexander... - Computer Vision and ..., 2001 - ieeexplore.ieee.org
2]). If all F x P flow-vectors across the entire image sequence are coded relative to ... matrix B. Assuming the cameras are synchronized, an additional constraint for the multi-view case is ... We updated the reference patch of each point every 10 frames in order to accommodate the ...
Cited by 251 Related articles All 24 versions Cite Save

Compression and interpolation of 3D stereoscopic and multiview video
M Siegel, S Sethuraman... - Electronic ..., 1997 - proceedings.spiedigitallibrary.org
... To extend these features to encoding a multi-view sequence, we retain a similar frame structure across all ... while retaining the described frame structure, we notice: 1. An IA-frame can be coded using disparity ... This can result in considerable reduction in residual coding overhead ...
Cited by 36 Related articles All 17 versions Cite Save
# Index of Claims

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Art Unit: 2439
Applicant(s)/Patent Under Reexamination: LEE ET AL.
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Total Claims Allowed: 8

Assistant Examiner /BRADLEY HOLDER/ Primary Examiner. Art Unit 2439

Date: 03/14/2015

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**Total Claims Allowed:**

8

(Primary Examiner)  
03/14/2015

O.G. Print Claim(s) | O.G. Print Figure

1 | 1
Correspondence Address/Fee Address Change

The following fields have been set to Customer Number 127226 on 10/03/2014
  • Correspondence Address

The address of record for Customer Number 127226 is:

127226
Birch, Stewart, Kolasch & Birch, LLP
P.O. Box 747
Falls Church, VA 22040-0747
NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/10/2014.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/enguyen/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101
I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 02292

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

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as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 02292

☐ Firm or Individual Name

Address

<table>
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</table>

Telephone

Email

Assignee Name and Address:

HUMAX HOLDINGS CO., LTD.
(Yubang-dong) 2, Yeongmun-ro, Cheoin-gu
Yongin-si, Gyeonggi-do 449-934, Republic of Korea

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/86 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee.

Signature

Name

Title

Date

Telephone

Yongseok LEE

+82 31 776 6243

29, May 2014

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.
Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency’s responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.
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**Warnings:**

**Information:**

Total Files Size (in bytes): 286921

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.
**TRANSMITTAL FORM**

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**ENCLOSURES** (Check all that apply)

- [ ] Fee Transmittal Form
- [ ] Fee Attached
- [ ] Amendment/Reply
- [X] After Final
- [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement

- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/Incomplete Application
  - [ ] under 37 CFR 1.52 or 1.53

- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation
- [ ] Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s)
- [ ] Landscape Table on CD

**SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT**

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<th>Firm Name</th>
<th>BIRCH, STEWART, KOLASCH &amp; BIRCH, LLP</th>
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<tr>
<td>Printed name</td>
<td>Esther H. Chong</td>
</tr>
<tr>
<td>Date</td>
<td>SEP 10 2014</td>
</tr>
<tr>
<td>Reg. No.</td>
<td>40953</td>
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**CERTIFICATE OF TRANSMISSION/MAILING**

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

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This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.
STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: HUMAX HOLDINGS CO., LTD.

Application No./Patent No.: 11/813,969

Filed/Issue Date: July 13, 2007

Titled: REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

HUMAX HOLDINGS CO., LTD. a CORPORATION

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☑ the assignee of the entire right, title, and interest in;

2. ☐ an assignee of less than the entire right, title, and interest in

(The extent (by percentage) of its ownership interest is _______ %); or

3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made) the patent application/patent identified above, by virtue of either:

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel ____________, Frame ____________, or for which a copy therefore is attached.

OR

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Yung-Lyu LEE et al. To: HUMAX CO., LTD.

The document was recorded in the United States Patent and Trademark Office at Reel 019623, Frame 0472, or for which a copy thereof is attached.

2. From: HUMAX CO., LTD. To: HUMAX HOLDINGS CO., LTD.

The document was recorded in the United States Patent and Trademark Office at Reel 033555, Frame 0343, or for which a copy thereof is attached.

3. From: __________________________ To: __________________________

The document was recorded in the United States Patent and Trademark Office at Reel ____________, Frame ____________, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature

Date

Easter H. Chong, Reg. No. 40953

Attorney of Record

Printed or Typed Name

Title

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.
Request for Continued Examination (RCE) Transmittal

Application Number: 11/813,969
Filing Date: July 13, 2007
First Named Inventor: Yung-Lyu LEE
Art Unit: 2439
Examiner Name: B. L. OLION
Attorney Docket Number: 5200-0104-PUS1

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.

Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. **Submission required under 37 CFR 1.114**
   - [ ] Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.
   - [ ] Consider the arguments in the Appeal Brief or Reply Brief previously filed on ________________
   - [ ] Other Amendment After Final Rejection filed on February 10, 2014

2. **Miscellaneous**
   - [ ] Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of ________ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)
   - [ ] Other

3. **Fees**
   - [ ] The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.
   - [ ] The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. 02-2448
   - RCE fee required under 37 CFR 1.17(e)
   - Extension of time fee (37 CFR 1.136 and 1.17)
   - Other
   - [ ] Check in the amount of $________ enclosed
   - [ ] Payment by credit card (Form PTO-2038 enclosed)

**WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

**SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED**

Signature: __________________________ Date: March 7, 2014
Name (Print/Type): Esther H. Chong Registration No.: 40,953

**CERTIFICATE OF MAILING OR TRANSMISSION**

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature: __________________________ Date: ______________
Name (Print/Type): __________________________
**Electronic Patent Application Fee Transmittal**

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# Electronic Acknowledgement Receipt

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<td>11813969</td>
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<td><strong>International Application Number:</strong></td>
<td></td>
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<tr>
<td><strong>Confirmation Number:</strong></td>
<td>9254</td>
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<tr>
<th><strong>Title of Invention:</strong></th>
<th>Reference Frame Ordering For Multi-View Coding</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>First Named Inventor/Applicant Name:</strong></th>
<th>Yung-Lyul Lee</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customer Number:</strong></td>
<td>2292</td>
</tr>
<tr>
<td><strong>Filer:</strong></td>
<td>Esther Hyeri Chong/Ruth Calendine</td>
</tr>
<tr>
<td><strong>Filer Authorized By:</strong></td>
<td>Esther Hyeri Chong</td>
</tr>
<tr>
<td><strong>Attorney Docket Number:</strong></td>
<td>5200-0104PUS1</td>
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| **Application Type:**                    | U.S. National Stage under 35 USC 371 |

## Payment information:

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<td>CHONG, ESTER H.</td>
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</table>

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

- Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees)
- Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)
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**Multipart Description/PDF files in .zip description**

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<td>Extension of Time</td>
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**Warnings:**

**Information:**

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**Total Files Size (in bytes): 241839**

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.
FEE TRANSMITTAL

<table>
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<tr>
<th>Complete if known</th>
<th>Application Number</th>
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<td></td>
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<td>9254</td>
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<th>Docket No.</th>
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<td>5200-0104PUS1</td>
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<td>☑ Credit Card</td>
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<td>☑ Money Order</td>
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<tr>
<td>☑ Deposit Account</td>
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<tr>
<td>☑ Deposit Account Number: 02-2448</td>
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<tr>
<td>☑ Deposit Account Name: Birch, Stewart, Kolach &amp; Birch, LLP</td>
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<th>FEE CALCULATION</th>
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<tr>
<td>1. BASIC FILING, SEARCH, AND EXAMINATION FEES (U = undiscounted fee; S = small entity fee; M = micro entity fee)</td>
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* The $140 small entity status filing fee for a utility application is further reduced to $70 for a small entity status applicant who files the application via EFS-Web.

2. EXCESS CLAIM FEES

<table>
<thead>
<tr>
<th>Fee Description</th>
<th>Undiscounted Fee ($)</th>
<th>Small Entity Fee ($)</th>
<th>Micro Entity Fee ($)</th>
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<td>Indep. Claims</td>
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HP = highest number of total claims paid for, if greater than 20.
HP = highest number of independent claims paid for, if greater than 3.

3. APPLICATION SIZE Fee

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.212(e)), the application size fee due is $400 ($200 for small entity) ($100 for micro entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(c).

<table>
<thead>
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<th>Total Sheets</th>
<th>Extra Sheets</th>
<th>Number of each additional 50 or fraction thereof</th>
<th>Fee ($)</th>
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4. OTHER FEE(S)

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<th>Non-Electronic filing fee under 37 CFR 1.16(t) for a utility application, $400 fee ($200 small or micro entity)</th>
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<td>Other (e.g., late filing surcharge): Petition for Extension of Time ($200) and RCE ($1,700)</td>
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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Signature</td>
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<tr>
<td></td>
</tr>
<tr>
<td>Name (Print/Type)</td>
</tr>
<tr>
<td>Esther H. Chong</td>
</tr>
</tbody>
</table>

Date: March 7, 2014

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 90 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.
## PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

**Application Number**  11/813,969  
**Filed**  July 13, 2007

**For**  REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

**Art Unit**  2439  
**Examiner**  B. L. OLION

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

<table>
<thead>
<tr>
<th>Fee</th>
<th>Small Entity Fee</th>
<th>Micro Entity Fee</th>
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<tbody>
<tr>
<td>One month (37 CFR 1.17(a)(1))</td>
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<td>$100</td>
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<tr>
<td>Two months (37 CFR 1.17(a)(2))</td>
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<tr>
<td>Three months (37 CFR 1.17(a)(3))</td>
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<tr>
<td>Four months (37 CFR 1.17(a)(4))</td>
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<tr>
<td>Five months (37 CFR 1.17(a)(5))</td>
<td>$3,000</td>
<td>$1,500</td>
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</table>

☐ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29. Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

☐ A check in the amount of the fee is enclosed.

☑ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 02-2448

☐ Payment made via EFS-Web.

**WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant.

☑ attorney or agent of record. Registration number 40,953

☐ attorney or agent acting under 37 CFR 1.34. Registration number

____Signature____  
____March 7, 2014____  
____703-205-8000____

____Typed or printed name____

**NOTE:** This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below.

☑  * Total of 1 forms are submitted.*

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 55 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.
This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.
<table>
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<tr>
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<th>FILING DATE</th>
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<th>ATTORNEY DOCKET NO.</th>
<th>CONFIRMATION NO.</th>
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<td>07/13/2007</td>
<td>Yung-Lyul Lee</td>
<td>5200-0104PUS1</td>
<td>9254</td>
</tr>
</tbody>
</table>

2292  7590  03/06/2014
BIRCH STEWART KOLASCH & BIRCH, LLP
PO BOX 747
FALLS CHURCH, VA 22040-0747

EXAMINER
OLION, BRIAN L

ART UNIT   PAPER NUMBER
2439

NOTIFICATION DATE   DELIVERY MODE
03/06/2014     ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com
Advisory Action
Before the Filing of an Appeal Brief

Application No. 11/813,969
Applicant(s) LEE ET AL.
Examiner BRIAN OLION
Art Unit 2439
AIA (First Inventor to File) Status No

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 10 February 2014 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☑ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance;
   (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:
   a) ☑ The period for reply expires 3 months from the mailing date of the final rejection.
   b) ☑ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
   c) ☑ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires months from the mailing date of the prior Advisory Action or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.

   Examiner Note: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANT'S FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

   Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☑ The Notice of Appeal was filed on ______. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☑ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   a) ☑ They raise new issues that would require further consideration and/or search (see NOTE below);
   b) ☑ They raise the issue of new matter (see NOTE below);
   c) ☑ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   d) ☑ They present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: Claims now recite additional limitation "encoding or decoding said current frame by making direct reference, with respect to any of the frames of the same kind as said current frame" This claim further defines what direct reference means as a result presents new issues that would require additional consideration and search. (See 37 CFR 1.116 and 41.33(a)).

4. ☑ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).

5. ☑ Applicant's reply has overcome the following rejection(s):

6. ☑ Newly proposed or amended claim(s) ______ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).

7. ☑ For purposes of appeal, the proposed amendment(s): (a) ☑ will not be entered, or (b) ☑ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☑ A declaration(s)/affidavit(s) under 37 CFR 1.130(b) was/were filed on ______.

9. ☑ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).

10. ☑ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).

11. ☑ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☑ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: ______.

13. ☑ Note the attached Information Disclosure Statement(s). (PTO/SB/08) Paper No(s). ______.

14. ☑ Other:

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:
   Claim(s) allowed: __________
   Claim(s) objected to: __________
   Claim(s) rejected: 1, 2, 5-8 and 11-14

/LUU PHAM/
Supervisory Patent Examiner, Art Unit 2439

/BRIAN OLION/
Examiner, Art Unit 2439
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application of:
Yung-Lyul LEE et al.

Application No.: 11/813,969
Confirmation No.: 9254

Filed: July 13, 2007
Art Unit: 2439

For: REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING
Examiner: B. L. OLION

AMENDMENT UNDER 37 C.F.R. § 1.116

MS AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

INTRODUCTORY COMMENTS

In reply to the Office Action dated November 8, 2013, the following amendments and remarks are respectfully submitted in connection with the above-identified application.

Amendments to the Claims; and

Remarks.

Attachment: Translation of Priority Document with Verification of Translation (KR 10-2005-0003948)
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application of:
Yung-Lyul LEE et al.

Application No.: 11/813,969 Confirmation No.: 9254

Filed: July 13, 2007 Art Unit: 2439

For: REFERENCE FRAME ORDERING FOR
MULTI-VIEW CODING

Examiner: B. L. OLION

AMENDMENT UNDER 37 C.F.R. § 1.116

MS AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

INTRODUCTORY COMMENTS

In reply to the Office Action dated November 8, 2013, the following amendments and remarks are respectfully submitted in connection with the above-identified application.

Amendments to the Claims; and

Remarks.

Attachment: Translation of Priority Document with Verification of Translation (KR 10-2005-0003948)
AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method of setting an order of reference frames for multi-view coding performed by a plurality of processors, the method comprising:

   selecting one or more first frames of a same kind that have a same-view relation with a current frame, the one or more first frames being encoded or decoded prior to said current frame by a processor used to encode or decode said current frame;

   selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames, the specific frame being encoded or decoded immediately before said current frame by the processor used to encode or decode said current frame; and

   encoding or decoding said current frame by making direct reference, with respect to any of the frames of the same kind as said current frame, to the selected one or more first frames and the selected one or more second frames.

2. (Previously Presented) The method of claim 1, wherein said one or more first frames of the same kind are extracted in the reverse order of encoding or decoding.

3. (Canced)

4. (Canced)

5. (Previously Presented) The method of claim 1, wherein the current frame is one of a plurality of frames that are generated by a plurality of cameras in a temporal order of an I frame, a first B frame, a second B frame, and a P frame, the plurality of frames being encoded or decoded in an order of the I frame, the P frame, the first B frame, and the second B frame about a time axis.

6. (Previously Presented) The method of claim 1, wherein the current frame is one of a plurality of frames that includes picture information inputted by a plurality of cameras, the
picture information being generated as one of 1-D parallel data, 1-D arc data, and 2-D parallel data.

7. (Currently Amended) A non-transitory recorded medium tangibly embodying a program of instructions executable by an encoding device or a decoding device having a plurality of processors for setting an order of reference frames for multi-view coding, the program readable by said encoding device or decoding device, the recorded medium executing:

selecting one or more first frames of a same kind that have a same-view relation with a current frame, the one or more first frames being encoded or decoded prior to said current frame by a processor used to encode or decode said current frame;

selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames, the specific frame being encoded or decoded immediately before said current frame by the processor used to encode or decode said current frame; and

encoding or decoding said current frame by making direct reference, with respect to any of the frames of the same kind as said current frame, to the selected one or more first frames and the selected one or more second frames.

8. (Previously Presented) The recorded medium of claim 7, wherein said one or more first frames of the same kind are extracted in the reverse order of encoding or decoding.

9. (Canceled)

10. (Canceled)

11. (Previously Presented) The recorded medium of claim 7, wherein the current frame is one of a plurality of frames generated by a plurality of cameras in a temporal order of an I frame, a first B frame, a second B frame, and a P frame, the plurality of frames being encoded or decoded in an order of the I frame, the P frame, the first B frame, and the second B about a time axis.
12. (Previously Presented) The recorded medium of claim 7, wherein the current frame is one of a plurality of frames that includes picture information inputted by a plurality of cameras, the picture information being generated as one of 1-D parallel data, 1-D arc data, and 2-D parallel data.

13. (Previously Presented) The method of claim 1, wherein the encoding or decoding said current frame by making reference to the selected one or more first frames and the selected one or more second frames comprises:
   encoding or decoding said current frame by making direct reference to the selected one or more first frames and the selected one or more second frames.

14. (Previously Presented) The recorded medium of claim 7, wherein the encoding or decoding said current frame by making reference to the selected one or more first frames and the selected one or more second frames comprises:
   encoding or decoding said current frame by making direct reference to the selected one or more first frames and the selected one or more second frames.
REMARKS

Status of the Claims

Claims 1, 2, 5-8, and 11-14 are now pending. Claims 1 and 7 are independent.

The claims have been amended to clarify the features. These claims are fully supported by the original disclosure and the corresponding description in the filed specification. Thus, Applicants believe no new matter is added and reconsideration of this application, as amended, is respectfully requested.

Examiner Interview

Applicants thank the Examiner for discussing this case with Applicants’ representative on February 3, 2014. During the discussion, Applicants’ representative proposed filing an English translation of the priority document of the current application and the Examiner indicated the filing of the English translation of the priority document should overcome the current rejections pending a further review upon receiving the filed response. The English translation of the priority document has been filed accordingly based on the discussion with the Examiner.

Rejection under 35 U.S.C. § 112, 2nd Paragraph

Claims 1-14 stand rejected under 35 U.S.C. § 112, second paragraph. This rejection is respectfully traversed.

The Examiner has set forth certain instances wherein the claim language lacks antecedent basis or is not clearly understood.

In order to overcome this rejection, Applicants have amended the claims to correct each of the deficiencies specifically pointed out by the Examiner. Applicants respectfully submit that the claims, as amended, particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

Rejections under 35 U.S.C. §§ 102 and 103

Claims 1 and 6 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Ha; claims 2, 5, 8, and 11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ha in
view of Haskell; and claims 6 and 12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ha in view of Chou. These rejections are respectfully traversed.

Applicants hereby submit an English translation (as attached) of the priority document of the current application, Korean Application No. 10-2005-0003948, which has a filing date of January 14, 2005 being earlier than the effective filing date of Ha, which claims priority to U.S. Provisional Application No. 60/709,811 and has a filing date of August 22, 2005. In addition, Applicants hereby submit a Verification of Translation (as attached). Applicants also assert that the current claims are supported by Korean Application No. 10-2005-0003948.

Thus, the rejections are moot. Accordingly, reconsideration and withdrawal of the rejections are respectfully requested.

**Conclusion**

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all rejections in the Office Action and that they be withdrawn. It is believed that a full and complete response has been made to the Office Action, and as such, the present application is in condition for allowance.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Justen D. Fauth, Registration No. 63,559, at the telephone number of the undersigned below to conduct an interview in an effort to expedite prosecution in connection with the present application.
If necessary, the Director is hereby authorized in this, concurrent, and future replies to charge any fees required during the pendency of the above-identified application or credit any overpayment to Deposit Account No. 02-2448.

Dated: February 10, 2014

Respectfully submitted,

By

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Attachment: Translation of Priority Document with Verification of Translation (KR 10-2005-0003948)
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application of:
Yung-Lyul LEE et al.

Application No.: 11/813,969

Confirmation No.: 9254

Filed: July 13, 2007

Art Unit: 2439

For: REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

Examiner: B. L. OLION

VERIFICATION OF TRANSLATION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

The undersigned hereby declares the following:

I am knowledgeable in Korean and English. I have reviewed Korean Application No.: 10-2005-0003948 filed on January 14, 2005 and verify that the attached document is an accurate English translation thereof.

All statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true. Further, these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Feb. 4, 2014

By: [Signature]

Date

Name:

BIRCH, STEWART, KOLASCH & BIRCH, LLP

EHC/JDF/tem
REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

The present invention relates to setting the order of reference frames, more specifically to a method for setting the order of reference frames for multi-view coding and a recorded medium recording the method.

In general, digital data is transmitted from a certain type of transmitting device to a certain type of receiving device. A transmitting device typically comprises an encoder encoding the data for transmission, and a receiving device typically comprises a decoder decoding the received data. A variety of digital data, such as video data, audio data, and audio/video data, can be transmitted from a transmitting device to a receiving device and outputted through a receiving device.

Dominating video compression and transmission formats comes from a family called a hybrid block-based motion-compensated transform video coder. Examples of the above coder is ITU-T VCEG video coding standards, which comprise H.261, MPEG-1, H.262/MPEG-2 video, H.263, MPEG-4 visual of VCEG (Video Coding Experts Group)
and ISO/IEC MPEG (Moving Picture Experts Group) as well as the in-process draft standard H.264/AVC. Moreover, coding and compression standards are in place to synchronize and multiplex the signals for various other types of media, including still picture, audio, document, and webpage.

Video streams are generally made up in three types of frames or pictures, which are the infra frame (I frame), predictive frame (P frame), and bi-directionally predictive frame (B frame).

The I frame does simply codifies the frame by discrete cosine transform, without using motion estimation/compensation. The P frame does motion estimation/compensation while referring to the I frame or other P frames, and then codifies the rest of the data by discrete cosine transform. The B frame does motion compensation, like the P frame, but carries out motion estimation/compensation from two frames on the time axis.

The sequence in video stream is defined by a segment called the group of pictures (GOP). In the structure of I, B, B, P, B, B, P, ..., the GOP refers to the frames between an I frame to the next I frame. Generally, when displayed at an intended rate, the GOP is structured in a set of pictures having a predetermined duration (e.g., 0.5 seconds).

Generally, the MPEG-2 video stream or sequence is defined by a segment called GOP. Typically, the GOP is structured in a set of pictures having a duration of 0.5 seconds, when displayed at an intended rate.
As described above, the medium for delivering picture information such as video stream has been developed from the 2-dimensional terminal technology, such as television. In other words, as the development moves from black and white pictures to color pictures, as in SD (standard definition) television and high-resolution television (e.g., HDTV), the data amount of picture information is increasing.

Consequently, the current picture information is not 2-dimensional but 3-dimensional, and thus development of technologies related to 3-dimensional picture information is needed in order to deliver reproduce realistic, natural multimedia information.

However, since the technology standard such as MPEG-2 is for coding and decoding video from one view, the design of structure and process of data for expressing multi-view information is needed in order to codify multi-view video data. Although technology standards are proposing MVP (multi-view profile) for expanding the video used in MPEG-2 to a stereo video, this still does not suggest a proper solution for coding multi-view video.

【Disclosure】

【Technical Problem】

Contrived to solve the above problems, the present invention aims to provide a method for setting the order of reference frames and a recorded medium recording the
method that can provide better picture quality and 3-dimensionality owing to utilizing more reference frames.

The invention also aims to provide a method for setting the order of reference frames for multi-view coding and a recorded medium recording the method that can prevent the delay in process time when using the reference frame.

Another object of this invention is to provide a method for setting the order of reference frames for multi-view coding and a recorded medium recording the method that can maintain an optimal efficiency while the encoder and decoder are encoding and decoding.

Another object of the present invention is to provide a method for setting the order of reference frames for multi-view coding and a recorded medium recording the method that allows a user to select a picture of desired direction among pictures of various directions inputted through multiple cameras.

【Technical Solution】

In order to achieve the above objects, a first aspect of the present invention provides a method for setting the order of reference frames for multi-view coding.

According to a preferred embodiment, the method for setting the order of reference frames for multi-view coding can comprise the steps of selecting the n (integer) number of frames of the same kind that have a same-view relation with the current frame
and are encoded or decoded prior to the current frame as a first reference frame, selecting
the m (integer) number of frames of the same kind that have a same-view relation with the
current frame and have an inter-view relation with a frame of the same kind, which is
encoded or decoded immediately before, as a second reference frame, wherein the frame
of the same kind has a same-view relation with the current frame, and encoding or
decoding the current frame by making reference to the frames of the same kind included
in the first reference frame and the second reference frame.

The n number of frames of the same kind, included in the first reference frame,
can be extracted in the reverse order of encoding or decoding.

In case the method further comprises the step of selecting the k (integer) number
of frames of the same kind having an inter-view relation with the current frame as a third
reference frame, the current frame can be encoded or decoded by making reference to the
frames of the same kind included in the first through third reference frames.

The frame of the same kind can be a P frame of a B frame that is the same kind as
the current frame.

A plurality of frames generated by the plurality of cameras in the temporal order
of an I frame, a first B frame, a second B frame, and a P frame can be encoded or decoded
in the order of an I frame, a P frame, a first B frame, and a second B frame about the time
axis.

Picture information inputted by the plurality of cameras can be generated as one
of the forms consisting of 1-D parallel data, 1-D arc data, and 2-D parallel data.

In order to achieve aforementioned objects, a second aspect of the present invention provides a recorded medium recording a program for executing a method of setting the order of reference frames for multi-view coding.

According to a preferred embodiment of the present invention, the program recorded in the recorded medium is a program of instructions executable by a transmitting device or a receiving device, and can execute the steps of selecting the \( n \) (integer) number of frames of the same kind that have a same-view relation with the current frame and are encoded or decoded prior to the current frame as a first reference frame, wherein the current frame is a frame to be currently encoded or decoded among a plurality of frames successively generated by a plurality of cameras along the time, selecting the \( m \) (integer) number of frames of the same kind that have a same-view relation with the current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with the current frame, and encoding or decoding the current frame by making reference to the frames of the same kind included in the first reference frame and the second reference frame.

The \( n \) number of frames of the same kind, included in the first reference frame, can be extracted in the reverse order of encoding or decoding.
In case the method further comprises the step of selecting the k (integer) number of frames of the same kind having an inter-view relation with the current frame as a third reference frame, the current frame can be encoded or decoded by making reference to the frames of the same kind included in the first through third reference frames.

5 The frame of the same kind can be a P frame of a B frame that is the same kind as the current frame.

A plurality of frames generated by the plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame can be encoded or decoded in the order of an I frame, a P frame, a first B frame, and a second B frame about the time axis.

Picture information inputted by the plurality of cameras can be generated as one of the forms consisting of 1-D parallel data, 1-D arc data, and 2-D parallel data.

【Description of Drawings】

15 Fig. 1 shows an arrangement of a plurality of cameras for inputting 1-D parallel data, based on a preferred embodiment of the present invention;

Fig. 2 shows an arrangement of a plurality of cameras for inputting 1-D arc data, based on a preferred embodiment of the present invention;

Fig. 3 shows an arrangement of a plurality of cameras for inputting 2-D parallel data, based on a preferred embodiment of the present invention;
Fig. 4 shows a method of setting the order of reference frames in case the input data are 1-D parallel data and 1-D arc data, based on a preferred embodiment of the present invention;

Fig. 5 shows a method of setting the order of reference frames in case the input data is 2-D parallel data, based on a preferred embodiment of the present invention; and

Figs. 6-9 show graphs comparing the bit rate and signal-to-noise ratio according to a method for setting the order of reference frames for multi-view coding based on the anchor and the present invention.

【Mode for Invention】

In order to fully understand the present invention, the advantages of the present invention, and the objects achieved by embodying the present invention, the accompanying drawings illustrating embodiments of the present invention and their disclosed description must be referenced.

Below, preferred embodiments of the present invention will be described with reference to the accompanying drawings. To aid the overall understanding, the same reference numerals are used for the same means, regardless of the Fig. number.

Fig. 1 is an arrangement of a plurality of cameras for inputting 1-D parallel data, based on a preferred embodiment of the present invention, while Fig. 2 is an arrangement
of a plurality of cameras for inputting 1-D arc data, based on a preferred embodiment of
the present invention, and Fig. 3 is an arrangement of a plurality of cameras for inputting
2-D parallel data, based on a preferred embodiment of the present invention.

In the arrangement of a plurality of cameras for inputting 1-D parallel data, as
shown in Fig. 1, the n number of cameras, represented by 120a, 120b... 120n-1, and 120n,
are arranged in a line about the camera that is arranged perpendicular to an object 110.

When the n number of cameras 120a, 120b... 120n-1, 120n are arranged
according to a method shown in Fig. 1, the distance between each camera and the object is
different from each other. Of course, the distances between either side of the central
camera and the object 110 may be the same.

In the arrangement of a plurality of cameras for inputting 1-D arc data, as shown
in Fig. 2, the n number of cameras, represented by 120a, 120b... 120n-1, and 120n, are
sequentially arranged on an arc with a fixed distance d to an object 110.

When the n number of cameras 120a, 120b... 120n-1, 120n are arranged
according to a method shown in Fig. 2, the distance between each camera and the object
110 is the same.

In the arrangement of a plurality of cameras for inputting 2-D parallel data, as
shown in Fig. 3, a plurality of cameras, represented by 120a, 120b, 120c, 120d, and 120e,
are arranged on a pre-designated shape of structure according to a predetermined rule. Fig.
3 illustrates a cross-shaped structure, on which each camera is arranged on the center and
each projecting part. However, there can be an unlimited variety of structural shapes and
the number of cameras to arrange a plurality of cameras on a structure.

Each camera arranged by each method illustrated in Figs. 1-3 receives object
images inputted through the installed lens angle, with the passage of time, and generates
picture information, and the picture information is structured in segments, called GOP, of
I, B, B, P, B, B, P, ..., as described earlier.

The method of setting the order of reference frames and/or the scope of reference
frames for efficiently encoding or decoding each frame of picture information generated
by each method of camera arrangement is different from each other, and thus the
description will be made below by making reference to the relevant figure.

Fig. 4 is a method for setting the order of reference frames when the input data
are 1-D parallel data and 1-D arc data, based on a preferred embodiment of the present
invention.

As shown in Fig. 4, the GOP of 1-D parallel data and 1-D arc data can be
structured in the order of I frame, P frame, B frame, B frame, P frame, and B frame, and
the frames arranged along the x-axis (i.e., time) refer to picture information
independently generated by each camera. The GOP of this invention may be set to have
the duration of, for example, 1 second.

The encoding/decoding of multi-view coding on 1-D parallel data and 1-D arc
data is carried out in the order of 210, 220, 230, and 240. That is, after processing I frames 
generated at a same moment, P frames are processed, and then the previously generated B 
frames are processed before the later generated B frames are processed. Then, since there 
is no I frame until the next GOP, the process is repeated in the order of P frame, B frame, 
and B frame.

Suppose, in this process order, a P frame 250 (hereinafter referred to as “current 
frame”) has to be encoded or decoded. Here, a transmitting device and/or receiving 
device can use relevant P frame information as reference frames in order to encode or 
decode the P frame 250. In Fig. 4, CEV means the current frame to be decoded or encoded, 
and R means the reference frame index ordering.

In other words, in order to encode or decode the current frame, the transmitting 
device and/or receiving device extracts and references information related to a first P 
frame 255 (R=0), which is a frame of the same kind encoded or decoded immediately 
before the current frame, a second P frame 260 (R=1), which is a frame of the same kind 
encoded or decoded immediately before the first P frame 255, a third P frame 265 (R=2), 
which is a frame of the same kind encoded or decoded immediately before the second P 
frame 260, and a third P frame 270 (R=4) and fourth P frame 275 (R=5), which are frames 
of the same kind encoded or decoded by being generated by installed cameras at a 
moment near the first P frame 255. Here, the first P frame 255, the second P frame 260, 
and the third P frame 265 can be said to be same-views inputted through the same camera
on the continuous time axis, and the fourth P frame 270 and the fifth P frame 275 can be said to be inter-views inputted through neighboring cameras on the time axis that are the same as the first P frame 265. Of course, the number of reference frames and the order of reference, for encoding and/or decoding the current frame, can be different based on the method of realization. For example, a sixth P frame 280, which is an inter-view inputted through a neighboring camera on the time axis that is the same as the current frame 250.

In the method of setting the order of reference frames described above, the encoding and/or decoding is conducted by a single processor.

However, a transmitting device and/or receiving device can be made to have a plurality of processors independently encode and/or decode the frames generated by any cameras. For example, a first processor processes the frames generated by the first and fourth cameras, and the second processor processes the frames generated by the second and fifth cameras, while the third processor processes the frames generated by the third and sixth cameras. In this case, when setting a reference frame for the current frame, if frames processed by other processors are set as the reference frames, other processors must complete the processing of the reference frames before the current frame is processed. Unless this premise is not fulfilled, delays will be inevitable for the processing of the current frame as well as the processing of another current frame that sets the current frame as a reference frame. Hence, if a plurality of processors process the frames in parallel, the process efficiency can be improved by, for example, setting the same-views
only as the reference frame.

Although the process of P frames by a transmitting device and/or receiving device has been described above, it should be apparent that the same method can be applied to B frames, and thus the description will not be provided here.

Fig. 5 illustrates a method of setting the order of reference frames in case the input data is 2-D parallel data, based on a preferred embodiment of the present invention.

As shown in Fig. 5, the GOP of 2-D parallel data can be structured in the order of I frame, P frame, B frame, B frame, P frame, and B frame. In Fig. 5, the cameras are arranged in a cross shape. For the purpose of easy understanding, the arrangement of each frame is made to be identical to the arrangement of the camera. In this invention, the GOP can be set to have the duration of, for example, 1 second.

As described earlier, the encoding/decoding of multi-view coding on 2-D parallel data can be processed in the order of I frame, P frame, B frame, and B frame, and since there is no I frame until the next GOP, the process can be repeated in the order of P frame, B frame, and B frame.

Suppose, in this process order, that a P frame 310 (hereinafter referred to as “current frame”) is to be encoded or decoded. Here, a transmitting device and/or receiving device can use relevant P frame information as reference frames in order to encode or decode the current frame 350. In Fig. 5, CEV means the current frame to be
decoded or encoded, and R means the reference frame index ordering.

In other words, in order to encode or decode the current frame, the transmitting device and/or receiving device extracts and references information related to a plurality of P frames, represented by 315, 320, 325, 330, and 335, having a same-view relation as a frame of the same kind encoded or decoded sequentially before the current frame, and P frames, represented by 340, 345, 350, and 355, having an inter-view relation with the P frame 315, which has a same-view relation as a frame of the same kind encoded or decoded immediately before. Here, the same-views can be said to be frames inputted through the same camera on the continuous time axis, and the inter-views can be said to be frames inputted independently through a plurality of cameras on the same time axis.

Of course, the number of reference frames and the order of reference, for encoding and/or decoding the current frame, can be different based on the method of realization. For example, in case 360 is the current frame, 310, which is already encoded or decoded after being encoded through a different camera on the same time axis, can be used as a reference frame.

In the method of setting the order of reference frames described above, the encoding and/or decoding is conducted by a single processor. However, a transmitting device and/or receiving device can be made to have a plurality of processors independently encode and/or decode the frames generated by any cameras. In this case, when setting a reference frame for the current frame, frames processed by other
processors can be restricted from being set as reference frames, thereby improving the process efficiency.

Although the process of P frames by a transmitting device and/or receiving device has been described above, it should be apparent that the same method can be applied to B frames, and thus the description will not be provided here.

Figs 6 through 9 illustrate graphs comparing the bit rate and signal-to-noise ratio according to a method for setting the order of reference frames for multi-view coding based on the anchor and the present invention.

In the graphs shown in Figs. 6-9, the x-axis indicates the bit rate, and the y-axis indicates the peak signal-to-noise ratio (PSNR). The anchor of each graph indicates the conventional method of successively encoding or decoding the frames generated in a time sequence per each camera without referring to the frames generated by other cameras.

Fig. 6 is a comparison graph for the case of an aquarium having 1-D arc data inputted by arranging a plurality of cameras, for example, 15 cameras. As shown in Fig. 6, when the method of setting the order of reference frames for multi-view coding based on the present invention is used, an improvement of 0.5-0.8dB in picture quality is shown over the conventional method.

Fig. 7 is a comparison graph for the case of a horserace having 1-D parallel data inputted by arranging a plurality of cameras, for example, 8 cameras. As shown in Fig. 7,
when the method of setting the order of reference frames for multi-view coding based on the present invention is used, an improvement of 0.4-0.9dB in picture quality is shown over the conventional method.

Fig. 8 is a comparison graph for the case of a golf swing having 1-D parallel data inputted by arranging a plurality of cameras, for example, 8 cameras. As shown in Fig. 8, when the method of setting the order of reference frames for multi-view coding based on the present invention is used, an improvement of 2.2-2.5dB in picture quality is shown over the conventional method.

Fig. 9 is a comparison graph for the case of a flamenco dance having 2-D parallel data inputted by arranging a plurality of cameras, for example, 5 cameras. As shown in Fig. 9, when the method of setting the order of reference frames for multi-view coding based on the present invention is used, an improvement of 0.3-1.0dB in picture quality is shown over the conventional method.

The drawings and disclosure are examples of the present invention, used to describe the present invention, shall by no means be construed to limit or restrict the scope of the present invention disclosed in the appended claims. Any person of ordinary skill in the art to which the invention pertains shall understand that a very large number of permutations and equivalent embodiments are possible. The true scope of the present invention shall only be defined by the appended claims.
【Industrial Applicability】

As described above, a method for setting the order of reference frames for multi-view coding and a recorded medium recording the method, based on the present invention, can provide an improved picture quality and three-dimensionality and prevent the delay in processing time when using the reference frame by utilizing a larger number of reference frames.

The present invention also allows the encoder and decoder to maintain an optimal efficiency when encoding and decoding, respectively.

Moreover, the present invention allows a user to select a picture with a desired direction among pictures with a variety of direction that are inputted through a plurality of cameras.

Furthermore, the present invention can utilize the bypass logic, which is much simpler than the conventional bus-control logic.
【CLAIMS】

【Claim 1】

A method of setting the order of reference frames for multi-view coding, the
method selecting a reference frame for a current frame to be encoded or decoded among a
plurality of frames successively generated by a plurality of cameras along the time, the
method comprising the steps of:

selecting the \( n \) (integer) number of frames of the same kind that have a
same-view relation with said current frame and are encoded or decoded prior to said
current frame as a first reference frame;

selecting the \( m \) (integer) number of frames of the same kind that have a
same-view relation with said current frame and have an inter-view relation with a frame
of the same kind, which is encoded or decoded immediately before, as a second reference
frame, wherein the frame of the same kind has a same-view relation with said current
frame; and

encoding or decoding said current frame by making reference to the frames of
the same kind included in said first reference frame and said second reference frame.

【Claim 2】

The method of claim 1, wherein said \( n \) number of frames of the same kind,
included in said first reference frame, are extracted in the reverse order of encoding or
decoding.

【Claim 3】

The method of claim 1, wherein, in case the method further comprises the step of selecting the k (integer) number of frames of the same kind having an inter-view relation with said current frame as a third reference frame, said current frame is encoded or decoded by making reference to the frames of the same kind included in said first through third reference frames.

【Claim 4】

The method of claim 1, wherein said frame of the same kind is a P frame of a B frame that is the same kind as said current frame.

【Claim 5】

The method of claim 1, wherein a plurality of frames generated by said plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame are encoded or decoded in the order of an I frame, a P frame, a first B frame, and a second B frame about the time axis.

【Claim 6】
The method of claim 1, wherein picture information input by said plurality of cameras is generated as one of the forms consisting of 1-D parallel data, 1-D arc data, and 2-D parallel data.

5  **[Claim 7]**

A recorded medium tangibly embodying a program of instructions executable by an encoding device or a decoding device to perform a method of setting the order of reference frames for multi-view coding, the program readable by said encoding device or decoding device, the recorded medium executing the steps of:

10   selecting the n (integer) number of frames of the same kind that have a same-view relation with said current frame and are encoded or decoded prior to said current frame as a first reference frame, wherein said current frame is a frame to be currently encoded or decoded among a plurality of frames successively generated by a plurality of cameras along the time;

15   selecting the m (integer) number of frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with said current frame; and

20   encoding or decoding said current frame by making reference to the frames of
the same kind included in said first reference frame and said second reference frame.

【Claim 8】

The recorded medium of claim 7, wherein said n number of frames of the same kind, included in said first reference frame, are extracted in the reverse order of encoding or decoding.

【Claim 9】

The recorded medium of claim 7, wherein, in case the method further comprises the step of selecting the k (integer) number of frames of the same kind having an inter-view relation with said current frame as a third reference frame, said current frame is encoded or decoded by making reference to the frames of the same kind included in said first through third reference frames.

【Claim 10】

The recorded medium of claim 7, wherein said frame of the same kind is a P frame of a B frame that is the same kind as said current frame.

【Claim 11】

The recorded medium of claim 7, wherein a plurality of frames generated by said
plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame are encoded or decoded in the order of an I frame, a P frame, a first B frame, and a second B frame about the time axis.

5  【Claim 12】

The recorded medium of claim 7, wherein picture information inputted by said plurality of cameras is generated as one of the forms consisting of 1-D parallel data, 1-D arc data, and 2-D parallel data.
【ABSTRACT】

A method for setting the order of reference frames for multi-view coding and a recorded medium recording the method are disclosed. The method of setting the order of reference frames, in accordance with an embodiment of the present invention, comprises the steps of selecting the n (integer) number of frames of the same kind that have a same-view relation with said current frame and are encoded or decoded prior to said current frame as a first reference frame, selecting the m (integer) number of frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with said current frame, and encoding or decoding said current frame by making reference to the frames of the same kind included in said first reference frame and said second reference frame. With the present invention, an improved picture quality and three-dimensionality can be provided, and the delay in processing time can be prevented when using the reference frame.
FIG. 9

Flamenco2

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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.
AMENDMENT TRANSMITTAL LETTER

Docket No.
5200-0104PUS1

Application No.
11/813,969 - Conf. #9254

Filing Date
July 13, 2007

Examiner
B. L. OLION

Art Unit
2439

Applicant(s): Yung-Lyul LEE et al.

Invention: REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Transmitted herewith is an amendment in the above-identified application.

The fee has been calculated and is transmitted as shown below.

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TOTAL ADDITIONAL FEE FOR THIS AMENDMENT: 0.00

☑ Large Entity
☐ Small Entity

☑ No additional fee is required for this amendment.

☐ Please charge Deposit Account No. 02-2448 in the amount of $0.00.

☐ A check in the amount of $0.00 is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director is hereby authorized to charge and credit Deposit Account No. 02-2448 as described below.

☐ Credit any overpayment.

☒ Charge any additional filing or application processing fees required under 37 C.F.R. §§ 1.16 and 1.17.

Esther H. Chong
Attorney Reg. No.: 40,953

BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, VA 22040-0747
703-205-8000

Dated: February 10, 2014
### PATENT APPLICATION FEE DETERMINATION RECORD

**Substitute for Form PTO-875**

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#### APPLICATION SIZE FEE

- [ ] APPLICATION SIZE FEE (37 CFR 1.16(a))
- [ ] MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))

* If the difference in column 1 is less than zero, enter "0" in column 2.

### APPLICATION AS AMENDED – PART II

#### AMENDMENT 02/10/2014

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**FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))**

**TOTAL ADD'L FEE**

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**FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))**

**TOTAL ADD'L FEE**

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" in this space is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" in this space is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.
Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com
Office Action Summary

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO reply is received by the Office within three months after the mailing date of this communication, the application may be ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☑ Responsive to communication(s) filed on 7/26/2013.
   ☐ A declaration(s)/affidavit(s) under 37 CFR 1.130(b) was/were filed on _____.
2a) ☑ This action is FINAL.  
   2b) ☐ This action is non-final.
3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
4) ☑ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5) ☑ Claim(s) 1,2,5-8 and 11-14 is/are pending in the application.
   5a) Of the above claim(s) _____ is/are withdrawn from consideration.
6) ☐ Claim(s) _____ is/are allowed.
7) ☑ Claim(s) 1,2,5-8 and 11-14 is/are rejected.
8) ☐ Claim(s) _____ is/are objected to.
9) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the Patent Prosecution Highway program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10) ☐ The specification is objected to by the Examiner.
11) ☑ The drawing(s) filed on 7/13/2007 is/are: a) ☑ accepted or b) ☐ objected to by the Examiner.
    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All  
   b) ☐ Some *  
   c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____.
   3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
   Paper No(s)/Mail Date _____.
3) ☐ Interview Summary (PTO-413)  
   Paper No(s)/Mail Date: _____.
4) ☐ Other: ___________.

U.S. Patent and Trademark Office
PTOL-326 (Rev. 08-13)
The present application is being examined under the pre-AIA first to invent provisions.

This Office Action is in response to the Amendment filed on 7/26/2013.

In the instant Amendment, claims 1 and 7 are independent claims. Claims 1-2, 5-8, and 11-14 have been examined and are pending. **This Action is made FINAL.**

**Response to Amendment**

**Claim Rejections - 35 USC § 112**

2. The following is a quotation of 35 U.S.C. 112(b):
   (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

   The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
   The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-14 rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. Applicant has amended independent claims to recite “encoding or decoding said current frame by making direct reference to the selected one or more first frames and selected one or more second frames.” However, the term “direct” appears to be ambiguous and unclear in light of the specification. Applicant says that in Fig. 5 first frames (315, 320, and 325) along with second frames (340, 345, 350) are directly used to
encode or decode current frame 310. Arguments Pages 2-3. Examiner does not see how this figure indicates a direct reference to one of these frames.

Paragraphs 54-59 describe Fig. 5 and recite:

[0054] As shown in FIG. 5, the GOP of 2-D parallel data can be structured in the order of I frame, P frame, B frame, B frame, P frame, and B frame. In FIG. 5, the cameras are arranged in a cross shape. For the purpose of easy understanding, the arrangement of each frame is made to be identical to the arrangement of the camera. In this invention, the GOP can be set to have the duration of, for example, 1 second.

[0055] As described earlier, the encoding/decoding of multi-view coding on 2-D parallel data can be processed in the order of I frame, P frame, B frame, and B frame, and since there is no I frame until the next GOP, the process can be repeated in the order of P frame, B frame, and B frame.

[0056] Suppose, in this process order, that a P frame 310 (hereinafter referred to as "current frame") is to be encoded or decoded. Here, a transmitting device and/or receiving device can use relevant P frame information as reference frames in order to encode or decode the current frame 350. In FIG. 5, C, E, V means the current frame to be decoded or encoded, and R means the reference frame index ordering.

[0057] In other words, in order to encode or decode the current frame, the transmitting device and/or receiving device extracts and references information related to a plurality of P frames, represented by 315, 320, 325, 330, and 335, having a same-view relation as a frame of the same kind encoded or decoded sequentially before the current frame, and P frames, represented by 340, 345, 350, and 355, having an inter-view relation with the P frame 315, which has a same-view relation as a frame of the same kind encoded or decoded immediately before. Here, the same-views can be said to be frames inputted through the same camera on the continuous time axis, and the
inter-views can be said to be frames inputted independently through a plurality of cameras on the same time axis. Of course, the number of reference frames and the order of reference, for encoding and/or decoding the current frame, can be different based on the method of realization. For example, in case 360 is the current frame, 310, which is already encoded or decoded after being encoded through a different camera on the same time axis, can be used as a reference frame.

[0058] In the method of setting the order of reference frames described above, the encoding and/or decoding is conducted by a single processor. However, a transmitting device and/or receiving device can be made to have a plurality of processors independently encode and/or decode the frames generated by any cameras. In this case, when setting a reference frame for the current frame, frames processed by other processors can be restricted from being set as reference frames, thereby improving the process efficiency.

[0059] Although the process of P frames by a transmitting device and/or receiving device has been described above, it should be apparent that the same method can be applied to B frames, and thus the description will not be provided here.

There is no mention of direct or indirect references to particular frames. Furthermore Par 55 recites the order of encoding/decoding is I frame, P frame, B frame, B frame, P frame, B frame, B frame, P frame, etc... It is unclear how there can be “direct” reference from frame 310 to frame 315 (in Fig 5) when there are clearly two B frames that have to be encoded or decoded prior (this is also illustrated on the sidebar of Fig. 5). As a result, the term "direct" does not have support in the specification to enable one of ordinary skill in the art to a clear definition of the phrase means.
Response to Arguments

Applicant's arguments filed 7/26/2013 have been fully considered but they are not persuasive. Applicant argues that reference Ha does not anticipate “encoding or decoding said current frame by making direct reference to the selected one or more first frames and selected one or more second frames.” Arguments Page 2-3. However, the Examiner disagrees. The term "direct" in relation to encoding and decoding is not defined in the specification. As a result, the mere fact that frame 818 does not have an arrow pointing to frame 814 does not mean that there is not a "direct" reference to selected first frame. Reference frame 818 is used to encode frame 819, which is used to encode 814. This means that there is a direct reference to frame 818 from frame 814 via frame 819. Simply because there is no arrow between 814 and 819 does not mean there is not a "direct" reference. Neither claims nor specification describes what a "direct" reference is.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical
Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

5. **Claims 1 and 7** are rejected under 35 U.S.C. 102(e) as being anticipated by Ha USPN 2007/0041443 ( provisionally filed No. 60/709,811 on Aug 22, 2005)

**As per claims 1 and 7, Ha teaches** A method of setting an order of reference frames for multi-view coding performed by a plurality of processors, the method comprising:

- selecting one or more first frames of a same kind that have a same view relation with a current frame, the one or more first frames being encoded or decoded prior to said current frame by a processor used to encode or decode said current frame; *(Ha Fig 6 – 9, specifically Fig 7A-7F and related text, In Fig 8, there is a B frame 814 (current frame), another B frame 819 is selected that has the same view relation to B frame 814. Item 819 is encoded prior to item 814 because item 814 uses item 819 to encode as described in Par 42 and related text)*

- selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames of the same kind that have the same-view relation with said current frame, the specific frame being encoded or decoded immediately before said current frame, by the processor used to encode or
decode said current frame encoding or decoding said current frame by making direct
reference to the selected one or more first frames and the selected one or more second
frames (Ha Fig 8, and related text, B frame 818 (second frame) is used to encode
frames 819 and 814. B frame 818 has an interview relation to B frame 819. B frame
818 is encoded first then B frame 819 then B frame 814.)

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all
obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed
or described as set forth in section 102 of this title, if the differences between the
subject matter sought to be patented and the prior art are such that the subject
matter as a whole would have been obvious at the time the invention was made
to a person having ordinary skill in the art to which said subject matter pertains.
Patentability shall not be negatived by the manner in which the invention was
made.

USPQ 459 (1966), that are applied for establishing a background for determining
obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating
obviousness or nonobviousness.

8. Claims 2, 5, 8 and 11 are rejected under 35 U.S.C. 103(a) as being
unpatentable over Ha as applied to claims 1 and 7 above, and further in view of Haskell
USPN 6,055,012
As per claim 2 and 8, Ha teaches The method of claim 1, Ha doesn’t teach, wherein said n number of first frames of the same kind, included in said first reference frame, are extracted in the reverse order of encoding or decoding but Haskell teaches wherein said n number of first frames of the same kind, included in said first reference frame, are extracted in the reverse order of encoding or decoding (Haskell col. 13 line 50 – col. 14 line and Figs 17-19, the B frame 1702 frame is encoded after the 1703 frame, but is extracted before)

It would have been obvious to one of ordinary skill in the art at the time of the invention to implement encoding or decoding by the frame of a same kind as taught by Haskell in order to provide multi-view encoding/decoding (Haskell Summary of Invention)

As per claim 5 and 11, Ha teaches The method of claim 1, Ha doesn’t teach, wherein the current frame is one of a plurality of frames that are generated by a plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame, the plurality of frames being encoded or decoded in an order of the I frame, the P frame, the first B frame, and the second frame about a time axis but Haskell teaches wherein the current frame is one of a plurality of frames that are generated by a plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame, the plurality of frames being encoded or decoded in an order of the I frame, the P frame, the first B frame, and the second frame about a time axis (Haskell col. 1 line
45- col. 14 line 35, the 1700 frame (I frame) is encoded first then the 1703 (P frame) then the 1701 and 1702 frames (B frames)).

It would have been obvious to one of ordinary skill in the art at the time of the invention to implement encoding or decoding by the frame of a same kind as taught by Haskell in order to provide multi-view encoding/decoding (Haskell Summary of Invention)

9. **Claims 6 and 12** are rejected under 35 U.S.C. 103(a) as being unpatentable over Ha as applied to claim 1 and 7 above, and further in view of Chou USPN 2005/0129128.

As per claim 6 and 12, the Ha teaches The method of claim 1, Ha doesn’t teach, wherein the current frame is one of a plurality of frames that includes picture information inputted by a plurality of cameras, the picture information being generated as one of 1-D parallel data, I-D arc data, and 2-D parallel data but Chou wherein the current frame is one of a plurality of frames that includes picture information inputted by a plurality of cameras, the picture information being generated as one of I-D parallel data, I-D arc data, and 2-D parallel data **(Chou Fig 8 and 9, the data is generated as 1-D parallel data, see also Haskell)**.

It would have been obvious to one of ordinary skill in the art at the time of the invention to implement 1-D parallel data as taught by Chou in order to effectively
encode (Chou Summary of Invention)

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

    Winder USPN 2006/0029134 – par 44-48, using multiple views to encode/decode.

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

    A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

    A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any
extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRIAN OLION whose telephone number is (571)270-3353. The examiner can normally be reached on 5/4/9.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Luu Pham can be reached at 571-270-5002. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/BRIAN OLION/
Examiner, Art Unit 2439

/Yin-Chen Shaw/
Primary Examiner, Art Unit 2439
## EAST Search History

### EAST Search History (Prior Art)

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SUPPLEMENTAL AMENDMENT UNDER 37 C.F.R. § 1.111

MS AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

In reply to the Office Action dated April 08, 2013, and further to Applicant’s amendment of July 8, 2013, the following amendments and remarks are respectfully submitted in connection with the above-identified application.

Amendments to the Claims begin on page 2.

Remarks begin on page 6.
AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method of setting an order of reference frames for multi-view coding performed by a plurality of processors, the method comprising:

   selecting one or more first frames of a same kind that have a same-view relation with a current frame, the one or more first frames being encoded or decoded prior to said current frame by a processor used to encode or decode said current frame;

   selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames, the specific frame being encoded or decoded immediately before said current frame by the processor used to encode or decode said current frame; and

   encoding or decoding said current frame by making direct reference to the selected one or more first frames and the selected one or more second frames.

2. (Previously Presented) The method of claim 1, wherein said one or more first frames of the same kind are extracted in the reverse order of encoding or decoding.

3-4. (Canceled)

5. (Previously Presented) The method of claim 1, wherein the current frame is one of a plurality of frames that are generated by a plurality of cameras in a temporal order of an I frame, a first B frame, a second B frame, and a P frame, the plurality of frames being encoded or
decoded in an order of the I frame, the P frame, the first B frame, and the second B frame about a time axis.

6. (Previously Presented) The method of claim 1, wherein the current frame is one of a plurality of frames that includes picture information inputted by a plurality of cameras, the picture information being generated as one of 1-D parallel data, 1-D arc data, and 2-D parallel data.

7. (Currently Amended) A non-transitory recorded medium tangibly embodying a program of instructions executable by an encoding device or a decoding device having a plurality of processors for setting an order of reference frames for multi-view coding, the program readable by said encoding device or decoding device, the recorded medium executing:

- selecting one or more first frames of a same kind that have a same-view relation with a current frame, the one or more first frames being encoded or decoded prior to said current frame by a processor used to encode or decode said current frame;

- selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames, the specific frame being encoded or decoded immediately before said current frame by the processor used to encode or decode said current frame; and

- encoding or decoding said current frame by making direct reference to the selected one or more first frames and the selected one or more second frames.
8. (Previously Presented) The recorded medium of claim 7, wherein said one or more first frames of the same kind are extracted in the reverse order of encoding or decoding.

9-10. (Canceled)

11. (Previously Presented) The recorded medium of claim 7, wherein the current frame is one of a plurality of frames generated by a plurality of cameras in a temporal order of an I frame, a first B frame, a second B frame, and a P frame, the plurality of frames being encoded or decoded in an order of the I frame, the P frame, the first B frame, and the second B about a time axis.

12. (Previously Presented) The recorded medium of claim 7, wherein the current frame is one of a plurality of frames that includes picture information inputted by a plurality of cameras, the picture information being generated as one of 1-D parallel data, 1-D arc data, and 2-D parallel data.

13. (Previously Presented) The method of claim 1, wherein the encoding or decoding said current frame by making reference to the selected one or more first frames and the selected one or more second frames comprises:

   encoding or decoding said current frame by making direct reference to the selected one or more first frames and the selected one or more second frames.
14. (Previously Presented) The recorded medium of claim 7, wherein the encoding or decoding said current frame by making reference to the selected one or more first frames and the selected one or more second frames comprises:

encoding or decoding said current frame by making direct reference to the selected one or more first frames and the selected one or more second frames.
REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-2, 5-8 and 11-14 are pending, with claims 1 and 7 amended by the present amendment. Claims 1 and 7 are independent.

In the Official Action, claims 1 and 7 (sic) were rejected under 35 U.S.C. § 112, first paragraph; claims 1 and 7 (sic) were rejected under 35 U.S.C. § 112, second paragraph; claims 1 and 7 were rejected under 35 U.S.C. § 102(e) as being anticipated by Ha (U.S. Patent Pub. No. 2007/0041443); claims 2, 5, 8 and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ha in view of Haskell (U.S. Patent No. 6,055,012); and claims 6 and 12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ha in view of Chou (U.S. Patent Pub. No. 2005/0129128). The above rejections, insofar as they may pertain to the presently pending claims, are respectfully traversed.

A review of the file history reveals that the references of Applicant’s IDS of 7/13/07 have been acknowledged; Applicant’s drawings have been accepted; and Applicant’s claim to foreign priority has been acknowledged.

Applicant acknowledges with appreciation the telephone discussion between the Examiner and Applicant’s representative on July 18, 2013. During the discussion, Applicant’s claims were compared to Figs. 8-9 of Ha resulting in an agreement that Ha does not disclose or suggest encoding or decoding a current frame by making direct reference to a selected one or more first frames and a selected one or more second frames as recited in Applicant’s amended independent claims. The current amendment is presented to add the term “direct” to the independent claims.
In Applicant’s amendment of July 8, 2013, claims 1 and 7 were amended, and claims 13-14 were added, to more clearly describe and distinctly claim Applicant’s invention. In the present amendment, claims 1 and 7 are further amended in response to the telephone interview of July 18, 2013. Support for this amendment is found in Applicant’s originally filed specification. No new matter is added.


Briefly recapitulating, amended claim 1 is directed to

A method of setting an order of reference frames for multi-view coding performed by a plurality of processors, the method comprising:

selecting one or more first frames of a same kind that have a same-view relation with a current frame, the one or more first frames being encoded or decoded prior to said current frame by a processor used to encode or decode said current frame;

selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames, the specific frame being encoded or decoded immediately before said current frame by the processor used to encode or decode said current frame; and

encoding or decoding said current frame by making direct reference to the selected one or more first frames and the selected one or more second frames.

Applicant’s Fig. 5 (reproduced below) shows a sequence of frames, where a current frame 310 is encoded or decoded with reference to a) one or more first frames (315, 320, 325) of a same kind and that have a same-view relation with the current frame; and b) one or more second frames (340, 345, 350, 355) of the same kind having an inter-view relation with a specific frame 315 of the one or more first frames, the specific frame 315 being encoded or decoded immediately before the current frame 310. Here, one or more first frames (315, 320, 325) and
one or more second frames (340, 345, 350, 355) are directly used to encode or decode the current frame 310.

Applicant’s Fig. 5

Ha describes a multiview encoding method that includes categorizing a plurality of B frames into at least two groups according to a predetermined standard; and sequentially encoding the categorized plurality of B frames. Applied Figs. 8-9 of Ha (reproduced below) show a
horizontally extended unit encoding structure of a multiview video and a corresponding prediction sequence. Here, frames in the same column are predicted at the same time. Specifically, first, an I frame 801 is intra-predicted. Then, a P frame 803 and a P frame 816 in a second column are predicted, and B frames 802, 806, 811 and 818 and a P frame 805 in a third column are predicted. Next, B1 frames 817, 808 and 813, and B frames 804 and 820 are predicted. B2 frames 807 and 821 and B1 frames 810, 819 and 815 in a fifth column are then predicted. Finally, B2 frames 809 and 814 are predicted. Therefore, the prediction sequence according to the method of Ha is I, P, B, B1, B2, P, B, B1 and B2 pictures in order.

Fig. 8 of Ha
Fig. 9 of Ha

The Official Action asserts that Ha’s frame 814 is equivalent to Applicant’s claimed current frame and that Ha’s frame 819 is equivalent to Applicant’s claimed specific first frame having a same-view relation with the current frame and encoded prior to the current frame. The Official Action also asserts that Ha’s frame 818 is equivalent to Applicant’s claimed second frame having an inter-view relation with the specific frame and is used to encode frames 819 and 814. However, contrary to the Official Action and as agreed during the interview of July 18, 2013, while there is an arrow drawn from Ha’s frame 818 to frame 819 (as well as frames 817, 808, 813 and 820), there is no arrow drawn from Ha’s frame 818 to frame 814 or any other frame in same column as frame 819. Therefore, frame 818 is not a reference frame that is directly used for encoding the current frame. Accordingly, Ha does not disclose or suggest a) selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames, the specific frame being encoded or decoded immediately before said
current frame by the processor used to encode or decode said current frame; and b) encoding or decoding said current frame by making direct reference to the selected one or more first frames and the selected one or more second frames” as recited in amended independent claim 1.

Amended independent claim 7 patentably defines over Ha for reasons similar to those discussed above relative to amended independent claim 1.

MPEP § 2131 notes that “[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” Vergeaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987). Because Ha does not disclose or suggest all of the features recited in claims 1 and 7, Ha does not anticipate the invention recited in claims 1 and 7, and all claims depending therefrom.

Applicant has considered Haskell and Chou and submits Haskell and Chou do not cure the deficiencies of Ha. As none of the cited art, individually or in combination, disclose or suggest at least the above-noted features of independent claims 1 and 7, Applicant submits the inventions defined by claims 1 and 7, and all claims depending therefrom, are not rendered obvious by the asserted references for at least the reasons stated above.

MPEP § 2141 notes that an obviousness-type rejection must explain why the difference(s) between the prior art and the claimed invention would have been obvious to one of ordinary skill in the art. MPEP § 2141 goes on to list exemplary rationales that may support a conclusion of obviousness. However, Applicant submits that the Official Action and the applied references present no objective evidence that would support an obviousness-type rejection of Applicant’s pending claims based on one of these exemplary rationales.
CONCLUSION

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Michael E. Monaco, Registration No. 52041, at the telephone number of the undersigned below to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Director is hereby authorized in this, concurrent, and future replies to charge any fees required during the pendency of the above-identified application or credit any overpayment to Deposit Account No. 02-2448.

Dated: JUL 26 2013

Respectfully submitted,

By

Esther H. Chong
Registration No.: 40953
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, VA 22040-0747
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AMENDMENT TRANSMITTAL LETTER

Application No. 11/813,969 - Conf. #9254
Filing Date July 13, 2007
Examiner B. L. OLION
Art Unit 2439

Applicant(s): Yung-Lyul LEE et al.

Invention: REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Transmitted herewith is an amendment in the above-identified application.
The fee has been calculated and is transmitted as shown below.

CLAIMS AS AMENDED

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☒ Large Entity
☐ Small Entity

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Dated: JUL 26 2013

Esther H. Chong
Attorney Reg. No.: 40953

BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, VA 22040-0747
703-205-8000
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*** If the "Highest Number Previously Paid For" in this space is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application of:
Yung-Lyul LEE et al.

Application No.: 11/813,969  Confirmation No.: 9254

Filed: July 13, 2007  Art Unit: 2439

For: REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING  Examiner: B. L. OLION

AMENDMENT UNDER 37 C.F.R. § 1.111

MS AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

In reply to the Office Action dated April 08, 2013, the following amendments and remarks are respectfully submitted in connection with the above-identified application.

Amendments to the Claims begin on page 2.

Remarks begin on page 6.
AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method of setting an order of reference frames for multi-view coding performed by a plurality of processors, the method comprising:

   selecting one or more first frames of a same kind that have a same-view relation with a current frame, the one or more first frames being encoded or decoded prior to said current frame by a processor used to encode or decode said current frame;

   selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames of the same kind that have the same-view relation with said current frame, the specific frame being encoded or decoded immediately before said current frame by the processor used to encode or decode said current frame; and

   encoding or decoding said current frame by making reference to the selected one or more first frames and the selected one or more second frames.

2. (Previously Presented) The method of claim 1, wherein said one or more first frames of the same kind are extracted in the reverse order of encoding or decoding.

3-4. (Canceled)

5. (Previously Presented) The method of claim 1, wherein the current frame is one of a plurality of frames that are generated by a plurality of cameras in a temporal order of an I frame, a first B frame, a second B frame, and a P frame, the plurality of frames being encoded or
decoded in an order of the I frame, the P frame, the first B frame, and the second B frame about a time axis.

6. (Previously Presented) The method of claim 1, wherein the current frame is one of a plurality of frames that includes picture information inputted by a plurality of cameras, the picture information being generated as one of 1-D parallel data, 1-D arc data, and 2-D parallel data.

7. (Currently Amended) A non-transitory recorded medium tangibly embodying a program of instructions executable by an encoding device or a decoding device having a plurality of processors for setting an order of reference frames for multi-view coding, the program readable by said encoding device or decoding device, the recorded medium executing:

selecting one or more first frames of a same kind that have a same-view relation with a current frame, the one or more first frames being encoded or decoded prior to said current frame by a processor used to encode or decode said current frame;

selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames of the same kind that have the same-view relation with said current frame, the specific frame being encoded or decoded immediately before said current frame by the processor used to encode or decode said current frame; and

encoding or decoding said current frame by making reference to the selected one or more first frames and the selected one or more second frames.
8. (Previously Presented) The recorded medium of claim 7, wherein said one or more first frames of the same kind are extracted in the reverse order of encoding or decoding.

9-10. (Canceled)

11. (Previously Presented) The recorded medium of claim 7, wherein the current frame is one of a plurality of frames generated by a plurality of cameras in a temporal order of an I frame, a first B frame, a second B frame, and a P frame, the plurality of frames being encoded or decoded in an order of the I frame, the P frame, the first B frame, and the second B about a time axis.

12. (Previously Presented) The recorded medium of claim 7, wherein the current frame is one of a plurality of frames that includes picture information inputted by a plurality of cameras, the picture information being generated as one of 1-D parallel data, 1-D arc data, and 2-D parallel data.

13. (New) The method of claim 1, wherein the encoding or decoding said current frame by making reference to the selected one or more first frames and the selected one or more second frames comprises:

   encoding or decoding said current frame by making direct reference to the selected one or more first frames and the selected one or more second frames.
14. (New) The recorded medium of claim 7, wherein the encoding or decoding said current frame by making reference to the selected one or more first frames and the selected one or more second frames comprises:

encoding or decoding said current frame by making direct reference to the selected one or more first frames and the selected one or more second frames.
REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-2, 5-8 and 11-14 are pending, with claims 1 and 7 amended, and claims 13-14 added, by the present amendment. Claims 1 and 7 are independent.

In the Official Action, claims 1 and 7 (sic) were rejected under 35 U.S.C. § 112, first paragraph; claims 1 and 7 (sic) were rejected under 35 U.S.C. § 112, second paragraph; claims 1 and 7 were rejected under 35 U.S.C. § 102(e) as being anticipated by Ha (U.S. Patent Pub. No. 2007/0041443); claims 2, 5, 8 and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ha in view of Haskell (U.S. Patent No. 6,055,012); and claims 6 and 12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ha in view of Chou (U.S. Patent Pub. No. 2005/0129128). The above rejections, insofar as they may pertain to the presently pending claims, are respectfully traversed.

A review of the file history reveals that the references of Applicant’s IDS of 7/13/07 have been acknowledged; Applicant’s drawings have been accepted; and Applicant’s claim to foreign priority has been acknowledged.

Claims 1 and 7 are amended, and claims 13-14 are added, to more clearly describe and distinctly claim Applicant’s invention. Support for this amendment is found in Applicant’s originally filed specification. No new matter is added.

The rejections under 35 U.S.C. § 112, first and second paragraph, are moot in view of the current amendment.
Briefly recapitulating, amended claim 1 is directed to

A method of setting an order of reference frames for multi-view coding performed by a plurality of processors, the method comprising:

selecting one or more first frames of a same kind that have a same-view relation with a current frame, the one or more first frames being encoded or decoded prior to said current frame by a processor used to encode or decode said current frame;

selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames, the specific frame being encoded or decoded immediately before said current frame by the processor used to encode or decode said current frame; and

encoding or decoding said current frame by making reference to the selected one or more first frames and the selected one or more second frames.

Applicant’s Fig. 5 (reproduced below) shows a sequence of frames, where a current frame 310 is encoded or decoded with reference to a) one or more first frames (315, 320, 325) of a same kind and that have a same-view relation with the current frame; and b) one or more second frames (340, 345, 350, 355) of the same kind having an inter-view relation with a specific frame 315 of the one or more first frames, the specific frame 315 being encoded or decoded immediately before the current frame 310. Here, one or more first frames (315, 320, 325) and one or more second frames (340, 345, 350, 355) are encoded or decoded by a processor used to encode or decode the current frame 310.
Ha describes a multiview encoding method that includes categorizing a plurality of B frames into at least two groups according to a predetermined standard; and sequentially encoding the categorized plurality of B frames. Applied Figs. 8-9 of Ha (reproduced below) show a horizontally extended unit encoding structure of a multiview video and a corresponding prediction sequence. Here, frames in the same column are predicted at the same time. Specifically, first, an I frame 801 is intra-predicted. Then, a P frame 803 and a P frame 816 in a
second column are predicted, and B frames 802, 806, 811 and 818 and a P frame 805 in a third column are predicted. Next, B1 frames 817, 808 and 813, and B frames 804 and 820 are predicted. B2 frames 807 and 821 and B1 frames 810, 819 and 815 in a fifth column are then predicted. Finally, B2 frames 809 and 814 are predicted. Therefore, the prediction sequence according to the method of Ha is I, P, B, B1, B2, P, B, B1 and B2 pictures in order.

![Diagram showing prediction sequence]

Fig. 8 of Ha
The Official Action asserts that Ha’s frame 814 is equivalent to Applicant’s claimed current frame and that Ha’s frame 819 is equivalent to Applicant’s claimed specific first frame having a same-view relation with the current frame and encoded prior to the current frame. The Official Action also asserts that Ha’s frame 818 is equivalent to Applicant’s claimed second frame having an inter-view relation with the specific frame and is used to encode frames 819 and 814. However, contrary to the Official Action, while there is an arrow drawn from Ha’s frame 818 to frame 819 (as well as frames 817, 808, 813 and 820), there is no arrow drawn from Ha’s frame 818 to frame 814 or any other frame in same column as frame 819. Therefore, frame 818 is not a reference frame for encoding the current frame. Accordingly, Ha does not disclose or suggest a) selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames, the specific frame being encoded or decoded immediately before said current frame by the processor used to encode or decode said
current frame; and b) encoding or decoding said current frame by making reference to the
selected one or more first frames and the selected one or more second frames” as recited in
amended independent claim 1.

Amended independent claim 7 patentably defines over Ha for reasons similar to those
discussed above relative to amended independent claim 1.

MPEP § 2131 notes that “[a] claim is anticipated only if each and every element as set
forth in the claim is found, either expressly or inherently described, in a single prior art
reference.” Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 U.S.P.Q.2d
1051, 1053 (Fed. Cir. 1987). Because Ha does not disclose or suggest all of the features recited
in claims 1 and 7, Ha does not anticipate the invention recited in claims 1 and 7, and all claims
depending therefrom.

Applicant has considered Haskell and Chou and submits Haskell and Chou do not cure
the deficiencies of Ha. As none of the cited art, individually or in combination, disclose or
suggest at least the above-noted features of independent claims 1 and 7, Applicant submits the
inventions defined by claims 1 and 7, and all claims depending therefrom, are not rendered
obvious by the asserted references for at least the reasons stated above.

MPEP § 2141 notes that an obviousness-type rejection must explain why the
difference(s) between the prior art and the claimed invention would have been obvious to one of
ordinary skill in the art. MPEP § 2141 goes on to list exemplary rationales that may support a
conclusion of obviousness. However, Applicant submits that the Official Action and the applied
references present no objective evidence that would support an obviousness-type rejection of
Applicant’s pending claims based on one of these exemplary rationales.
CONCLUSION

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Michael E. Monaco, Registration No. 52041, at the telephone number of the undersigned below to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Director is hereby authorized in this, concurrent, and future replies to charge any fees required during the pendency of the above-identified application or credit any overpayment to Deposit Account No. 02-2448.

Dated: JUL 08 2013

Respectfully submitted,

By

Esther H. Chong
Registration No.: 40953
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, VA 22040-0747
703-205-8000
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Filing Date July 13, 2007
Examiner B. L. OLION
Art Unit 2439

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Attorney Reg. No.: 40953

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* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

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*** If the "Highest Number Previously Paid For" in this space is less than 3, enter "3".

The 'Highest Number Previously Paid For' (Total or Independent) is the highest number found in the appropriate box in column 1.
Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com
### Office Action Summary

**Application No.**
11/813,969

**Applicant(s)**
LEE ET AL.

**Examiner**
BRIAN OLION

**Art Unit**
2439

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**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1) [x] Responsive to communication(s) filed on **07 September 2012**

2a) [ ] This action is FINAL.

2b) [x] This action is non-final.

3) [ ] An election was made by the applicant in response to a restriction requirement set forth during the interview on ****; the restriction requirement and election have been incorporated into this action.

4) [ ] Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

5) [x] Claim(s) **1,2,5-8,11 and 12** is/are pending in the application.

5a) Of the above claim(s) ____ is/are withdrawn from consideration.

6) [ ] Claim(s) ____ is/are allowed.

7) [x] Claim(s) **1,2,5-8,11 and 12** is/are rejected.

8) [ ] Claim(s) ____ is/are objected to.

9) [ ] Claim(s) ____ are subject to restriction and/or election requirement.

*If any claims have been determined allowable, you may be eligible to benefit from the Patent Prosecution Highway program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).*

**Application Papers**

10) [ ] The specification is objected to by the Examiner.

11) [x] The drawing(s) filed on **13 July 2007** is/are: a) [x] accepted or b) [ ] objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12) [x] Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) [x] All
b) [ ] Some * [ ] None of:

1. [x] Certified copies of the priority documents have been received.

2. [ ] Certified copies of the priority documents have been received in Application No. ____.

3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) [x] Notice of References Cited (PTO-892) 3) [ ] Interview Summary (PTO-413)

2) [ ] Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date __________

4) [ ] Other: ________
Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant’s submission filed on 9/07/2012 has been entered.

Response to Arguments

2. Applicant’s arguments with respect to claims 1-2, 5-8, and 11-12 have been considered but are moot because the arguments do not apply to any of the references being used in the current rejection. Reference Ha USPN 2007/0041443 is now used to teach of the amended limitations

Response to Amendment

Claim Rejections - 35 USC § 112

3. The following is a quotation of 35 U.S.C. 112(a):
   (a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), first paragraph:
The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 1 and 7 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for pre-AIA the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 (and 7) recites “selecting one or more first frames of a same kind that have a same view relation with a current frame, the one or more first frames being encoded or decoded prior to said current frame by a processor used to encode or decode said current frame; selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames of the same kind that have the same-view relation with said current frame, the specific frame being encoded or decoded immediately before said current frame, by the processor used to encode or decode said current frame.” This claims requires the first frame to be a same kind and in the same view as a current frame. This means that the first frame and current frame are produced by the same camera (see par 49 and Fig 4 of applicants published specification (2008/0130738)). Then the claims, disclose a second reference frame have an inter-view relation with a specific frame of one or more first frames. Par 49 and Fig 4 of applicant’s specification describes frames with “inter-view” relations as occurring at the same time but on different cameras. For example,
Par 49 recites "fourth P frame 270 and fifth P frame 275 can said to be inter-views ...."
This means the second frame occurs at the same time as the first frame it is just on a
different camera. However, the claims further state that the second frame also has a
same-view relation with the said current frame. The Examiner does not see how the
specification describes a current frame that is in the same view as a first frame, and a
second frame that is an interview relation to a first frame, but in a same view relation to
a current frame. The Examiner assumes the claim language to read like this because
Applicant earlier in the claims said that a first frame has the same-view relation with the
current frame, so Examiner is not sure why Applicant would restate that in claims. As a
result, the Examiner believes that the language of the claim means that the second
frame has an inter-view relation with a first frame, and a same view relation with a
current frame.

**Claim Rejections - 35 USC § 112**

5. The following is a quotation of 35 U.S.C. 112(b):

(B) CONCLUSION.—The specification shall conclude with one or more claims
particularly pointing out and distinctly claiming the subject matter which the inventor or a
joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

The specification shall conclude with one or more claims particularly pointing out and
distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 1 and 7 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA),
second paragraph, as being indefinite for failing to particularly point out and distinctly
claim the subject matter which the inventor or a joint inventor, or for pre-AIA the
applicant regards as the invention. Claim 1 (and 7) recites “selecting one or more first frames of a same kind that have a same view relation with a current frame, the one or more first frames being encoded or decoded prior to said current frame by a processor used to encode or decode said current frame; selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames of the same kind that have the same-view relation with said current frame, the specific frame being encoded or decoded immediately before said current frame, by the processor used to encode or decode said current frame.” The Examiner is confused on if the second frame has an inter-view relation to the first frame and a same view relation to a current frame or if it is the fact that a second frame has an inter-view relation to the first and then the first frame has a same view relation to the current. As stated above, Examiner is confused why Applicant would restated that a first frame has a same view relation to a current frame if it was already previously mentioned in the claim. As a result, the Examiner believes that the second frame has an inter-view relationship with the first frame and a same-view relation with the current frame. However because this ambiguity exists the Examiner request Applicant clarify functionality in the claims.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant
for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

8. Claims 1 and 7 are rejected under 35 U.S.C. 102(e) as being anticipated by Ha USPN 2007/0041443 (provisionally filed No. 60/709,811 on Aug 22, 2005)

As per claims 1 and 7, Ha teaches A method of setting an order of reference frames for multi-view coding performed by a plurality of processors, the method comprising:

selecting one or more first frames of a same kind that have a same view relation with a current frame, the one or more first frames being encoded or decoded prior to said current frame by a processor used to encode or decode said current frame; (Ha Fig 6 – 9, specifically Fig 7A-7F and related text, In Fig 8, there is a B frame 814 (current frame), another B frame 819 is selected that has the same view relation to B frame 814. Item 819 is encoded prior to item 814 because item 814 uses item 819 to encode as described in Par 42 and related text)
selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames of the same kind that have the same-view relation with said current frame, the specific frame being encoded or decoded immediately before said current frame, by the processor used to encode or decode said current frame encoding or decoding said current frame by making reference to the selected one or more first frames and the selected one or more second frames (Ha Fig 8, and related text, B frame 818 (second frame) is used to encode frames 819 and 814. B frame 818 has an interview relation to B frame 819. B frame 818 is encoded first then B frame 819 then B frame 814.)

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. The factual inquiries set forth in Graham v. John Deere Co., 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
11. Claims 2, 5, 8 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ha as applied to claims 1 and 7 above, and further in view of Haskell USPN 6,055,012

As per claim 2 and 8, Ha teaches The method of claim 1, Ha doesn’t teach, wherein said n number of first frames of the same kind, included in said first reference frame, are extracted in the reverse order of encoding or decoding but Haskell teaches wherein said n number of first frames of the same kind, included in said first reference frame, are extracted in the reverse order of encoding or decoding (Haskell col. 13 line 50 – col. 14 line and Figs 17-19, the B frame 1702 frame is encoded after the 1703 frame, but is extracted before)

It would have been obvious to one of ordinary skill in the art at the time of the invention to implement encoding or decoding by the frame of a same kind as taught by Haskell in order to provide multi-view encoding/decoding (Haskell Summary of Invention)

As per claim 5 and 11, Ha teaches The method of claim 1, Ha doesn’t teach, wherein the current frame is one of a plurality of frames that are generated by a plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame, the plurality of frames being encoded or decoded in an order of the I frame, the P frame, the first B frame, and the second frame about a time axis but Haskell teaches wherein the current frame is one of a plurality of frames that are generated by a plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame, the plurality of frames being encoded or decoded in an order of the I frame, the
P frame, the first B frame, and the second frame about a time axis (Haskell col. 1 line 45- col. 14 line 35, the 1700 frame (I frame) is encoded first then the 1703 (P frame) then the 1701 and 1702 frames (B frames)).

It would have been obvious to one of ordinary skill in the art at the time of the invention to implement encoding or decoding by the frame of a same kind as taught by Haskell in order to provide multi-view encoding/decoding (Haskell Summary of Invention)

1. Claims 6 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ha as applied to claim 1 and 7 above, and further in view of Chou USPN 2005/0129128.

\textbf{As per claim 6 and 12, the Ha teaches} The method of claim 1, Ha doesn’t teach, wherein the current frame is one of a plurality of frames that includes picture information inputted by a plurality of cameras, the picture information being generated as one of 1-D parallel data, 1-D arc data, and 2-D parallel data but Chou wherein the current frame is one of a plurality of frames that includes picture information inputted by a plurality of cameras, the picture information being generated as one of 1-D parallel data, 1-D arc data, and 2-D parallel data (Chou Fig 8 and 9, the data is generated as 1-D parallel data, see also Haskell).

It would have been obvious to one of ordinary skill in the art at the time of the invention to implement 1-D parallel data as taught by Chou in order to effectively encode (Chou Summary of Invention)
Conclusion

2. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Winder USPN 2006/0029134 – par 44-48, using multiple views to encode/decode.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRIAN OLION whose telephone number is (571)270-3353. The examiner can normally be reached on 5/4/9.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Edan Orgad can be reached on 571-272-7884. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/BRIAN OLION/
Examiner, Art Unit 2439
# Notice of References Cited

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## U.S. PATENT DOCUMENTS

## FOREIGN PATENT DOCUMENTS

## NON-PATENT DOCUMENTS

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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).) Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.*
### EAST Search History

#### EAST Search History (Prior Art)

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Part of Paper No.: 20130211
# Index of Claims

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☐ Claims renumbered in the same order as presented by applicant  ☐ CPA  ☐ T.D.  ☐ R.1.47

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Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

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This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application. Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).
   a. □ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.
      i. □ Consider the arguments in the Appeal Brief or Reply Brief previously filed on
      ii. □ Other __________________________
   b. □ Enclosed
      i. □ Amendment/Reply
      ii. □ Affidavit(s)/ Declaration(s)
      iii. □ Information Disclosure Statement (IDS)
      iv. □ Other __________________________

2. Miscellaneous
   a. □ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of ______ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)
   b. □ Other __________________________

3. Fees
   a. □ The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.
      The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. 02-2448
         i. □ RCE fee required under 37 CFR 1.17(e)
         ii. □ Extension of time fee (37 CFR 1.136 and 1.17)
         iii. □ Other __________________________
   b. □ Check in the amount of $________________________enclosed
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WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Name (Print/Type) | Esther H. Chong
Date
Registration No. 40653

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

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Name (Print/Type)
Date

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (by the USPTO to process) an application. Confidentiality is governed by 37 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 15 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application of:
Yung-Lyul LEE et al.

Application No.: 11/813,969
Confirmation No.: 9254

Filed: July 13, 2007
Art Unit: 2439

For: REFERENCE FRAME ORDERING FOR
MULTI-VIEW CODING
Examiner: B. L. OLION

AMENDMENT UNDER 37 C.F.R. § 1.114

MS RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

INTRODUCTORY COMMENTS

In reply to the Office Action dated June 08, 2012, the following amendments and remarks are respectfully submitted in connection with the above-identified application.

Amendments to the Claims begin on page 2.

Remarks begin on page 5.
AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method of setting an order of reference frames for multi-view coding performed by a plurality of processors, the method selecting a reference frame for a current frame to be encoded or decoded among a plurality of frames successively generated by a plurality of cameras over time, the method comprising:

selecting a first reference frame as one or more first frames of a same kind that have a same-view relation with said current frame, the one or more first frames being and that are encoded or decoded prior to said current frame by a processor used to encode or decode said current frame;

the selecting performed by a first processor of the plurality of processors;

selecting a second reference frame as one or more second frames of the same kind having an inter-view relation with a frame a specific frame of the one or more first frames of the same kind that has the same-view relation with said current frame, the specific frame being and that is encoded or decoded immediately before said current frame by the processor used to encode or decode said current frame; and

the selecting performed by the first processor of the plurality of processors; and

encoding or decoding said current frame by making reference to the selected one or more first frames and the selected one or more second frames of the same kind.

2. (Currently Amended) The method of claim 1, wherein said one or more first frames of the same kind are extracted in the reverse order of encoding or decoding.

3-4. (Canceled)
5. (Currently Amended) The method of claim 1, wherein the current frame is one of a plurality of frames that are generated by a plurality of cameras in a temporal order of an I frame, a first B frame, a second B frame, and a P frame, the plurality of frames being encoded or decoded in an order of an I frame, a P frame, a first B frame, and a second B frame, the I frame, the P frame, the first B frame, and the second B frame about a time axis.

6. (Currently Amended) The method of claim 1, wherein the current frame is one of a plurality of frames that includes picture information inputted by a plurality of cameras, the picture information being generated is generated as one of the forms including 1-D parallel data, 1-D arc data, and 2-D parallel data.

7. (Currently Amended) A non-transitory recorded medium tangibly embodying a program of instructions executable by an encoding device or a decoding device having a plurality of processors for setting an order of reference frames for multi-view coding, the program readable by said encoding device or decoding device, the recorded medium executing:

   selecting a first reference frame as one or more first frames of a same kind that have a same-view relation with a current frame, the one or more first frames being and that are encoded or decoded prior to said current frame by a processor used to encode or decode said current frame;

   the selecting performed by a first processor of the plurality of processors;

   selecting a second reference frame as one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames, a frame of the same kind that has the specific frame being
and that is encoded or decoded immediately before said current frame by the processor used to encode or decode said current frame; and

the selecting performed by the first processor of the plurality of processors; and

encoding or decoding said current frame by making reference to the selected one or more first frames and the selected one or more second frames of the same kind.

8. (Currently Amended) The recorded medium of claim 7, wherein said one or more first frames of the same kind are extracted in the reverse order of encoding or decoding.

9-10. (Canceled)

11. (Currently Amended) The recorded medium of claim 7, wherein the current frame is one of a plurality of frames generated by said plurality of cameras in a temporal order of an I frame, a first B frame, a second B frame, and a P frame, the plurality of frames being encoded are encoded or decoded in an order of the I frame, the P frame, the first B frame, and the second B frame, a P frame, a first B frame, and a second B frame about a time axis.

12. (Currently Amended) The recorded medium of claim 7, wherein the current frame is one of a plurality of frames that includes picture information inputted by said plurality of cameras, the picture information being generated is generated as one of the forms including 1-D parallel data, 1-D arc data, and 2-D parallel data.
REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-2, 5-8 and 11-12 are pending, with claims 1-2, 5-8 and 11-12 amended by the present amendment. Claims 1 and 7 are independent.

In the Official Action, claims 1-2, 5-8 and 11-12 (sic) were rejected under 35 U.S.C. § 103(a) as being unpatentable over Xin (U.S. Patent Pub. No. 2006/0132610) in view of Haskell (U.S. Patent No. 6,055,012); and claims 6 and 12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Xin in view of Haskell and Chou (U.S. Patent Pub. No. 2005/0129128). The above rejections, insofar as they may pertain to the presently pending claims, are respectfully traversed.

Applicant again notes that paragraph 3 of the Detailed Action identifies claims 6 and 12 as being unpatentable (now over Xin in view of Haskell.) However, claims 6 and 12 are not addressed in the detailed comments. Instead, claims 6 and 12 are addressed in the detailed comments relative to Xin in view of Haskell and Chou. Accordingly, paragraph 3 of the Detailed Action misidentifies the claims. Applicant requests that future actions correctly identify all claims and all grounds of rejection.

A review of the file history reveals that the references of Applicant’s IDS of 7/13/07 have been acknowledged; Applicant’s drawings have been accepted; and Applicant’s claim to foreign priority has been acknowledged.

Claims 1-2, 5-8 and 11-12 are amended to more clearly describe and distinctly claim Applicant’s invention. Support for this amendment is found in Applicant’s originally filed specification. No new matter is added.
Briefly recapitulating, amended claim 1 is directed to

A method of setting an order of reference frames for multi-view coding performed by a plurality of processors, the method comprising:

selecting one or more first frames of a same kind that have a same-view relation with a current frame, the one or more first frames being encoded or decoded prior to said current frame by a processor used to encode or decode said current frame;

selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames of the same kind that have the same-view relation with said current frame, the specific frame being encoded or decoded immediately before said current frame by the processor used to encode or decode said current frame; and

encoding or decoding said current frame by making reference to the selected one or more first frames and the selected one or more second frames.

Applicant's Fig. 5 (reproduced below) shows a sequence of frames, where a current frame 310 is encoded or decoded with reference to a) one or more first frames (315, 320, 325) of a same kind that have a same-view relation with the current frame; and b) one or more second frames (340, 345, 350, 355) of the same kind having an inter-view relation with a specific frame 315 of the one or more first frames of the same kind, the specific frame 315 being encoded or decoded immediately before the current frame 310. Here, one or more first frames (315, 320, 325) and one or more second frames (340, 345, 350, 355) are encoded or decoded by a processor used to encode or decode the current frame 310.
Xin describes a method for decomposing multiview videos. However, as acknowledged in the Official Action, Xin does not disclose or suggest “selecting a first reference frame as one or more frames of a same kind that have a same-view relation with said current frame and that are encoded or decoded prior to said current frame.” To cure this deficiency, the Official Action applies Haskell.

Haskell describes a method for displaying multiple different views of a scene. Haskell’s Fig. 1 (reproduced below) shows scene 100 is captured by a bank of cameras (or other imaging
sensors) 105, where camera 101, 102, 103 and 104 capture corresponding different views of the scene 100 and output these different views on lines 111, 112, 113 and 114.

Haskell's four views on lines 111, 112, 113 and 114 are input to a Spatial View Decimate and Multiplexer ("Mux") 120, which reduces the spatial resolution of the views for the purpose of generating two super-views by multiplexing the various views onto two lines. The two Mux signals are then output on lines 121 and 122 to Super View Pair Encoder 130. Encoder 130 takes the two input views and encodes them in such a manner that the first super-view is coded independently and the second super-view is coded with respect to a decoded first super-view in order to generate layered bitstreams, such as those obtained by using the temporal scalability of MPEG-2 video standard.

Haskell's applied Fig. 17 (reproduced below) shows a prediction structure for coding of a pair of super-view video signals which is based on the MPEG temporal prediction structure. The super-view 1 includes frames 1700, 1701, 1702, 1703. Super-view 1 is input to an MPEG encoder which uses a constant value of M=3. This value represents the prediction distance between a pair of consecutive anchor frames, where an anchor frame can be a P or an I frame. The number of B pictures between anchor frames is M-1. In the coding of super-view 1, MPEG standard coding with M-3 requires that frame 1700 be coded first by itself, followed by codex of
frame 1703, which is coded with respect to frame 1700, followed by codex of frames 1701 and 1702 using decoded frames 1700 and 1703, and the process repeats.

![Diagram](image)

Also shown in Haskell's Fig. 17 is super-view 2 which is input to an MPEG-2 temporal scalability-like encoder and includes a sequence of incoming frames 1750, 1751, 1752, ... etc., which are coded with respect to decoded frames of super-view 1. In super-view 2, only B picture coding of the super-view 2 frames are used, each of which use pairs of decoded frames of super-view 1 as anchors. Although B pictures are used, no reordering of super-view 2 frames is necessary, as these B pictures use different semantics as compared to B pictures used in coding of super-view 1. The prediction structure employed in super-view 2 involves a prediction of each B picture of super-view 2 using a temporally coincident frame and temporally adjacent frame from decoded super-view 1. The vertical arrows in Fig. 17 correspond to the coding with temporally coincident frames and the angled arrows correspond to the coding with the temporally adjacent frames. The temporally adjacent frames in Fig. 17 are the frames that are encoded immediately before the current super view 2 frame.
However, while Haskell’s frames 1751, 1701 and 1702 are all “same kind frames” and while Haskell’s Fig. 17 shows a B frame 1751 that is encoded based on temporally coincident B frame 1701 and temporally adjacent B frame 1702, Haskell uses a first processor to encode/decode frame 1751 and a second processor to encode/decode frames 1701/1702. Because Haskell uses different processors to encode/decode the temporally coincident and temporarily adjacent frames, Haskell does not disclose or suggest using the same processor for encoding or decode related frames.

Applicant notes that the use of a common processor in the claimed invention provides specific benefits. That is, with Applicant’s claimed invention, when setting a reference frame for the current frame, frames processed by other processors can be restricted from being used to process reference frames, thereby improving processing efficiency and speed.

In summary, because Haskell uses different processors to encode/decode the temporally coincident and temporarily adjacent frames, Haskell fails to disclose or suggest a) selecting one or more first frames of a same kind that have a same-view relation with said current frame, the one or more first frames being encoded or decoded prior to said current frame by a processor used to encode or decode said current frame; b) selecting one or more second frames of the same kind having an inter-view relation with a specific frame of the one or more first frames of the same kind that have the same-view relation with said current frame, the specific frame being encoded or decoded immediately before said current frame by the processor used to encode or decode said current frame. Thus, Haskell also does not disclose or suggest c) encoding or decoding said current frame by making reference to the selected one or more first frames and the selected one or more second frames. Accordingly, amended independent claim 1 patentably defines over Xin and Haskell.
Applicant submits that amended independent claim 7 patentably defines over Xin and Haskell for reasons similar to those discussed above relative to amended independent claim 1.

Applicant has considered Chou and submits Chou does not cure the deficiencies of Xin and Haskell. As none of the cited art, individually or in combination, disclose or suggest at least the above-noted features of independent claims 1 and 7, Applicant submits the inventions defined by claims 1 and 7, and all claims depending therefrom, are not rendered obvious by the asserted references for at least the reasons stated above.

MPEP 2141 notes that an obviousness-type rejection must explain why the difference(s) between the prior art and the claimed invention would have been obvious to one of ordinary skill in the art. MPEP 2141 goes on to list exemplary rationales that may support a conclusion of obviousness. However, Applicant submits that the Official Action and the applied references present no objective evidence that would support an obviousness-type rejection of Applicant’s amended claims based on one of these exemplary rationales.

**Conclusion**

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant(s) therefore respectfully request that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Michael E. Monaco, Registration No. 52041, at the telephone number of the undersigned below to conduct an interview in an effort to expedite prosecution in connection with the present application.
If necessary, the Director is hereby authorized in this, concurrent, and future replies to charge any fees required during the pendency of the above-identified application or credit any overpayment to Deposit Account No. 02-2448.

Dated: SEP 07 2012

Respectfully submitted,

By
Esther H. Chong
Registration No.: 40953
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, VA 22040-0747
703-205-8000
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**Title of Invention:** Reference Frame Ordering For Multi-View Coding

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<th>Yung-Lyul Lee</th>
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- **Payment Type:** Credit Card
- **Payment was successfully received in RAM:** $930
- **RAM confirmation Number:** 3914
- **Deposit Account:** 022448
- **Authorized User:** CHONG, ESTER H.

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**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.
**FEE TRANSMITTAL**

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**TOTAL AMOUNT OF PAYMENT** ($930.00)

**METHOD OF PAYMENT** (check all that apply)

- [x] Check
- [ ] Credit Card
- [ ] Money Order
- [ ] None
- [ ] Other (please identify):

**Deposit Account**

- Deposit Account Number: 02-2448
- Deposit Account Name: Birch, Stewart, Kolasch & Birch, LLP

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

- [x] Charge fee(s) indicated below
- [ ] Charge fee(s) indicated below, except for the filing fee
- [ ] Credit any overpayments

**WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

**FEE CALCULATION**

1. **BASIC FILING, SEARCH, AND EXAMINATION FEES**

   **FILING FEES**
   - Small Entity
   - Fee ($)
   - Utility 380
   - Design 250
   - Plant 250
   - Reissue 380
   - Provisional 250

   **SEARCH FEES**
   - Small Entity
   - Fee ($)
   - 620
   - 120
   - 380
   - 620
   - 0

   **EXAMINATION FEES**
   - Small Entity
   - Fee ($)
   - 310
   - 60
   - 190
   - 310
   - 0

   **FEES PAID ($)**
   - Utility 125
   - Design 80
   - Plant 100
   - Reissue 375
   - Provisional 0

2. **EXCESS CLAIM FEES**

   **Fee Description**
   - Each claim over 20 (including Reissues)
   - Each independent claim over 3 (including Reissues)
   - Multiple dependent claims

   **Small Entity**
   - Fee ($)
   - Utility 60
   - Design 250
   - Plant 450

   **FEES PAID ($)**
   - Utility 0
   - Design 125
   - Plant 225

3. **APPLICATION SIZE FEE**

   If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.161(e).

   **Total Sheets**
   - Fee ($)
   - Number of each additional 50 or fraction thereof
   - Fee Paid ($)
   - 0 / 50 = 0 (round up to a whole number) x 0.00

4. **OTHER FEE(S)**

   - Non-English Specification, $130 fee (no small entity discount)
   - Other (e.g., late filing surcharge): RCE - $930

**SUBMITTED BY**

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<td>Esther H. Chong</td>
<td>40953</td>
<td>703-205-8000</td>
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**Date:** SEP 07 2012

This collection of information is required by 37 CFR 1.138. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.
# PATENT APPLICATION FEE DETERMINATION RECORD

**APPLICATION AS FILED – PART I**

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- **BASIC FEE** ([§ 37 CFR 1.16(a), (b), or (g)]): N/A | N/A |
- **SEARCH FEE** ([§ 37 CFR 1.16(b), (i), or (m)]): N/A | N/A |
- **EXAMINATION FEE** ([§ 37 CFR 1.16(i), (p), or (q)]): N/A | N/A |
- **TOTAL CLAIMS** ([§ 37 CFR 1.16(j)]): minus 20 = * |
- **INDEPENDENT CLAIMS** ([§ 37 CFR 1.16(h)]): minus 3 = * |
- **APPLICATION SIZE FEE** ([§ 37 CFR 1.16(c)]): If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(e). |

- **MULTIPLE DEPENDENT CLAIM PRESENT** ([§ 37 CFR 1.16(j)]): *

* If the difference in column 1 is less than zero, enter "0" in column 2.

**APPLICATION AS AMENDED – PART II**

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    - Independent ([§ 37 CFR 1.16(h)]: 2 - Minus **3** = 0
  - **APPLICATION SIZE FEE** ([§ 37 CFR 1.16(c)]:
    - **FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM** ([§ 37 CFR 1.16(j)]:
      - **TOTAL ADD'L FEE**:

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    - Independent ([§ 37 CFR 1.16(h)]: 2 - Minus **** = 0
  - **APPLICATION SIZE FEE** ([§ 37 CFR 1.16(c)]:
    - **FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM** ([§ 37 CFR 1.16(j)]:
      - **TOTAL ADD'L FEE**:

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* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" in this space is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" in this space is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner: /STEFANIE BRYCE/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.
Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com
Office Action Summary

Application No. 11/813,969
Applicant(s) LEE ET AL.
Examiner BRIAN OLION
Art Unit 2439

--- The MAILING DATE of this communication appears on the cover sheet with the correspondence address ---

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.  
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication. 
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication. 
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) x Responsive to communication(s) filed on 14 March 2012
2a) x This action is FINAL.
2b) □ This action is non-final.
3) □ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
4) □ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5) x Claim(s) 1,2,5-8,11 and 12 is/are pending in the application.
   5a) Of the above claim(s) _____ is/are withdrawn from consideration.
6) □ Claim(s) _____ is/are allowed.
7) x Claim(s) 1,2,5-8,11 and 12 is/are rejected.
8) □ Claim(s) _____ is/are objected to.
9) □ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10) □ The specification is objected to by the Examiner.
11) x The drawing(s) filed on 13 July 2007 is/are: a) x accepted or b) □ objected to by the Examiner.

   Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

   Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
12) □ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13) x Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) □ All  b) □ Some * c) □ None of:
      1. x Certified copies of the priority documents have been received.
      2. □ Certified copies of the priority documents have been received in Application No. ______.
      3. □ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

   * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) x Notice of References Cited (PTO-892)
2) □ Notice of Draftsperson’s Patent Drawing Review (PTO-948)
3) □ Information Disclosure Statement(s) (PTO/SB/08)
   Paper No(s)/Mail Date ______.
4) □ Interview Summary (PTO-413)
   Paper No(s)/Mail Date ______.
5) □ Notice of Informal Patent Application
6) □ Other: ______.

U.S. Patent and Trademark Office
PTOL-326 (Rev. 03-11) Office Action Summary Part of Paper No./Mail Date 20120523
DETAILED ACTION

Claims 1-2, 5-8, and 11-12 are pending

Response to Arguments

1. Applicant’s arguments with respect to claims 1-2, 5-8, and 11-12 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

   (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in Graham v. John Deere Co., 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

   1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1-2, 5-8, and 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xin USPN 2006/0132610, and further in view of Haskell USPN 6,055,012.

**As per claims 1 and 7, Xin teaches** A method of setting an order of reference frames for multi-view coding performed by a plurality of processors, the method selecting a reference frame for a current frame to be encoded or decoded among a plurality of frames successively generated by a plurality of cameras along-over time, the method comprising:

selecting a first reference frame as one or more frames of a same kind that have a same-view relation with said current frame and that are encoded or decoded prior to said current frame, the selecting performed by a first processor of the plurality of processors;

selecting a second reference frame as one or more second frames of the same kind having an inter-view relation with a frame of the same kind that has the same-view relation with said current frame and that is encoded or decoded immediately before said current frame, the selecting performed by the first processor of the plurality of processors; and encoding or decoding said current frame by making reference to the selected one or more first and second [frames of the same kind.](Xin Par 28-32, there are 4 camera views. Each of the camera views produces a string of frames as seen in Fig 5 and 6. In Fig 6 there is an H frame that uses frames in
both time (temporal) and space (spatial) to encode. Thus the H frame uses a same view (i.e. temporal) frames in order to encode as well as interview (spatial) frames to encode.)

Xin didn’t teach frames of the same kind, but Haskell teaches frames of the same kind (Haskell Fig. 17, there are two reference B frames used to encode/decode a B frame)

It would have been obvious to one of ordinary skill in the art at the time of the invention to implement encoding or decoding by the frame of a same kind as taught by Haskell in order to provide multi-view encoding/decoding (Haskell Summary of Invention)

As per claim 2 and 8, the combination of Xin-Haskell teaches The method of claim 1, wherein said n number of frames of the same kind, included in said first reference frame, are extracted in the reverse order of encoding or decoding (Haskell col. 13 line 50 – col. 14 line and Figs 17-19, the B frame 1702 frame is encoded after the 1703 frame, but is extracted before)

As per claim 5 and 11, the combination of Xin-Haskell teaches The method of claim 1, wherein a plurality of frames generated by said plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame are encoded or decoded in the order of an I frame, a P frame, a first B frame, and a second B frame about the time axis (Haskell col. 1 line 45-col. 14 line 35, the 1700 frame (I frame) is encoded first then the 1703 (P frame) then the 1701 and 1702 frames (B frames))).
4. Claims 6 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Haskell and Xin as applied to claim 1 above, and further in view of Chou USPN 2005/0129128.

As per claim 6 and 12, the combination of Xin-Haskell teaches The method of claim 1, the combination doesn’t teach, wherein picture information inputted by said plurality of cameras is generated as one of the forms consisting of 1-D parallel data, 1-D arc data, and 2-D parallel data but Chou teaches wherein picture information inputted by said plurality of cameras is generated as one of the forms consisting of 1-D parallel data, 1-D arc data, and 2-D parallel data (Chou Fig 8 and 9, the data is generated as 1-D parallel data, see also Haskell).

It would have been obvious to one of ordinary skill in the art at the time of the invention to implement 1-D parallel data as taught by Chou in order to effectively encode (Chou Summary of Invention)

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Winder USPN 2006/0029134 – par 44-48, using multiple views to encode/decode.

1. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRIAN OLION whose telephone number is (571)270-3353. The examiner can normally be reached on 5/4/9.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edan Orgad can be reached on 571-272-7884. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/BRIAN OLION/
Examiner, Art Unit 2439

/Yin-Chen Shaw/
Primary Examiner, Art Unit 2439
**Notice of References Cited**

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**U.S. PATENT DOCUMENTS**

**FOREIGN PATENT DOCUMENTS**

**NON-PATENT DOCUMENTS**

*Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages*

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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).) Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.*
### Search Notes

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- **Claims renumbered in the same order as presented by applicant**
- **CPA**
- **T.D.**
- **R.1.47**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application of:
Yung-Lyul LEE et al.

Application No.: 11/813,969       Confirmation No.: 9254
Filed: July 13, 2007      Art Unit: 2439
For: REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING
Examiner: B. L. OLION

AMENDMENT UNDER 37 C.F.R. § 1.111

MS AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

In reply to the Office Action dated December 19, 2011, the following amendments and remarks are respectfully submitted in connection with the above-identified application:

Amendments to the Claims begin on page 2.

Remarks begin on page 6.
AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method of setting an order of reference frames for multi-view coding performed by one or more plurality of processors, the method selecting a reference frame for a current frame to be encoded or decoded among a plurality of frames successively generated by a plurality of cameras along over time, the method comprising:

    selecting one or more frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before; and

    selecting a first reference frame as one or more frames of a same kind that have a same-view relation with said current frame and that are encoded or decoded prior to said current frame, the selecting performed by a first processor of the plurality of processors;

    selecting a second reference frame as one or more second frames of the same kind having an inter-view relation with a frame of the same kind that has the same-view relation with said current frame and that is encoded or decoded immediately before said current frame, the selecting performed by the first processor of the plurality of processors; and

    encoding or decoding said current frame by making reference to the selected one or more first and second frames of the same kind,

    wherein said one or more frames of the same kind is a P-frame.

2. (Previously Presented) The method of claim 1, wherein said one or more frames of the same kind are extracted in the reverse order of encoding or decoding.
3-4. (Canceled)

5. (Previously Presented) The method of claim 1, wherein a plurality of frames generated by said plurality of cameras in a temporal order of an I frame, a first B frame, a second B frame, and a P frame are encoded or decoded in an order of an I frame, a P frame, a first B frame, and a second B frame about a time axis.

6. (Previously Presented) The method of claim 1, wherein picture information inputted by said plurality of cameras is generated as one of the forms including 1-D parallel data, 1-D arc data, and 2-D parallel data.

7. (Currently Amended) A non-transitory recorded medium tangibly embodying a program of instructions executable by an encoding device or a decoding device having one or more plurality of processors for setting an order of reference frames for multi-view coding, the program readable by said encoding device or decoding device, the recorded medium executing:

- selecting one or more frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before; and
selecting a first reference frame as one or more frames of a same kind that have a same-view relation with said current frame and that are encoded or decoded prior to said current frame, the selecting performed by a first processor of the plurality of processors;

selecting a second reference frame as one or more second frames of the same kind having an inter-view relation with a frame of the same kind that has the same-view relation with said current frame and that is encoded or decoded immediately before said current frame, the selecting performed by the first processor of the plurality of processors; and

encoding or decoding said current frame by making reference to the selected one or more first and second frames of the same kind,

wherein said one or more frames of the same kind is a P frame.

8. (Previously Presented) The recorded medium of claim 7, wherein said one or more frames of the same kind are extracted in the reverse order of encoding or decoding.

9-10. (Canceled)

11. (Previously Presented) The recorded medium of claim 7, wherein a plurality of frames generated by said plurality of cameras in a temporal order of an I frame, a first B frame, a second B frame, and a P frame are encoded or decoded in an order of an I frame, a P frame, a first B frame, and a second B frame about a time axis.
12. (Previously Presented) The recorded medium of claim 7, wherein picture information inputted by said plurality of cameras is generated as one of the forms including 1-D parallel data, 1-D arc data, and 2-D parallel data.
REMARKS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-2, 5-8 and 11-12 are pending, with claims 1 and 7 amended by the present amendment. Claims 1 and 7 are independent.

In the outstanding Office Action, claims 1-2, 5-8 and 11-12 (sic) were rejected under 35 U.S.C. § 103(a) as being unpatentable over Haskell (U.S. Patent No. 6,055,012) in view of Sun (U.S. Patent Pub. No. 2006/0013490); and claims 6 and 12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Haskell in view of Sun and Chou (U.S. Patent Pub. No. 2005/0129128).

Applicant notes that paragraph 3 of the Detailed Action identifies claims 6 and 12 as being unpatentable over Haskell in view of Sun. However, claims 6 and 12 are not addressed in the detailed comments. Instead, claims 6 and 12 are addressed in the detailed comments relative to Haskell in view of Sun and Chou. Accordingly, paragraph 3 of the Detailed Action appears to misidentify the claims. Applicant requests that future actions correctly identify all claims and all grounds of rejection.

Claims 1 and 7 are amended to more clearly describe and distinctly claim Applicant’s invention. Support for this amendment is found in Applicant’s originally filed specification. No new matter is added.

Briefly recapitulating, amended independent claim 1 is directed to

A method of setting an order of reference frames for multi-view coding performed by a plurality of processors, the method selecting a reference frame for a current frame to be encoded or decoded among a plurality of frames successively generated by a plurality of cameras over time, the method comprising:
selecting a first reference frame as one or more frames of a same kind that have a same-view relation with said current frame and that are encoded or decoded prior to said current frame, the selecting performed by a first processor of the plurality of processors;

selecting a second reference frame as one or more second frames of the same kind having an inter-view relation with a frame of the same kind that has the same-view relation with said current frame and that is encoded or decoded immediately before said current frame, the selecting performed by the first processor of the plurality of processors; and

encoding or decoding said current frame by making reference to the selected one or more first and second frames of the same kind.

With Applicant’s claimed invention, when setting a reference frame for the current frame, frames processed by other processors can be restricted from being set as reference frames, thereby improving the process efficiency. Thus, by selecting a first and second reference frame, the claimed invention can prevent/avoid processing of a current frame from being delayed when a corresponding reference frame is decoded by other processors and the processing of the other processors is delayed.

Haskell describes a method for displaying multiple different views of a scene. Haskell’s Fig. 1 (reproduced below) shows scene 100 is captured by a bank of cameras (or other imaging sensors) 105, where camera 101, 102, 103 and 104 capture corresponding different views of the scene 100 and output these different views on lines 111, 112, 113 and 114.
Haskell's four views on lines 111, 112, 113 and 114 are input to a Spatial View Decimate and Multiplexer ("Mux") 120, which reduces the spatial resolution of the views for the purpose of generating two super-views by multiplexing the various views onto two lines. The two Mux signals are then output on lines 121 and 122 to Super View Pair Encoder 130. Encoder 130 takes the two input views and encodes them in such a manner that the first super-view is coded independently and the second super-view is coded with respect to a decoded first super-view in order to generate layered bitstreams, such as those obtained by using the temporal scalability of MPEG-2 video standard.

Haskell's applied Fig. 17 (reproduced below) shows a prediction structure for coding of a pair of super-view video signals which is based on the MPEG temporal prediction structure. The super-view 1 includes frames 1700, 1701, 1702, 1703. Super-view 1 is input to an MPEG encoder which uses a constant value of M=3. This value represents the prediction distance between a pair of consecutive anchor frames, where an anchor frame can be a P or an I frame. The number of B pictures between anchor frames is M-1. In the coding of super-view 1, MPEG standard coding with M-3 requires that frame 1700 be coded first by itself, followed by codex of frame 1703, which is coded with respect to frame 1700, followed by codex of frames 1701 and 1702 using decoded frames 1700 and 1703, and the process repeats.
Also shown in Haskell’s Fig. 17 is super-view 2 which is input to an MPEG-2 temporal scalability-like encoder and includes a sequence of incoming frames 1750, 1751, 1752, … etc., which are coded with respect to decoded frames of super-view 1. In super-view 2, only B picture coding of the super-view 2 frames are used, each of which use pairs of decoded frames of super-view 1 as anchors. Although B pictures are used, no reordering of super-view 2 frames is necessary, as these B pictures use different semantics as compared to B pictures used in coding of super-view 1. The prediction structure employed in super-view 2 involves prediction of each B picture of super-view 2 using a temporally coincident frame and temporally adjacent frame from decoded super-view 1. The vertical arrows in Fig. 17 correspond to the coding with temporally coincident frames and the angled arrows correspond to the coding with the temporally adjacent frames. The temporally adjacent frames in Fig. 17 are the frames that are encoded immediately before the current super view 2 frame.

However, while Haskell’s frames 1751, 1701 and 1702 are all “same kind frames” and while Haskell’s Fig. 17 shows a B frame 1751 that is encoded based on temporally coincident B
frame 1701 and temporally adjacent B frame 1702, Haskell does not disclose or suggest a) selecting a first reference frame as one or more frames of a same kind that have a same-view relation with said current frame and that are encoded or decoded prior to said current frame, the selecting performed by a first processor of the plurality of processors; b) selecting a second reference frame as one or more second frames of the same kind having an inter-view relation with a frame of the same kind that has the same-view relation with said current frame and that is encoded or decoded immediately before said current frame, the selecting performed by the first processor of the plurality of processors; and c) encoding or decoding said current frame by making reference to the selected one or more first and second frames of the same kind. That is, assuming arguendo that Haskell’s temporally adjacent frame is equivalent to Applicant’s “frame of the same kind that has the same-view relation with said current frame and that is encoded or decoded immediately before said current frame,” Haskell’s temporally coincident frame is not equivalent to Applicant’s “one or more frames of a same kind that have a same-view relation with said current frame and that are encoded or decoded prior to said current frame.” Accordingly, amended independent claim 1 patentably defines over Haskell.

Applicant submits that amended independent claim 7 patentably defines over Haskell for reasons similar to those discussed above relative to amended independent claim 1.

Applicant has considered Sun and Chou and submits Sun and Chou do not cure the deficiencies of Haskell and Sun. As none of the cited art, individually or in combination, disclose or suggest at least the above-noted features of independent claims 1 and 7, Applicant submits the inventions defined by claims 1 and 7, and all claims depending therefrom, are not rendered obvious by the asserted references for at least the reasons stated above.
MPEP 2141 notes that an obviousness-type rejection must explain why the difference(s) between the prior art and the claimed invention would have been obvious to one of ordinary skill in the art. MPEP 2141 goes on to list exemplary rationales that may support a conclusion of obviousness. However, Applicant submits that the Official Action and the applied references present no objective evidence that would support an obviousness-type rejection of Applicant’s amended claims based on one of these exemplary rationales.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Michael E. Monaco, Registration No. 52041, at the telephone number of the undersigned below to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Director is hereby authorized in this, concurrent, and future replies to charge any fees required during the pendency of the above-identified application or credit any overpayment to Deposit Account No. 02-2448.

Dated: March 14, 2012

Respectfully submitted,

By

Esther H. Chong
Registration No.: 40953
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, VA 22040-0747
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**New Applications Under 35 U.S.C. 111**
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.
AMENDMENT TRANSMITTAL LETTER

Application No. 11/813,969 - Conf. #9254
Filing Date July 13, 2007
Examiner B. L. OLION
Art Unit 2439

Applicant(s): Yung-Lyul LEE et al.

Invention: REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

Transmitted herewith is an amendment in the above-identified application.

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☐ No additional fee is required for this amendment.

☐ Please charge Deposit Account No. 02-2448 in the amount of $ 0.00.
   A duplicate copy of this sheet is enclosed.

☐ A check in the amount of $ 0.00 is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director is hereby authorized to charge and credit Deposit Account No. 02-2448 as described below.

☐ Credit any overpayment.

☐ Charge any additional filing or application processing fees required under 37 C.F.R. §§ 1.16 and 1.17.

Esther H. Chong
Attorney Reg. No.: 40953

Dated: March 14, 2012

BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, VA 22040-0747
703-205-8000
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Substitute for Form PTO-875

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** If the "Highest Number Previously Paid For" in THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" in THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner: /CHARMIE CARTER/
Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com
**Office Action Summary**

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<tbody>
<tr>
<td>BRIAN OLION</td>
<td>2439</td>
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**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1) [x] Responsive to communication(s) filed on **24 October 2011**.

2a) [ ] This action is FINAL.  
2b) [x] This action is non-final.

3) [ ] An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

4) [ ] Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

5) [x] Claim(s) **1,2,5-8,11 and 12** is/are pending in the application.

5a) Of the above claim(s) ____ is/are withdrawn from consideration.

6) [ ] Claim(s) ____ is/are allowed.

7) [x] Claim(s) **1,2,5-8,11 and 12** is/are rejected.

8) [ ] Claim(s) ____ is/are objected to.

9) [ ] Claim(s) ____ are subject to restriction and/or election requirement.

**Application Papers**

10) [ ] The specification is objected to by the Examiner.

11) [x] The drawing(s) filed on **13 July 2007** is/are: a) [x] accepted or b) [ ] objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12) [ ] The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

13) [x] Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) [x] All  

b) [ ] Some * c) [ ] None of:

1. [x] Certified copies of the priority documents have been received.

2. [ ] Certified copies of the priority documents have been received in Application No. ____.

3. [ ] Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

<table>
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DETAILED ACTION

Claims 1-2, 5-8, and 11-12 are pending

Response to Arguments

1. Applicant’s arguments with respect to claims 1-2, 5-8, and 11-12 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

   (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in Graham v. John Deere Co., 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

   1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1-2, 5-8, and 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Haskell USPN 6,055,012, and further in view of Sun USPN 2006/0013490.

As per claims 1 and 7, Haskell teaches A method of setting an order of reference frames for multi-view coding, performed by one or more processors the method selecting a reference frame for a current frame to be encoded or decoded among a plurality of frames successively generated by a plurality of cameras along time, the method comprising:

one or more frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, and encoding or decoding said current frame by making reference to the selected one or more frames of the same kind, [wherein said one or more frames of the same kind is a P frame] (Haskell col. 13 line 50 – col. 14 line 35, and Figs 17-19. there is an encoder value selected x (i.e. 3), this corresponds to the anchor frames and there are x-1 B frames in between these anchor frames, thus for a B frame (i.e. Fig 17 item 1702) it has a reference B frame
(i.e. 1701) a reference I frame (i.e. 1700) and a reference P frame (i.e. 1703). The 1701, 1700, and 1703 are all encode/decode prior to the 1701 frame and are thus used as references)

**Haskell doesn’t teach**, wherein said one or more frames of the same kind is a P frame **but Sun teaches** wherein said one or more frames of the same kind is a P frame *(Sun Fig. 1 there is decoding done using P frames from the same camera view)*

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have a P frame decoding a P frame in a 3D environment in order to provide better coding efficiency than conventional techniques. *(Sun Par 009)*

**As per claim 2 and 8, the combination of Haskell-Sun teaches** The method of claim 1, wherein said number of frames of the same kind, included in said first reference frame, are extracted in the reverse order of encoding or decoding *(Haskell col. 13 line 50 – col. 14 line and Figs 17-19, the B frame 1702 frame is encoded after the 1703 frame, but is extracted before)*

**As per claim 5 and 11, the combination of Haskell-Sun teaches** The method of claim 1, wherein a plurality of frames generated by said plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame are encoded or decoded in the order of an I frame, a P frame, a first B frame, and a second B frame about the time axis *(Haskell col. 1 line 45- col. 14 line 35, the 1700 frame (I
frame) is encoded first then the 1703 (P frame) then the 1701 and 1702 frames (B frames)).

4. Claims 6 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Haskell and Sun as applied to claim 1 above, and further in view of Chou USPN 2005/0129128.

As per claim 6 and 12, the combination of Haskell-Sun teaches The method of claim 1, the combination doesn’t teach, wherein picture information inputted by said plurality of cameras is generated as one of the forms consisting of 1-D parallel data, I-D arc data, and 2-D parallel data but Chou teaches wherein picture information inputted by said plurality of cameras is generated as one of the forms consisting of 1-D parallel data, I-D arc data, and 2-D parallel data (Chou Fig 8 and 9, the data is generated as 1-D parallel data, see also Haskell).

It would have been obvious to one of ordinary skill in the art at the time of the invention to implement 1-D parallel data as taught by Chou in order to effectively encode (Chou Summary of Invention)

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant’s disclosure.
Winder USPN 2006/0029134 – par 44-48, using multiple views to encode/decode.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRIAN OLION whose telephone number is (571)270-3353. The examiner can normally be reached on 5/4/9.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Edan Orgad can be reached on 571-272-7884. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/BRIAN OLION/
Examiner, Art Unit 2439

/Edan Orgad/
Supervisory Patent Examiner, Art Unit 2439
**Index of Claims**

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### EAST Search History

#### EAST Search History (Prior Art)

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**Examiner**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application of:
Yung-Lyul LEE et al.

Application No.: 11/813,969
Confirmation No.: 9254

Filed: July 13, 2007
Art Unit: 2439

For: REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING
Examiner: B. L. Olion

AMENDMENT UNDER 37 C.F.R. § 1.111

MS AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In reply to the Office Action dated July 22, 2011, the following amendments and remarks are respectfully submitted in connection with the above-identified application:

Amendments to the Specification begin on page 2.
Amendments to the Abstract of the Disclosure begin on page 3.
Amendments to the Claims begin on page 4.
Remarks begin on page 7.
AMENDMENTS TO THE SPECIFICATION

Please amend the specification on page 1, line 1 as shown below:

[DESCRIPTION]

Please amend the specification on page 1, line 2 as shown below:

[Invention-Title]

Please amend the specification on page 1, line 5 as shown below:

[Technical-Field] Field of the Invention

Please amend the specification on page 1, line 10 as shown below:

[Background-Art] Background Art

Please amend the specification on page 2, beginning with line 8 as shown below:

The I frame does simply codifies the frame by discrete cosine transform, without using motion estimation/compensation. The P frame does motion estimation/compensation while referring to the I frame or other P frames, and then codifies the rest of the data by discrete cosine transform. The B frame does motion compensation, like the P frame, but carries out motion estimation/compensation from two frames on the time axis.

Please amend the specification on page 3, line 17 as shown below:

[Disclosure]

Please amend the specification on page 3, line 18 as shown below:

[Technical-Problem] Summary of the Invention

Please amend the specification on page 4, line 15 as shown below:

[Technical-Solution]

Please amend the specification on page 7, line 14 as shown below:

[Description of Drawings] Description of Drawings

Please amend the specification on page 8, line 10 as shown below:

[Mode-for-Invention] Description of Embodiments of Invention

Please amend the specification on page 17, line 2 as shown below:

[Industrial-Applicability]
AMENDMENTS TO THE ABSTRACT OF THE DISCLOSURE

Please amend the Abstract of the Disclosure as follows:

A method for setting the order of reference frames for multi-view coding and a recorded medium recording the method are disclosed. The method of setting the order of reference frames, in accordance with an embodiment of the present invention, comprises the steps of selecting the n (integer) number of frames of the same kind that have a same-view relation with said current frame and are encoded or decoded prior to said current frame as a first reference frame, selecting the m (integer) number of frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with said current frame and encoding or decoding said current frame by making reference to the frames of the same kind included in said first reference frame and said second reference frame. With the present invention, an improved picture quality and threedimensionality can be provided, and the delay in processing time can be prevented when using the reference frame. A method of setting an order of reference frames for multi-view coding performed by one or more processors. The method includes selecting one or more frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before; and encoding or decoding the current frame by making reference to the selected one or more kind. Further, the one or more frames of the same kind is a P frame.
AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method of setting the order of reference frames for multi-view coding performed by one or more processors, the method selecting a reference frame for a current frame to be encoded or decoded among a plurality of frames successively generated by a plurality of cameras along the time, the method comprising the steps of:

   selecting the n (integer) number of frames of the same kind that have a same view relation with said current frame and are encoded or decoded prior to said current frame as a first reference frame;

   selecting the m (integer) number of one or more frames of the same kind that have a same view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same view relation with said current frame; and

   encoding or decoding said current frame by making reference to the frames of the same kind included in said first reference frame and said second reference frame, the selected one or more frames of the same kind,

   wherein said one or more frames of the same kind is a P frame.

2. (Currently Amended) The method of claim 1, wherein said n number of one or more frames of the same kind, included in said first reference frame, are extracted in the reverse order of encoding or decoding.

3. (CANCELED)

4. (CANCELED)

5. (Currently Amended) The method of claim 1, wherein a plurality of frames generated by said plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame are encoded or decoded in the temporal order of an I frame, a P frame, a first B frame, and a second B frame about the time axis.
6. (Currently Amended) The method of claim 1, wherein picture information inputted by said plurality of cameras is generated as one of the forms consisting of including 1-D parallel data, 1-D arc data, and 2-D parallel data.

7. (Currently Amended) A non-transitory recorded medium tangibly embodying a program of instructions executable by an encoding device or a decoding device to perform a method of having one or more processors for setting the an order of reference frames for multi-view coding, the program readable by said encoding device or decoding device, the recorded medium executing the steps of:

   selecting the n (integer) number of frames of the same kind that have a same-view relation with said current frame and are encoded or decoded prior to said current frame as a first reference frame, wherein said current frame is a frame to be currently encoded or decoded among a plurality of frames successively generated by a plurality of cameras along the time;

   selecting the m (integer) number of one or more frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with said current frame; and

   encoding or decoding said current frame by making reference to the frames of the same kind—included in said first reference frame and said second reference frame, the selected one or more frames of the same kind,

   wherein said one or more frames of the same kind is a P frame.

8. (Currently Amended) The recorded medium of claim 7, wherein said n number of one or more frames of the same kind, included in said first reference frame, are extracted in the reverse order of encoding or decoding.

9. (Canceled)

10. (Canceled)

11. (Currently Amended) The recorded medium of claim 7, wherein a plurality of frames
generated by said plurality of cameras in-the-a temporal order of an I frame, a first B frame, a second B frame, and a P frame are encoded or decoded in-the-an order of an I frame, a P frame, a first B frame, and a second B frame about-the-a time axis.

12. (Currently Amended) The recorded medium of claim 7, wherein picture information inputted by said plurality of cameras is generated as one of the forms-consisting-of-including 1-D parallel data, 1-D arc data, and 2-D parallel data.
REMARKS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1, 2, 5-8, 11 and 12 are pending in this application. Claims 3, 4, 9 and 10 are canceled and claims 1, 2, 5-8, 11 and 12 have been amended by the present Amendment.

In the outstanding Office Action, claims 1-12 were rejected under 35 U.S.C. § 101; claims 1, 3, 7 and 9 were rejected under 35 U.S.C. § 112, second paragraph; and claims 1-12 were rejected under 35 U.S.C. § 103(a) as unpatentable over Chou in view of Haskell.

Regarding the rejection of claims 1-12 under 35 U.S.C. § 101, claim 1 has been amended to be tied to a particular piece of hardware, and claim 7 has been amended to recite a non-transitory recording medium. Accordingly, it is respectfully requested this rejection be withdrawn.

Regarding the rejection of claims 1 and 7 under 35 U.S.C. § 112, second paragraph, claims 1 and 7 have been amended to address the comments noted in the Office Action, (claims 3 and 9 have been canceled).

Claims 1-12 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Chou in view of Haskell. This rejection is respectfully traversed.

Amended independent claim 1 includes a combination of features and is directed to a method of setting an order of reference frames for multi-view coding performed by one or more processors, the method selecting a reference frame for a current frame to be encoded or decoded among a plurality of frames successively generated by a plurality of cameras along time, the method comprising: selecting one or more frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before; and encoding or decoding said current frame by making reference to the selected one or more frames of the same kind. Further, the one or more frames of the same kind is a P frame. Independent claim 7 includes similar features in a varying scope.

These features are supported at least by the non-limiting example shown in Figs. 1-4 and described in the corresponding description in the specification. For example, these figures illustrate a method of setting an order of reference frames for multi-view coding performed by one or more processors (see page 12, lines 7-11), the method selecting a reference frame for a
current frame to be encoded or decoded among a plurality of frames successively generated by a plurality of cameras 120a-120n in Figs. 1 and 2 along time, the method comprising: selecting one or more frames of the same kind that have a same-view relation (P frames 255, 260 and 265 in Fig. 4) with said current frame (P frame 250) and have an inter-view relation (P frames 270 and 275) with a frame of the same kind, which is encoded or decoded immediately before (see Fig. 4); and encoding or decoding said current frame (P frame 250) by making reference to the selected one or more frames of the same kind, wherein said one or more frames of the same kind is a P frame (see Fig. 4).

As discussed in the background art of the present application, the current picture information is not 2-dimensional but 3-dimensional, and thus development of technology related to 3-dimensional picture information is needed in order to deliver realistic, natural multimedia information (see page 3, lines 6-9, for example).

As discussed above, the present invention solves the problems of the related art by selecting one or more frames of the same kind that have a same-view (a same camera) relation with said current frame and have an inter-view relation (different camera) with a frame of the same kind, which is encoded or decoded immediately before. Further, the frame of the same kind is a P frame as shown in the example in Fig. 4, for example.

Thus, in the present invention, a P frame is encoded/decoded by making reference to a P frame only. However, Haskell and Chou make reference to an I frame to encode/decode a P frame and make reference to a P frame to encode/decode a B frame as is done in the background art of the present application. Haskell also does not teach or suggest making reference to a P frame having an inter-view relation with a P frame.

Accordingly, it is respectfully submitted independent claims 1 and 7 and each of the claims depending therefrom are allowable.

Further, the specification has been amended to include the proper headings and to correct other minor formalities. A new Abstract has also been added to correspond with U.S. patent practice. No new matter has been added.
CONCLUSION

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Michael E. Monaco, Reg. No. 52,041, at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§ 1.16 or 1.147; particularly, extension of time fees.

Dated: October 24, 2011

Respectfully submitted,

[Signature]

DAVID A. BILODEAU
USPTO #42,325

Esther H. Chong
Registration No.: 40,953
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, VA 22040-0747
703-205-8000
## Electronic Acknowledgement Receipt

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<td>Reference Frame Ordering For Multi-View Coding</td>
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<tr>
<td>First Named Inventor/Applicant Name:</td>
<td>Yung-Lyul Lee</td>
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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.
AMENDMENT TRANSMITTAL LETTER

Application No. 11/813,989 - Conf. #9254
Filing Date June 13, 2007
Examiner B. L. Olion
Art Unit 2439

Applicant(s): Yung-Lyu LEE et al.

Invention:REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Transmitted herewith is an amendment in the above-identified application.
The fee has been calculated and is transmitted as shown below.

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TOTAL ADDITIONAL FEE FOR THIS AMENDMENT: 0.00

[Box marked] X Large Entity [ ] Small Entity

[Box marked] X No additional fee is required for this amendment.

[ ] Please charge Deposit Account No. 02-2448 in the amount of $ 0.00.

A duplicate copy of this sheet is enclosed.

[ ] A check in the amount of $ 0.00 is enclosed.

[ ] Payment by credit card. Form PTO-2038 is attached.

[Box marked] X The Director is hereby authorized to charge and credit Deposit Account No. 02-2448 as described below.

[Box marked] X Credit any over payment.

[Box marked] X Charge any additional filing or application processing fees required under 37 C.F.R. §§ 1.16 and 1.17.

Dated: October 24, 2011

Esther H. Chong
Attorney Reg. No.: 40,953

BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, VA 22040-0747
703-205-8000

DAVID A. BILODEAU
USPTO #42,325
### PATENT APPLICATION FEE DETERMINATION RECORD

**Application or Docket Number:** 11/813,969  
**Filing Date:** 07/13/2007  
**To be Mailed:**

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*** If the “Highest Number Previously Paid For” in this SPACE is less than 3, enter “3”.

**Legal Instrument Examiner:**
PAMELA THERATT

---

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.
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2292             7590        07/22/2011
BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com
**Office Action Summary**

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--- The MAILING DATE of this communication appears on the cover sheet with the correspondence address ---

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1) ☑ Responsive to communication(s) filed on 13 July 2007.
2a) ☐ This action is FINAL. 2b) ☑ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4) ☑ Claim(s) 1-12 is/are pending in the application.
   4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☑ Claim(s) 1-12 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9) ☐ The specification is objected to by the Examiner.
10) ☑ The drawing(s) filed on 13 July 2007 is/are: a) ☑ accepted or b) ☐ objected to by the Examiner.

   Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

   Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12) ☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☑ All  b) ☐ Some  c) ☐ None of:
      1. ☑ Certified copies of the priority documents have been received.
      2. ☑ Certified copies of the priority documents have been received in Application No. _____.
      3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

   * See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☑ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsman’s Patent Drawing Review (PTO-948)
3) ☑ Information Disclosure Statement(s) (PTO/SB/08)
   Paper No(s)/Mail Date 7/13/2007
4) ☐ Interview Summary (PTO-413)
   Paper No(s)/Mail Date _____
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____
DETAILED ACTION

Claims 1-12 are pending

Claim Rejections - 35 USC § 101

1. 35 U.S.C. 101 reads as follows:

   Whoever invents or discovers any new and useful process, machine,
   manufacture, or composition of matter, or any new and useful
   improvement thereof, may obtain a patent therefor, subject to the
   conditions and requirements of this title.

Claims 1-7 are rejected under 35 U.S.C. 101 because the claimed invention is

directed to non-statutory subject matter. Claim 1 recites a method claim, but the
method is not tied to a particular piece of hardware. Method claims must be tied
to a particular machine or transform a particular article (In re Bilski, 545 F.3d 943,
88 U.S.P.Q.2d 1385)

Claims 7-12 are rejected under 35 U.S.C. 101 because the claimed
invention is directed to non-statutory subject matter. Claim 12 recites a recoded
medium. However, it is unclear is this recorded medium is a transitory or non-
transitory medium. A transitory medium is non patentable subject matter. The
Examiner suggests for applicant to specify the medium as a non-transitory
medium to avoid misinterpretation, and overcome the rejection. Applicant is also
welcome to distinctly recite the medium (i.e. CD-ROM) to overcome the rejection.
Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:
   The specification shall conclude with one or more claims particularly
   pointing out and distinctly claiming the subject matter which the applicant
   regards as his invention.

2. Claims 1 and 7 are rejected under 35 U.S.C. 112, second paragraph, as
   being indefinite for failing to particularly point out and distinctly claim the subject
   matter which applicant regards as the invention. Claims state the n number and
   the m number, but these are indefinite values, as this number could be anything.

3. Claims 3 and 9 are rejected under 35 U.S.C. 112, second paragraph, as
   being indefinite for failing to particularly point out and distinctly claim the subject
   matter which applicant regards as the invention. Claims state the k number of
   frames, but these is an indefinite value as it could be anything.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for
   all obviousness rejections set forth in this Office action:

   (a) A patent may not be obtained though the invention is not identically
   disclosed or described as set forth in section 102 of this title, if the
   differences between the subject matter sought to be patented and the
   prior art are such that the subject matter as a whole would have been
obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negativied by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertain[ing] the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 1-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chou USPN 2005/0129128, and further in view of Haskell USPN 6,055,012.

**As per claims 1 and 7, Chou teaches** A method of setting the order of reference frames for multi-view coding/the method selecting a reference frame for a current frame to be encoded or decoded among a plurality of frames successively generated by a plurality of cameras along the time, the method comprising the steps off:
selecting the n (integer) number of frames of the same kind that have a same-view relation with said current frame and are encoded or decoded prior to said current frame as a first reference frame (Chou Par 60-62, each view's frames may be predicted its own frames or by frames captured by nearby cameras. Fig 11, shows different cameras obtaining different frames thus encoding a frame produced by camera 1 uses previous camera 1 frames (i.e. selecting the n number of frames) and or frames from camera 2)

Chou doesn’t explicitly state number of frames of the same kind, but Haskell teaches number of frames of the same kind (Haskell col. 13 line 50 – col. 14 line 35, and Figs 17-19. there is an encoder value selected x (i.e. 3), this corresponds to the anchor frames and there are x-1 B frames in between these anchor frames, thus 2 B frames (i.e. selecting the number of frames of the same kind) are selected. And the encoding of the B frame is based on a previous B frame and other anchor frames (I or P))

It would have been obvious to one of ordinary skill in the art at the time of the invention to implement encoding as taught by Haskell into the multi view camera of Chou in order to effectively compress data (Haskell col. 13 line 50 - col. 14 line 35 and col. 3 line 35 – col. 30)

Chou doesn’t teach, selecting the m (integer) number of frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded
immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with said current frame and encoding or decoding said current frame by making reference to the frames of the same kind included in said first reference frame and said second reference frame, **but Haskell teaches** selecting the m (integer) number of frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with said current frame and encoding or decoding said current frame by making reference to the frames of the same kind included in said first reference frame and said second reference frame. (Haskell col. 13 line 50 – col. 14 line 35, and Figs 17-19. there is an encoder value selected x (i.e. 3), this corresponds to the anchor frames and there are x-1 B frames in between these anchor frames, thus for a B frame (i.e. Fig 17 item 1702) it has a reference B frame (i.e. 1701) a reference I frame (i.e. 1700) and a reference P frame (i.1. 1703). The 1701 1700 and 1703 are all encode/decode prior to the 1701 frame and are thus uses as references)

**As per claim 2 and 8, the combination of Chou-Haskell teaches** The method of claim 1, wherein said n number of frames of the same kind, included in said first reference frame, are extracted in the reverse order of encoding or decoding (Haskell col. 13 line 50 – col. 14 line and Figs 17-19, the B frame
1702 frame is encoded after the 1703 frame, but is extracted before).

As per claim 3 and 9, the combination of Chou-Haskell teaches The method of claim 1, wherein, in case the method further comprises the step of selecting the k (integer) number of frames of the same kind having an inter-view relation with said current frame as a third reference frame, said current frame is encoded or decoded by making reference to the frames of the same kind included in said first through third reference frames (Haskell col. 13 line 50 – col. 14 line 35, and Figs 17-19. there is an encoder value selected x (i.e. 3), this corresponds to the anchor frames and there are x-1 B frames in between these anchor frames, thus for a B frame (i.e. Fig 17 item 1702) it has a reference B frame (i.e. 1701) a reference I frame (i.e. 1700) and a reference P frame (i.1. 1703). The 1701 1700 and 1703 are all encode/decode prior to the 1701 frame and are thus uses as references).

As per claim 4 and 10, the combination of Chou-Haskell teaches The method of claim 1, wherein said frame of the same kind is a P frame of a B frame that is the same kind as said current frame (Haskell Fig 17-19 and col.13 lines 45-65, the frames can be a P frame).

As per claim 5 and 11, the combination of Chou-Haskell teaches The method of claim 1, wherein a plurality of frames generated by said plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame,
and a P frame are encoded or decoded in the order of an I frame, a P frame, a first B frame, and a second B frame about the time axis (Haskell col. 1 line 45-col. 14 line 35, the 1700 frame (I frame) is encoded first then the 1703 (P frame) then the 1701 and 1702 frames (B frames)).

As per claim 6 and 12, the combination of Chou-Haskell teaches The method of claim 1, wherein picture information inputted by said plurality of cameras is generated as one of the forms consisting of 1-D parallel data, 1-D arc data, and 2-D parallel data (Chou Fig 8 and 9, the data is generated as 1-D parallel data, see also Haskell).

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Winder USPN 2006/0029134 – par 44-48, using multiple views to encode/decode.

Sun USPN 2006/0013490 – coding video to be viewed in 3D utilizing multiple views.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRIAN OLION whose telephone number is (571)270-3353. The examiner can normally be reached on 5/4/9.
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edan Orgad can be reached on 571-272-7884. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Christian LaForgia/
Primary Examiner, Art Unit 2439

/BRIAN OLION/
Examiner, Art Unit 2439
## Notice of References Cited

**U.S. PATENT DOCUMENTS**

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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)

Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

U.S. Patent and Trademark Office
PTO-892 (Rev. 01-2001)  Notice of References Cited  Part of Paper No. 20110609
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**SERIAL NUMBER**
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**FILING or 371(c) DATE**
07/13/2007

**CLASS**
375

**GROUP ART UNIT**
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**ATTORNEY DOCKET NO.**
5200-0104PUS1

**APPLICANTS**
- Yung-Lyul Lee, Seoul, KOREA, REPUBLIC OF;
- Euee-S Jang, Seoul, KOREA, REPUBLIC OF;
- Chung-Ku Lee, Incheon, KOREA, REPUBLIC OF;

**CONTINUING DATA ***************
This application is a 371 of PCT/KR05/04250 12/13/2005

**FOREIGN APPLICATIONS ***************
REPUBLIC OF KOREA 10-2005-0003948 01/14/2005

**IF REQUIRED, FOREIGN FILING LICENSE GRANTED **
02/26/2008

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**ADDRESS**
BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747
UNITED STATES

**TITLE**
Reference Frame Ordering For Multi-View Coding

**FILING FEE RECEIVED**
900

**FEES:** Authority has been given in Paper No. ___________ to charge/credit DEPOSIT ACCOUNT No. ___________ for following:

- ☐ All Fees
- ☐ 1.16 Fees (Filing)
- ☐ 1.17 Fees (Processing Ext. of time)
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Yung-I.yul LEE et al.

Application No.: NEW
Confirmation No.: N/A

Filed: July 13, 2007
Art Unit: N/A

For: REFERENCE FRAME ORDERING FOR
MULTI-VIEW CODING
Examiner: Not Yet Assigned

INFORMATION DISCLOSURE STATEMENT (IDS)

MS PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Pursuant to 37 CFR 1.56, 1.97 and 1.98, the attention of the Patent and Trademark Office is hereby directed to the references listed on the attached PTO/SB/08. It is respectfully requested that the information be expressly considered during the prosecution of this application, and that the references be made of record therein and appear among the “References Cited” on any patent to issue therefrom.

This Information Disclosure Statement accompanies the new patent application submitted herewith.

A summary/abstract translation of the non-English language references is enclosed.

In accordance with 37 CFR 1.98(a)(2)(ii), Applicant has not submitted copies of U.S. patents and U.S. patent applications. Applicant submits herewith copies of foreign patents and non-patent literature in accordance with 37 CFR 1.98(a)(2).
A concise explanation of relevance of the items listed on form PTO/SB/08 is in the form of an English language copy of a Search Report from a foreign patent office, issued in a counterpart application, which refers to the relevant portions of the references.

In accordance with 37 CFR 1.97(g), the filing of this Information Disclosure Statement shall not be construed to mean that a search has been made or that no other material information as defined in 37 CFR 1.56(a) exists. In accordance with 37 CFR 1.97(h), the filing of this Information Disclosure statement shall not be construed to be an admission that any patent, publication or other information referred to therein is "prior art" for this invention unless specifically designated as such.

It is submitted that the Information Disclosure Statement is in compliance with 37 CFR 1.98 and the Examiner is respectfully requested to consider the listed references.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to our Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under § 1.17, particularly, extension of time fees.

Dated: July 13, 2007

Respectfully submitted,

[Signature]

By

James T. Eller, Jr.
Registration No.: 39,538
Registration # 27295

BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road
Suite 100 East
P.O. Box 747
Falls Church, Virginia 22040-0747
(703) 205-8000
Attorney for Applicant

Attachment(s)
**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**

(Use as many sheets as necessary)

| Sheet | 1 of 1 |

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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 608. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: These application(s) which are marked with an asterisk (*) next to the Cite No. are not supplied under 37 CFR 1.98(h)(2)(B) because that application was filed after June 30, 2003 or is available in the IFW. 
* Applicant's unique citation designation number (optional). 
* See kind codes of USPTO Patent Documents at www.uspto.gov or MPEP 801.04. 
* Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 
* For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 
* Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.10 if possible. 
* Applicant is to place a check mark here if English language Translation is attached.
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I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with 37 CFR 1.8(a)(4):

MS PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

on July 13, 2007
Date

Signature

James T. Eller, Jr.
Typed or printed name of person signing Certificate

39,538
Registration Number, if applicable

(703) 205-8000
Telephone Number

Note: Each paper must have its own certificate of mailing.

Electronic Certificate for Information Disclosure Statement (Fillable PDF).
## EAST Search History

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**EAST Search History (Interference)**

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**6/15/2011 7:07:35 PM**
CONFIRMATION NO. 9254

BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747

Title: Reference Frame Ordering For Multi-View Coding

Publication Date: 06/05/2008

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publicly available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 306-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Pre-Grant Publication Division, 703-605-4283
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**CONFIRMATION NO. 9254**

**FILING RECEIPT**

Date Mailed: 03/03/2008

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination's Filing Receipt Corrections. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections.

**Applicant(s)**

Yung-Lyul Lee, Seoul, KOREA, REPUBLIC OF;
Euee-S Jang, Seoul, KOREA, REPUBLIC OF;
Chung-Ku Lee, Incheon, KOREA, REPUBLIC OF;

**Power of Attorney:** The patent practitioners associated with Customer Number 2292

**Domestic Priority data as claimed by applicant**

This application is a 371 of PCT/KR05/04250 12/13/2005

**Foreign Applications**

REPUBLIC OF KOREA 10-2005-0003948 01/14/2005

**If Required, Foreign Filing License Granted:** 02/26/2008

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 11/813,969**

**Projected Publication Date:** 06/05/2008

**Non-Publication Request:** No

**Early Publication Request:** No
PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process simplifies the filing of patent applications on the same invention in member countries, but does not result in a grant of “an international patent” and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

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Applicants may wish to consult the USPTO booklet, “General Information Concerning Patents” (specifically, the section entitled “Treaties and Foreign Patents”) for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

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Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

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NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office in its capacity as a Designated / Elected Office (37 CFR 1.495), has determined that the above identified international application has met the requirements of 35 U.S.C. 371, and is ACCEPTED for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above and the relevant dates are:

07/13/2007
DATE OF RECEIPT OF 35 U.S.C. 371(c)(1), (c)(2) and (c)(4) REQUIREMENTS

07/13/2007
DATE OF COMPLETION OF ALL 35 U.S.C. 371 REQUIREMENTS

A Filing Receipt (PTO-103X) will be issued for the present application in due course. THE DATE APPEARING ON THE FILING RECEIPT AS THE "FILING DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 (c)(1), (c)(2) and (c)(4) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN ABOVE. The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363). Once the Filing Receipt has been received, send all correspondence to the Group Art Unit designated thereon.

The following items have been received:

• Copy of the International Application filed on 07/13/2007
• Copy of the International Search Report filed on 07/13/2007
• Copy of IPE Report filed on 07/13/2007
• Information Disclosure Statements filed on 07/13/2007
• Oath or Declaration filed on 07/13/2007
• Request for Immediate Examination filed on 07/13/2007
• U.S. Basic National Fees filed on 07/13/2007
• Priority Documents filed on 07/13/2007
Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

VIRGINIA L. IRBY

Telephone: (703) 308-9140 EXT 229
NOTICE OF NEW OR REVISED PROJECTED PUBLICATION DATE

The above-identified application has a new or revised projected publication date. The current projected publication date for this application is 06/05/2008. If this is a new projected publication date (there was no previous projected publication date), the application has been cleared by Licensing & Review or a secrecy order has been rescinded and the application is now in the publication queue.

If this is a revised projected publication date (one that is different from a previously communicated projected publication date), the publication date has been revised due to processing delays in the USPTO or the abandonment and subsequent revival of an application. The application is anticipated to be published on a date that is more than six weeks different from the originally-projected publication date.

More detailed publication information is available through the private side of Patent Application Information Retrieval (PAIR) System. The direct link to access PAIR is currently http://pair.uspto.gov. Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Questions relating to this Notice should be directed to the Office of Patent Publication at 1-888-786-0101.

PART 1 - ATTORNEY/APPLICANT COPY
# DO/ EO WORKSHEET

Virginia Irby, Patent Application Specialist/ National Stage Division

U.S. Appl. No. 11/813969

International Appl. No. PCT/KRO6/04250

Application filed by:  
☐ 20 months  ☑ 30 months

## WIPO PUBLICATION INFORMATION:

- **Publication No.**: WO2006/158447
- **Publication Language**: ☑ English  ☐ German  ☐ Japanese  ☐ Chinese  ☐ Korean  ☐ French  ☐ Spanish  ☐ Russian  ☐ Other: ________
- **Publication Date**: 20 Jul 2006
- **Not Published**: ☐ U.S. only designated  ☐ EP request  ☑ Published:  ☑ EP request

## INTERNATIONAL APPLICATION PAPERS IN THE APPLICATION FILE:

- ☑ International Application (RECORD COPY)
- ☑ Article 19 Amendments
  -  ☑ US  ☑ FR  ☑ CN  ☐ ES  ☑ RU  ☐ AT  ☐ KR  ☐ __________
- ☑ Annexes to 409
    -  ☑ US  ☑ FR  ☑ CN  ☐ ES  ☑ RU  ☐ AT  ☐ KR  ☐ __________
- ☑ Search Report References
  -  ☑ Priority Document(s) No. __________
  -  ☑ N/A  ☑ Priority Document was NOT AVAILABLE at the time of paralegal review
  -  ☑ Other:
- ☑ Preliminary Amendment(s) Filed on:
  -  ☑ same as 371 request date 1. __________  2. __________  3. __________
- ☑ Information Disclosure Statement(s) Filed on:
  -  ☑ same as 371 request date 1. __________  2. __________  3. __________
- ☑ Assignment Document (forwarded to Assignment Branch)
- ☑ Assignee Statement Under 37 CFR 3.73(b)
- ☑ Assignee PG Publication Notice
- ☑ Substitute Specification Filed on:
  -  ☑ same as 371 request date 1. __________  2. __________  3. __________
- ☑ Verified Small Status Statement
- ☑ Oath/ Declaration (executed)
- ☑ Oath/ Declaration ☐ unsigned  ☐ no citizenship  ☐ other
- ☑ DNA Diskette  ☐ Sequence Listing
- ☑ Other:

## RECEIPTS FROM THE APPLICANT (other than checked above):

- ☑ Basic National Fee (or authorization to charge) 17
- ☑ Description  ☑ Claims  ☑ Abstract
- ☑ Drawing Figure(s) - (# of drwgs. 9)
- ☑ Translation of Article 19 Amendments ☐ entered  ☐ not entered:
  -  ☑ not a page for page substitution  ☑ replaced by Article 34 Amendment
- ☑ Annexes to 409
  -  ☑ entered  ☐ not entered:
    -  ☑ not a page for page substitution  ☑ no translation  ☐ other:
- ☑ Application Data Sheet
- ☑ Power of Attorney
- ☑ Change of Address

## NOTES:

- ☑ I.A. used as Specification  ☐ Other:

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Date Acceptable Oath/Declaration Received 13 July 2007

Date of Completion of requirements under 35 U.S.C. 371 13 July 2007

Date of Completion of DO/ EO 903 - Notification of Acceptance 26 Feb 2008

Date of Completion of DO/ EO 905 - Notification of Missing Requirements

Date of Completion of DO/ EO 909 - Notification of Abandonment

Date of Completion of DO/ EO 916 - Notification of Defective Response

Date of Completion of DO/ EO 922 - Notification to Comply w/ Requirements for Patent Applications Containing Nucleotide and/or Amino Acid Sequence Disclosures

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**Effective December 8, 2004**

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* First Presentation of Multiple Dependent Claim

**Notes:**
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- ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than '20', enter '20'.
- *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than '3', enter '3'.
- The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Yung-Lyul LEE et al.

Application No.: NEW
Confimation No.: N/A

Filed: July 13, 2007
Art Unit: N/A

For: REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING
Examiner: Not Yet Assigned

INFORMATION DISCLOSURE STATEMENT (IDS)

MS PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Pursuant to 37 CFR 1.56, 1.97 and 1.98, the attention of the Patent and Trademark Office is hereby directed to the references listed on the attached PTO/SB/08. It is respectfully requested that the information be expressly considered during the prosecution of this application, and that the references be made of record therein and appear among the “References Cited” on any patent to issue therefrom.

This Information Disclosure Statement accompanies the new patent application submitted herewith.

A summary/abstract translation of the non-English language references is enclosed.

In accordance with 37 CFR 1.98(a)(2)(ii), Applicant has not submitted copies of U.S. patents and U.S. patent applications. Applicant submits herewith copies of foreign patents and non-patent literature in accordance with 37 CFR 1.98(a)(2).
A concise explanation of relevance of the items listed on form PTO/SB/08 is in the form of an English language copy of a Search Report from a foreign patent office, issued in a counterpart application, which refers to the relevant portions of the references.

In accordance with 37 CFR 1.97(g), the filing of this Information Disclosure Statement shall not be construed to mean that a search has been made or that no other material information as defined in 37 CFR 1.56(a) exists. In accordance with 37 CFR 1.97(h), the filing of this Information Disclosure statement shall not be construed to be an admission that any patent, publication or other information referred to therein is “prior art” for this invention unless specifically designated as such.

It is submitted that the Information Disclosure Statement is in compliance with 37 CFR 1.98 and the Examiner is respectfully requested to consider the listed references.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to our Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under § 1.17; particularly, extension of time fees.

Dated: July 13, 2007

Respectfully submitted,

By
James T. Eller, Jr.
Registration No.: 39,538
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road
Suite 100 East
P.O. Box 747
Falls Church, Virginia 22040-0747
(703) 205-8000
Attorney for Applicant

Attachment(s)
**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**

(Use as many sheets as necessary)

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*EXAMINER: Initial if references considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO: These application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(3)(B)) because that application was filed after June 30, 2003 or is available in the IFW. * Applicant's unique citation designation number (optional). * See Kind Codes of USPTO Patent Documents at www.uspto.gov or MPEP 804. * Patent Office that issued the document, by the two-letter code (WIPO Standard ST.3). * For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. * Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. * Applicant is to place a check mark here if English language Translation is attached.

** Examiner Signature **

** Date Considered **

** JTE/sec **

** Birch, Stewart, Koiss & Rich, LLP **
Certificate of Electronic Filing Under 37 CFR 1.8

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with 37 CFR 1.8(e)(4):

MS PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

on ___________ July 13, 2007 Date

__________________________
Signature

__________________________
Typed or printed name of person signing Certificate

James T. Eiler, Jr.

__________________________
Registration Number, if applicable 39,536

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Telephone Number (703) 205-8000

Note: Each paper must have its own certificate of mailing.

Electronic Certificate for Information Disclosure Statement (Fillable PDF).
## Electronic Patent Application Fee Transmittal

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REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

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Charge any Additional Fees required under 37 C.F.R. Section 1.16 and 1.17

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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

**New Applications Under 35 U.S.C. 111**
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.
REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

The present invention relates to setting the order of reference frames, more specifically to a method for setting the order of reference frames for multi-view coding and a recorded medium recording the method.

In general, digital data is transmitted from a certain type of transmitting device to a certain type of receiving device. A transmitting device typically comprises an encoder encoding the data for transmission, and a receiving device typically comprises a decoder decoding the received data. A variety of digital data, such as video data, audio data, and audio/video data, can be transmitted from a transmitting device to a receiving device and outputted through a receiving device.

Dominating video compression and transmission formats comes from a family called a hybrid block-based motion-compensated transform video coder. Examples of the above coder is ITU-T VCEG video coding standards, which comprise H.261, MPEG-1, H.262/MPEG-2 video, H.263, MPEG-4 visual of VCEG (Video Coding Experts Group).
and ISO/IEC MPEG (Moving Picture Experts Group) as well as the in-process draft standard H.264/AVC. Moreover, coding and compression standards are in place to synchronize and multiplex the signals for various other types of media, including still picture, audio, document, and webpage.

Video streams are generally made up in three types of frames or pictures, which are the infra frame (I frame), predictive frame (P frame), and bi-directionally predictive frame (B frame).

The I frame does simply codifies the frame by discrete cosine transform, without using motion estimation/compensation. The P frame does motion estimation/compensation while referring to the I frame or other P frames, and then codifies the rest of the data by discrete cosine transform. The B frame does motion compensation, like the P frame, but carries out motion estimation/compensation from two frames on the time axis.

The sequence in video stream is defined by a segment called the group of pictures (GOP). In the structure of I, B, B, P, B, P, ..., the GOP refers to the frames between an I frame to the next I frame. Generally, when displayed at an intended rate, the GOP is structured in a set of pictures having a predetermined duration (e.g., 0.5 seconds).

Generally, the MPEG-2 video stream or sequence is defined by a segment called GOP. Typically, the GOP is structured in a set of pictures having a duration of 0.5 seconds, when displayed at an intended rate.
As described above, the medium for delivering picture information such as video stream has been developed from the 2-dimensional terminal technology, such as television. In other words, as the development moves from black and white pictures to color pictures, as in SD (standard definition) television and high-resolution television (e.g., HDTV), the data amount of picture information is increasing.

Consequently, the current picture information is not 2-dimensional but 3-dimensional, and thus development of technologies related to 3-dimensional picture information is needed in order to deliver reproduce realistic, natural multimedia information.

However, since the technology standard such as MPEG-2 is for coding and decoding video from one view, the design of structure and process of data for expressing multi-view information is needed in order to codify multi-view video data. Although technology standards are proposing MVP (multi-view profile) for expanding the video used in MPEG-2 to a stereo video, this still does not suggest a proper solution for coding multi-view video.

[Disclosure]

[Technical Problem]

Contrived to solve the above problems, the present invention aims to provide a method for setting the order of reference frames and a recorded medium recording the
method that can provide better picture quality and 3-dimensionality owing to utilizing
more reference frames.

The invention also aims to provide a method for setting the order of reference
frames for multi-view coding and a recorded medium recording the method that can
prevent the delay in process time when using the reference frame.

Another object of this invention is to provide a method for setting the order of
reference frames for multi-view coding and a recorded medium recording the method that
can maintain an optimal efficiency while the encoder and decoder are encoding and
decoding.

Another object of the present invention is to provide a method for setting the
order of reference frames for multi-view coding and a recorded medium recording the
method that allows a user to select a picture of desired direction among pictures of
various directions inputted through multiple cameras.

[Technical Solution]

In order to achieve the above objects, a first aspect of the present invention
provides a method for setting the order of reference frames for multi-view coding.

According to a preferred embodiment, the method for setting the order of
reference frames for multi-view coding can comprise the steps of selecting the n (integer)
number of frames of the same kind that have a same-view relation with the current frame
and are encoded or decoded prior to the current frame as a first reference frame, selecting the m (integer) number of frames of the same kind that have a same-view relation with the current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with the current frame, and encoding or decoding the current frame by making reference to the frames of the same kind included in the first reference frame and the second reference frame.

The n number of frames of the same kind, included in the first reference frame, can be extracted in the reverse order of encoding or decoding.

In case the method further comprises the step of selecting the k (integer) number of frames of the same kind having an inter-view relation with the current frame as a third reference frame, the current frame can be encoded or decoded by making reference to the frames of the same kind included in the first through third reference frames.

The frame of the same kind can be a P frame of a B frame that is the same kind as the current frame.

A plurality of frames generated by the plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame can be encoded or decoded in the order of an I frame, a P frame, a first B frame, and a second B frame about the time axis.

Picture information inputted by the plurality of cameras can be generated as one
of the forms consisting of 1-D parallel data, 1-D arc data, and 2-D parallel data.

In order to achieve aforementioned objects, a second aspect of the present invention provides a recorded medium recording a program for executing a method of setting the order of reference frames for multi-view coding.

According to a preferred embodiment of the present invention, the program recorded in the recorded medium is a program of instructions executable by a transmitting device or a receiving device, and can execute the steps of selecting the \( n \) (integer) number of frames of the same kind that have a same-view relation with the current frame and are encoded or decoded prior to the current frame as a first reference frame, wherein the current frame is a frame to be currently encoded or decoded among a plurality of frames successively generated by a plurality of cameras along the time, selecting the \( m \) (integer) number of frames of the same kind that have a same-view relation with the current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with the current frame, and encoding or decoding the current frame by making reference to the frames of the same kind included in the first reference frame and the second reference frame.

The \( n \) number of frames of the same kind, included in the first reference frame, can be extracted in the reverse order of encoding or decoding.
In case the method further comprises the step of selecting the k (integer) number of frames of the same kind having an inter-view relation with the current frame as a third reference frame, the current frame can be encoded or decoded by making reference to the frames of the same kind included in the first through third reference frames.

The frame of the same kind can be a P frame of a B frame that is the same kind as the current frame.

A plurality of frames generated by the plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame can be encoded or decoded in the order of an I frame, a P frame, a first B frame, and a second B frame about the time axis.

Picture information inputted by the plurality of cameras can be generated as one of the forms consisting of 1-D parallel data, 1-D arc data, and 2-D parallel data.

[Description of Drawings]

Fig. 1 shows an arrangement of a plurality of cameras for inputting 1-D parallel data, based on a preferred embodiment of the present invention;

Fig. 2 shows an arrangement of a plurality of cameras for inputting 1-D arc data, based on a preferred embodiment of the present invention;

Fig. 3 shows an arrangement of a plurality of cameras for inputting 2-D parallel data, based on a preferred embodiment of the present invention;
Fig. 4 shows a method of setting the order of reference frames in case the input data are 1-D parallel data and 1-D arc data, based on a preferred embodiment of the present invention;

Fig. 5 shows a method of setting the order of reference frames in case the input data is 2-D parallel data, based on a preferred embodiment of the present invention; and

Figs. 6-9 show graphs comparing the bit rate and signal-to-noise ratio according to a method for setting the order of reference frames for multi-view coding based on the anchor and the present invention.

【Mode for Invention】

In order to fully understand the present invention, the advantages of the present invention, and the objects achieved by embodying the present invention, the accompanying drawings illustrating embodiments of the present invention and their disclosed description must be referenced.

Below, preferred embodiments of the present invention will be described with reference to the accompanying drawings. To aid the overall understanding, the same reference numerals are used for the same means, regardless of the Fig. number.

Fig. 1 is an arrangement of a plurality of cameras for inputting 1-D parallel data, based on a preferred embodiment of the present invention, while Fig. 2 is an arrangement
of a plurality of cameras for inputting 1-D arc data, based on a preferred embodiment of
the present invention, and Fig. 3 is an arrangement of a plurality of cameras for inputting
2-D parallel data, based on a preferred embodiment of the present invention.

In the arrangement of a plurality of cameras for inputting 1-D parallel data, as
shown in Fig. 1, the n number of cameras, represented by 120a, 120b... 120n-1, and 120n,
are arranged in a line about the camera that is arranged perpendicular to an object 110.

When the n number of cameras 120a, 120b... 120n-1, 120n are arranged
according to a method shown in Fig. 1, the distance between each camera and the object is
different from each other. Of course, the distances between either side of the central

camera and the object 110 may be the same.

In the arrangement of a plurality of cameras for inputting 1-D arc data, as shown
in Fig. 2, the n number of cameras, represented by 120a, 120b... 120n-1, and 120n, are
sequentially arranged on an arc with a fixed distance d to an object 110.

When the n number of cameras 120a, 120b... 120n-1, 120n are arranged
according to a method shown in Fig. 2, the distance between each camera and the object
110 is the same.

In the arrangement of a plurality of cameras for inputting 2-D parallel data, as
shown in Fig. 3, a plurality of cameras, represented by 120a, 120b, 120c, 120d, and 120e,
are arranged on a pre-designated shape of structure according to a predetermined rule. Fig.
3 illustrates a cross-shaped structure, on which each camera is arranged on the center and
each projecting part. However, there can be an unlimited variety of structural shapes and the number of cameras to arrange a plurality of cameras on a structure.

Each camera arranged by each method illustrated in Figs. 1-3 receives object images inputted through the installed lens angle, with the passage of time, and generates picture information, and the picture information is structured in segments, called GOP, of I, B, B, P, B, B, P, ..., as described earlier.

The method of setting the order of reference frames and/or the scope of reference frames for efficiently encoding or decoding each frame of picture information generated by each method of camera arrangement is different from each other, and thus the description will be made below by making reference to the relevant figure.

Fig. 4 is a method for setting the order of reference frames when the input data are 1-D parallel data and 1-D arc data, based on a preferred embodiment of the present invention.

As shown in Fig. 4, the GOP of 1-D parallel data and 1-D arc data can be structured in the order of I frame, P frame, B frame, B frame, P frame, and B frame, and the frames arranged along the x-axis (i.e., time) refer to picture information independently generated by each camera. The GOP of this invention may be set to have the duration of, for example, 1 second.

The encoding/decoding of multi-view coding on 1-D parallel data and 1-D arc
data is carried out in the order of 210, 220, 230, and 240. That is, after processing I frames generated at a same moment, P frames are processed, and then the previously generated B frames are processed before the later generated B frames are processed. Then, since there is no I frame until the next GOP, the process is repeated in the order of P frame, B frame, and B frame.

Suppose, in this process order, a P frame 250 (hereinafter referred to as “current frame”) has to be encoded or decoded. Here, a transmitting device and/or receiving device can use relevant P frame information as reference frames in order to encode or decode the P frame 250. In Fig. 4, CEV means the current frame to be decoded or encoded, and R means the reference frame index ordering.

In other words, in order to encode or decode the current frame, the transmitting device and/or receiving device extracts and references information related to a first P frame 255 (R=0), which is a frame of the same kind encoded or decoded immediately before the current frame, a second P frame 260 (R=1), which is a frame of the same kind encoded or decoded immediately before the first P frame 255, a third P frame 265 (R=2), which is a frame of the same kind encoded or decoded immediately before the second P frame 260, and a third P frame 270 (R=4) and fourth P frame 275 (R=5), which are frames of the same kind encoded or decoded by being generated by installed cameras at a moment near the first P frame 255. Here, the first P frame 255, the second P frame 260, and the third P frame 265 can be said to be same-views inputted through the same camera
on the continuous time axis, and the fourth P frame 270 and the fifth P frame 275 can be
said to be inter-views inputted through neighboring cameras on the time axis that are the
same as the first P frame 265. Of course, the number of reference frames and the order of
reference, for encoding and/or decoding the current frame, can be different based on the
method of realization. For example, a sixth P frame 280, which is an inter-view inputted
through a neighboring camera on the time axis that is the same as the current frame 250.

In the method of setting the order of reference frames described above, the
encoding and/or decoding is conducted by a single processor.

However, a transmitting device and/or receiving device can be made to have a
plurality of processors independently encode and/or decode the frames generated by any
cameras. For example, a first processor processes the frames generated by the first and
fourth cameras, and the second processor processes the frames generated by the second
and fifth cameras, while the third processor processes the frames generated by the third
and sixth cameras. In this case, when setting a reference frame for the current frame, if
frames processed by other processors are set as the reference frames, other processors
must complete the processing of the reference frames before the current frame is
processed. Unless this premise is not fulfilled, delays will be inevitable for the processing
of the current frame as well as the processing of another current frame that sets the current
frame as a reference frame. Hence, if a plurality of processors process the frames in
parallel, the process efficiency can be improved by, for example, setting the same-views
only as the reference frame.

Although the process of P frames by a transmitting device and/or receiving device has been described above, it should be apparent that the same method can be applied to B frames, and thus the description will not be provided here.

Fig. 5 illustrates a method of setting the order of reference frames in case the input data is 2-D parallel data, based on a preferred embodiment of the present invention.

As shown in Fig. 5, the GOP of 2-D parallel data can be structured in the order of I frame, P frame, B frame, B frame, P frame, and B frame. In Fig. 5, the cameras are arranged in a cross shape. For the purpose of easy understanding, the arrangement of each frame is made to be identical to the arrangement of the camera. In this invention, the GOP can be set to have the duration of, for example, 1 second.

As described earlier, the encoding/decoding of multi-view coding on 2-D parallel data can be processed in the order of I frame, P frame, B frame, and B frame, and since there is no I frame until the next GOP, the process can be repeated in the order of P frame, B frame, and B frame.

Suppose, in this process order, that a P frame (hereinafter referred to as “current frame”) is to be encoded or decoded. Here, a transmitting device and/or receiving device can use relevant P frame information as reference frames in order to encode or decode the current frame. In Fig. 5, CEV means the current frame to be
decoded or encoded, and R means the reference frame index ordering.

In other words, in order to encode or decode the current frame, the transmitting device and/or receiving device extracts and references information related to a plurality of P frames, represented by 315, 320, 325, 330, and 335, having a same-view relation as a frame of the same kind encoded or decoded sequentially before the current frame, and P frames, represented by 340, 345, 350, and 355, having an inter-view relation with the P frame 315, which has a same-view relation as a frame of the same kind encoded or decoded immediately before. Here, the same-views can be said to be frames inputted through the same camera on the continuous time axis, and the inter-views can be said to be frames inputted independently through a plurality of cameras on the same time axis.

Of course, the number of reference frames and the order of reference, for encoding and/or decoding the current frame, can be different based on the method of realization. For example, in case 360 is the current frame, 310, which is already encoded or decoded after being encoded through a different camera on the same time axis, can be used as a reference frame.

In the method of setting the order of reference frames described above, the encoding and/or decoding is conducted by a single processor. However, a transmitting device and/or receiving device can be made to have a plurality of processors independently encode and/or decode the frames generated by any cameras. In this case, when setting a reference frame for the current frame, frames processed by other
processors can be restricted from being set as reference frames, thereby improving the
process efficiency.

Although the process of P frames by a transmitting device and/or receiving
device has been described above, it should be apparent that the same method can be
applied to B frames, and thus the description will not be provided here.

Figs 6 through 9 illustrate graphs comparing the bit rate and signal-to-noise ratio
according to a method for setting the order of reference frames for multi-view coding
based on the anchor and the present invention.

In the graphs shown in Figs. 6-9, the x-axis indicates the bit rate, and the y-axis
indicates the peak signal-to-noise ratio (PSNR). The anchor of each graph indicates the
conventional method of successively encoding or decoding the frames generated in a time
sequence per each camera without referring to the frames generated by other cameras.

Fig. 6 is a comparison graph for the case of an aquarium having 1-D arc data
inputted by arranging a plurality of cameras, for example, 15 cameras. As shown in Fig. 6,
when the method of setting the order of reference frames for multi-view coding based on
the present invention is used, an improvement of 0.5-0.8dB in picture quality is shown
over the conventional method.

Fig. 7 is a comparison graph for the case of a horserace having 1-D parallel data
inputted by arranging a plurality of cameras, for example, 8 cameras. As shown in Fig. 7,
when the method of setting the order of reference frames for multi-view coding based on the present invention is used, an improvement of 0.4-0.9dB in picture quality is shown over the conventional method.

Fig. 8 is a comparison graph for the case of a golf swing having 1-D parallel data inputted by arranging a plurality of cameras, for example, 8 cameras. As shown in Fig. 8, when the method of setting the order of reference frames for multi-view coding based on the present invention is used, an improvement of 2.2-2.5dB in picture quality is shown over the conventional method.

Fig. 9 is a comparison graph for the case of a flamenco dance having 2-D parallel data inputted by arranging a plurality of cameras, for example, 5 cameras. As shown in Fig. 9, when the method of setting the order of reference frames for multi-view coding based on the present invention is used, an improvement of 0.3-1.0dB in picture quality is shown over the conventional method.

The drawings and disclosure are examples of the present invention, used to describe the present invention, shall by no means be construed to limit or restrict the scope of the present invention disclosed in the appended claims. Any person of ordinary skill in the art to which the invention pertains shall understand that a very large number of permutations and equivalent embodiments are possible. The true scope of the present invention shall only be defined by the appended claims.
Industrial Applicability

As described above, a method for setting the order of reference frames for multi-view coding and a recorded medium recording the method, based on the present invention, can provide an improved picture quality and three-dimensionality and prevent the delay in processing time when using the reference frame by utilizing a larger number of reference frames.

The present invention also allows the encoder and decoder to maintain an optimal efficiency when encoding and decoding, respectively.

Moreover, the present invention allows a user to select a picture with a desired direction among pictures with a variety of direction that are inputted through a plurality of cameras.

Furthermore, the present invention can utilize the bypass logic, which is much simpler than the conventional bus-control logic.
[CLAIMS]

[Claim 1]

A method of setting the order of reference frames for multi-view coding, the method selecting a reference frame for a current frame to be encoded or decoded among a plurality of frames successively generated by a plurality of cameras along the time, the method comprising the steps of:

selecting the n (integer) number of frames of the same kind that have a same-view relation with said current frame and are encoded or decoded prior to said current frame as a first reference frame;

selecting the m (integer) number of frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with said current frame; and

encoding or decoding said current frame by making reference to the frames of the same kind included in said first reference frame and said second reference frame.

[Claim 2]

The method of claim 1, wherein said n number of frames of the same kind, included in said first reference frame, are extracted in the reverse order of encoding or
decoding.

【Claim 3】

The method of claim 1, wherein, in case the method further comprises the step of selecting the k (integer) number of frames of the same kind having an inter-view relation with said current frame as a third reference frame, said current frame is encoded or decoded by making reference to the frames of the same kind included in said first through third reference frames.

【Claim 4】

The method of claim 1, wherein said frame of the same kind is a P frame of a B frame that is the same kind as said current frame.

【Claim 5】

The method of claim 1, wherein a plurality of frames generated by said plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame are encoded or decoded in the order of an I frame, a P frame, a first B frame, and a second B frame about the time axis.

【Claim 6】
The method of claim 1, wherein picture information inputted by said plurality of cameras is generated as one of the forms consisting of 1-D parallel data, 1-D arc data, and 2-D parallel data.

5  **[Claim 7]**

A recorded medium tangibly embodying a program of instructions executable by an encoding device or a decoding device to perform a method of setting the order of reference frames for multi-view coding, the program readable by said encoding device or decoding device, the recorded medium executing the steps of:

10 selecting the \( n \) (integer) number of frames of the same kind that have a same-view relation with said current frame and are encoded or decoded prior to said current frame as a first reference frame, wherein said current frame is a frame to be currently encoded or decoded among a plurality of frames successively generated by a plurality of cameras along the time;

selecting the \( m \) (integer) number of frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with said current frame; and

20 encoding or decoding said current frame by making reference to the frames of
the same kind included in said first reference frame and said second reference frame.

【Claim 8】

The recorded medium of claim 7, wherein said n number of frames of the same kind, included in said first reference frame, are extracted in the reverse order of encoding or decoding.

【Claim 9】

The recorded medium of claim 7, wherein, in case the method further comprises the step of selecting the k (integer) number of frames of the same kind having an inter-view relation with said current frame as a third reference frame, said current frame is encoded or decoded by making reference to the frames of the same kind included in said first through third reference frames.

【Claim 10】

The recorded medium of claim 7, wherein said frame of the same kind is a P frame of a B frame that is the same kind as said current frame.

【Claim 11】

The recorded medium of claim 7, wherein a plurality of frames generated by said
plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame are encoded or decoded in the order of an I frame, a P frame, a first B frame, and a second B frame about the time axis.

【Claim 12】

The recorded medium of claim 7, wherein picture information inputted by said plurality of cameras is generated as one of the forms consisting of 1-D parallel data, 1-D arc data, and 2-D parallel data.
[ABSTRACT]

A method for setting the order of reference frames for multi-view coding and a recorded medium recording the method are disclosed. The method of setting the order of reference frames, in accordance with an embodiment of the present invention, comprises the steps of selecting the \( n \) (integer) number of frames of the same kind that have a same-view relation with said current frame and are encoded or decoded prior to said current frame as a first reference frame, selecting the \( m \) (integer) number of frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with said current frame, and encoding or decoding said current frame by making reference to the frames of the same kind included in said first reference frame and said second reference frame. With the present invention, an improved picture quality and three-dimensionality can be provided, and the delay in processing time can be prevented when using the reference frame.
COMBINED DECLARATION AND POWER OF ATTORNEY
FOR PATENT AND DESIGN APPLICATIONS

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated next to my name; that I verily believe that I am the original, first and sole inventor (if only one inventor is named below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

the specification of which is attached hereto. If not attached hereto, the application is identified by the attorney docket number as set forth above and/or the following:

The specification was filed on as United States Application Number ______________________;
and amended on ______________________ (if applicable) and/or
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the specification was filed on 12/18/2009 as PCT International Application Number PCT/US09/03220; and was amended on ______________________ (if applicable)
I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendments referred to above.
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<td>Yung-Chul LEE</td>
<td></td>
<td>July 7, 2019</td>
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Residence (City, State & Country):
Seoul, Korea, Republic of

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<th>INVENTOR'S SIGNATURE</th>
<th>DATE</th>
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<td>Eun-Sung JANG</td>
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<td>Chang-Kyu LEE</td>
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Residence (City, State & Country):

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*I DATE OF SIGNATURE*
As a below named Inventor, I hereby declare that my residence, post office address and citizenship are as stated next to my name; that I verify believe that I am the original, first and sole inventor (if only one inventor is named below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

The specification of which is attached herein, if not attached herein, the application is identified by the attorney docket number as set forth above and/or the following:

<table>
<thead>
<tr>
<th>Specification filed on</th>
<th>United States Application Number</th>
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<td>and amended on</td>
<td>(if applicable) and/or</td>
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</table>

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 35, Code of Federal Regulations, §1.56.

I do not know and do not believe the same was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, that the invention has not been patented or made public by the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representative or assigns more than twelve months (twelve months for design) prior to this application, and that no application for patent or inventor's certificate on this invention has been filed in any country foreign to the United States of America prior to this application by me or my legal representative or assigns, except as follows:

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified, below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

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<td>January 14, 2005</td>
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I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below.

<table>
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<th>Provisional Application(s)</th>
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All Foreign Applications, if any, for any Patent or Inventor's Certificate Filed More Than 12 Months (6 Months for Design) Prior to the Filing Date of this Application:

Country

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I hereby claim the benefit under Title 35, United States Code, §120 of any United States and/or PCT application(s), including for continuation-in-part application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States and/or PCT application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose information which is material to the patentability as defined in Title 35, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

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<td>(Status - patented, pending, abandoned)</td>
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</table>
I hereby appoint the practitioners at CUSTOMER NO. 02292 as my attorneys or agents to prosecute this application and/or an international application based on this application and to transact all business in the United States Patent and Trademark Office connected therewith and in connection with the resulting patent based on instructions received from the entity who first sent the application papers to the practitioners, unless the inventor(s) or assignee provides said practitioners with a written notice to the contrary.

Send Correspondence to:

CUSTOMER NO. 02292; BIRCH, STEWART, KOLASCH & BIRCH, LLP
Telephone: (703) 203-5000  •  Facsimile: (703) 203-5050

<table>
<thead>
<tr>
<th>FULL NAME OF INVENTOR</th>
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Page 2 of 2

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BIRCH, STEWART, KOLASCH & BIRCH, LLP
FIG. 2

110

Object

120a

Camera

d

d

d

120b

Camera

120n

Camera

120n-1
3/9
FIG. 3

120a
120b
120c
120d
120e

PROBLEM TO BE SOLVED: To encode a multi-view-point image at a high efficiency and to decode an optional block of an optional multi-view-point image in real time in the case of coding/decoding the multi-view-point image.

SOLUTION: A multi-view-point image input means 101 gives images resulting from photographing a three-dimensional object from a plurality of points respectively to a multi-view-point image coding means 102, the means 102 divides the multi-view-point image into m×n pixels to design a code book 103 and vector quantization is applied to each multi-view-point image to obtain index data 104, a multiplexer means 105 multiplexes the designed code book 103 and the calculated index data 104 to generate coded data 106. A demultiplexer means 107 demultiplexes the transmitted coded data 106 into a code book 108 and index data 109, a multi-view-point image decoding means 110 references a representative vector in a code book 108 corresponding to the index data 109 to decode an optional block of the multi-view-point image from a required view point.
(54)【発明の名称】 多次点画像符号化復号化装置および多次点画像符号化復号化方法

(57)【要約】
【課題】多次点画像を符号化復号化する際に高効率で符号化できると共に、任意の多次点画像の任意のブロックの復号をリアルタイムで行えるようにする。
【解決手段】多次点画像入力手段101によって3次元物体を複数の視点それぞれからの観影した画像を入力し、多次点画像符号化手段102によって多次点画像を$m \times n$画素に分割してコードブック103を設定すると共に多次点画像にベクトル量化を施してインデックスデータ104を求め、設計されたコードブック103と算出したインデックスデータ104を多重化手段105により多重化して符号化データ106を作成し、伝送された符号化データ106を多重分離手段107によってコードブック108とインデックスデータ109に分割し、多次点画像復号化手段110によりインデックスデータ109に対応するコードブック108内の代表ベクトルを参照して必要な視点の多次点画像の任意のブロックを復号する。
【特許請求の範囲】
【請求項１】3次元物体について複数の地点それぞれで
撮影した画像を入力する多視点画像入力手段と、
前記入力された多視点画像をm×n画素に分割してコー
ドブックを設計すると共に各多視点画像にベクトル量子
化を施してインデックスデータを算出する多視点画像符号
化手段と、
前記設計されたコードブックと前記算出されたインデックスデータより符号化データを作成する手段と、
この作成された符号化データを伝送または蓄積する手段と、
【請求項２】前記多視点画像符号化手段にはコードブックを符号化する処理装置を備え、前記多視点画像符号化手段には符号化されたコードブックを復元する処理装置を備えることにより特徴とする請求項１記載の多視点画像符号化装置
【請求項３】前記多視点画像符号化手段は、各部分に類似したベクトルが入力するコードブック中の代表ベクトルを入力する状態を差分誤差と符号化する処理機能を備え、前記多視点画像符号化手段は、代表ベクトルの差分誤差と符号化された前記コードブックを復元する処理機能を備えることにより特徴とする請求項２記載の多視点画像符号化装置
【請求項４】前記多視点画像符号化手段は、コードブック内の代表ベクトルの使用順序に応じて代表ベクトルに
用いる符号量を変化させてコードブックを符号化する処理機能を備え、前記多視点画像符号化手段は、符号化さ
れた前記コードブックを復元する処理機能を備えることにより特徴とする請求項２記載の多視点画像符号化装置
【請求項５】前記多視点画像符号化手段は、インデックスデータを符号化する処理機能を備え、前記多視点画像符号化手段は、符号化されたインデックスデータを復元する処理機能を備えることにより特徴とする請求項４記載の多視点画像符号化装置
【請求項６】3次元物体について複数の地点それぞれで
撮影した画像を入力する多視点画像入力手段と、
前記入力された多視点画像をm×n画素に分割してコー
ドブックを設計すると共に各多視点画像にベクトル量子
化を施してインデックスデータを算出する多視点画像符号
化手段と、
前記設計されたコードブックと前記算出されたインデックスデータより符号化データを作成する手段と、
この作成された符号化データを伝送または蓄積する手段と、
【請求項７】符号化装置により作成されたコードブック
とインデックスデータの符号化データを受けてこれによりコー
ドブックとインデックスデータを復元する処理機能を備えることにより特徴とする多視点画像符号化装置
【請求項８】3次元物体を複数の地点それぞれで撮影した画像を入力する多視点画像入力手段と、前記入力された多視点画像をm×n画素に分割してコードブックを設計すると共に各多視点画像にベクトル量子化を施してインデックスデータを求める必要がある多視点画像符号化装置を備えることにより特徴とする多視点画像符号化装置
【請求項９】前記多視点画像符号化手段は、コードブックを符号化する処理を行い、前記多視点画像符号化手段は、符号化されたコードブックを復元する処理を行うことにより特徴とする請求項８記載の多視点画像符号化装置
【請求項１０】前記多視点画像符号化手段は、各部分に
類似したベクトルを入力するコードブック中の代表ベクトルを入力する状態を差分誤差と符号化する処理機能を備え、前記多視点画像符号化手段は、符号化されたコードブックを復元する処理機能を備えることにより特徴とする請求項９記載の多視点画像符号化装置
【請求項１１】前記多視点画像符号化手段は、コードブック内の代表ベクトルの使用順序に応じて代表ベクトルに
用いる符号量を変化させてコードブックを符号化する処理機能を備え、前記多視点画像符号化手段は、符号化され
れた前記コードブックを復元する処理機能を備えることにより特徴とする請求項１０記載の多視点画像符号化装置
【発明の詳細な説明】
【0001】
【発明の使用技術分野】この発明は、視点の異なる複数の画像を入力とし、これらの画像からコードブックを
設計してベクトル量子化により、多視点画像の符号化復

号化を行う多視点画像符号化システムおよび多視点画像符号化システムに関するものである。
【0002】従来の技術【コンピュータを使用するバーチャルリアリティ（仮想現実）】、動画やゲームに使用する場合でのDOS（コンピュータグラフィックス）で、そして、インターネットの仮想店舗等において、新たな視点方向に適応してその視点方向から対象物を観察した画像が得られるようにするイメージベースストレングニングの技術が重要である。そして、この場合において、対象物の観察方向が変わることに連れて、画像が薄らかに、しかも自然に変化する必要がある。
【0003】すなわち、ここで重要なのは、3次元物体に対するイメージベースストレングニング技術であり、できるだけ詳細な画像を高速で作成できるようにすること、リアルタイムでこのような画像を取得できるようにする今後のイメージベースストレングニング技術にとって重要である。
【0004】図1に示すように、この技術に基づき、図1に示すようなシステムであって、立体造形の被写体を載せたテーブル、及びこのテーブル上の被写体を撮影するカメラを用意し、テーブルの両側に位置を図って、一定位置のカメラにて被写体を撮影することにより、多視点画像を取得。そして、これらの得られた多視点画像を、新たに画像を合成しない視点位置の情報を任意視点画像合成装置に送って処理すると、被写体にあたる空間において、任意視点画像合成装置において画像を合成して、特定の視点位置から見える仮想の画像を出力することができる。
【0005】このように、任意視点画像合成技術は、このようにして得られた任意視点画像の合成を行うことができる。なお、視点方向を変えることができる。図1に示すように、この技術を利用して、任意視点画像合成装置において、任意視点画像を得るため、任意視点画像をどうするかを示す方法が考えられる。
【0006】図1において、このようにして得られた任意視点画像合成装置は、3次元物体を複数の視点から撮影した画像を入力し、これを複数の視点画像を合成化する方法がある。この方法は、多視点画像符号化と呼ばれる方法で、動画を構成するフレームの各ストリーム毎に、任意視点画像合成装置において、任意視点画像を得ることで、任意視点画像を得るための方法が考えられる。
【0007】このようにして得られた任意視点画像を得ることにより、任意視点画像を得ることができ、多視点画像を得ることができ、任意視点画像を得るための方法が考えられる。
【0017】ここでは2次元可変長符号化とは国際標準の画像符号化であるJPEGなどで用いられているものと同様方法である。
【0018】画像を直交変換して得られるDCT係数の大きさは画像の空間周波数成分の低域から高域に減衰していく。よって、低域から高域にかけてディジタル化される。このとき、0の個数（RUN）とその直後の量子化レベル（LEVEL）を組み合わせた情報に対して可変長符号化を割り当て符号化する。このような方法でここでの2次元可変長符号化である。次に、DCT係数の2次元可変長符号化処理はここで説明した方法を意味することとする。
【0019】さて、仮想された符号化データ1205は、2次元可変長符号化部1206で2次元可変長符号化処理され、仮想入力1207で量子化（IQ）され、仮想出力1208で逆離散コサイン変換（IDCT）を施されて再生多視点画像1209が得られる。
【0020】このように符号化を各多視点画像について別々に行うところによって各多視点画像を符号化することができ、所望の視点位置からの画像を復元することが可能になる。
【0021】しかし、この場合、画像はそれぞれの多視点画像領域に対する符号化であるから、圧縮率は十分で、データ量は膨大なものとされる。現実的でない。そこで、それぞれの多視点画像領域の相関を利用して高い圧縮率で符号化できる方法としてあげられるのが図14に示す多視点画像符号化復号化化装置である。
【0022】すなわち、この図14で示す多視点画像符号化復号化装置の場合は、動き補償フレーム間予測と直交変換符号化を行うハイブリッド方式による多視点画像符号化復号化を行う。この方法では動き補償フレーム間予測によって得られる予測誤差をDCTを用いて符号化する。
【0023】作用を説明すると、まず、入力多視点画像1301は動き補償フレーム間予測1302で動き補償フレーム間予測され、その予測誤差が逆離散コサイン変換1303においてブロック毎に離散コサイン変換（DCT）される。そして、離散コサイン変換部1303で得られたDCT係数が量子化部1304で量子化され、量子化されたDCT係数が2次元可変長符号化部1305で2次元可変長符号化される。
【0024】このデータは2次元可変長符号化部1306で可変長符号化された動きベクトルデータと共に多視点化部1307で多重化されて、符号化データ1308が送信される。
【0025】さらに符号化部分では、量子化されたDCT係数が逆量子化部1309で逆量子化（IQ）され、逆離散コサイン変換部1310で逆離散コサイン変換（IDCT）を施されて量子化差分データが再生される。
【0026】このデータは前の予測画像に加算されて、動画画像としてフレームメモリ1311に蓄えられる。
【0027】この局域復号画像は次のフレームを動き補償予測部1302で動き補償予測するために使われる。伝送された符号化データ1308は復号化処理で、逆変換出力1312で量子化差分データと動きベクトルデータに多重化される。量子化差分データは2次元可変長符号化部1313で2次元可変長符号化され、逆量子化部1314で逆量子化された後、逆離散コサイン変換部1315で逆離散コサイン変換（IDCT）を施されて予測誤差が復号化される。
【0028】フレームメモリ1316に蓄えられた前フレームの復号画像と可変長符号化部1317で可変長符号化された動きベクトルデータを用いて動き補償部1318で動き補償して現フレームが復号され、復号された予測誤差と加算して再生多視点画像1319が復号される。
【0029】発明が解決しようとする課題】これにより、従来のイメージベーストレンダリング技術の3次元物体を複数の視点から撮影した画像を入力し、この視点の多視点画像を符号化復号化する方法があるが、この方法では直交変換符号化を利用したインタラック符号化を異なり、フレーム内関数と共に前フレームとの相関も利用して符号化することで圧縮符号化が期待できる。
【0030】しかし、それにより、3次元物体を複数の視点から撮影した画像を入力し、この視点の多視点画像を符号化復号化する方法があるが、この方法では直交変換符号化を利用したインタラック符号化を異なり、フレーム内関数と共に前フレームとの相関も利用して符号化することで圧縮符号化が期待できる。
【0031】また、動き補償フレーム間予測と直交変換符号化を組み合わせたハイブリッド方式による符号化では、それぞれの多視点画像の相関を利用して高い圧縮率で符号化できるが、一方、必要なフレームを復号するために、以前からのフレームを復号する必要がある。
【0032】シーケンシャルに符号化されればより動画像の再生では、パッファを用いることにより以前のフレームを復号してならならないという複雑な復号の問題は解決されるが、モーション画像を利用しての任意視点画像の合成を考えた場合、より高いリアルタイム性を持っている視点画像が復号される必要があるだけでなく、
合成のために多視点画像内の任意のブロックが素早く参照される必要がある。
【0033】よって、ハイブリッド方式を用いた符号化復号化では必要なブロックの復号を行うために時間がかかりリアルタイム性に劣るという問題点があった。
【0034】そこで、この発明の目的とするとれば、多視点画像を符号化する際に、各多視点画像領域の関係を利用して高い圧縮率を実現し、さらに、多視点画像のうちの任意の画像およびブロックを素早く復号する必要がある多視点画像の再生、任意視点画像の合成をリアルタイムに復号できるように多視点画像信号復号装置および多視点画像信号復号装置を提供することにある。
【0035】
【課題を解決するための手段】上記目的を達成するため、本発明は次のように構成する。
【0036】すなわち、本発明は、符号化手段として3次元物光の複数の地点から撮影して得た画像を入力する多視点画像入力手段と、前記入力された多視点画像をx × n 画素に分割してコードブックスを設計する手段と共に各多視点画像はベクトル量化信号を施してインデックスデータを求めると多視点画像信号復号装置および前記設計されたコードブックスを前記算出したインデックスデータとして符号化データを作成する手段と、それら符号化データを伝送または蓄積する手段を構成し、また、復号化手段として、この伝送され、または蓄積された前記符号化データよりコードブックスをインデックスデータを構成し、コードブックスよりインデックスデータに対応したブロックを復号化して多視点画像を復号化する多視点画像復号化手段を備えて構成する。
【0037】そして、多視点画像復号化手段により被体である3次元物体を複数の地点から撮影して得た画像を入力すると、この多視点画像信号復号化手段は前記入力された多視点画像をx × n 画素に分割してコードブックスを設計すると共に各多視点画像はベクトル量化を施してインデックスデータを求め、符号化データを作成手段は前記設計されたコードブックスと前記算出したインデックスデータより符号化データを作成する。そして、復号化手段では、この符号化データよりコードブックスとインデックスデータを変換して得たコードブックスよりインデックスデータに対応したブロックを参照して多視点画像を復号化する。
【0038】このように、ベクトル量化を利用して、3次元物光とコードブックスとのインデックスデータを作成して伝送または蓄積するようにした上で、多視点画像を復号化する手段を作成し、同時に、コードブックスとインデックスデータを作成し、さらに、復号化処理においては受取ったコードブックスとインデックスデータは保持され、復号化処理は矢印で示すように復号化処理が行われる。
野に用いる符号化方法としては問題がある。
【0045】こちらフレーム内DCT符号化やハイブリッド符号化の両側問題を解消するため、多点画像の符号化にペクトル量化を用いることが考えられる。そこで、次にそのペクトル量化を導入する多点画像の符号化について述べる。
【0046】ペクトル量化を用いる一般的な画像符号化方法は、一般的なペクトル量化を用いて画像符号化を行う手法について説明しておく。上述したフレーム内DCT符号化やハイブリッド符号化でもDCT係数の量子化（Q）が行われていた。これは、連続する信号を適当な離隔で代表値に置き換えて、代表値の番号を符号化しているものであり、スカラー量化と呼ばれる。つまりは、1次元の量子化を行ったことになる。
【0047】ペクトル量化（VQ：Vector Quantization）は、更にデータをまとめ、ペクトル単位で多次元空間を代表ベクトルに置き換えて、代表ベクトルの番号（インデックス）を符号化する手法であり、多次元空間の量子化を行うことを意味する。画像の符号化という表現では、画像を複数のブロックに分割し、各ブロックに含まれる画素値をベクトルの要素と見なし、ブロック全体を一括してある代表ブロックに置き換えて量子化することになる。
【0048】例えば、2次元の場合のベクトル量化におけるベクトル空間は空間1のようになる。代表ベクトルで自分が代表する領域が決まており、代表ベクトルでポリゴン分割された平面になっている。例えば、2次元平面内にベクトルが入力されると、距離が最短に近い代表ベクトルに量子化されて、このベクトルが出力される。
【0049】ベクトル量化における一般的な画像符号化方法については図2を用いて説明する。入力画像をK個の画素からなるブロックに分割して、それぞれをK次元のペクトルPとみる。
【0050】P = (p1, p2, ... , pK) ただし、(p1, p2, ... , pK) は、それぞれ個々の画素値である。
【0051】送信側（符号化側）と受信側（復号化側）ではN個のK次元ベクトルからなるコードブック（Q1, Q2, ... , QN）を用意しておく。送信側ではこのコードブックの中から入力ベクトルPと距離が最も近い代表ベクトルを距離計算によって求め、それがQiであるならば、その代表ベクトルのインデックスiを出力符号として送信する。
【0052】受信側では送られてきたインデックスiで示される代表ベクトルとコードブックから読み出して逆ブロック化して再構成画像として出力する。
【0053】効率の良いベクトル量化を実現するために、コードブックの設計が重要になってくる。一般的には入力画像を代表するようなテスト画像を複数枚用意し、それらに対して符号化された（量子化された）を最小ににするような代表ベクトルの組を逐次的に求める方法をとる。コードブックの代表的な設計法である“k-mean法”（この“k-mean法”については、高本幹雄、下田隆久，“画像解析ハンドブック”，東京大学出版会, p. 648-581, (1991年)に詳しい）の説明は省略であるが以下に示す。
【0054】(1) 代表ベクトルQiに量子化されるm×n次元ペクトル空間の領域をSiとする。また、トレーニングシーケンスst1, ... , stkに用意する。
【0055】(2) 代表ベクトルQi (i = 1 ～N) に適当な初期値を与え。
【0056】(3) 各代表ベクトルQiとトレーニングシーケンスst1, ... , stkとの距離を計算して、各Siに対してどのようにトレーニングシーケンスが属するかを調べる。
【0057】(4) 各Si毎に、その中に属するのの重心を新たな代表ベクトルQiにする。
【0058】以上の(3)と(4)を量子化誤差が十分小さい値に収斎するまで繰り返す。
【0059】このように設計したコードブックを用いて画像符号化を行うのである。
【0060】次に、上述した一般的な画像符号化を多視点画像に適用させて、多視点画像の符号化復号化を行う。
【0061】ペクトル量化（VQ）を用いて多視点画像を符号化する際には、一般的なVQによる符号化と大きく異なる手法を用いる。VQを用いたコードブックを設計し、この設計したコードブックと全インデックスデータを復号化処理に送信して復号化処理を行うのである。
とならない。
【0084】具体的に、ベクトル量子化による多視点画像符号化を考えてみる。これは、図1に示すように、符号化側において、まずはじめに、全多視点画像をブロック化したものをトレーニングシーンとして用意し、k-means法を施し、コードブックを設計する。作成されたコードブックをもとに、全多視点画像内のブロックについて距離計算を行い、最も近い代表ベクトルのインデクスを出力する。
【0085】符号化処理側は最後に、全多視点画像から設計されたコードブックと、全多視点画像についてのインデクスデータを伝送する。
【0086】復号処理側ではこれらとコードブック、及び全多視点画像内のブックについてのインデクスデータを受信して、メモリに格納、任意視点画像合成工事で視点情報に応じてどのブロックを復号するかの指示をつける。そして、要求されたブロックに応じたインデクスの番号を持つブロックをコードブック内から選んできて、合成が必要なブロックを復号する。
【0071】本発明の基本の概念はこのようなのであがり、コードブックとインデクスの情報を利用して復号するように手法は従来よりある。しかし、従来の手法の場合は、コードブックは符号化処理側と復号処理側にそれぞれのものを用意しており、符号化処理側では合成しようとする視点に対応するインデクスを自己のコーディングブックから抽出し、当該インデクスだけを送って復号処理側においてはそのインデクスに基づき合成する画像をコードブックから得て画像を合成するようにしている。
【0088】この場合、コードブックは汎用のものとなりざるを得ず、最終的に得られる画像が従来のものとならないを得ない。
【0089】本発明の特徴点、汎用ではなく、画像に応じて、その画像型のコードブックを作成して復号側に送り、復号側でこれを用意し、受け取ったインデクスから画像を再生するように実装性を持たせる実装ベースでのバーチャルアリティやアームスルー、そして、バーチャルスペースでの商品展示、イラストレーションの本などと同様に版画のように最適な符号化・復号化方法を実現するようになる。
【0070】本発明方式の場合、ブロック単位でベクトル量子化しているので、画像内の相間を用いた符号化になっている。現在、全て多視点画像をコードブックを設計しているので、フレーム内のDCT符号化には異なり、各多視点画像の相間を用いた符号化がなされている。そのため、効率的なデータ圧縮がなされていて短時間で情報伝送が可能になる。
【0071】また、メモリに保持されたデータは、設計されたコードブックと全多視点画像内の各ブロックについてのインデクスデータであり、どちらも固定長データであるので、フレーム内のDCT符号化やハイプリッド符号化のように、可変長復号や、階層的な復号を施す必要がなく、インデクス的に記したコードブックの代表ベクトルの参照という単純な操作だけで任意のブロックを素早く復号することができる。
【0072】次に、本発明の具体的実施例を説明する。
【0073】図1に図示した実施例の多視点画像符号化復号化装置の構成を示す図である。図3において、101が3次元物体を複数の視点から撮影した画像を入力する多視点画像入力手段、102は多視点画像入力手段、101によって入力された多視点画像からコードブックを設計して、ベクトル量子化によって多視点画像を符号化する多視点画像符号化手段、103は多視点画像符号化手段102によって入力された多視点画像から作成されたコードブック、104は多視点画像符号化手段102によって作成された各視点画像を復号することに必要なインデクスデータ、105は前記設計されたコードブック103と記憶に保存されたインデクスデータ104と、すなわち、複号化データ106を作成する多視点画像復号化手段である。
【0074】このような構成の本装置では、被写体である3次元物体を多視点画像入力手段101が複数の視点から撮影した画像を入力する。
【0075】多視点画像符号化手段102では、多視点画像入力手段101によって入力された多視点画像からコードブックを設計して、ベクトル量子化によって多視点画像を符号化する。すなわち、多視点画像符号化手段102では図1で説明したように、まずはじめに、全多視点画像をブロック化し、これをトレーニングシーンとしてk-means法を施すことによってコードブック103を作成する。この作成されたコーディングブック103をもとに、全多視点画像内の各ブロックについて距離計算を行い、最も近い代表ベクトルのインデクス104を得る。
0はインデックスデータ109によっことコードブック10を参照して必要な視点の多視点画像を復号する。
【0078】発明の概念で説明したように、本発明では、符号化処理においては、まずはじめに、全多視点画像をブロック化したものをトレーニングシーケンスとして用意して“k-mean法”を施し、コードブックを設計して、この設計されたブロック作成されたコードブックをともに、全多視点画像のブロックについて距離計算を行い、最も近い代表ベクトルのインデックスを求める、符号化処理後の、全多視点画像から設計されたコードブックと、全多視点画像についてのインデックスデータを伝送する。
【0079】そして、復号化処理ではこれらコードブック、及び全多視点画像内ブロックについてのインデックスデータを受け取り、モーメントに保持し、任意視点画像合成生成が視点情報に応じてどのブロックを復号するかの指示を伴う。そして、要求されたブロックに応じたインデックスの番を追加するブロックをコードブックから選ぶことにより、合成する必要のブロックを復号する。
【0080】この発明の実施例においてはこのような概念を装置として実現するものであり、この発明の場合、ブロック単位でベクトル量子化しているもの、画像内の相間を用いた符号化されており、さらに、全多視点画像を用いてコードブックを設計しているもので、フレーム内のDCCT符号化機は異なり、各多視点画像間の相関も利用した符号化がなされている。そのため、必要な情報を効率良く符号化できてデータの短時間伝送が可能になり、物体のコードブックとインデックスデータを復号化装置に無理なく渡すことができるようになるので、実用ベースでの映像再現が容易になる。また、復号化処理後のモーメントに保持されたデータは、設計されたコードブックと全多視点画像内のブロックに関するインデックスデータであり、どちらも固定長データである。
【0081】よって、フレーム内のDCCT符号化機はハイブリッド符号化のように、可変長符号化や階層的な復号を施す必要なく、インデックスに応じたコードブック内の代表ベクトルの参照という単純な操作だけで任意のブロックを素早く復号することができるのリアルタイム性を損なうことがない。
【0082】第1実施例における各要素の詳細を説明しておく。
【0083】第2実施例における入力手段は、イメージベースストレージングがもとになる多視点画像は、多視点画像入力手段101で取得して入力するが、これらの視点画像入力手段101の具体的構成は第12図に示す加えて、このような図において、101は多視点画像を示す視点としての3次元物体、202はこの3次元物体を201を被覆するカメラ、203は3次元物体201を載せて回転するテーブル構成である。
【0084】被写体である3次元物体201はトレーニングシーケンスを203に載せて必要な視点の多視点画像を復号する。トレーニングシーケンス203は、ある回り角度毎に少しずつ回転させようにして、各回り角度毎に、任意のカメラ202によって3次元物体201を被覆する。そして、トレーニングシーケンス203が360度回転するまで同じ作業を続ける。
【0085】αを360の約数として、この方法によってα[度]で求めたトレーニングシーケンス203を回転させて被覆する。F＝360/α（枚）の多視点画像を撮影することができる。以降、多視点画像数をF（枚）とする。
デスクテア402は、固定長データのままメモリに保持される。すなわち、この実装例においては、符号化側で作成されたコードブックとF[枚]分のインデックスデータ自身は符号化処理されていないので、いずれも固定長データである。そのため、可変長の場合のように符号を元のデータに戻すトランシデータが不要であり、任意のブロックがテーブルの参照のみによってメモリから読み取ることができる。

[0010] F [枚] 分のインデックスデータのうち、現在、復号化したい多視点画像が一番目の多視点画像であるときと、一番目の多視点画像のインデックスデータ402内のインデックスが、順にコードブック参照処理403に遅れて、同じインデックスを持つm×n次元代表ベクトルのコードブック401から参照される。

[0012] まず、m×n次元代表ベクトル、つまり参照されたm×n画素ブロックは順に逆ブロック変換処理404に送られて、一番目の1枚の多視点画像405に復号される。

[0020] さらに、ベクトル量子化を利用し、3次元物体毎にコードブックとインデックスデータを作成して伝送することにより、多視点画像全体の相関を用いた高圧縮符号化が実現できる。また、インデックスの参照という処理だけで画素スライドによるアルゴリズム特性を実現した復号化を行うことができる。

[0024] 以上のように、この実装例では、符号化側として3次元物体を複数の部位から撮影した画像を入力すると、前記入力された多視点画像入力手段と、前記設計されたコードブックの入力処理を順に行い、コードブック内で得られたインデックスデータに対応したブロックを参照して多視点画像復号化処理を行う。
３次元物体を複数の地地点から撮影した画像を入力すると、多視点画像符号化エンジンが入力された多視点画像をコードブックを設計して、ベクトル量化により、多視点画像を符号化する。すなわち、多視点画像符号化エンジンではまずもって、全ての視点をブロックに分割し、これをトレーニングデータとして“k-means法”を適用することによってコードブックを生成する。この作成されたコードブックを固定長のデータ構造を持つものである。この作成されたコードブックをもとに、全ての視点画像のブロックについて距離計算を行い、最も近い代表ベクトルのインデックスを符号化する。このインデックスデータを固定長のデータ構造を持つものである。

【0113】そして、このコードブックをもと、各視点画像を復号するのに必要なインデックスのデータを多重化エンジンによって多重化し、符号化データを生成する。

【0114】復号化処理では、伝送された符号化データを多重化エンジンによって多重化し、コードブックを生成し、インデックスデータを復号する。

【0115】多視点画像符号化エンジンは、符号化データを多重化エンジンによって多重化し、コードブックを生成し、インデックスデータを復号する。

【0116】このように、多視点画像入力エンジンにより被写体である3次元物体より複数の地地点から撮影して取得した画像を入力すると、この多視点画像符号化エンジンは被写体の複数視点画像からコードブックデータを生成し、各視点画像を対応するコードブックデータとインデックスデータを多重化エンジンに送り、多重化エンジンはこのコードブックデータを接続し、全ての視点画像を多重化エンジンによって多重化したデータを生成する。
子電化帯とIDCT（逆離散コサイン変換）部から成るコードブック復号化工段、607は符号化コードブック605を復号化工段で得られたコードブック608と作成されたものです。608はインデックスデータを計算する1番目の多視点画像、609は1番目の多視点画像をm x n画素のブロック分割したブロック化コードブックを元にインデックスデータを計算するインデックス計算用に、611はインデックス計算用段階610で作成された1番目の多視点画像のインデックスデータである。

【0124】図7における構成で第1実施形態における構成に新たに追加された構成要素部分における処理について説明する。すなわち、前多視点画像601を元に、ブロック化手段602により画像をブロック化し、これよりコードブック作成手段603にてコードブック605を作成するまでの処理、および1番目の多視点画像608をブロック化手段609によりブロック化してインデックス計算手段610に与え、インデックス計算手段610はコードブックを用いてインデックスデータを計算するようしている処理は第1実施形態における対応変更の処理と変わりはない。ただし、第2実施形態ではその後の段階における処理が追加されている。そして、インデックス計算手段610が用いるコードブックは、符号化したコードブック605は復号化工段のものである点が異なる。

【0125】すなわち、本実施形態においては、コードブック作成手段603において作成されたコードブック605はコードブック内の代表ベクトルに、コードブック符号化手段604で代表ベクトルの各成分に含まれるベクトルを利用して符号化される。例えば、ここでの符号化は直交変換による符号化が考えられ、そして、この場合、ここでは直交変換としてIDCT変換され、これによって得られたIDCT係数の量子化されて量子化されたIDCT係数が2次元固定変換が符号化されている。

【0126】このようにしてコードブック符号化手段604により符号化されたコードブック605は多重化手段に送られると共に、符号化処理段階に新たに追加されたコードブック復号化手段606において2次元可変化処理（VLC）、逆量子化（IQ）、IDCTを用いる逆ブロック化処理により、復号化工段607が得られる。

【0127】一方、符号化処理段階におけるインデックス計算手段610においては、この復号化工段607で量子化されたベクトルを量子化して、復号化工段607で量子化されたベクトルのインデックスが多重化手段に送られる。

【0128】このようにして、符号化処理段階では、作成した固定長のコードブック605をデータ量増加のために可変長符号化し、この可変長符号化されたコードブックを符号化処理段階に送る。また、復号化工段では可変長符号化されたコードブックしかないので、符号化処理段階ではこの可変長符号化されたコードブックに基づい
コードブックとインデックスデータを作成して、伝送する処理を短時間に実施可能である。また、復号化したコードブックは復号化処理側では復号化して固定化データに戻し、メモリに格納して固定化のコードブックとして用いるので、インデックスデータからリアルタイム性を維持して画像を復元することができる。そのため、写込み性の高い画像をリアルタイム性を以て合成可能なシステムを実現可能になる。

【0136】また、上記した多波点画像符号化手法で説明した構成で多対点画像を符号化する多対点画像符号化工程と、多対点画像符号化手法で説明した構成で多対点画像を復号化する多対点画像符号化工程を考えることにより、多対点画像符号化復号化方法を実現することが可能になる。

【0137】上記に示したコードブックを符号化して圧縮してから伝送することによって、伝送する符号量を減らすようにしたものであるが、代表ベクトル間の相関を利用して符号量を減らすこともできる。

【0138】従って、次にこのような実施例を第4実施形態として説明する。

【0139】（第4実施形態）第3実施形態で説明したコードブック符号化帯域率0.4においてコードブック内に内のベクトルを並べ替えて、前代表ベクトルとの差分誤差をDCT、量子化、2次元可変長符号化する処理を持たせ、コードブック復号化帯域率0.2において符号化される。ここでは、2次元可変長符号化、量子化、IDCT（逆離散コサイン変換）を演算処理されている。

【0140】コードブック符号化帯域率0.2において符号化されて固定化データとなったコードブック703とインデックスデータ704がメモリに格納されて保持される。メモリに格納されて保持されたコードブック703およびインデックスデータ704, およびインデックスデータ704, およびインデックスデータ704は、この段階では固定化データとなっているので、任意のプロックをテーブルの参照のみによってメモリーから読み取ることができる。

【0141】コードブック選択手段705の、この復号化コードブック703内においてインデックスを持たすm×n次元代表ベクトルを参照して逆ブロック化手段706へブロックを送る。

【0142】以下のよう、ペクトル量子化を利用して、m次元ベクトル毎にコードブックとインデックスデータを作成して、更にコードブックを符号化して圧縮してから伝送することによって、伝送する符号量を減らすことができる。コードブックとインデックスデータを伝送するに要する時間を短縮できる。従って、3次元物体を容易にコード化できる。
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を利用することにより、符号量削減を図ることに
する、作成されたコードブックの符号化処理に特徴が
ある。
【0143】この特徴部分を中心に説明する。各実施形
態で説明した如きの手続きにより、コードブックB01は
作成される。作成されたコードブックB01は個々の
データである。コードブックを並べ替え手段B02では、
このコードブックB01内の代表ベクトルを距離の近い
順（算分を取った際の各成分の2乗の小さな順）に並
べ替える。コードブック内の代表ベクトル数をn個とし
ると、コードブックをセキュエンシャルに並べ替える
全場合の数はn！（順列）存在して、n！（順列）の並
べ方にずれ差分誤差の和を求めなければならないと
は得られない。
【0144】しかし、実用的な画質を実現するために必
要な代表ベクトル数をn＝2**2**（倒）程度であり、実時
間での最適な並べ替え方式は困難であると思われる
ようである。
【方法1】代表ベクトルの各成分の平均値の代表ベク
トルとを並べ替える。
【0145】（方法2）まず、最小平均値の高い代表
ベクトルを選出し、順に距離の小さい代表ベクトルを
順に上に付加してn個（倒）する。
【0146】（方法3）まず、ダイナミックレンジか
ら計算して平均的な平均値の代表ベクトルを選ぶ。平均
値以上の代表ベクトルの中で距離が最も近い代表ベクト
ルと、平均値がn以下の代表ベクトルの中で距離が最も近い
代表ベクトルを選び、上下に付加してn個（倒）する。
【0147】などの方法によって差分誤差の和が小さく
なるように並べ替えることができる。
【0148】コードブックを並べ替え手段B02で並べ替
えられたコードブックは、従来のフレーム間予測と同
様に順にブロック間差分誤差を求め、その誤差に
DCT、量化を、2次元変換符号化が施されて、符号
化された符号に差分コードブックB09が作成される。
【0149】符号化差分コードブックB09は図7の構
成におけるコードブック符号化手順B08において2次
元変換復号化、逆量化、1DCTが施されると内部復
号化されて、インデックス値を指しシーケンシャルに
出力されて内部出力される。また、符号化され差分コ
ードブックB09はインデックスデータと共に記録され、伝送、重
複抽出されて、図Bの構成におけるコードブック符号化手
順B02において2次元変換復号化、逆量化、1D
CTが施されて逆符号化コードブックB14が得られる。
【0150】復号化され固定長データとなった復号化
コードブックB14をインデックスデータが必要に処理
されて保持される。
【0151】メモリに積み重ねて保持された復号化コー
ドブックB14とインデックスデータをいわゆる固定長デ
ータであるので、任意のブロックがテーブルの参照のみ
によってメモリから読み取り可能である。
【0152】また、全ての代表ベクトルをシーケンシャル
に並べることによって予測して符号量を減らすのではなく
て、差分誤差がある程度大きい場合は途中で直接変
換符号化された代表ベクトルを配置する。もしくは、原
画像の代表ベクトルを配置するという手法でのコードブ
ックの符号化復号化も実現可能である。
【0153】以上のように、ベクトル量子化を利用して
て、3次元物体毎にコードブックとインデックスデータを
作成して、更にコードブック内の代表ベクトルを並べ替
えて差分誤差を符号化して伝送することによって、より
符号量を減らすことができる。コードブックとインデックス
データを伝送する際の必要時間を短縮できる。従って、
3次元物体毎にコードブックとインデックスデータを作成
して、伝送する処理を短時間に実施可能である。また、
復号化されたコードブックは復号化処理部では復号化して
固定長データに戻し、メモリに積み重ねて固定長のコード
ブックとして用いるので、インデックスデータを再プロ
タイム性を維持して画像を復元することができる。その
ため、写実性の高い画像をリアルタイム性を満たす可
能なシステムを実現可能になる。
【0154】また、述べた多視点画像符号化手段で説
明した構成で多視点画像を符号化する多視点画像符号化
工程と、多視点画像復号化手段で説明した構成で多視点
画像を復号化する多視点画像復号化工程を考えることに
より、多視点画像符号化復号化方法を実現することがで
きる。
【0155】以上のように、コードブックとインデックスデータを
利用して、3次
元物体毎にコードブックとインデックスデータを作成し
て、更にコードブック内の代表ベクトルを並べ替えて差
分誤差を符号化して伝送することによって、より符号量
を減少するようにしたのであるが、コードブックを使用
頻度に対応に並べ替え、使用頻度の高いものほど、小さ
い符号に割り当てる符号化方法を適用して符号化すれば、
効率的に符号量を減らすことができる。
【0156】従って、次にこのような実施例を第3実施
形態として説明する。
【0157】（第3実施形態）第3実施形態で説明した
コードブック符号化手順B04とコードブック復号化手
順B08、702において、予め被るが多視点画像データ
（枚）分のインデックスデータを求める代表ベクトルの使
用頻度を求めておく。その使用頻度を利用することより
効率的に符号量を減らす多視点画像符号化復号化装置
および多視点画像符号化復号化方法を実現することができる。
【0158】図10は第5実施形態におけるコードブ
ック符号化手段およびコードブック使用化手順での多視点
画像符号化復号化装置の構成を説明する図である。図10
において、001は予め求められたコードブック使用
頻度情報、902はコードブック使用頻度情報901に
応じて符号化を制御する符号化制御器、⑨③はコードブック作成手段⑨③において作成されたコードブック、⑨④はDCT部、⑨⑤は量子化部、⑨⑥は2次元変換処理部、⑨⑦はインデックスデータと共に多重化、伝送、多重分離される符号化コードブック、⑨⑧はDCT部、⑨⑨は量子化部、⑨⑩はDCT部、⑨⑪はビデオ変換コードブックである。

【0159】図10のコードブック符号化復号化処理について説明する。この実施例には、コードブックを使用する場合に並べ替え、使用頻度の高いものほど、小さい符号に割り当てた符号化方式を適用して符号化する。つまり、DCT、量子化、2次元変換処理を適用して符号化される。さらに、多重化するインデックスデータを算出する前に、前の符号化された前のコードブックを使用して全多視点画像データの符号化データを調べ、コードブック内での代表ベクトルの使用頻度を調べる。この使用頻度に応じて、より頻度の高い代表ベクトルには多くの符号量を、低頻度の代表ベクトルには符号量をあらかじめ割り当てないようにして、コードブック符号化手段⑨④において符号化コードブックを求める。また、この符号化手段に応じた復号化手段によってコードブック復号化手段⑨②、⑨③で符号化コードブックを複号化する。

【0161】具体的な符号量を割り当てて方法としては、i）使用頻度が関係の大きい意味の代表ベクトルは符号化せず、ある関係の小さい意味の代表ベクトルのみ直交変換符号化する。

【0162】あるいは、ii）使用頻度に応じたステップサイズでブロック毎に直交変換符号化を施す。

【0163】なる符号化構成方法がある。

【0164】符号化されたコードブック符号化コードブック⑨④は図7の構成におけるコードブック復号化手段⑨④において2次元変換処理、量子化、1DCTが施されても直交変換符号化、インデックス算出手段⑨③によって再びインデックスデータが算出される。

【0165】また、符号化コードブック⑨⑦はインデックスデータと共に多重化、伝送、多重分離されて、図8の構成におけるコードブック復号化手段⑨①において2次元変換処理、量子化、1DCTが施されて多重化コードブック⑨①が得られる。多重化された多重化インデックスコードブック⑨①とインデックスデータがメモリに展開され多重化されたコードブック数とインデックスデータは固定保持されているので、任意のブロックがテーブルの参照によってメモリから読み取り可能である。

【0166】以上のように、ベクトル量子化を制御して、3次元変換処理コードブックとインデックスデータを作成して、更にコードブック使用頻度情報を応じて符号化を制御してコードブックを符号化して伝送することにより、より効率的に符号量を割り当てることができる。故に、コードブックとインデックスデータを伝送する時間に有効で、3次元変換処理コードブックとインデックスデータを作成して、伝送する処理を短時間に実施可能である。また、復号化したコードブックは復号化処理部で復号化して固定長データを検出し、メモリに格納して固定長のコードブックとして用いるので、インデックスデータからリアルタイム性を持たせた画像を復元することができる。そのため、写真の真実の画像をリアルタイム性を以て合成可能なシステムを実現可能になる。

【0167】また、上述の多視点画像符号化手段で説明した構成で多視点画像を符号化する多視点画像符号化処理、複視点画像符号化手段で説明した構成で複視点画像を符号化する複視点画像符号化処理を考えることにより、多視点画像符号化手段で符号化する多視点画像符号化処理を実現することができる。

【0168】以上のように、コードブックの使用頻度を参照してデータ圧縮を主体にしたが、それにインデックスデータも圧縮することで、符号量削減に効果が期待できる。コードブックの符号化と併用するわけである。このような目的に利用可能な実施例を第8の実施例として説明する。

【0169】（第8実施例）第6実施例においてインデックスデータの圧縮と伸張処理を主体にしている。この第8実施例においては、第1実施例の多視点画像符号化手段⑨⑫にインデックスデータを符号化する処理を加え、多視点画像復号化手段⑨⑲において符号化されたインデックスデータを復号化する処理を検出し、多視点画像の符号化復号化を行い、より符号量を減らすことが可能になっている。

【0170】以下にインデックスデータの符号化復号化を備えた多視点画像符号化復号化処理および多視点画像符号化復号化方法について説明する。

【0171】図11は第8実施形態における多視点画像符号化手段の構成を説明する図である。図11において1001は多視点画像符号化処理で撮影された完全F枚数の多視点画像、1002は多視点画像をM×N画素のブロックに分割するブロック化手段、1003はブロックを元にブロックを作成するコードブック作成手段、1004は多重化されるコードブック、1005はインデックスデータを計算されるスパム番号の多視点画像。]
006はi番目の多様点画像をm×nanskのブロックに分割するブロック数段、1007はブロックとコードブックを元にインデックスを算出するインデックス数段手順、1008はインデックスデータを変換可能とする変換可能データを持つインデックスデータ、1009は可変長数値データである。

(0172) 図11を新たに第1実施形態に付加された処理について説明する。インデックス数段手順1007において入力ブロックとコードブック1004を元に算出されたインデックスデータは、可変長数値データ1010をもとに可変長数値データ1008において可変長符号化される。

(0173) そして、可変長符号化された符号化インデックスデータ1009は可変長符号テーブル1010が、コードブック1004と共に多重化、伝送、多重分離される。

(0174) この可変長符号テーブル1010はインデックス数段手順1007で計算されるインデックスの使用頻度に応じて3次元物体毎に設計して伝送する。また、実施例として示された平均的な可変長符号テーブルを使うこととしてもよい。

(0175) 図12は第2実施形態における多様点画像符号化手段を説明する図である。図12において、1101は多様点画像符号化手段で作成されたコードブック1102は可変長符号化されたインデックスデータ、1103は可変長符号テーブル、1104は可変長符号化されたインデックスデータ1102を可変長符号テーブル1103とともに可変長符号化する可変長符号化手段（VLD）、1105はi番目の多様点画像のインデックスデータに対応するコードブック1101内のm×nansk元代表ベクトルを参照するコードブック参照手段、1108はm×nanskブロックを多様点画像に従って仮ブロック数段、1107は符号化されたi番目の多様点画像である。

(0176) 図12を新たに第1実施形態に付加された処理について説明する。多重化、伝送、多重分離されてきた可変長符号化インデックスデータ1102は、可変長符号テーブル1103をもとに可変長符号化手段1104において仮符号化され、後述されて固定長データとなったインデックスデータとコードブック1101がメモリーに展開されて保持される。

(0177) メモリーに展開されて保持されたインデックスデータとコードブック1101は固定長データであるので、任意のブロックがテーブルの参照のみによってメモリから読み取り可能である。コードブック参照手段1105は、コードブック1101内に同じインデックスを持ちm×nansk代表ベクトルを参照して仮ブロック数段1106へブロックを送る。

(0178) 以上のように、ベクトル量化を利用し、3次元物体毎にコードブックとインデックスデータを作成して、更にインデックスデータを可変長符号化して伝送することによって、より符号量を減らすことができる。

(0179) 以上、上述した多様点画像符号化手段で説明した構成で多様点画像を符号化する多様点画像符号化工数と、多様点画像符号化手段で説明した構成で多様点画像を符号化する多様点画像符号化プロセスを考えることにより、多様点画像符号化符号化方法を実現することが可能である。

(0180) 以上、様々な形態を説明したが要するに、本発明の基本概念は、汎用ではなく、画像に応じてそれを画像のコードブックを作成し仮符号化にした、仮符号化後を用意し、受け取ったインデックスから画像を生成するように伝送できる写真表示マシン、パープルチャリティディア・ウォークスルー、そして、パープルチャリティディア表示装置、インタラクティブな電子博物館などと芸術家が選択可能な符号化・仮符号化方法を実現しようとするものであり、3次元物体分布のコードブックを作成するために、符号化処理においては、まずはじめに、全多様点画像をブロック化したものをトーナリングシーケンスとして用意して"k-mean法"を施し、コードブックを設計して、その設計されたコードブックをもとに、全多様点画像内のブロックに関する座標計算を行い、最も近い代表ベクトルのインデックスを求め、符号化処理側は最後に、全多様点画像からの設計されたコードブックと、全多様点画像についてのインデックスデータを伝送するようにして、仮符号化処理側ではそれをコードブック、及び仮符号化処理内ブロックについてのインデックスデータを受け取り、メモリーに保持し、任意位置点画像合成のためにブロックを仮符号化するかの指示を出すように、指示が与えられたらその指示対応のブロック（要求されたブロック）に応じたインデックスの番号を持っているブロックをコードブック内から選択することにより、合成に必要なブロックを仮符号化するものである。

(0181) 特に、多様点画像をベクトル量化することにより多様点画像全体に含まれる相関を利用して情報圧縮を行うことができ、効率的なデータ量削減がなされていきが情報伝送可能な。また、仮符号化処理側では固定長データのコードブックとインデックスデータをメモリーに展開、保持してインデックスを参照するだけで所望点の画像再生を行うことができるようになっており、より高いリアルタイム性で多様点画像の復号を実現でき、実用ベースでリアルタイム性を維持しつつ所望点の画像を再生することができるようになる。

(0182) これにより、実用ベースでパーキャラティディア・ウォークスルー、そして、パーカラティディア表示装置、インタラクティブな電子博物館などと芸術家が選択可能な符号化・仮符号化方法を実現できた。
なるものである。
【0183】なお、本発明は上述した実施形態に限定されるものではなく、種々変形して実施可能である。また、上述の実施形態に記載した手順は、コンピュータに実行させることのできるプログラムとして、磁気ディスク（フロッピーディスク、ハードディスクなど）、光ディスク（CD-ROM、DVDなど）、半導体メモリなどの記録媒体に格納して頒布することもできる。
【0184】発明の効果】以上記述したように本発明によれば、多視点画像がベクトル量化することにより多視点画像全体に含まれる情報を利用して情報圧縮を行うことができ、短時間で情報伝送可能になり、また、複号化技術により固定長データのコードブック化とインデクスデータをメモリに展開、保持してインデクスを参照するだけで所望視点の画像再生を行うことができるようになって、よりリアルタイム性で多視点画像の復号化実現でき、実際においてリアルタイム性を維持しつつ所望視点の画像を呈示することができるようになるという効果を奏する。
【面面の簡単に説明】
【図1】本発明を説明するための図であって、本発明の概念を説明するための図。
【図2】本発明を説明するための図であって、本発明の第1実施形態での双視点画像符号化復号化装置および多視点画像入力装置101における双視点画像の取得装置を説明する図。
【図3】本発明を説明するための図であって、本発明の第1実施形態における多視点画像符号化復号化装置の構成を示す図。
【図4】本発明を説明するための図であって、本発明の第1実施形態における多視点画像符号化復号化装置の構成を示す図。
【図5】本発明を説明するための図であって、本発明の第2実施形態における多視点画像符号化復号化方法の流れを示すフローチャート。
【図6】本発明を説明するための図であって、本発明の第2実施形態における多視点画像符号化復号化方法の流れを示すフローチャート。
【図7】本発明を説明するための図であって、本発明の第3実施形態における多視点画像符号化復号化方法の流れを示すフローチャート。
【図8】本発明を説明するための図であって、本発明の第3実施形態における多視点画像符号化復号化方法の流れを示すフローチャート。
【図9】本発明を説明するための図であって、本発明の第4実施形態における多視点画像符号化復号化方法の流れを示すフローチャート。
【図10】本発明を説明するための図であって、本発明の第4実施形態における多視点画像符号化復号化方法の流れを示すフローチャート。
501…多視点画像入力端子
502…多視点画像符号化端子
504…インデックスデータ
505…多重化工程
508…符号化データ
507…多重分離工程
508…コードブック
509…インデックスデータ
510…多視点画像符号化工程
604…F（枚）の全て視点画像
602…ブロック化手段
603…コードブック作成手段
604…コードブック符号化手段（DCT→Q→VLC）
605…符号化コードブック
606…コードブック符号化手段（VLD→I Q→I D C T）
607…復号化コードブック
608…i番目の多視点画像
609…ブロック化手段
810…インデックス算出手段
811…i番目の多視点画像のインデックスデータ
701…伝送された符号化コードブック
702…コードブック復号化手段（VLD→I Q→I D C T）
703…復号化コードブック
704…伝送されたi番目の多視点画像のインデックスデータ
705…コードブック参照手段
706…逆ブロック化手段
707…復号化されたi番目の多視点画像
801…コードブック
802…コードブック変換手段
803…DCT符号化器
804…量子化器
805…810…可変長符号化器
806…811…多重化部
807…逆DCT復号化器
808…813…ブロックメモリ
809…符号化された差分コードブック
812…逆DCT復号化器
814…911…復号化されたコードブック
901…コードブック使用周波数情報
902…符号化制御器
903…1004…1101…コードブック
904…DCT符号化器
905…量子化器
906…可変長符号化器
907…符号化されたコードブック
2. Korean Patent no. 10-0480518 ('METHOD FOR ENCODING OR DECODING IMAGE DATA AND AN APPARATUS FOR THE SAME CAPABLE OF PERFORMING STORAGE AND TRANSMISSION')

PURPOSE: A method for encoding or decoding image data and an apparatus for the same are provided to compress the image data once by using a key frame method by once, thereby capable of performing storage and transmission.

CONSTITUTION: An image capture member(710) captures image of image data photographed by a camera. A difference detecting member(711) compares data of a present image frame and image data of a predetermined reference frame and detects the difference between the data. A reference frame setting member(719) sets a predetermined image frame of the image data as a reference frame. A compressing member compresses the present image frame on the basis of the detected difference. The present image frames are at least two or more continued image frames.
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전성진

상식권 : 김건수

(54) 영상 데이터 인코딩 또는 디코딩 방법 및 그 장치

요약

본 발명은 디지털 비디오 레코더에서 영상 데이터를 기 프레임 방식으로 압축함으로써 한번의 압축으로 영상 데이터의 저장 및 전송을 동시에 할 수 있는 영상 데이터 인코딩 또는 디코딩 방법 및 그 장치에 관한 것이다.

본 발명의 바람직한 실행시에는 다음과 같은 영상 데이터를 인코딩하는 방법을 영상 데이터를 MPEG 방식으로 압축하여 기 프레임 방식으로 압축함으로써 한 번에 입력 받는 단계와 상기 영상 데이터로부터 영상 프레임을 추출하는 단계, 기 프레임의 코딩 방식의 압축이 심화된 경우, 상기 추출된 영상 프레임을 기 프레임을 추출하는 단계, 및 상기 기 프레임을 참조 프레임(Reference frame)으로 하여 상기 기 프레임이 이제 연속되는 것이므로 두 개 이상의 영상 프레임을 압축하는 단계를 포함하는 것을 특징으로 한다.

본 발명에 따르면, 기 프레임을 확실하게 전송하는 경우 전 프레임 전송시에 문제가 발생되더라도 해당 프레임이 극단되기 때문에 GOP 단위로 처리해야 하는 MPEG-4 표준에 비해 효율 제이가 용이하다.

대표도

도 1

색인

영상 데이터, 인코딩, 디코딩, 디지털 비디오 레코더

방식서

도면의 간단한 실행

도 1은 총해 모질 JPEG 압축 방식을 사용하는 경우의 동작을 나타내는 도면이다.

도 2는 총해 MPEG 압축 방식을 사용하는 경우의 동작을 나타내는 도면이다.

도 3은 B-B-P 구조를 갖는 경우의 프레임의 인코딩 방법을 나타내는 도면이다.
도 4는 I-P 구조를 갖는 경우의 프레임의 인코딩 방법을 나타내는 도면이다.
도 5는 본 방법에 따른 키 프레임 구조를 갖는 경우의 프레임 참조 방법을 나타내는 도면이다.
도 6은 참조 영상에 따른 차분치를 비교하기 위한 도면이다.
도 7은 본 방법에 따른 동영상 데이터를 쌓는 장치의 구성을 나타내는 도면이다.
도 8은 MPEG 표준 압축 방식에 따른 기 프레임으로 설정된 1 프레임을 코딩하는 장치를 나타내는 도면이다.
도 9는 MPEG 표준 압축 방식에 따른 P 프레임을 코딩하는 장치의 구성품 나타내는 도면이다.
도 10은 MPEG 표준 압축 방식에 따른 B 프레임을 코딩하는 장치의 구성품 나타내는 도면이다.
도 11은 본 방법에 따른 영상 데이터를 인코딩하는 장치의 구성도이다.
도 12는 본 방법에 따른 영상 데이터를 디코딩하는 장치의 구성도이다.
도 13은 본 방법의 실시에 따른 영상 데이터를 인코딩하는 방법을 나타내는 도면이다.
도 14는 본 방법의 다른 실시예에 따른 영상 데이터를 인코딩하는 방법을 나타내는 도면이다.
도 15는 본 방법에 따른 영상 데이터를 디코딩하는 방법을 나타내는 도면이다.
도 16은 본 방법에 따른 영상 데이터를 인코딩 및 디코딩하는 방법을 나타내는 도면이다.

<도면의 주요 부분에 대한 부호의 설명>
610: 입력 영상
620: FPS가 높은 경우 이전 영상을 기준으로 한 차분치
630: FPS가 낮은 경우 이전 영상을 기준으로 한 차분치
640: 키 프레임을 기준으로 한 차분치
710, 810, 900, 1000: 이미지 캡처부
711, 910, 1010: 차이 검출부
712, 820, 913, 1013: DCT부
713, 830, 914, 1014: 양자화(Quantization)부
714: 음직임 텍스처 코딩(Motion Texture coding)부
715: 비디오 멀티플렉서(Video Multiplexer)
716, 850, 916, 1016: 역양자화(Inverse Quantization)부
717, 860, 917, 1017: 역(Inverse) DCT부
718: 코딩 방식 반단부 719: 기존 프레임 설정부
720, 870, 919: 프레임 저장(Frame Storage)부
721, 722, 723: 제1, 2, 3 예측(Prediction)부
724: 스위칭부 726: 셰이프 코딩(shape coding)부
725, 911, 1011: 음직임 추정(Motion Estimation)부
840, 915, 1015: 린 엔스 코딩(Length Coding)부
912, 1012: 운전자 보상(Motion Compensation)부
918: 영상 검출부
920: 미래 프레임 저장(Future Frame Storage)부
1019: 이전 프레임 저장(Previous Frame Storage)부
1020: 다음 프레임 저장(Next Frame Storage)부
1110: 기준 프레임 설정부 1120: 차이 검출부
1130: 압축부 1210: 압축 방식 판단부
1220: 기준 프레임 추출부 1230: 복원부

발명의 상세한 설명
발명의 목적
발명은 속하는 기술 및 그 분야의 증례기술

본 발명은 영상 데이터를 인코딩 또는 디코딩하는 방법 및 그 장치에 관한 것으로, 더욱 상세하게는 디지털 비디오 레코더에서 영상 데이터를 기 프레임 방식으로 압축함으로써 완란의 영향으로 영상 데이터의 저장 및 전송을 동시에 할 수 있는 영상 데이터 인코딩 또는 디코딩 방법 및 그 장치에 관한 것이다.

일반적으로 디지털 비디오 레코더(Digital Video Recorder)는 감시 카메라를 통해 입력된 영상 신호를 캡처(capture)하여 압축한 다음 탄광의 하드디스크 또는 광디스크 등의 저장 매체에 저장한다. 디지털 비디오 레코더는 저장된 영상을 시간별, 날짜별, 카메라별, 이벤트별로 쉽게 검색 및 재생할 수 있고, 백업 및 편집이 용이하다. 디지털 비디오 레코더는 복수의 감시 카메라를 사용할 경우 각각의 감시카메라로부터 입력된 영상을 1대의 도트니 비디오 출력에서 분할하여 감시할 수 있는 멀티플렉서(multiplexer) 기능을 수행할 수 있다. 디지털 비디오 레코더는 녹화된 영상을 복원구간 이상으로 이용할 수 있는 디지털 영상 저장 장치로, 현재 내장형 디스크, 주사장, 금속기판, 공항 등에 설치되어 보안상태를 점검하는데 널리 이용되고 있다.

최근에는 교통사고, 안전사고 등의 사고 발생시 증거자료로 확보하기 위해 버스, 자갈, 순찰차량에 설치가 장착되어 사용되고 있으며, 또한 사회의 발전속도의 빈대가 빠르게 변화하게 발생하고 있으므로 가정에서도 이를 대비하기 위한 보안장비로 디지털 비디오 레코더의 설치 요구가 높아지고 있다.

중대 사고 비디오 레코더는 정지 영상 기반 코덱(Codec)으로 모션(Motion) 장치영상 전문가 그룹(Joint Photographic Experts Group: JPEG)과 함께, JPEG 2000, 웨이브레트(Wavelet) 방식을 사용하고, 입력되는 영상을 비디오 JPEG로 압축한 후, 압축된 JPEG 영상은 프레임 프레임(Frame Per Second)이하 FPS라고 함)에 따라 저장하거나 전송한다. FPS 프레임률(control)은 프레임간의 상관 관계가 없기 때문에 프레임 스트리밍(Frame, skip) 방식으로 설정되므로 이상의 프레임을 버릴 수 있다. 이러한 정지 영상 기반 코덱은 도 1에 도시된 것과 같은 JPEG 압축 방식을 이용한 동영상 기반 코덱에 비해 간단하고, 영상 데이터를 1회 압축함으로써 저장 및 전송하기에 동시에 수행할 수 있다.

도 1을 참조하여 중대 JPEG 압축 방식을 이용한 디지털 비디오 레코더의 동작을 간략하게 설명하면 다음과 같다. JPEG 압축 방식을 이용한 중대 디지털 비디오 레코더는 카메라로부터 입력된 영상으로부터 이미지 데이터를 캡처하고(110), 캡처된 이미지 데이터를 JPEG 방식으로 압축한다(120). 디지털 비디오 레코더는 압축된 이미지 데이터를 저장하는 메모리에 저장하고(130), 저장하기 전에는 압축된 이미지 데이터를 저장하고(140). 디지털 비디오 레코더는 압축된 이미지 데이터를 테스트위크로 전송하고(150). 전송하기 전에는 압축된 이미지 데이터를 테스트위크로 전송하고(160), 디지털 비디오 레코더는 압축된 이미지 데이터를 저장되거나 전송이 완료되었는지 여부를 판단하고(170), 완료된 경우 동작을 종료한다.

정지 영상 기반 코덱은 단순히 프레임을 투영하여 속도와 복잡함에 따른 복잡한 생성, 속도 생성 등의 구조가 관리된다. 하지만, 중대 정지 영상 기반 코덱은 영상의 형태가 동영상 기반 코덱에 비해 빠르게 작동만이 많이 사용하고, 프레임 데이터 테스트위크 전송 효율이 높아지는 단점이 있다.

따라, 디지털 비디오 레코더는 MPEG-I, II, IV, H-263, H-263+와 같은 방식의 동영상 기반 코덱을 사용하는 경우 도 2에 도시된 것과 같이 FPS 채워져서 입력되는 영상 저장, FPS와 테스트위크 전송 FPP에 맞도록 각각 압축하여야 하는 단점이 있다.

도 2를 참조하여 동영상 기반 코덱을 이용하는 중대 디지털 비디오 레코더의 동작을 간략하게 설명하면 다음과 같다. 중대 동영상 기반 코덱을 이용한 디지털 비디오 레코더는 카메라로부터 입력된 영상 이미지를 캡처한다(210). 상기 캡처된 영상 데이터가 전송용 압축이 필요한지를 판단하고(221), 전송용 압축이 필요한 경우 영상 저장 FPP 채워져서 상기 영상
상 데이터를 MPEG 방식 압축하고(222), 압축된 영상 데이터를 네트워크로 전송한다(223). 상기 캡처된 영상 데이터가 저장용 액체가 필요할 경우 저장용 액체의 여부를 판단하기(231), 저장용 액체가 필요한 경우 저장위치를 통해 상기 영상 데이터를 MPEG 방식으로 압축하고(231), 압축된 영상 데이터를 저장한다(233). 상기 영상 데이터의 저장 또는 저장위치에 따른 전송할 경우 디지털 비디오 레코딩을 증폭한다.

동영상 기반 코덱은 프레임간 수신 판매 자료에 의한 FGS 코덱이 불가능하고, 비디오의 영상을 사용하는 경우 영상 데이터의 저장과 전송을 위해 네트워크 코덱을 사용함에 따라 비용이 2배가 증가하는 문제점이 있고, 동영상 기반 코덱은 복잡한 자료에 의한 FGS 코덱이 저장용에 적절하지 않으나이다. 동영상 기반 코덱은 소프트웨어 방식을 사용하는 경우 CPU 성능을 높이기 위해 경쟁적으로 비용을 높이고, 압축 효율을 사전에 하여 하지는 하지 않아도 하지 않아도 하지 않는다는 점이 있다. 또한, 저장용 및 네트워크 전송용의 영상 데이터 인코딩으로 MPEG 코덱을 사용하는 경우 압축 비용은 증가하지만, 투호 화 방법의 특성상 압축량의 관계에 따라 압축률을 크게 할 수 없는 단점이 있으며, 역량형 코덱 및 가속 코덱을 사용해서 저장 용량을 증가시키려 하는 위치에 있다.

이에 따라 증가의 디지털 비디오 레코더는 저장용의 영상 데이터 인코딩(encoding)은 MPEG 등을 이용하고, 네트워크 전송용의 영상 데이터 인코딩은 Motion JPEG 방식을 이용하는 경우가 많아서 2개의 코덱을 사용하는 경우가 많았으며, 이에 따라 비용이 증가하였다. 저장용 및 네트워크 전송용의 영상 데이터 인코딩으로 Motion JPEG 방식을 사용하는 경우에는 압축 효율이 높아지기 때문에, 저장 용량을 높이므로 저소득층에 대하는 보다 적절하게 하되, 압박 코덱의 사용이 하지 않아도 하지 않아도 하지 않는다는 점의 비슷한 위치에 있다.

발명이 이루고자 하는 기술적 문제

본 발명은 상기와 같은 문제를 개선하기 위해 안될 것으로서, 영상 데이터를 코 프레임 방식으로 압축하는 영상 데이터 인코딩 방식 및 그 장치를 제공하는 것을 목적으로 한다.

본 발명의 다른 목적은 디지털 비디오 레코더에서 영상 데이터를 현장하며 압축하여 저장 및 전송을 모두 할 수 있는 영상 데이터 인코딩 방식 및 장치를 제공하는 것이다.

본 발명의 또 다른 목적은 디지털 비디오 레코더에서 압축된 영상 데이터의 압축 방식에 따라 압축된 영상 데이터를 디코딩하는 방식 및 장치를 제공하는 것이다.

본 발명의 또 다른 목적은 영상 데이터 인코딩 방식에서 영상 데이터 인코딩 방식을 조합하여 사용하며, 압축 효율도 우수하고 네트워크 전송에 어려움이 없는 영상 데이터 인코딩 방식을 제공하는 것이다.

발명의 구성 및 작용

상기의 목적을 이루고 증가기술의 문제점을 해결하기 위하여, 본 발명은 영상 데이터를 MPEG 방식으로 압축하는 기기 프레임 방식으로 압축하며, 헤비로 업로드시 영상 프레임을 저장하던 전송을 위해 네트워크 코덱을 사용하는 경우의 2배가 증가하는 단점과, 기기 프레임 방식의 압축비에서 총계 메릴에서 기기 프레임을 선택하는 단계 및 기기 프레임을 참조 프레임을 이용하여 압축비를 선택하는 단계를 포함하는 것을 목적으로 하는 영상 데이터 인코딩 방식을 제공한다.

본 발명의 입출력에 따르면 디지털 비디오 레코더에서 영상 데이터를 인코딩하는 방법은 상기 영상 데이터를 영상 프레임을 제공하고, 압축 비율을 낮추고, 네트워크 전송에 어려움이 없는 영상 프레임을 압축하여 저장하며, 보다 효율적으로 전송할 수 있는 방식을 제공한다.

본 발명의 다른 입력에 따르면, 영상 데이터를 네트워크에 압축하여 전송하던 단계와, 기기 프레임 방식의 압축비를 낮추고, 현재 영상 프레임을 압축하여 그 자체를 포함하는 단계를 포함하는 것을 목적으로 하는 영상 데이터 인코딩 방식을 제공한다.
이 값을 이용하여 상기 코퍼레이션 영상 데이터를 복구하는 단계 및 상기 코퍼레이션 영상 데이터를 복구하는 단계로서 상기 기초 프레임을 기준 프레임으로 설정하는 기초 프레임 설정부 외 기존 프레임과 현재 영상 데이터를 비교하여 그 차이를 검출하는 검출부 및 상기 검출된 차이에 기초하여 상기 현재 영상 데이터를 복구하는 단계를 포함하는 것을 특징으로 하는 영상 데이터를 인코딩 및 디코딩하는 방법이 제공된다.

본 발명의 또 다른 인축에 따르면, 영상 데이터의 소정의 영상 데이터를 기준 프레임으로 설정하는 기준 프레임 설정부 외 기존 프레임과 현재 영상 데이터를 비교하여 그 차이를 검출하는 검출부 및 상기 검출된 차이에 기초하여 상기 현재 영상 데이터를 복구하는 단계를 포함하는 것을 특징으로 하는 영상 데이터를 인코딩 및 디코딩하는 방법이 제공된다.

본 발명의 또 다른 인축에 따르면, 영상 데이터의 소정의 영상 데이터를 기준 프레임으로 설정하는 기준 프레임 설정부 외 기존 프레임과 현재 영상 데이터를 비교하여 그 차이를 검출하는 검출부 및 상기 검출된 차이에 기초하여 상기 현재 영상 데이터를 복구하는 단계를 포함하는 것을 특 징으로 하는 영상 데이터를 인코딩 및 디코딩하는 방법이 제공된다.

본 발명에서 사용되는 프레임의 정의는 다음과 같다.

기 프레임(key frame)은 기 프레임 이후 연속되는 적어도 두 개 이상의 영상 프레임을 음직할 때 사용되는 참조 프레임(reference frame)이다. 인트라 프레임(intra frame)은 이하의 프레임이란 한다. 다른 프레임과 독립적으로 부호화되는 프레임으로서 다른 프레임을 사용하지 않고 자바적으로 압축되는 프레임이다. 예측 프레임(predictive frame)은 이하의 프레임이란 한다. 부호화된 프레임의 내용을 예측하기 위하여 이전(전방, 전방) 프레임을 사용함으로써 음직임의 검출 및 보수가 가능하다. 전방 프레임은 이미지의 앞쪽 프레임을 사용하여 음직임의 방향을 결정함으로써 음직임을 보다 정확히 검출함으로써 발전한 트렌드를 적정한 방향으로 보정함으로써 프레임의 음직임을 부호화하는 프레임이다. 전방 프레임으로 부 터의 정보를 사용하는 음직임의 검출 및 보정을 통하여 부호화되는 프레임이다.

이하에서는 첨단된 도면을 참조하여 본 발명의 실시예를 상세히 설명한다.

도 3은 I-B-P-P 구조를 갖는 경우 동영상의 인코딩 방식을 나타내는 도면으로서, I 프레임(I 프레임, B 프레임, P 프레임)과 두(두)의 P 프레임(I 프레임 또는 P 프레임)를 참조한다.

도 3은 참조하면, I 프레임(300)은 다른 프레임을 참조하지 않고 인코딩 및 디코딩되며, P 프레임(303)은 I 프레임(300)을 참조하여 인코딩된다. I 프레임(301)은 방향의 프레임인 I 프레임(300)과 I 프레임(301)과 P 프레임(303)을 참조하여 인코딩된다. I 프레임(301)은 방향의 프레임인 I 프레임(300)과 I 프레임(301)과 P 프레임(303)을 참조하여 인코딩된다. I 프레임(301)은 방향의 프레임인 I 프레임(300)과 I 프레임(301)과 P 프레임(303)을 참조하여 인코딩된다. I 프레임(301)은 방향의 프레임인 I 프레임(300)과 I 프레임(301)과 P 프레임(303)을 참조하여 인코딩된다. I 프레임(301)은 방향의 프레임인 I 프레임(300)과 I 프레임(301)과 P 프레임(303)을 참조하여 인코딩된다. I 프레임(301)은 방향의 프레임인 I 프레임(300)과 I 프레임(301)과 P 프레임(303)을 참조하여 인코딩된다. I 프레임(301)은 방향의 프레임인 I 프레임(300)과 I 프레임(301)과 P 프레임(303)을 참조하여 인코딩된다. I 프레임(301)은 방향의 프레임인 I 프레임(300)과 I 프레임(301)과 P 프레임(303)을 참조하여 인코딩된다. I 프레임(301)은 방향의 프레임인 I 프레임(300)과 I 프레임(301)과 P 프레임(303)을 참조하여 인코딩된다.

도 10을 참조하면, 이미지 레이어(1000)는 카세트로부터 얻은 영상으로부터 저장 또는 전송하고자 하는 이미지 데이터를 저장한다. 카세트 결함(1010)은 B 프레임의 압축하여 음직임 벡터가 저장하는 영역의 차이를 감지한다. 음직임 예측(1101)은 기존 영상과 비교하여 가장 비슷한 부분을 찾는 작업을 수행하여 음직임을 예측하기 위한 음직임 벡터가 저장되는 부분의 일정 영역을 가린다. DCT(1102)는 차이 결함(1101)에게 주어진 근접 프레임을(1210)과 현재 영상 프레임(1110)의 영상 데이터 차이값을 이산 코사인 변환하고, 양자화(1114)로 이루어진 DCT(1102)로부터 추출되는 신호를 일정 반이 어두운 영역, 연속적 코프(1105)는 영상 영역(1104)의 차분값이 있는 영역의 영역을 고려하여 강조하고 영상을 영상 데이터를 역DCT(1102)로 변환한다. 근접 프레임 생성(1108)은 음직임 벡터가 있고 영상 데이터의 차분값이 있는 경우 이전 영상의 모든 영역을 그대로 가져오고, 상기 영상 데이터의 차분값이 있는 경우 상기 차분값(1d2)을 기존 영상 데이터(1d1)에 더하여 영상 데이터를 확장한다. B 프레임의 경우 이전 프레임 저장(1191)에 저장된 이전 프레임(11d2)과 다음 프레임 저장(120d)에 저장된 다음 프레임(Next frame)을 비교하여 유리한 값을 확보하여 확장한다.

도 11은 본 방법에 따른영상 데이터를 인코딩하는 장치의 구성도로서, 기존 프레임 저장부(1110), 차이 감출부(1120), 압축부(1130)로 구성된다.

도 12는 본 방법에 따른 영상 데이터를 인코딩하는 장치의 구성도로서, 압축 방식 디버그(1210), 기존 프레임 추출부(1220), 복원부(1230)로 구성한다.

도 13은 본 방법의 실용에 따른 디버그 레코더에서 영상 데이터를 인코딩하는 방법을 나타내는 도면으로, MPEG 표준 방식 또는 키 프레임 코딩 방식에 따라 영상 데이터를 확장한다.

도 14는 본 방법에 따른 영상 데이터를 인코딩하는 방법을 나타내는 도면으로, 현재 영상 프레임과 기존 프레임을 비교하여 그 차이에 기반하여 현재 영상 프레임을 확장한다.
도 15는 본 범위에 따른 압축된 영상 데이터를 디코딩하는 방법을 나타내는 도면으로, 압축된 영상 데이터의 압축 방식을 편한 후 압축 방식에 따라 압축 방식을 디코딩한다.

도 12 및 도 15를 참조하면, 단계(1510)에서 압축된 영상 데이터가 MPEG 표준 방식으로 압축되었는지 또는 기 프레임 코딩 방식으로 압축되었는지에 관한 압축 방식을 알 수 있다. 상기 압축 방식은 코딩 자체에서 영상 데이터를 압축할 때 압축된 영상 데이터 정보에 포함될 수도 있으며, 사용자의 요청에 따라 조정된 압축 방식으로도 압축될 수 있다. 단계(1520)에서 압축된 영상 데이터(1210)는 상기 입력된 압축 방식에 따라 기 프레임 코딩 방식에서 비디오 프레임만을 선택하고, 단계(1530)에서 본 범위(1200)는 상기 기 프레임 코딩을 사용하여 기 프레임 이후에 압축되어 있는 작아도 두 개 이상의 영상 프레임을 디코딩한다.

도 16은 본 범위에 따른 영상 데이터를 인코딩 및 디코딩하는 방법을 나타내는 도면이다.

도 11, 도 12 및 도 16을 참조하면, 단계(1610)에서 차이 검출부(1120)는 현재 영상 프레임과 이전 영상 프레임을 비교하여 차이 값을 검출하고, 단계(1620)에서 압축부(1130)는 상기 검출된 차이 값을 기반하여 제1 코딩 방식에 따라 상기 영상 데이터를 코딩한다. 상기 제1 코딩 방식은 MPEG 표준 방식과 같은 일반적인 영상 데이터의 코딩 방식일 수 있다.

단계(1630)에서 기존에 기존의 설정부(1140)는 영상 데이터의 소스가 영상 프레임을 기존 프레임으로 식별하고, 단계(1640)에서 차이 검출부(1120)는 상기 기존 프레임에서 다른 영상 프레임이 충돌하는 경우 상기 기존 프레임과의 차이 다른 영상 프레임을 비교하여 그 차이 값을 검출하고, 압축부(1130)는 상기 검출된 차이 값을 기반하여 차이 다른 영상 프레임을 제2 코딩 방식에 따라 코딩한다. 상기 제2 코딩 방식은 본 범위에 따른 특정 프레임을 기존 프레임(기 프레임)에 인코딩(폐기)을 들어 I 프레임으로 설정한 후 상기 기존 프레임을 코딩하여 영상 프레임을 압축하는 방식일 수 있다.

단계(1650)에서 압축된 영상 데이터의 코딩 방식이 제1 코딩 방식이 아닌 경우 단계(1670)에서 압축된 영상 데이터(1210)의 코딩 방식이 상기 제2 코딩 방식으로 편한 후 압축부(1230)는 상기 압축된 영상 데이터를 코딩한다. 상기 압축된 영상 데이터의 코딩 방식이 상기 제2 코딩 방식으로 편한 후 압축부(1230)는 상기 압축된 영상 데이터를 코딩한다. 상기 제2 코딩 방식이 상기 제2 코딩 방식이 아닌 경우 단계(1680)에서 압축된 영상 데이터(1210)는 상기 압축된 영상 데이터를 코딩한다.

본 범위의 실제 예제들은 다양한 컴퓨터로 구현되는 등을 수발하기 위한 프로그램 명령을 포함하는 컴퓨터 코드를 생성하기 위한 여러 가지 방법을 포함한다. 상기 컴퓨터 디스크 가상 메모리에 기록되는 데이터는 프로그램 명령, 데이터 파일, 데이터 구조 등을 단일로 또는 조합하여 포함할 수 있다. 상기 컴퓨터 디스크 가상 메모리의 기록되는 데이터는 프로그램 명령과 같은 정보의 단일로 또는 조합하여 포함할 수 있다. 상기 컴퓨터 디스크 가상 메모리의 기록되는 데이터는 프로그램 명령과 같은 정보의 단일로 또는 조합하여 포함할 수 있다.

이상과 같이 본 범위는 비슷한 개념의 코딩의 도면에 의해 설명되었으나, 본 범위는 상기의 설명에 있거나 기존의 컴퓨터로 영상 데이터를 압축하여 저장 및 전송을 동시에 수행할 수 있는 영상 데이터 인코딩 방법 및 장치가 제공된다.

또한 본 범위에 따르면, 디지털 비디오 레코더에서 하나의 코덱으로 영상 데이터를 압축하여 저장 및 전송을 동시에 수행할 수 있는 영상 데이터 인코딩 방법 및 장치가 제공된다.

또한 본 범위에 따르면, 디지털 비디오 레코더에서 하나의 코덱으로 영상 데이터를 압축하여 저장 및 전송을 동시에 수행할 수 있는 영상 데이터 인코딩 방법 및 장치가 제공된다.

또한 본 범위에 따르면, 압축된 영상 데이터의 압축 방식이 MPEG-4 양축 방식 또는 기 프레임 압축 방식인지 여부를 확인함으로써 압축된 영상 데이터를 디코딩하는 방법 및 장치가 제공된다.

또한 본 범위에 따르면, 압축된 영상 데이터의 압축 방식이 MPEG-4 양축 방식 또는 기 프레임 압축 방식인지 여부를 확인함으로써 압축된 영상 데이터를 디코딩하는 방법 및 장치가 제공된다.

또한 본 범위에 따르면, 압축된 영상 데이터의 압축 방식이 MPEG-4 양축 방식 또는 기 프레임 압축 방식인지 여부를 확인함으로써 압축된 영상 데이터를 디코딩하는 방법 및 장치가 제공된다.
(57) 정구의 범위

정구항 1.

영상 데이터를 인코딩하는 방법에 있어서,
상기 영상 데이터를 MPEB 방식으로 압축할지 기 프레임 코딩 방식으로 압축할지에 관한 선택을 입력 받는 단계;
상기 영상 데이터로부터 영상 프레임을 추출하는 단계;
기 프레임 코딩 방식의 압축이 선택된 경우, 상기 추출된 영상 프레임 중에서 기 프레임을 선택하는 단계; 및
상기 기 프레임을 참조 프레임(reference frame)으로 하여 상기 기 프레임 이후 연속되는 적어도 두 개 이상의 영상 프레
임을 압축하는 단계

를 포함하는 것을 특징으로 하는 영상 데이터 인코딩 방법.

정구항 2.

제1항에 있어서.
상기 기 프레임 이후 연속되는 적어도 두 개 이상의 프레임을 압축하는 단계는.

MPEB 방식의 압축에서 참조 프레임으로 사용되는 B 프레임 또는 P 프레임 대신 상기 기 프레임을 참조 프레임으로 하여
상기 기 프레임 이후 연속되는 적어도 두 개 이상의 프레임을 압축하는 것을 특징으로 하는 영상 데이터 인코딩 방법.

정구항 3.

디지털 비디오 레코더에서 영상 데이터를 인코딩하는 방법에 있어서,
상기 영상 데이터를 MPEB 방식으로 압축할지 기 프레임 코딩 방식으로 압축할지에 관한 선택을 입력 받는 단계;
상기 영상 데이터로부터 영상 프레임을 추출하는 단계;
기 프레임 코딩 방식의 압축이 선택된 경우, 상기 추출된 영상 프레임 중에서 기 프레임을 선택하는 단계;
상기 기 프레임을 참조 프레임(reference frame)으로 하여 상기 기 프레임 이후 연속되는 적어도 두 개 이상의 영상 프레
임을 압축하는 단계; 및
상기 압축된 영상 프레임을 상기 디지털 비디오 레코더에 저장하고 소정의 네트워크 인터페이스를 통하여 네트워크 전송
하는 단계

를 포함하는 것을 특징으로 하는 영상 데이터 인코딩 방법.

정구항 4.

영상 데이터를 인코딩하는 방법에 있어서,
상기 영상 데이터로부터 복수 개의 영상 프레임을 추출하는 단계;
상기 추출된 영상 프레임 중 복수의 프레임을 압축하는데 참조하는 기준 프레임을 설정하고, 현재 영상 프레임과 상기 기
준 프레임을 비교하여 그 차이를 검출하는 단계; 및
상기 검출된 차이에 기반하여 상기 현재 영상 프레임을 압축하여 저장하는 단계

를 포함하는 것을 특징으로 하는 영상 데이터 인코딩 방법.
청구항 5.
제1항에 있어서,
상기 기준 프레임을 I 프레임인 것으로 하는 영상 데이터를 인코딩하는 방법.

청구항 6.
암축된 영상 데이터를 디코딩하는 방법에 있어서,
상기 영상 데이터가 MPEG 방식으로 암축되었는지 키 프레임 코딩 방식으로 암축되었는지에 관란 암축 방식을 판단하는 단계;
상기 영상 데이터가 키 프레임 코딩 방식으로 암축된 경우, 상기 영상 데이터를 구성하는 복수 개의 영상 프레임 중에서 키 프레임을 식별하는 단계; 및
상기 키 프레임을 참조 프레임으로 하여 상기 키 프레임 이후 연속되는 적어도 두 개 이상의 영상 프레임을 디코딩하는 단계
를 포함하는 것으로 하는 영상 데이터 디코딩 방법.

청구항 7.
제6항에 있어서,
상기 키 프레임 이후 연속되는 적어도 두 개 이상의 프레임을 디코딩하는 단계는,
MPEG 방식의 암축에서 참조 프레임으로 사용되는 B 프레임 또는 P 프레임 대신 상기 키 프레임을 참조 프레임으로 하여 상기 키 프레임 이후 연속되는 적어도 두 개 이상의 프레임을 디코딩하는 것을 특징으로 하는 영상 데이터 디코딩 방법.

청구항 8.
영상 데이터를 인코딩 및 디코딩하는 방법에 있어서,
현재 영상 프레임과 이전 영상 프레임을 비교하여 이전 영상 프레임과의 차이 값을 기초하여 제1 코딩 방식에 따라 상기 영상 데이터를 코딩하는 단계;
영상 데이터의 소정의 영상 프레임을 기준 프레임으로 설정하고, 상기 기준 프레임 이외의 다른 영상 프레임을 저장하는 경우 상기 기준 프레임과의 차이 다른 영상 프레임을 비교하여 그 차이 값을 검출하고, 상기 검출된 차이 값에 기초하여 상기 다른 영상 프레임을 제2 코딩 방식에 따라 코딩하는 단계;
상기 암축된 영상 데이터의 코딩 방식이 상기 제1 코딩 방식인지의 여부를 판단하는 단계;
상기 코딩 방식이 상기 제1 코딩 방식이 아닌 것으로 판단되면, 상기 암축된 영상 데이터의 암축 방식이 상기 제2 코딩 방식인 여부를 판단하는 단계;
상기 암축된 영상 데이터의 암축 방식이 상기 제1 코딩 방식인 것으로 판단되면, 상기 이전 영상 프레임과의 차이 값을 이용하여 상기 코딩된 영상 데이터를 복원하는 단계; 및
상기 암축된 영상 데이터의 암축 방식이 상기 제2 코딩 방식인 것으로 판단되면, 상기 검출된 차이 값을 상기 기준 프레임을 이용하여 상기 코딩된 영상 데이터를 복원하는 단계
를 포함하는 것으로 하는 영상 데이터를 인코딩 및 디코딩하는 방법.

청구항 9.
제1항 내지 제8항의 방법 중 어느 하나의 항에 따른 방법을 컴퓨터에서 실행하기 위한 프로그램을 기록하는 컴퓨터에서
판독 가능한 기록 매체.

청구항 10.

영상 데이터를 인코딩하는 장치에 있어서,

상기 영상 데이터의 소정의 영상 프레임은 기준 프레임으로 설정하는 기준 프레임 설정부;

상기 기준 프레임과 현재 영상 프레임을 비교하여 그 차이를 검출하는 차이 검출부; 및

상기 검출된 차이에 기초하여 상기 현재 영상 프레임을 압축하는 압축부

를 포함하고,

상기 기준 프레임에 기초하여 압축되는 상기 현재 영상 프레임은 적어도 연속된 두 개 이상의 영상 프레임인 것을 특징으
로 하며 영상 데이터 인코딩 장치.

청구항 11.

압축된 영상 데이터를 디코딩하는 장치에 있어서,

상기 영상 데이터가 MPEG 방식으로 압축되었는지 키 프레임 코딩 방식으로 압축되었는지에 관한 압축 방식을 판단하는
압축 방식 판단부;

상기 압축 방식에 따라 상기 압축된 영상 데이터로부터 기준 프레임을 추출하는 기준 프레임 추출부; 및

상기 기준 프레임을 기초하여 상기 압축 방식에 대응하는 디코딩 방식으로 상기 압축된 영상 데이터를 디코딩하는 복원
부

를 포함하는 것을 특징으로 하는 영상 데이터를 디코딩하는 장치.

도변
도면 12

도면 13

시작

입력 방식 입력

영상 프레임 추출

키 프레임 방식?

아니오

MPEG 방식 입력

예

영상 프레임 중
키 프레임 선택

키 프레임을 참조
프레임으로 하여
영상 프레임 입력

입력된 영상 프레임
저장 및 전송

종료
시작

영상 데이터로부터 복수 개의 영상 프레임 추출

기존 프레임 설정

현재 영상 프레임과 기존 프레임을 비교, 그 차이를 검출

검출된 차이에 기반하여 현재 영상 프레임 압축 저장

종료
시작

현재 영상 프레임과 이전 영상 프레임 비교 1610

프레임간의 차이값에 기초하여 제1 코딩 방식에 따라 영상 데이터 코딩 1620

현재 영상 프레임과 이전 영상 프레임 비교 1630

기준 프레임과 다른 영상 프레임의 차이값에 기초하여 제2 코딩 방식에 따라 영상 데이터 코딩 1640

제1 코딩 방식? 1650

아니오 1670

제2 코딩 방식? 1680

아니오 1670

예 1660

이전 영상 프레임 과의 차이값을 이용하여 코딩된 영상 데이터 복원

검출된 차이값과 기준 프레임을 이용하여 코딩된 영상 데이터 복원
PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

To:

LEE, Kyeong-ran
502 BYC Bldg., 648-1
Yeoksam 1-dong, Kangnam-ku
Seoul 136-081
RÉPUBLIQUE DE CORÉE

Date of mailing (day/month/year)
17 August 2006 (17.08.2006)

Applicant's or agent's file reference
OPF0485PCT

International application No.
PCT/KR2005/004250

International filing date (day/month/year)

Priority date (day/month/year)
14 January 2005 (14.01.2005)

Applicant
HUMAX CO., LTD. et al

IMPORTANT NOTICE

1. ATTENTION: For any designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002 (30 months from the priority date), does apply, please see Form PCT/IB/308(Second and Supplementary Notice) (to be issued promptly after the expiration of 28 months from the priority date).

2. Notice is hereby given that the following designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002, does not apply, has/have requested that the communication of the international application, as provided for in Article 20, be effected under Rule 93bis.1. The International Bureau has effected that communication on the date indicated below:
   20 July 2006 (20.07.2006)
   CH

   In accordance with Rule 47.1(c-bis)(iii), those Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

3. The following designated Offices, for which the time limit under Article 22(1), as in force from 1 April 2002, does not apply, have not requested, as at the time of mailing of the present notice, that the communication of the international application be effected under Rule 93bis.1:
   LU, SE, TZ, UG, ZM

   In accordance with Rule 47.1(c-bis)(ii), those Offices accept the present notice as conclusive evidence that the Contracting State for which that Office acts as a designated Office does not require the furnishing, under Article 23, by the applicant of a copy of the international application.

4. TIME LIMITS for entry into the national phase

   For the designated Office(s) listed above, and unless a demand for international preliminary examination has been filed before the expiration of 19 months from the priority date (see Article 39(1)), the applicable time limit for entering the national phase will, subject to what is said in the following paragraph, be 20 MONTHS from the priority date.

   In practice, time limits other than the 20-month time limit will continue to apply, for various periods of time, in respect of certain of the designated Offices listed above. For regular updates on the applicable time limits (20 or 21 months, or other time limit), Office by Office, refer to the PCT Gazette, the PCT Newsletter and the PCT Applicant's Guide, Volume II, National Chapters, all available from WIPO's Internet site, at http://www.wipo.int/pct/en/index.html.

   It is the applicant's sole responsibility to monitor all these time limits.
PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

To:

LEE, Kyeong-ran
502 BYC Bldg., 648-1
Yeoksam 1-dong, Kangnam-ku
Seoul 135-081
RÉPUBLIQUE DE CORÉE

PCT
NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

Date of mailing (day/month/year)
17 March 2006 (17.03.2006)

Applicant or agent's file reference
OPF0485PCT

International application No.
PCT/KR2005/004250

International publication date (day/month/year)
Not yet published

Applicant
HUMAX CO., LTD. et al

IMPORTANT NOTIFICATION

International filing date (day/month/year)

Priority date (day/month/year)
14 January 2005 (14.01.2005)

1. By means of this Form, which replaces any previously issued notification concerning submission or transmittal of priority documents, the applicant is hereby notified of the date of receipt by the International Bureau of the priority document(s) relating to all earlier application(s) whose priority is claimed. Unless otherwise indicated by the letters "NR", in the right-hand column or by an asterisk appearing next to a date of receipt, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).

2. (If applicable) The letters "NR" appearing in the right-hand column denote a priority document which, on the date of mailing of this Form, had not yet been received by the International Bureau under Rule 17.1(a) or (b). Where, under Rule 17.1(a), the priority document must be submitted by the applicant to the receiving Office or the International Bureau, but the applicant fails to submit the priority document within the applicable time limit under that Rule, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

3. (If applicable) An asterisk (*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b) (the priority document was received after the time limit prescribed in Rule 17.1(a) or the request to prepare and transmit the priority document was submitted to the receiving Office after the applicable time limit under Rule 17.1(b)). Even though the priority document was not furnished in compliance with Rule 17.1(a) or (b), the International Bureau will nevertheless transmit a copy of the document to the designated Offices, for their consideration. In such case a copy is not accepted by the designated Office as the priority document, Rule 17.1(c) provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<table>
<thead>
<tr>
<th>Priority date</th>
<th>Priority application No.</th>
<th>Country or regional Office or PCT receiving Office</th>
<th>Date of receipt of priority document</th>
</tr>
</thead>
</table>

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Authorized officer
Carlos Roy - Gijsbertus Beijer

Facsimile No. +41 22 338 82 70
Telephone No. +41 22 338 95 61

Form PCT/IB/304 (October 2005)
**NOTIFICATION CONCERNING AVAILABILITY OF THE PUBLICATION OF THE INTERNATIONAL APPLICATION**

**Applicant's or agent's file reference**  
OPF0485PCT

**Date of mailing (day/month/year)**  
20 July 2006 (20.07.2006)

**International application No.**  
PCT/KR2005/004250

**International filing date (day/month/year)**  

**Priority date (day/month/year)**  
14 January 2005 (14.01.2005)

**Applicant**  
HUMAX CO., LTD. et al.

The applicant is hereby notified that the International Bureau:

- [✓] has published the above-indicated international application on 20 July 2006 (20.07.2006) under No. WO 2006/075844

- [ ] has republished the above-indicated international application on under No. WO

For an explanation as to the reason for this republishing of the international application, reference is made to INID codes (15), (48) or (88) (as the case may be) on the front page of the published international application.

A copy of the international application is available for viewing and downloading on WIPO's website at the following address: http://www.wipo.int/pctdb/ (under "Query" enter the PCT or WO number).

The applicant may also request a paper copy of the published international application from the International Bureau in writing from pct.eproducts@wipo.int or the contact details provided below.

**The International Bureau of WIPO**  
34, chemin des Colombettes  
tél. 11 Geneva 20, Switzerland

**Authorized officer**  
Philippe Becamel

**Facsimile No.**  
+41 22 338 82 70

**Form PCT/IIB/311 (April 2006)**

**e-mail:** pl12@wipo.int

**WO 2006/075844**  
PCT/KR2005/004250
PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

FOR FURTHER ACTION

See Form PCT/IPEA/416

Applicant's or agent's file reference

OF0485/PCT

International application No.

PCT/KR2005/004250

International filing date (day/month/year)


Priority date (day/month/year)

14 JANUARY 2005 (14.01.2005)

International Patent Classification (IPC) or national classification and IPC

H04N 7/24(2006.01)i

Applicant

HUMAX Co., Ltd. et al

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:
   a. ☐ (sent to the applicant and to the International Bureau) a total of _______ sheets, as follows:
      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and for sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 807 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _______ containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:
   ☑ Box No. I Basis of the report
   ☑ Box No. II Priority
   ☑ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   ☑ Box No. IV Lack of unity of invention
   ☑ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   ☑ Box No. VI Certain documents cited
   ☑ Box No. VII Certain defects in the international application
   ☑ Box No. VIII Certain observations on the international application

Date of submission of the demand

25 JULY 2006 (25.07.2006)

Date of completion of this report

01 MAY 2007 (01.05.2007)

Name and mailing address of the IPEA/KR

Korean Intellectual Property Office

920 Dusan-dong, Seo-gu, Daejeon 302-701, Republic of Korea

Authorized officer

CHO, Woo Yeon

Fax/telephone No. 82-42-472-7140

Telephone No. 82-42-481-8524

Form PCT/IPEA/409 (cover sheet) (April 2007)
INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

Box No. 1  Basis of the report

1. With regard to the language, this report is based on:

☐ the international application in the language in which it was filed.

☒ a translation of the international application into English which is the language of a translation furnished for the purposes of:

☐ international search (under Rules 12.3(a) and 23.1(b)).

☒ publication of the international application (under Rule 12.4(a)).

☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a)).

2. With regard to the elements of the international application, this report is based on (replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):

☒ the international application as originally filed/furnished

☐ the description:

pages* received by this Authority on

pages* as originally filed/furnished

☐ the claims:

pages* received by this Authority on

pages* as amended (together with any statement) under Article 19

pages* received by this Authority on

☐ the drawings:

pages* received by this Authority on

pages* as originally filed/furnished

☐ the sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages

☐ the claims, Nos.

☐ the drawings, sheets

☐ the sequence listing (specify):

☐ any table(s) related to sequence listing (specify):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(a)).

☐ the description, pages

☐ the claims, Nos.

☐ the drawings, sheets

☐ the sequence listing (specify):

☐ any table(s) related to sequence listing (specify):

5. ☐ This report has been established taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91 (Rule 70.2(c)).

* If item 4 applies, some or all of those sheets may be marked "superseded."
2. Citations and explanations (Rule 70.7)

Reference is made to the following documents:

D1: US 6,072,831 A (06 Jun 2000)

1. Novelty

Claims 1-12 are considered to be novel over the available prior art, because no individual documents disclose all of the technical features as specifically set out in the claims of the present application (Article 35(2) PCT).

2. Inventive Step

The subject matter of claims 1-12 of the present application relates to a reference frame ordering method for multi-view coding, characterized by selecting a reference frame for a voluntary present frame to be coded or decoded among a plurality of frames generated in regular sequence by a plurality of cameras.

D1 and D2 are considered to be the closest prior art.

D1 discloses rate control for stereoscopic digital video encoding, characterized in that rate control in a stereoscopic digital video communication system is achieved by modifying the quantization level of P or B-frame data in the enhancement layer depending on whether the frame is temporally predicted or disparity predicted.

D2 disclosed temporal and spatial scaling of video images including video object planes (VOPs) in an input digital video sequence for improving coding efficiency by adaptively compressing scaled field mode video.

(Continued on Supplemental Sheet.)
Neither D1 nor D2 provides the characterizing feature of the present invention, that is, the step of coding and decoding the present frame out of the plural frames by referring to the first reference frame and the second reference frame selected from the same kind of frames (from a point of view) as the present frame.

Thus, claims 1-12 involve an inventive step and meet the requirement of Article 33(3) PCT.

3. Industrial Applicability

The present invention is industrially applicable (Article 33(4) PCT).
PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
LEE, Kyeong-Ran
502 BYC Bldg., 648-1 Yeoksam 1-dong, Kangnam-ku, Seoul
135-081 Republic of Korea

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43bis.1)

Date of mailing
(day/month/year) 30 MARCH 2006 (30.03.2006)

Applicant's or agent's file reference
OPP/0485PCT

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/KR2005/004250


Priority date (day/month/year) 14 JANUARY 2005 (14.01.2005)

International Patent Classification (IPC) or both national classification and IPC
I HoN 7/24(2006.01)i

Applicant
HUMAX Co., Ltd. et al

1. This opinion contains indications relating to the following items:

- [x] Box No. I Basis of the opinion
- [ ] Box No. II Priority
- [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV Lack of unity of invention
- [x] Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI Certain documents cited
- [ ] Box No. VII Certain defects in the international application
- [ ] Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
920 Duman-dong, Seo-gu, Daejeon
302-701, Republic of Korea
Facsimile No. 82-42-472-7140

Date of completion of this opinion
29 MARCH 2006 (29.03.2006)

Authorized officer
MA, Jung Youn

Telephone No. 82-42-481-5675

Form PCT/ISA/237 (cover sheet) (April 2005)
1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This opinion has been established on the basis of a translation from the original language into the following language, which is the language of a translation furnished for the purposes of international search (under Rules 23.3 and 23.1(b)).

2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material
   ☐ a sequence listing
   ☐ table(s) related to the sequence listing

b. format of material
   ☐ on paper
   ☐ in electronic form

c. time of filing/furnishing
   ☐ contained in the international application as filed.
   ☐ filed together with the international application in electronic form.
   ☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:
### Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

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<td>Claims</td>
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</table>

2. **Citations and explanations:**

   Reference is made to the following documents:

   - D1: US 6,072,831 A (06 Jun 2000)
   - D2: US 6,057,884 A (11 May 2000)

1. **Novelty**

   Claims 1–12 are considered to be novel over the available prior art, because no individual documents disclose all of the technical features as specifically set out in the claims of the present application (Article 33(2) PCT).

2. **Inventive Step**

   The subject matter of claims 1–12 of the present application relates to a reference frame ordering method for multi-view coding, characterized by selecting a reference frame for a voluntary present frame to be coded or decoded among a plurality of frames generated in regular sequence by a plurality of cameras.

   D1 and D2 are considered to be the closest prior art.

   D1 discloses rate control for stereoscopic digital video encoding, characterized in that rate control in a stereoscopic digital video communication system is achieved by modifying the quantization level of P or B-frame data in the enhancement layer depending on whether the frame is temporally predicted or disparity predicted.

   D2 disclosed temporal and spatial scaling of video images including video object planes (VOPs) in an input digital video sequence for improving coding efficiency by adaptively compressing scaled field mode video.

   (Continued on Supplemental Sheet.)
Neither D1 nor D2 provides the characterizing feature of the present invention, that is, the step of coding and decoding the present frame out of the plural frames by referring to the first reference frame and the second reference frame selected from the same kind of frames (from a point of view) as the present frame.

Thus, claims 1–12 involve an inventive step and meet the requirement of Article 33(3) PCT.

3. Industrial Applicability

The present invention is industrially applicable (Article 33(4) PCT).
INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference
OPF0485PCT

FOR FURTHER ACTION
see Form PCT/ISA/220
as well as, where applicable, item 5 below.

International application No.
PCT/KR2005/004250

International filing date (day/month/year)

(Earliest) Priority Date (day/month/year)
14 JANUARY 2005 (14.01.2005)

Applicant
HUMAX Co., Ltd. et al

This International search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☑ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report
   a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
      ☐ The international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
   b. ☐ With regard to any nucleotide and/or amino acid sequence disclosed in the international application, see Box No. I.

2. ☐ Certain claims were found unsearchable (See Box No. II)

3. ☐ Unity of invention is lacking (See Box No. III)

4. With regard to the title,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,
   a. the figure of the drawings to be published with the abstract is Figure No. 4
      ☒ as suggested by the applicant.
      ☐ because the applicant failed to suggest a figure.
      ☐ because this figure better characterizes the invention.
   b. ☐ none of the figure is to be published with the abstract.

Form PCT/ISA/210 (first sheet) (April 2005)
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

H04N 7/24(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 8 H04N 7/12; 7/24; 7/32; 13/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models since 1975
Japanese Utility models and applications for Utility models since 1975

Electronic database consulted during the international search (name of database and where practicable, search terms used)
WPI, ESPASNET, INSPECT, IER/IEEE, PAJ, eKIPASS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>US 6,072,831 A (Xuemin Chen) 06 Jun 2000 See the abstract, figure 1</td>
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<td>KR 10-0480518 B1 (Choi Hee-Wool) 7 Apr 2005 See the abstract</td>
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</table>

☐ Further documents are listed in the continuation of Box C.  ☒ See patent family annex.

* Special categories of cited documents:
  "A" document defining the general state of the art which is not considered to be of particular relevance
  "E" earlier application or patent published on or after the international filing date
  "L" document which may throw doubts on priority claim(s) or which is cited to establish the citation date of another special reason (as specified)
  "O" document referring to an oral disclosure, use, exhibition or other means
  "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search
29 MARCH 2006 (29.03.2006)

Date of mailing of the international search report
30 MARCH 2006 (30.03.2006)

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
920 Dunsan-dong, Seo-gu, Daejeon 302-701,
Republic of Korea
Facsimile No. 82-42-472-7140

Authorized officer
MA, Jung Youn
Telephone No. 82-42-481-5679

Form PCT/ISA/210 (second sheet) (April 2005)
<table>
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**TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371**

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<th>PRIORITY DATE CLAIMED</th>
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**ATTORNEY'S DOCKET NUMBER**

5200-0104PUS1

**U.S. APPLICATION NO.** (If known, see 37 CFR 1.5)

NEW

**TITLE OF INVENTION**

REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

**APPLICANT(S) FOR DO/EO/US**

Yung-Lyul LEE, Euee-S. JANG; Chang-Ku LEE

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. **[x]** This is a FIRST submission of items concerning a submission under 35 U.S.C. 371.

2. **[ ]** This is a SECOND or SUBSEQUENT submission of items concerning a submission under 35 U.S.C. 371.

3. **[x]** This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.

4. **[x]** The US has been elected (Article 31).

5. **[x]** A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   - **[ ]** is attached hereto (required only if not communicated by the International Bureau).
   - **[x]** has been communicated by the International Bureau.
   - **[ ]** is not required, as the application was filed in the United States Receiving Office (RO/US).

6. **[x]** An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   - **[x]** is attached hereto.
   - **[ ]** has been previously submitted under 35 U.S.C. 154(d)(4).

7. **[x]** Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   - **[ ]** are attached hereto (required only if not communicated by the International Bureau).
   - **[ ]** have been communicated by the International Bureau.
   - **[ ]** have not been made; however, the time limit for making such amendments has NOT expired.
   - **[x]** have not been made and will not be made.

8. **[ ]** An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).

9. **[x]** An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).

10. **[ ]** An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11 to 20 below concern document(s) or information included:**

11. **[x]** An Information Disclosure Statement under 37 CFR 1.97 and 1.98.

12. **[ ]** An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

13. **[ ]** A preliminary amendment.

14. **[ ]** An Application Data Sheet under 37 CFR 1.76.

15. **[ ]** A substitute specification.

16. **[ ]** A power of attorney and/or change of address letter.

17. **[ ]** A computer-readable form of the sequence listing in accordance with PCT Rule 13(ter.2) and 37 CFR 1.821 - 1.825.


**The following fees have been submitted**

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**TOTAL OF 21, 22 and 23 =** $900.00

**Surcharge of $130 for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.462(h)).**

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**TOTAL OF ABOVE CALCULATIONS =** $900.00

**SUBTOTAL =** $900.00

**TOTAL NATIONAL FEE =** $900.00

**Fee for recording the enclosed assignment (37 CFR 1.21(n)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.30, 3.31). $40.00 per property**

**TOTAL FEES ENCLOSED =** $940.00

Amount to be refunded: $

Amount to be charged: $940.00
a. □ A check in the amount of $ _____________ to cover the above fees is enclosed.

b. □ Please charge my Deposit Account No. 02-2448 in the amount of $ 940.00 to cover the above fees.

c. □ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-2448. A duplicate copy of this sheet is enclosed.

d. □ Fees are to be charged to a credit card. WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.485 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

SEND ALL CORRESPONDENCE TO:

July 13, 2007

CUSTOMER NUMBER: 02292

/signature

ROBERT F. GNUSE
Registration # 27295

NAME: James F. Eller, Jr.

CIRCUIT 39,538

REGISTRATION NUMBER
Certificate of Electronic Filing Under 37 CFR 1.8

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with 37 CFR 1.6(e)(4):

MS PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

on July 13, 2007
Date

______________________________
Signature

______________________________
James T. Eller, Jr.
Typed or printed name of person signing Certificate

39,538 (703) 205-8000
Registration Number, if applicable Telephone Number

Note: Each paper must have its own certificate of mailing.

PCT/IB/308; PCT/IB/304; PCT/IB/311; PCT/PEA/409 (4 sheets);
PCT/ISA/237 (4 sheets); PCT/ISA/210; Drawings (4 sheets)
English language translation of the international application
Oath or declaration of the inventor(s)
Transmittal Letter to the United States Designated-Elected Office (3 pages)
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A SUBMISSION UNDER 35 U.S.C. 371

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<td>5200-0104PUS1</td>
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TITLE OF INVENTION
REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

APPLICANT(S) FOR DO/EO/US
Yung-Lyul LEE, Euee-S. JANG; Chang-Ku LEE

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [x] This is a FIRST submission of items concerning a submission under 35 U.S.C. 371.
2. [ ] This is a SECOND or SUBSEQUENT submission of items concerning a submission under 35 U.S.C. 371.
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   a. [ ] is attached hereto (required only if not communicated by the International Bureau).
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7. [x] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [x] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [x] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
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17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 37 CFR 1.821 – 1.825.
The following fees have been submitted

| 21. x | Basic national fee (37 CFR 1.492(a)) | $300 |
| 22. x | Examination fee (37 CFR 1.492(c)) | $200.00 |
| 23. x | Search fee (37 CFR 1.492(b)) | $400.00 |

TOTAL OF 21, 22 and 23 = $900.00

<table>
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Surcharge of $130 for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.492(h)).

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TOTAL OF ABOVE CALCULATIONS = $900.00

SUBTOTAL = $900.00

Processing fee of $130.00 for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.462(b)).

TOTAL NATIONAL FEES = $900.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property

TOTAL FEES ENCLOSED = $940.00

Amount to be refunded: $

Amount to be charged $940.00
a. [ ] A check in the amount of $ ______________ to cover the above fees is enclosed.
b. [x] Please charge my Deposit Account No. 02-2448 in the amount of $ 940.00 to cover the above fees.
c. [x] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-2448. A duplicate copy of this sheet is enclosed.
d. [ ] Fees are to be charged to a credit card. WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.485 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

SEND ALL CORRESPONDENCE TO:

July 13, 2007

CUSTOMER NUMBER: 02292

/scp

Robert F. Gnuse
Registration # 27295

NAME: James T. Eller, Jr.

39,538

REGISTRATION NUMBER
Certificate of Electronic Filing Under 37 CFR 1.8

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with 37 CFR 1.6(e)(4):

MS PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA  22313-1450

on       July 13, 2007       Date

[Signature]

James T. Eller, Jr.

Typed or printed name of person signing Certificate

39,538  (703) 205-8000
Registration Number, if applicable  Telephone Number

Note: Each paper must have its own certificate of mailing.
PCT/IB/308; PCT/IB/304; PCT/IB/311; PCT/PEA/409 (4 sheets);
PCT/ISA/237 (4 sheets); PCT/ISA/210; Drawings (4 sheets)
English language translation of the international application
Oath or declaration of the inventor(s)
Transmittal Letter to the United States Designated-Elected Office (3 pages)
Title: REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

Abstract: A method for setting the order of reference frames for multi-view coding and a recorded medium recording the method are disclosed. The method of setting the order of reference frames, in accordance with an embodiment of the present invention, comprises the steps of selecting the n (integer) number of frames of the same kind that have a same-view relation with said current frame and are encoded or decoded prior to said current frame as a first reference frame, selecting the m (integer) number of frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with said current frame, and encoding or decoding said current frame by making reference to the frames of the same kind included in said first reference frame and said second reference frame. With the present invention, an improved picture quality and three-dimensionality can be provided, and the delay in processing time can be prevented when using the reference frame.
REFERENCE FRAME ORDERING FOR MULTI-VIEW CODING

The present invention relates to setting the order of reference frames, more specifically to a method for setting the order of reference frames for multi-view coding and a recorded medium recording the method.

In general, digital data is transmitted from a certain type of transmitting device to a certain type of receiving device. A transmitting device typically comprises an encoder encoding the data for transmission, and a receiving device typically comprises a decoder decoding the received data. A variety of digital data, such as video data, audio data, and audio/video data, can be transmitted from a transmitting device to a receiving device and outputted through a receiving device.

Dominating video compression and transmission formats comes from a family called a hybrid block-based motion-compensated transform video coder. Examples of the above coder is ITU-T VCEG video coding standards, which comprise H.261, MPEG-1, H.262/MPEG-2 video, H.263, MPEG-4 visual of VCEG (Video Coding Experts Group)
and ISO/IEC MPEG (Moving Picture Experts Group) as well as the in-process draft
standard H.264/AVC. Moreover, coding and compression standards are in place to
synchronize and multiplex the signals for various other types of media, including still
picture, audio, document, and webpage.

Video streams are generally made up in three types of frames or pictures, which
are the infra frame (I frame), predictive frame (P frame), and bi-directionally predictive
frame (B frame).

The I frame does simply codifies the frame by discrete cosine transform, without
using motion estimation/compensation. The P frame does motion
estimation/compensation while referring to the I frame or other P frames, and then
codifies the rest of the data by discrete cosine transform. The B frame does motion
compensation, like the P frame, but carries out motion estimation/compensation from two
frames on the time axis.

The sequence in video stream is defined by a segment called the group of
pictures (GOP). In the structure of I, B, B, P, B, B, P, ..., the GOP refers to the frames
between an I frame to the next I frame. Generally, when displayed at an intended rate, the
GOP is structured in a set of pictures having a predetermined duration (e.g., 0.5 seconds).

Generally, the MPEG-2 video stream or sequence is defined by a segment called
GOP. Typically, the GOP is structured in a set of pictures having a duration of 0.5
seconds, when displayed at an intended rate.
As described above, the medium for delivering picture information such as video stream has been developed from the 2-dimensional terminal technology, such as television. In other words, as the development moves from black and white pictures to color pictures, as in SD (standard definition) television and high-resolution television (e.g., HDTV), the data amount of picture information is increasing.

Consequently, the current picture information is not 2-dimensional but 3-dimensional, and thus development of technologies related to 3-dimensional picture information is needed in order to deliver reproduce realistic, natural multimedia information.

However, since the technology standard such as MPEG-2 is for coding and decoding video from one view, the design of structure and process of data for expressing multi-view information is needed in order to codify multi-view video data. Although technology standards are proposing MVP (multi-view profile) for expanding the video used in MPEG-2 to a stereo video, this still does not suggest a proper solution for coding multi-view video.

【Disclosure】

【Technical Problem】

Contrived to solve the above problems, the present invention aims to provide a method for setting the order of reference frames and a recorded medium recording the
method that can provide better picture quality and 3-dimensionality owing to utilizing more reference frames.

The invention also aims to provide a method for setting the order of reference frames for multi-view coding and a recorded medium recording the method that can prevent the delay in process time when using the reference frame.

Another object of this invention is to provide a method for setting the order of reference frames for multi-view coding and a recorded medium recording the method that can maintain an optimal efficiency while the encoder and decoder are encoding and decoding.

Another object of the present invention is to provide a method for setting the order of reference frames for multi-view coding and a recorded medium recording the method that allows a user to select a picture of desired direction among pictures of various directions inputted through multiple cameras.

【Technical Solution】

In order to achieve the above objects, a first aspect of the present invention provides a method for setting the order of reference frames for multi-view coding.

According to a preferred embodiment, the method for setting the order of reference frames for multi-view coding can comprise the steps of selecting the n (integer) number of frames of the same kind that have a same-view relation with the current frame
and are encoded or decoded prior to the current frame as a first reference frame, selecting
the m (integer) number of frames of the same kind that have a same-view relation with the
current frame and have an inter-view relation with a frame of the same kind, which is
encoded or decoded immediately before, as a second reference frame, wherein the frame
of the same kind has a same-view relation with the current frame, and encoding or
decoding the current frame by making reference to the frames of the same kind included
in the first reference frame and the second reference frame.

The n number of frames of the same kind, included in the first reference frame,
can be extracted in the reverse order of encoding or decoding.

In case the method further comprises the step of selecting the k (integer) number
of frames of the same kind having an inter-view relation with the current frame as a third
reference frame, the current frame can be encoded or decoded by making reference to the
frames of the same kind included in the first through third reference frames.

The frame of the same kind can be a P frame of a B frame that is the same kind as
the current frame.

A plurality of frames generated by the plurality of cameras in the temporal order
of an I frame, a first B frame, a second B frame, and a P frame can be encoded or decoded
in the order of an I frame, a P frame, a first B frame, and a second B frame about the time
axis.

Picture information inputted by the plurality of cameras can be generated as one
of the forms consisting of 1-D parallel data, 1-D arc data, and 2-D parallel data.

In order to achieve aforementioned objects, a second aspect of the present invention provides a recorded medium recording a program for executing a method of setting the order of reference frames for multi-view coding.

According to a preferred embodiment of the present invention, the program recorded in the recorded medium is a program of instructions executable by a transmitting device or a receiving device, and can execute the steps of selecting the \( n \) (integer) number of frames of the same kind that have a same-view relation with the current frame and are encoded or decoded prior to the current frame as a first reference frame, wherein the current frame is a frame to be currently encoded or decoded among a plurality of frames successively generated by a plurality of cameras along the time, selecting the \( m \) (integer) number of frames of the same kind that have a same-view relation with the current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with the current frame, and encoding or decoding the current frame by making reference to the frames of the same kind included in the first reference frame and the second reference frame.

The \( n \) number of frames of the same kind, included in the first reference frame, can be extracted in the reverse order of encoding or decoding.
In case the method further comprises the step of selecting the \( k \) (integer) number of frames of the same kind having an inter-view relation with the current frame as a third reference frame, the current frame can be encoded or decoded by making reference to the frames of the same kind included in the first through third reference frames.

The frame of the same kind can be a P frame of a B frame that is the same kind as the current frame.

A plurality of frames generated by the plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame can be encoded or decoded in the order of an I frame, a P frame, a first B frame, and a second B frame about the time axis.

Picture information inputted by the plurality of cameras can be generated as one of the forms consisting of 1-D parallel data, 1-D arc data, and 2-D parallel data.

【Description of Drawings】

Fig. 1 shows an arrangement of a plurality of cameras for inputting 1-D parallel data, based on a preferred embodiment of the present invention;

Fig. 2 shows an arrangement of a plurality of cameras for inputting 1-D arc data, based on a preferred embodiment of the present invention;

Fig. 3 shows an arrangement of a plurality of cameras for inputting 2-D parallel data, based on a preferred embodiment of the present invention;
Fig. 4 shows a method of setting the order of reference frames in case the input data are 1-D parallel data and 1-D arc data, based on a preferred embodiment of the present invention;

Fig. 5 shows a method of setting the order of reference frames in case the input data is 2-D parallel data, based on a preferred embodiment of the present invention; and

Figs. 6-9 show graphs comparing the bit rate and signal-to-noise ratio according to a method for setting the order of reference frames for multi-view coding based on the anchor and the present invention.

【Mode for Invention】

In order to fully understand the present invention, the advantages of the present invention, and the objects achieved by embodying the present invention, the accompanying drawings illustrating embodiments of the present invention and their disclosed description must be referenced.

Below, preferred embodiments of the present invention will be described with reference to the accompanying drawings. To aid the overall understanding, the same reference numerals are used for the same means, regardless of the Fig. number.

Fig. 1 is an arrangement of a plurality of cameras for inputting 1-D parallel data, based on a preferred embodiment of the present invention, while Fig. 2 is an arrangement
of a plurality of cameras for inputting 1-D arc data, based on a preferred embodiment of
the present invention, and Fig. 3 is an arrangement of a plurality of cameras for inputting
2-D parallel data, based on a preferred embodiment of the present invention.

In the arrangement of a plurality of cameras for inputting 1-D parallel data, as
shown in Fig. 1, the n number of cameras, represented by 120a, 120b... 120n-1, and 120n,
are arranged in a line about the camera that is arranged perpendicular to an object 110.

When the n number of cameras 120a, 120b... 120n-1, 120n are arranged
according to a method shown in Fig. 1, the distance between each camera and the object is
different from each other. Of course, the distances between either side of the central
camera and the object 110 may be the same.

In the arrangement of a plurality of cameras for inputting 1-D arc data, as shown
in Fig. 2, the n number of cameras, represented by 120a, 120b... 120n-1, and 120n, are
sequentially arranged on an arc with a fixed distance d to an object 110.

When the n number of cameras 120a, 120b... 120n-1, 120n are arranged
according to a method shown in Fig. 2, the distance between each camera and the object
110 is the same.

In the arrangement of a plurality of cameras for inputting 2-D parallel data, as
shown in Fig. 3, a plurality of cameras, represented by 120a, 120b, 120c, 120d, and 120e,
are arranged on a pre-designated shape of structure according to a predetermined rule. Fig.
3 illustrates a cross-shaped structure, on which each camera is arranged on the center and
each projecting part. However, there can be an unlimited variety of structural shapes and the number of cameras to arrange a plurality of cameras on a structure.

Each camera arranged by each method illustrated in Figs. 1-3 receives object images inputted through the installed lens angle, with the passage of time, and generates picture information, and the picture information is structured in segments, called GOP, of I, B, B, P, B, B, P, ..., as described earlier.

The method of setting the order of reference frames and/or the scope of reference frames for efficiently encoding or decoding each frame of picture information generated by each method of camera arrangement is different from each other, and thus the description will be made below by making reference to the relevant figure.

Fig. 4 is a method for setting the order of reference frames when the input data are 1-D parallel data and 1-D arc data, based on a preferred embodiment of the present invention.

As shown in Fig. 4, the GOP of 1-D parallel data and 1-D arc data can be structured in the order of I frame, P frame, B frame, B frame, P frame, and B frame, and the frames arranged along the x-axis (i.e., time) refer to picture information independently generated by each camera. The GOP of this invention may be set to have the duration of, for example, 1 second.

The encoding/decoding of multi-view coding on 1-D parallel data and 1-D arc
data is carried out in the order of 210, 220, 230, and 240. That is, after processing I frames generated at a same moment, P frames are processed, and then the previously generated B frames are processed before the later generated B frames are processed. Then, since there is no I frame until the next GOP, the process is repeated in the order of P frame, B frame, and B frame.

Suppose, in this process order, a P frame 250 (hereinafter referred to as “current frame”) has to be encoded or decoded. Here, a transmitting device and/or receiving device can use relevant P frame information as reference frames in order to encode or decode the P frame 250. In Fig. 4, CEV means the current frame to be decoded or encoded, and R means the reference frame index ordering.

In other words, in order to encode or decode the current frame, the transmitting device and/or receiving device extracts and references information related to a first P frame 255 (R=0), which is a frame of the same kind encoded or decoded immediately before the current frame, a second P frame 260 (R=1), which is a frame of the same kind encoded or decoded immediately before the first P frame 255, a third P frame 265 (R=2), which is a frame of the same kind encoded or decoded immediately before the second P frame 260, and a third P frame 270 (R=4) and fourth P frame 275 (R=5), which are frames of the same kind encoded or decoded by being generated by installed cameras at a moment near the first P frame 255. Here, the first P frame 255, the second P frame 260, and the third P frame 265 can be said to be same-views inputted through the same camera.
on the continuous time axis, and the fourth P frame 270 and the fifth P frame 275 can be said to be inter-views inputted through neighboring cameras on the time axis that are the same as the first P frame 265. Of course, the number of reference frames and the order of reference, for encoding and/or decoding the current frame, can be different based on the method of realization. For example, a sixth P frame 280, which is an inter-view inputted through a neighboring camera on the time axis that is the same as the current frame 250.

In the method of setting the order of reference frames described above, the encoding and/or decoding is conducted by a single processor.

However, a transmitting device and/or receiving device can be made to have a plurality of processors independently encode and/or decode the frames generated by any cameras. For example, a first processor processes the frames generated by the first and fourth cameras, and the second processor processes the frames generated by the second and fifth cameras, while the third processor processes the frames generated by the third and sixth cameras. In this case, when setting a reference frame for the current frame, if frames processed by other processors are set as the reference frames, other processors must complete the processing of the reference frames before the current frame is processed. Unless this premise is not fulfilled, delays will be inevitable for the processing of the current frame as well as the processing of another current frame that sets the current frame as a reference frame. Hence, if a plurality of processors process the frames in parallel, the process efficiency can be improved by, for example, setting the same-views
only as the reference frame.

Although the process of P frames by a transmitting device and/or receiving
device has been described above, it should be apparent that the same method can be
applied to B frames, and thus the description will not be provided here.

Fig. 5 illustrates a method of setting the order of reference frames in case the
input data is 2-D parallel data, based on a preferred embodiment of the present invention.

As shown in Fig. 5, the GOP of 2-D parallel data can be structured in the order of
I frame, P frame, B frame, B frame, P frame, and B frame. In Fig. 5, the cameras are
arranged in a cross shape. For the purpose of easy understanding, the arrangement of each
frame is made to be identical to the arrangement of the camera. In this invention, the GOP
can be set to have the duration of, for example, 1 second.

As described earlier, the encoding/decoding of multi-view coding on 2-D
parallel data can be processed in the order of I frame, P frame, B frame, and B frame, and
since there is no I frame until the next GOP, the process can be repeated in the order of P
frame, B frame, and B frame.

Suppose, in this process order, that a P frame 310 (hereinafter referred to as
“current frame”) is to be encoded or decoded. Here, a transmitting device and/or
receiving device can use relevant P frame information as reference frames in order to
encode or decode the current frame 350. In Fig. 5, CEV means the current frame to be
decoded or encoded, and R means the reference frame index ordering.

In other words, in order to encode or decode the current frame, the transmitting
device and/or receiving device extracts and references information related to a plurality
of P frames, represented by 315, 320, 325, 330, and 335, having a same-view relation as a
frame of the same kind encoded or decoded sequentially before the current frame, and P
frames, represented by 340, 345, 350, and 355, having an inter-view relation with the P
frame 315, which has a same-view relation as a frame of the same kind encoded or
decoded immediately before. Here, the same-views can be said to be frames inputted
through the same camera on the continuous time axis, and the inter-views can be said to
be frames inputted independently through a plurality of cameras on the same time axis.

Of course, the number of reference frames and the order of reference, for encoding and/or
decoding the current frame, can be different based on the method of realization. For
example, in case 360 is the current frame, 310, which is already encoded or decoded after
being encoded through a different camera on the same time axis, can be used as a
reference frame.

In the method of setting the order of reference frames described above, the
encoding and/or decoding is conducted by a single processor. However, a transmitting
device and/or receiving device can be made to have a plurality of processors
independently encode and/or decode the frames generated by any cameras. In this case,
when setting a reference frame for the current frame, frames processed by other
processors can be restricted from being set as reference frames, thereby improving the process efficiency.

Although the process of P frames by a transmitting device and/or receiving device has been described above, it should be apparent that the same method can be applied to B frames, and thus the description will not be provided here.

Figs 6 through 9 illustrate graphs comparing the bit rate and signal-to-noise ratio according to a method for setting the order of reference frames for multi-view coding based on the anchor and the present invention.

In the graphs shown in Figs. 6-9, the x-axis indicates the bit rate, and the y-axis indicates the peak signal-to-noise ratio (PSNR). The anchor of each graph indicates the conventional method of successively encoding or decoding the frames generated in a time sequence per each camera without referring to the frames generated by other cameras.

Fig. 6 is a comparison graph for the case of an aquarium having 1-D arc data inputted by arranging a plurality of cameras, for example, 15 cameras. As shown in Fig. 6, when the method of setting the order of reference frames for multi-view coding based on the present invention is used, an improvement of 0.5-0.8dB in picture quality is shown over the conventional method.

Fig. 7 is a comparison graph for the case of a horserace having 1-D parallel data inputted by arranging a plurality of cameras, for example, 8 cameras. As shown in Fig. 7,
when the method of setting the order of reference frames for multi-view coding based on the present invention is used, an improvement of 0.4-0.9dB in picture quality is shown over the conventional method.

Fig. 8 is a comparison graph for the case of a golf swing having 1-D parallel data inputted by arranging a plurality of cameras, for example, 8 cameras. As shown in Fig. 8, when the method of setting the order of reference frames for multi-view coding based on the present invention is used, an improvement of 2.2-2.5dB in picture quality is shown over the conventional method.

Fig. 9 is a comparison graph for the case of a flamenco dance having 2-D parallel data inputted by arranging a plurality of cameras, for example, 5 cameras. As shown in Fig. 9, when the method of setting the order of reference frames for multi-view coding based on the present invention is used, an improvement of 0.3-1.0dB in picture quality is shown over the conventional method.

The drawings and disclosure are examples of the present invention, used to describe the present invention, shall by no means be construed to limit or restrict the scope of the present invention disclosed in the appended claims. Any person of ordinary skill in the art to which the invention pertains shall understand that a very large number of permutations and equivalent embodiments are possible. The true scope of the present invention shall only be defined by the appended claims.
【Industrial Applicability】

As described above, a method for setting the order of reference frames for multi-view coding and a recorded medium recording the method, based on the present invention, can provide an improved picture quality and three-dimensionality and prevent the delay in processing time when using the reference frame by utilizing a larger number of reference frames.

The present invention also allows the encoder and decoder to maintain an optimal efficiency when encoding and decoding, respectively.

Moreover, the present invention allows a user to select a picture with a desired direction among pictures with a variety of direction that are inputted through a plurality of cameras.

Furthermore, the present invention can utilize the bypass logic, which is much simpler than the conventional bus-control logic.
【CLAIMS】

【Claim 1】

A method of setting the order of reference frames for multi-view coding, the method selecting a reference frame for a current frame to be encoded or decoded among a plurality of frames successively generated by a plurality of cameras along the time, the method comprising the steps of:

selecting the n (integer) number of frames of the same kind that have a same-view relation with said current frame and are encoded or decoded prior to said current frame as a first reference frame;

selecting the m (integer) number of frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with said current frame; and

encoding or decoding said current frame by making reference to the frames of the same kind included in said first reference frame and said second reference frame.

【Claim 2】

The method of claim 1, wherein said n number of frames of the same kind, included in said first reference frame, are extracted in the reverse order of encoding or
decoding.

【Claim 3】
The method of claim 1, wherein, in case the method further comprises the step of selecting the k (integer) number of frames of the same kind having an inter-view relation with said current frame as a third reference frame, said current frame is encoded or decoded by making reference to the frames of the same kind included in said first through third reference frames.

【Claim 4】
The method of claim 1, wherein said frame of the same kind is a P frame of a B frame that is the same kind as said current frame.

【Claim 5】
The method of claim 1, wherein a plurality of frames generated by said plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame are encoded or decoded in the order of an I frame, a P frame, a first B frame, and a second B frame about the time axis.

【Claim 6】
The method of claim 1, wherein picture information inputted by said plurality of cameras is generated as one of the forms consisting of 1-D parallel data, 1-D arc data, and 2-D parallel data.

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Claim 7]

A recorded medium tangibly embodying a program of instructions executable by an encoding device or a decoding device to perform a method of setting the order of reference frames for multi-view coding, the program readable by said encoding device or decoding device, the recorded medium executing the steps of:

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selecting the \( n \) (integer) number of frames of the same kind that have a same-view relation with said current frame and are encoded or decoded prior to said current frame as a first reference frame, wherein said current frame is a frame to be currently encoded or decoded among a plurality of frames successively generated by a plurality of cameras along the time;

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selecting the \( m \) (integer) number of frames of the same kind that have a same-view relation with said current frame and have an inter-view relation with a frame of the same kind, which is encoded or decoded immediately before, as a second reference frame, wherein the frame of the same kind has a same-view relation with said current frame; and

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encoding or decoding said current frame by making reference to the frames of
the same kind included in said first reference frame and said second reference frame.

【Claim 8】

The recorded medium of claim 7, wherein said n number of frames of the same kind, included in said first reference frame, are extracted in the reverse order of encoding or decoding.

【Claim 9】

The recorded medium of claim 7, wherein, in case the method further comprises the step of selecting the k (integer) number of frames of the same kind having an inter-view relation with said current frame as a third reference frame, said current frame is encoded or decoded by making reference to the frames of the same kind included in said first through third reference frames.

【Claim 10】

The recorded medium of claim 7, wherein said frame of the same kind is a P frame of a B frame that is the same kind as said current frame.

【Claim 11】

The recorded medium of claim 7, wherein a plurality of frames generated by said
plurality of cameras in the temporal order of an I frame, a first B frame, a second B frame, and a P frame are encoded or decoded in the order of an I frame, a P frame, a first B frame, and a second B frame about the time axis.

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[Claim 12]

The recorded medium of claim 7, wherein picture information inputted by said plurality of cameras is generated as one of the forms consisting of 1-D parallel data, 1-D arc data, and 2-D parallel data.
FIG. 1

110

Object

\[ \text{Camera} \]

120a

120b

\[ \text{Camera} \]

120n-1

120n
Document made available under the Patent Cooperation Treaty (PCT)

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Application Number: 10-2005-0003948

Date of Application: JAN 14, 2005

 Applicant(s): 주식회사 휴맥스

Commissioner: [Stamp]
【서류명】 특허출원서
【관리구분】 특허
【수신처】 특허청장
【제출일자】 2005.01.14
【발명의 국문명칭】 다-시정 코딩을 위한 참조 프레임 순서 설정 방법 및 그 방법을 기록한 기록매체
【발명의 영문명칭】 Method for setting reference frame order for multi-view coding and computer readable medium storing thereof
【출원인】
【명칭】 (주)휴맥스
【출원인코드】 1-1998-000063-1
【대리인】
【성명】 이경란
【대리인코드】 9-1998-000651-6
【포괄위임등록번호】 2004-073908-7
【발명자】
【성명의 국문표기】 이영렬
【성명의 영문표기】 LEE, Yung-Lyu
【주민등록번호】 611030-1047211
【우편번호】 138-160
【주소】 서울 송파구 가락동 192 극동 APT. 1-704호
【국적】 KR
【발명자】
【성명의 국문표기】 장의선
【성명의 영문표기】 JANG, Euee S.
【주민등록번호】 681220-1481119
【우편번호】 133-791
【주소】 서울 성동구 행당1동 한양대학교 산학발달 501호
【국적】 KR
【발명자】
【성명의 국문표기】 이충구
【성명의 영문표기】 LEE, Chung Ku
【주민등록번호】 670224-1155119
【우편번호】 403-011
【주소】 인천 부평구 부평1동 동아아파트 15동 304호
【국적】 KR
【취지】 특허법 제42조의 규정에 의하여 위와 같이 출원합니다. 대리인 이경란 (인)
【수수료】
【기본출원료】 0 면 38,000 원
【가산출원료】 32 면 0 원
【우선권주장료】 0 건 0 원
【심사청구료】 0 항 0 원
【합계】 38,000 원
【감면사유】 중소기업
【감면후 수수료】 19,000 원
【첨부서류】 1. 중소기업기본법시행령 제2조에의한 중소기업에 해당함을 증명하는 서류_1통 2. 기타첨부서류[중소기업기본법]_1통
【요약서】

【요약】

본 발명은 다-시점 코딩을 위한 참조 프레임 순서 설정 방법 및 그 방법을 기록한 기록매체에 관한 것이다. 본 발명에 따른 다-시점 코딩을 위한 참조 프레임 순서 설정 방법은 현재 프레임과 동일-뷰(same-view) 관계를 가지고, 상기 현재 프레임 이전에 인코딩 또는 디코딩된 n(자연수)개의 동종 프레임을 제1 참조 프레임으로 선택하는 단계; 상기 현재 프레임과 동일-뷰(same-view) 관계를 가지고, 직전에 인코딩 또는 디코딩된 동종 프레임과 인터-뷰(interview) 관계를 가지는 m(자연수)개의 동종 프레임을 제2 참조 프레임으로 선택하는 단계; 및 상기 제1 참조 프레임과 상기 제2 참조 프레임에 포함된 동종 프레임을 참조하여 상기 현재 프레임을 인코딩 또는 디코딩하는 단계를 포함하여 구성된다. 따라서, 본 발명에 의하여 보다 나은 영상 화질과 임체감을 제공할 수 있고, 참조 프레임 이용시의 처리 시간 지연을 방지할 수 있다.

【대표도】

도 2

【색인어】

다-시점 코딩, 참조 프레임, 인코딩, 디코딩
다-시점 코딩을 위한 참조 프레임 순서 설정 방법 및 그 방법을 기록한 기록매체(Method for setting reference frame order for multi-view coding and computer readable medium storing thereof)

도면의 간단한 설명

1. 도 1a는 본 발명의 바람직한 일 실시예에 따른 1차원 병렬 데이터(1-D Parallel Data) 입력을 위한 다수의 카메라 배열 방법을 나타낸 도면.

2. 도 1b는 본 발명의 바람직한 일 실시예에 따른 1차원 아크 데이터(1-D Arc Data) 입력을 위한 다수의 카메라 배열 방법을 나타낸 도면.

3. 도 1c는 본 발명의 바람직한 일 실시예에 따른 2차원 병렬 데이터(2-D Parallel Data) 입력을 위한 다수의 카메라 배열 방법을 나타낸 도면.

4. 도 2는 본 발명의 바람직한 일 실시예에 따른 입력 데이터가 1차원 병렬 데이터 및 1차원 아크 데이터인 경우의 참조 프레임 순서 설정 방법을 나타낸 도면.

5. 도 3은 본 발명의 바람직한 일 실시예에 따른 입력 데이터가 2차원 병렬 데이터인 경우의 참조 프레임 순서 설정 방법을 나타낸 도면.

6. 도 4 내지 도 7은 엠크(Anchor)와 본 발명에 따른 다-시점 코딩을 위한 참조 프레임 순서 설정 방법에 따른 윤-왜곡 비교 곡선을 나타낸 도면.
【발명의 상세한 설명】

【발명의 목적】

【발명이 속하는 기술분야 및 그 분야의 종래기술】

본 발명은 다-시점 코딩을 위한 다-시점 코딩을 위한 참조 프레임 순서 설정 방법 및 그 방법을 기록한 기록매체에 관한 것으로, 보다 상세하게는 보다 나은 영상 화질과 엄체감을 제공할 수 있고, 인코더 및 디코더의 효율적인 인코딩 및 디코딩을 가능하게 하는 다-시점 코딩을 위한 참조 프레임 순서 설정 방법 및 그 방법을 기록한 기록매체에 관한 것이다.

일반적으로, 디지털 데이터는 일정한 타입의 전송 장치로부터 일정한 타입의 수신 장치로 전송된다. 그리고, 전송 장치는 전송을 위한 데이터를 인코딩 (encoding)하는 인코더( encoder)를 통상적으로 포함하고, 수신 장치는 수신된 데이터를 디코딩(decoding)하는 디코더(decoder)를 포함한다. 비디오 데이터, 오디오 데이터, 오디오/비디오 데이터 등과 같은 다양한 형태의 디지털 데이터가 전송 장치로부터 수신 장치로 전송되어 수신 장치를 통해 출력될 수 있다.

지배적인 비디오 암축 및 전송 포맷들은 혼성 블록 기반 화상 신호 보정 변환 비디오 부호기(hybrid block-based motion-compensated transform video coder)라고 불리는 군(family)으로부터 유래하는데, 상기 부호기의 예는 ITU-T VCEG 비디오 코딩 표준들을 포함하고, 비디오 코딩 표준들은 (Video Coding Experts

일반적으로 비디오 스트림은 세 가지 타입의 프레임들(Frames) 또는 영상들(pictures)로 구성된다. 세 가지 타입의 프레임들이란 화면 내 영상(I 프레임: intra frame), 예측 영상(P 프레임: predictive frame) 및 양방향 예측 영상(B 프레임: bi-directionally predictive frame)이다.

I 프레임은 움직임 벡터 추정/보상을 이용하지 않고 단순히 그 프레임만을DCT하여 부호화하고, P 프레임은 I 프레임 또는 다른 P 프레임을 참조하면서 움직임 추정/보상을 한 후, 나머지 차분의 데이터를 DCT하여 부호화하며, B 프레임은 P 프레임과 같이 움직임 보상을 사용하지만 시간축 상에 있는 두 개의 프레임으로부터 움직임 추정/보상을 수행한다.

비디오 스트림에서 또는 시퀀스는 GOP(Group of Pictures)라 부리는 세그먼트에 의해 정의되며, I, B, B, P, B, B, P, …와 같이 이루어진 구조에서 I 프레임부터 다음의 I 프레임까지를 GOP(Group of Picture)라 정한다. 통상적으로, GOP는 의도된 속도로 디스플레이 되는 경우, 미리 설정된 시간(예를 들어, 0.5초)의 지속 시간(duration)을 갖는 한 세트의 영상으로 구성된다.
통상적으로, MPEG-2 비디오 스트림 또는 시퀀스는 GOP (Groups of Pictures) 라 불리는 세그먼트에 의해 정의된다. 통상적으로, GOP는 의도된 속도로 디스플레이 되는 경우, 0.5초의 지속시간 (duration)을 갖는 한 세트의 영상으로 구성된다.

상술한 바와 같은 비디오 스트림 등의 영상 정보 전달을 위한 메체는 텔레비전과 같은 2차원 단말기 기술로부터 발전해왔다. 즉, 흑백 영상에서 출발하여 흑백 영상, 즉 SD (Standard Definition)급 텔레비전에서 고해상도 텔레비전 (예로, HDTV)으로 발전함에 따라 영상 정보의 데이터량은 증가하는 추세인 것이다.

이에, 현재 영상 정보는 평면적인 2차원의 세계가 아니라 공간을 포함하는 3차원적인 것이므로, 현실감 및 자연 자체의 멀티미디어 정보의 전달을 위해서는 그 자체 그대로 재현할 수 있는 3차원 영상 정보가 관련된 기술의 개발이 필요하게 되었다.

그러나, MPEG-2 등과 같은 기술 표준은 한 개의 시점에 대한 동영상 부호화 및 복호화에 대한 표준이기 때문에 다-시점 동영상 데이터를 부호화하기 위해 구조에 대한 설계 및 다 시점의 정보를 나타내는 데이터에 대한 처리가 필요하며, MPEG-2에서 사용되는 동영상을 스테레오 동영상으로 확장하기 위하여 MVP (Multi-view profile)를 제안하고는 있지만 다-시점 동영상의 코딩을 위한 적절한 방안이 제시되고 있지 못한 문제점이 있었다.
【발명이 이루고자 하는 기술적 과제】

따라서 본 발명은 상기의 제반 문제점을 해결하기 위하여 안축한 것으로서, 보다 많은 참조 프레임을 활용할 수 있어 보다 나은 영상 화질과 임체감을 제공할 수 있고, 참조 프레임 이용시의 처리 시간 지연을 방지할 수 있는 다시점 코딩을 위한 참조 프레임 순서 설정 방법 및 그 방법을 기록한 기록매체를 제공하는 것이다.

본 발명의 다른 목적은 인코더 및 디코더에서 인코딩 및 디코딩 작업을 수행함에 있어 최적의 효율을 유지할 수 있는 다시점 코딩을 위한 참조 프레임 순서 설정 방법 및 그 방법을 기록한 기록매체를 제공하는 것이다.

본 발명의 또 다른 목적은 사용자가 다수의 카메라를 통해 입력된 다양한 방향의 영상들 중에서 원하는 방향의 영상을 용이하게 선택하여 제공받을 수 있는 다시점 코딩을 위한 참조 프레임 순서 설정 방법 및 그 방법을 기록한 기록매체를 제공하기 위한 것이며, 그 외의 다른 본 발명의 목적들은 이하에 서술되는 바람직한 실시예를 통하여 보다 명확해질 것이다.

【발명의 구성】

상술한 목적이 달성하기 위하여 본 발명의 제1측면에 따르면, 다시점 코딩을 위한 참조 프레임 순서 설정 방법을 제공할 수 있다.

바람직한 일 실시예에 의할 때, 상기 다시점 코딩을 위한 참조 프레임 순서
설정 방법은 현재 프레임과 동일-뷰(same-view) 관계를 가지고, 상기 현재 프레임 이전에 인코딩 또는 디코딩된 n(자연수)개의 동종 프레임을 제1 참조 프레임으로 선택하는 단계; 상기 현재 프레임과 동일-뷰(same-view) 관계를 가지고, 직전에 인코딩 또는 디코딩된 동종 프레임과 인터-뷰(interview) 관계를 가지는 m(자연수)개의 동종 프레임을 제2 참조 프레임으로 선택하는 단계; 및 상기 제1 참조 프레임과 상기 제2 참조 프레임에 포함된 동종 프레임을 참조하여 상기 현재 프레임을 인코딩 또는 디코딩하는 단계를 포함하여 구성된다.

상기 제1 참조 프레임에 포함되는 상기 n개의 동종 프레임은 인코딩 또는 디코딩된 순서의 역순으로 추출되는 것을 특징으로 한다.

또한, 상기 현재 프레임과 인터-뷰(inter-view) 관계를 가지는 k(자연수)개의 동종 프레임을 제3 참조 프레임으로 선택하는 단계가 더 포함되는 경우, 상기 제1 참조 프레임 내지 상기 제3 참조 프레임에 포함된 동종 프레임을 참조하여 상기 현재 프레임을 인코딩 또는 디코딩하는 것을 특징으로 한다.

상기 동종 프레임은 상기 현재 프레임과 동일한 유형인 P 프레임 또는 B 프레임인 것을 특징으로 한다.

상기 복수의 카메라에 의해 시간에 따라 순차적으로 I 프레임, 제1 B 프레임, 제2 B 프레임, P 프레임 순으로 생성된 복수의 프레임들의 인코딩 또는 디코딩은 시간축을 기준으로 I 프레임, P 프레임, 제1 B 프레임, 제2 B 프레임의 순으로 이루어질 수 있다.

상기 복수의 카메라에 의해 입력되는 영상 정보는 1차원 병렬 데이터(1-D)
Parallel Data), 1차원 아크 데이터(1-D Arc Data), 2차원 병렬 데이터(2-D Parallel Data) 중 어느 하나의 형태로 생성되는 것을 특징으로 한다.

상술한 목적을 달성하기 위하여 본 반영의 제 2증면에 따르면, 다-시점 코딩을 위한 참조 프레임 순서 설정 방법을 수행하기 위한 프로그램을 기록한 기록매체를 제공할 수 있다.

바람직한 일 실시에 의한 때, 상기 기록매체에 기록된 프로그램은 전송 장치 또는 수신 장치에 의해 실행될 수 있는 명령어들의 프로그램으로서, 현재 프레임과 동일-뷰(same-view) 관계를 가지고, 상기 현재 프레임 이전에 인코딩 또는 디코딩된 n(자연수)개의 동종 프레임을 제1 참조 프레임으로 선택하는 단계-여기서, 상기 현재 프레임은 복수의 카테고리에 의해 시간에 따라 순차적으로 생성된 복수의 프레임 중에서 현재 인코딩 또는 디코딩된 임의의 프레임임.; 상기 현재 프레임과 동일-뷰(same-view) 관계를 가지고, 적절에 인코딩 또는 디코딩된 동종 프레임과 인터-뷰(interview) 관계를 가지는 m(자연수)개의 동종 프레임을 제2 참조 프레임으로 선택하는 단계- 및 상기 제1 참조 프레임과 상기 제2 참조 프레임에 포함된 동종 프레임을 참조하여 상기 현재 프레임을 인코딩 또는 디코딩하는 단계를 실행하는 것을 특징으로 한다.

상기 제1 참조 프레임에 포함되는 상기 n개의 동종 프레임은 인코딩 또는 디코딩된 순서의 역순으로 추출되는 것을 특징으로 한다.

또한, 상기 현재 프레임과 인터-뷰(inter-view) 관계를 가지는 k(자연수)개
의 동종 프레임을 제3 참조 프레임으로 선택하는 단계가 더 포함되는 경우, 상기 제1 참조 프레임 내지 상기 제3 참조 프레임에 포함된 동종 프레임을 참조하여 상기 현재 프레임을 인코딩 또는 디코딩하는 것을 특정으로 한다.

상기 동종 프레임은 상기 현재 프레임과 동일한 유형인 P 프레임 또는 B 프레임인 것을 특정으로 한다.

상기 복수의 카메라에 의해 시간에 따라 순차적으로 1 프레임, 제1 B 프레임, 제2 B 프레임, P 프레임 순으로 생성된 복수의 프레임들의 인코딩 또는 디코딩은 시간축을 기준으로 1 프레임, P 프레임, 제1 B 프레임, 제2 B 프레임의 순으로 이루어질 수 있다.

상기 복수의 카메라에 의해 입력되는 영상 정보는 1차원 병렬 데이터(1-D Parallel Data), 1차원 아크 데이터(1-D Arc Data), 2차원 병렬 데이터(2-D Parallel Data) 중 어느 하나의 형태로 생성되는 것을 특정으로 한다.

이하, 점부한 도면들을 참조하여 본 발명에 따른 다-시점 코딩을 위한 참조 프레임 순서 설정 방법 및 그 방법을 기록한 기록매체의 비밀적한 실시예를 상세히 설명하기로 하며, 점부 도면을 참조하여 설명함에 있어 도면 부호에 상관없이 동일 하거나 대응하는 구성 요소는 동일한 참조번호를 부여하고 이에 대한 중복되는 설 명은 생략하기로 한다.

도 1a는 본 발명의 비밀적한 일 실시예에 따른 1차원 병렬 데이터(1-D
Parallel Data) 입력을 위한 다수의 카메라 배열 방법을 나타낸 도면이고, 도 1b는 본 발명의 바람직한 일 실시예에 따른 1차원 아크 데이터(1-D Arc Data) 입력을 위한 다수의 카메라 배열 방법을 나타낸 도면이며, 도 1c는 본 발명의 바람직한 일 실시예에 따른 2차원 병렬 데이터(2-D Parallel Data) 입력을 위한 다수의 카메라 배열 방법을 나타낸 도면이다.

도 1a에 도시된 1차원 병렬 데이터(1-D Parallel Data) 입력을 위한 다수의 카메라 배열 방법은 피사체(110)와 수직으로 배치된 임의의 카메라를 기준으로 n개의 카메라들(120a, 120b, ..., 120n-1, 120n)을 일렬로 배치하는 카메라 배열 방법이다.

도 1a에 도시된 방법에 따라 n개의 카메라(120a, 120b, ..., 120n-1, 120n)를 배열하는 경우 각 카메라와 피사체간의 거리는 일반적으로 동일하지 않게 된다. 물론, 중앙에 배치된 카메라를 기준으로 양측에 배치된 두 개의 카메라와 피사체(110)간의 거리는 일치할 수 있다.

도 1b에 도시된 1차원 아크 데이터(1-D Arc Data) 입력을 위한 다수의 카메라 배열 방법은 피사체(110)를 기준으로 일정 거리(d) 이격된 원주상에 n개의 카메라들(120a, 120b, ..., 120n-1, 120n)을 순차적으로 배치하는 카메라 배열 방법이다.

도 1b에 도시된 방법에 따라 n개의 카메라(120a, 120b, ..., 120n-1, 120n)를 배열하는 경우 각 카메라와 피사체(110)간의 거리는 d로 동일하다.

도 1c에 도시된 2차원 병렬 데이터(2-D Parallel Data) 입력을 위한 다수의
카메라 배열 방법은 복수의 카메라들 (120a, 120b, 120c, 120d, 120e)을 미리 지정된 형태의 구조물상에 미리 지정된 규칙에 따라 배치하는 카메라 배열 방법이다. 도 1c에는 점심 (++)자 보양의 구조물 중앙 및 각 돌출부에 하나씩의 카메라를 배열한 형태가 예시되어 있다. 그러나, 복수의 카메라를 하나의 구조물 상에 배치하기 위한 구조물의 형태와 카메라 수량은 구현 방법에 따라 다양하게 구현될 수 있음을 자명하다.

도 1a 내지 도 1c에 각각 예시된 방법으로 배치된 각각의 카메라는 시간이 경과함에 따라 설치된 렌즈 각도를 통해 입력되는 피사체 영상을 입력받아 영상 정보를 생성하며, 당해 영상 정보는 앞서 설명한 바와 같이 I, B, B, P, B, B, P...와 같이 이루어진 GOP (Group of Picture)라는 세그먼트들로 구성된다.

또한, 각각의 카메라 배열 방법에 의해 생성된 영상 정보의 각 프레임을 효율적으로 인코딩 또는 디코딩하기 위하여 참조 프레임의 범위 및/또는 참조 프레임 순서를 설정하는 방법은 각각 상이하므로 이하에서 관련 도면을 참조하여 각각 설명하기로 한다.

도 2는 본 발명의 바람직한 일 실시예에 따른 입력 데이터가 1차원 병렬 데이터 및 1차원 아크 데이터인 경우의 참조 프레임 순서 설정 방법을 나타낸 도면이다.

도 2에 도시된 바와 같이, 1차원 병렬 데이터 및 1차원 아크 데이터의 GOP는 I 프레임, P 프레임, B 프레임, B 프레임, P 프레임, B 프레임 등의 순으로 구성된
수 있으며, 세로축(즉, 시간)으로 각각 배열된 프레임들은 각 카메라별에 의해 독립적으로 생성되는 영상 정보를 의미한다. 본 발명에서의 GOP는 예를 들어 1초의 지속시간(duration)을 지정하도록 설정될 수 있다.

1차원 병렬 데이터 및 1차원 아크 데이터들에 대한 다-시점 코딩(multi-view coding)의 인코딩(encoding)/디코딩(decoding)은 210, 220, 230, 240의 순으로 이루어진다. 즉, 동일 시각에서 생성된 I 프레임들에 대한 처리가 일단 수행된 후, P 프레임에 대한 처리가 수행되며, 먼저 생성된 B 프레임에 대한 처리가 수행되고, 나중에 생성된 B 프레임에 대한 처리가 수행된다. 이후에는 다음 GOP때까지 I 프레임이 제재하지 않으므로 P 프레임, B 프레임, B 프레임이 순으로 반복 처리된다.

이러한 처리 순서상에서, 임의의 P 프레임(250, 이하 현재 프레임이라 정함)이 인코딩 또는 디코딩되어야 한다고 가정한다. 이때, 전송 장치 및/또는 수신 장치는 해당 P 프레임(250)의 인코딩 또는 디코딩을 위한 참조 프레임으로서 관련 P 프레임 정보들을 이용할 수 있다. 또 2에서 CEV는 디코딩 또는 인코딩 되어야 하는 현재 프레임(current frame)을 의미하고, R은 참조 프레임 인덱스 순서(Reference frame index ordering)을 의미한다.

즉, 현재 프레임을 인코딩 또는 디코딩하기 위하여 전송 장치 및/또는 수신 장치는 현재 프레임 직전에 인코딩 또는 디코드된 동종 프레임인 제1 P 프레임(255, R=0), 제1 P 프레임(255) 직전에 인코딩 또는 디코드된 동종 프레임인 제2 P 프레임(260, R=1), 제2 P 프레임(260) 직전에 인코딩 또는 디코드된 동종 프레임인 제3 P 프레임(265, R=2), 제1 P 프레임(255)과 동일 시점에 인접하여 설치된 카메
라들에 의해 생성되어 인코드 또는 디코드된 동종 프레임인 제3 P 프레임(270, R=4)과 제4 P 프레임(275, R=5)에 관한 정보를 추출하여 참조한다. 이때, 제1 P 프레임(255), 제2 P 프레임(260), 제3 P 프레임(265)은 연속된 시간축에서 동일한 카메라를 통해 입력되는 프레임들(same-views)이라 할 수 있고, 제4 P 프레임(270) 및 제5 P 프레임(275)은 제1 P 프레임(265)과 동일한 시간 축에서 인접한 카메라들 을 통해 입력된 프레임들(inter-views)이라 할 수 있다. 물론, 현재 프레임을 인코드 및 또는 디코드하기 위하여 이용되는 참조 프레임들의 수량 및 참조 순서는 구현 방법에 따라 상이하게 구현할 수 있음은 자명하다. 예를 들어, 현재 프레임 (250)과 동일한 시간 축에서 인접한 카메라를 통해 입력된 프레임(inter-view)인 제6 P 프레임(280) 등도 참조 프레임으로 활용될 수 있다.

이제까지 설명한 참조 프레임 순서 설정 방법은 하나의 프로세서에 의해 인코드 및 또는 디코드가 수행되는 경우에 관한 것이었다.

그러나, 복수의 프로세서가 각각 입력의 카메라들로부터 생성되는 프레임들에 대한 인코드 및 또는 디코드를 독립적으로 수행하도록 전송 장치 및 또는 수신 장치가 구현될 수도 있다. 예를 들어, 제1 프로세서는 제1 및 제4 카메라에 의해 생성된 프레임들을 처리하고, 제2 프로세서는 제2 및 제5 카메라에 의해 생성된 프레임들을 처리하며, 제3 프로세서는 제3 및 제6 카메라에 의해 생성된 프레임들을 처리하도록 구성하는 경우를 가정할 수 있다. 이러한 경우라면, 현재 프레임에 대한 참조 프레임을 설정할 때, 다른 프로세서에 의해 처리되는 프레임들을 참조 프레임으로 설정한다면 현재 프레임의 처리 이전에 다른 프로세서가 참조 프레임에
대한 처리를 완료하여야하는 전체 조건을 만족하여야 한다. 이러한 전체 조건이 만족되지 못한다면 현재 프레임에 대한 처리는 지연될 수밖에 없고, 현재 프레임을 참조 프레임으로 설정한 또 다른 현재 프레임의 처리도 지연될 수밖에 없다. 따라서, 복수의 프로세서가 병렬적으로 프레임들을 처리하는 경우에는 same-views들만을 참조 프레임으로 설정하는 등의 방법으로 처리 효율성을 증진시킬 수도 있다.

또한, 이전까지는 전송 장치 및/또는 수신 장치가 P 프레임을 처리하는 과정에 대해서만 설명하였으나, B 프레임에 대해서도 동일한 방법으로 처리될 수 있음은 자명하므로, 이에 대한 증복된 설명은 생략한다.

도 3은 본 발명의 바람직한 일 실시예에 따른 입력 데이터가 2차원 병렬 데이터인 경우의 참조 프레임 순서 설정 방법을 나타낸 도면이다.

도 3에 도시된 바와 같이, 2차원 병렬 데이터의 GOP는 I 프레임, P 프레임, B 프레임, B 프레임, P 프레임, B 프레임 등의 순으로 구성될 수 있다. 도 3에는, 카메라 배치가 열심(十)자 형태로 구성된 경우로서 이해의 편의를 위해 각 프레임의 배치를 카메라 배치와 동일하도록 도시하였다. 본 발명에서의 GOP는 예를 들어 1초의 지속 시간(duration)을 가지도록 설정될 수 있다.

2차원 병렬 데이터에 대한 다-시점 코딩(multi-view coding)의 인코딩(encoding)/디코딩(decoding)은 앞서 설명한 바와 같이 I 프레임, P 프레임, B 프레임, B 프레임의 순서로 처리될 수 있으며, 이후에는 다음 GOP때까지 I 프레임이 존재하지 않으므로 P 프레임, B 프레임, B 프레임의 순으로 반복 처리될 수 있다.
이러한 처리 순서상에서, 임의의 카메라에 의해 생성된 P 프레임(310, 이하 현재 프레임이라 칭함)이 인코드 또는 디코드되어야 한다고 가정한다. 이때, 전송 장치 및/또는 수신 장치는 현재 프레임(350)의 인코드 또는 디코드를 위한 참조 프레임으로서 관련 P 프레임 정보들을 이용할 수 있다. 또 3에서 CEV는 디코드 또는 인코드 되어야 하는 현재 프레임(current frame)을 의미하고, R은 참조 프레임 인덱스 순서(Reference frame index ordering)를 의미한다.

즉, 현재 프레임을 인코드 또는 디코드하기 위하여 전송 장치 및/또는 수신 장치는 현재 프레임 이전에 순차적으로 인코드 또는 디코드된 동종 프레임으로서 same-view의 관계를 가지는 복수의 P 프레임들(315, 320, 325, 330, 335), 직전에 인코드 또는 디코드된 동종 프레임으로서 same-view의 관계를 가지는 P 프레임 (315)과 inter-views 관계를 가지는 P 프레임들(340, 345, 350, 355)에 관한 정보를 추출하여 참조한다. 이때, same-views는 연속된 시간축에서 동일한 카메라를 통해 촬영된 프레임들이라 할 수 있고, inter-views는 동일한 시간 축에서 복수의 카메라들을 통해 개별적으로 촬영된 프레임들이라 할 수 있다. 물론, 현재 프레임을 인코드 및/또는 디코드하기 위하여 이용되는 참조 프레임들의 수량 및 참조 순서는 구현 방법에 따라 상이하게 구현할 수 있음은 자명하다. 예를 들어, 현재 프레임이 360안 경우에는 동일한 시간 축에서 다른 카메라를 통해 촬영되어 먼저 인코딩 또는 디코딩된 310도 참조 프레임으로 활용될 수 있다.

이제까지 설명한 참조 프레임 순서 설정 방법은 하나의 프로세서에 의해 인코드 및/또는 디코드가 수행되는 경우에 한한 것이었으며, 상술한 바와 같이 복수
의 프로세서가 각각 임의의 카메라로부터 생성되는 프레임들에 대한 인코딩 및/ 또는 디코딩을 독립적으로 수행하도록 전송 장치 및/또는 수신 장치가 구현될 수도 있다. 이러한 경우에는 현재 프레임에 대한 참조 프레임을 설정할 때, 다른 프로세서에 의해 처리되는 프레임들이 참조 프레임으로 설정되지 않도록 미리 제한할 수 있으며, 이러한 방법을 통해 처리 효율성을 증진시킬 수 있다.

또한, 이제까지는 전송 장치 및/또는 수신 장치가 P 프레임을 처리하는 과정에 대해서만 설명하였으나, B 프레임에 대해서도 동일한 방법으로 처리될 수 있을 은 자명하므로, 이에 대한 증복된 설명은 생략한다.

도 4 내지 도 7은 엔커(Anchor)와 본 발명에 따른 다-시점 코딩을 위한 참조 프레임 순서 설정 방법에 따른 옵-왜곡 곡선이 도시되어 있다.

도 4 내지 도 7에 도시된 각 그래프에서 가로축은 비트율을 나타내고 세로축은 PSNR(peak signal to noise ratio)을 나타낸다. 또한, 각 그래프에서의 엔커(Anchor)는 각 카메라별로 시간 순서대로 순차적으로 생성되는 프레임들을 다른 카메라에 의해 생성된 프레임을 참조하지 않고 순차적으로 인코딩 또는 디코딩하는 종래의 방법의 의미한다.

도 4는 아쿠아리움(Aquarium)에 복수의 카메라(예를 들어, 15개)를 배치하여 1차원 아크 데이터(1-D Arc Data)를 입력받은 경우의 비교 그래프이다. 도 4에서 보여지는 바와 같이, 본 발명에 따른 다-시점 코딩을 위한 참조 프레임 순서 설정 방법을 이용할 때 종래 방법에 비해 0.5 ~ 0.8dB의 화질 향상이 나타남을 알 수 있
도 5는 경마 영상(race)을 입력받기 위하여 복수의 카메라(예를 들어, 8개)를 배치하여 1차원 병렬 데이터(1-D Parallel Data)를 입력받은 경우의 비교 그래프이다. 도 5에서 보여지는 바와 같이, 본 발명에 따른 다-시점 코딩을 위한 참조 프레임 순서 설정 방법을 이용할 때 종래 방법에 비해 0.4 ~ 0.9dB의 화질 향상이 나타남을 알 수 있다.

도 6은 골프 스윙 영상을 입력받기 위하여 복수의 카메라(예를 들어, 8개)를 배치하여 1차원 병렬 데이터(1-D Parallel Data)를 입력받은 경우의 비교 그래프이다. 도 6에서 보여지는 바와 같이, 본 발명에 따른 다-시점 코딩을 위한 참조 프레임 순서 설정 방법을 이용할 때 종래 방법에 비해 2.2 ~ 2.5dB의 화질 향상이 나타남을 알 수 있다.

도 7은 플라멩코(Flamenco) 영상을 입력받기 위하여 복수의 카메라(예를 들어, 5개)를 배치하여 2차원 병렬 데이터(2-D Parallel Data)를 입력받은 경우의 비교 그래프이다. 도 7에서 보여지는 바와 같이, 본 발명에 따른 다-시점 코딩을 위한 참조 프레임 순서 설정 방법을 이용할 때 종래 방법에 비해 0.3 ~ 1.0dB의 화질 향상이 나타남을 알 수 있다.

【발명의 효과】

상술한 바와 같이 본 발명에 따른 다-시점 코딩을 위한 참조 프레임 순서 설정 방법 및 그 방법을 기록한 기록매체는 보다 많은 참조 프레임을 활용할 수 있도록
록 함으로써 보다 나은 영상 화질과 업체감을 제공할 수 있고, 참조 프레임 이용 시의 처리 시간 지연을 방지할 수 있는 효과가 있다.

또한, 본 발명은 인코더 및 디코더에서 인코딩 및 디코딩 작업을 수행함에 있어 최적의 효율을 유지할 수 있도록 하는 효과도 있다.

또한, 본 발명은 사용자가 다수의 카메라를 통해 입력된 다양한 방향의 영상을 중에서 원하는 방향의 영상을 용이하게 선택하여 제공받을 수 있도록 하는 효과도 있다.

상기에서는 본 발명의 바람직한 실시예를 참조하여 설명하였지만, 해당 기술 분야에서 통상의 지식을 가진 자라면 하기의 특허 청구의 범위에 기재된 본 발명의 사상 및 영역으로부터 벗어나지 않는 범위 내에서 본 발명을 다양하게 수정 및 변정시킬 수 있을음을 이해할 수 있을 것이다.
【특허청구범위】

【청구항 1】

복수의 카메라에 의해 시간에 따라 순차적으로 생성된 복수의 프레임 중에서 현재 인코딩 또는 디코딩될 임의의 현재 프레임을 위한 참조 프레임 선택 방법에 있어서,

현재 프레임과 동일-뷰(same-view) 관계를 가지고, 상기 현재 프레임 이전에 인코딩 또는 디코딩된 n(자연수)개의 동종 프레임을 제1 참조 프레임으로 선택하는 단계:

상기 현재 프레임과 동일-뷰(same-view) 관계를 가지고, 직전에 인코딩 또는 디코딩된 동종 프레임과 인터-뷰(interview) 관계를 가지는 m(자연수)개의 동종 프레임을 제2 참조 프레임으로 선택하는 단계; 및

상기 제1 참조 프레임과 상기 제2 참조 프레임에 포함된 동종 프레임을 참조하여 상기 현재 프레임을 인코딩 또는 디코딩하는 단계를 포함하는 것

을 특징으로 하는 다-시점 코딩을 위한 참조 프레임 순서 설정 방법.

【청구항 2】

제1항에 있어서,

상기 제1 참조 프레임에 포함되는 상기 n개의 동종 프레임은 인코딩 또는 디코딩된 순서의 역순으로 추출되는 것
을 특징으로 하는 다-시점 코딩을 위한 참조 프레임 순서 설정 방법.

【청구항 3】

제2항에 있어서,

상기 현제 프레임과 인터-뷰 (inter-view) 관계를 가지는 k(자연수)개의 동종 프레임을 제3 참조 프레임으로 선택하는 단계가 더 포함되는 경우,

상기 제1 참조 프레임 내지 상기 제3 참조 프레임에 포함된 동종 프레임을 참조하여 상기 현제 프레임을 인코딩 또는 디코딩하는 것

을 특징으로 하는 다-시점 코딩을 위한 참조 프레임 순서 설정 방법.

【청구항 4】

제2항에 있어서.

상기 동종 프레임은 상기 현제 프레임과 동일한 유형인 P 프레임 또는 B 프레임인 것

을 특징으로 하는 다-시점 코딩을 위한 참조 프레임 순서 설정 방법.

【청구항 5】

제2항에 있어서.

상기 복수의 카메라에 의해 시간에 따라 순차적으로 I 프레임, 제1 B

32-22
프레임, 제2 B 프레임, P 프레임 순으로 생성된 복수의 프레임들의 인코딩 또는 디코딩은 시간축을 기준으로 I 프레임, P 프레임, 제1 B 프레임, 제2 B 프레임의 순으로 이루어지는 것

을 특별으로 하는 대-시점 코딩을 위한 참조 프레임 순서 설정 방법.

【청구항 6】

제1항에 있어서,

상기 복수의 카메라에 의해 입력되는 영상 정보는 1차원 병렬 데이터(1-D Parallel Data), 1차원 아크 데이터(1-D Arc Data), 2차원 병렬 데이터(2-D Parallel Data) 중 어느 하나의 형태로 생성되는 것

을 특별으로 하는 대-시점 코딩을 위한 참조 프레임 순서 설정 방법.

【청구항 7】

다-시점 코딩을 위한 참조 프레임 순서 설정 방법을 수행하기 위해 인코딩 또는 디코딩 장치에 의해 실행될 수 있는 명령어들의 프로그램이 유형적으로 구현되어 있으며, 상기 인코딩 또는 디코딩 장치에 의해 관독될 수 있는 프로그램을 기록한 기록매체에 있어서,

현제 프레임과 동일-뷰(same-view) 관계를 가지고, 상기 현제 프레임 이전에 인코딩 또는 디코딩된 n(자연수)개의 동종 프레임을 제1 참조 프레임으로 선택하는
단계-여기서, 상기 현재 프레임은 복수의 카메라에 의해 시간에 따라 순차적으로 생성된 복수의 프레임 중에서 현재 인코딩 또는 디코딩될 인의의 프레임임:

상기 현재 프레임과 동일-뷰(same-view) 관계를 가지고, 직전에 인코딩 또는 디코딩된 동종 프레임과 인터-뷰(interview) 관계를 가지는 m(자연수)개의 동종 프레임을 제2 참조 프레임으로 선택하는 단계: 및

상기 제1 참조 프레임과 상기 제2 참조 프레임에 포함된 동종 프레임을 참조하여 상기 현재 프레임을 인코딩 또는 디코딩하는 단계를 실행하는 것

을 특정으로 하는 프로그램을 기록한 기록매체.

【청구항 8】

제7항에 있어서,

상기 제1 참조 프레임에 포함되는 상기 n개의 동종 프레임은 인코딩 또는 디코딩된 순서의 역순으로 추출되는 것

을 특정으로 하는 프로그램을 기록한 기록매체.

【청구항 9】

제7항에 있어서,

상기 현재 프레임과 인터-뷰(inter-view) 관계를 가지는 k(자연수)개의 동종 프레임을 제3 참조 프레임으로 선택하는 단계가 더 포함되는 경우,
상기 제1 참조 프레임 내지 상기 제3 참조 프레임에 포함된 동중 프레임을 참조하여 상기 현재 프레임을 인코딩 또는 디코딩하는 것

을 특징으로 하는 프로그램을 기록한 기록매체.

【청구항 10】

제7항에 있어서,

상기 동중 프레임은 상기 현재 프레임과 동일한 유형인 P 프레임 또는 B 프레임인 것

을 특징으로 하는 프로그램을 기록한 기록매체.

【청구항 11】

제7항에 있어서,

상기 복수의 카메라에 의해 시간에 따라 순차적으로 I 프레임, 제1 B 프레임, 제2 B 프레임, P 프레임 순으로 생성된 복수의 프레임들의 인코딩 또는 디코딩은 시간축을 기준으로 I 프레임, P 프레임, 제1 B 프레임, 제2 B 프레임의 순으로 이루어지는 것

을 특징으로 하는 프로그램을 기록한 기록매체.
【청구항 12】

제7항에 있어서, 상기 복수의 카메라에 의해 입력되는 영상 정보는 1차원 병렬 데이터(1-D Parallel Data), 1차원 아크 데이터(1-D Arc Data), 2차원 병렬 데이터(2-D Parallel Data) 중 어느 하나의 형태로 생성되는 것을 특징으로 하는 프로그램을 기록한 기록매체.
【도면】

【도 1a】

【도 1b】
【도 1c】
도 3
【도 6】

Golf2

![Graph](image)

【도 7】

Flamenco2

![Graph](image)
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International Patent Classification (IPC) or national classification and IPC

H04N 7/24(2006.01)i

Applicant

HUMAX Co., Ltd. et al

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:
   a. [ ] (sent to the applicant and to the International Bureau) a total of _______ sheets, as follows:
      - [ ] sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      - [ ] sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. [ ] (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _______ containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:
   - [ ] Box No. I  Basis of the report
   - [ ] Box No. II  Priority
   - [ ] Box No. III  Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - [ ] Box No. IV  Lack of unity of invention
   - [ ] Box No. V  Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - [ ] Box No. VI  Certain documents cited
   - [ ] Box No. VII  Certain defects in the international application
   - [ ] Box No. VIII  Certain observations on the international application

Date of submission of the demand

25 JULY 2006 (25.07.2006)

Date of completion of this report

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Form PCT/IPEA/409 (cover sheet) (April 2007)
Box No. I  Basis of the report

1. With regard to the language, this report is based on:
   - [ ] the international application in the language in which it was filed.
   - [X] a translation of the international application into English which is the language of a translation furnished for the purposes of:
     - [X] international search (under Rules 12.3(a) and 23.1(b)).
     - [ ] publication of the international application (under Rule 12.4(a)).
     - [ ] international preliminary examination (under Rules 55.2(a) and/or 55.3(a)).

2. With regard to the elements of the international application, this report is based on (replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):
   - [X] the international application as originally filed/furnished

   - [ ] the description:
     - pages
     - *pages
     - as originally filed/furnished received by this Authority on
     - pages
     - *pages
     - received by this Authority on

   - [ ] the claims:
     - pages
     - *pages
     - as amended (together with any statement) under Article 19
     - pages
     - *pages
     - received by this Authority on
     - pages
     - *pages
     - received by this Authority on

   - [ ] the drawings:
     - pages
     - *pages
     - as originally filed/furnished
     - pages
     - *pages
     - received by this Authority on
     - pages
     - *pages
     - received by this Authority on

   - [ ] the sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. [ ] The amendments have resulted in the cancellation of:
   - [ ] the description, pages
   - [ ] the claims, Nos.
   - [ ] the drawings, sheets
   - [ ] the sequence listing (specify):
   - [ ] any table(s) related to sequence listing (specify):

4. [X] This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - [ ] the description, pages
   - [ ] the claims, Nos.
   - [ ] the drawings, sheets
   - [ ] the sequence listing (specify):
   - [ ] any table(s) related to sequence listing (specify):

5. [ ] This report has been established taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91 (Rule 70.2(e)).

* If item 4 applies, some or all of those sheets may be marked "superseded."
INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

Box No. V  Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)
Claims 1-12
Claims None YES

Inventive step (IS)
Claims 1-12
Claims None YES

Industrial applicability (IA)
Claims 1-12
Claims None YES

2. Citations and explanations (Rule 70.7)
Reference is made to the following documents:

D1: US 6,072,831 A (06 Jun 2000)
D2: US 6,057,884 A (11 May 2000)

1. Novelty

Claims 1-12 are considered to be novel over the available prior art, because no individual documents disclose all of the technical features as specifically set out in the claims of the present application (Article 33(2) PCT).

2. Inventive Step

The subject matter of claims 1-12 of the present application relates to a reference frame ordering method for multi-view coding, characterized by selecting a reference frame for a voluntary present frame to be coded or decoded among a plurality of frames generated in regular sequence by a plurality of cameras.

D1 and D2 are considered to be the closest prior art.

D1 discloses rate control for stereoscopic digital video encoding, characterized in that rate control in a stereoscopic digital video communication system is achieved by modifying the quantization level of P or B-frame data in the enhancement layer depending on whether the frame is temporally predicted or disparity predicted,

D2 disclosed temporal and spatial scaling of video images including video object planes (VOPs) in an input digital video sequence for improving coding efficiency by adaptively compressing scaled field mode video.

(Continued on Supplemental Sheet.)
Neither D1 nor D2 provides the characterizing feature of the present invention, that is, the step of coding and decoding the present frame out of the plural frames by referring to the first reference frame and the second reference frame selected from the same kind of frames (from a point of view) as the present frame.

Thus, claims 1–12 involve an inventive step and meet the requirement of Article 33(3) PCT.

3. Industrial Applicability

The present invention is industrially applicable (Article 33(4) PCT).