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(54) Title: SIMPLIFIED DEPTH BASED BLOCK PARTITIONING METHOD

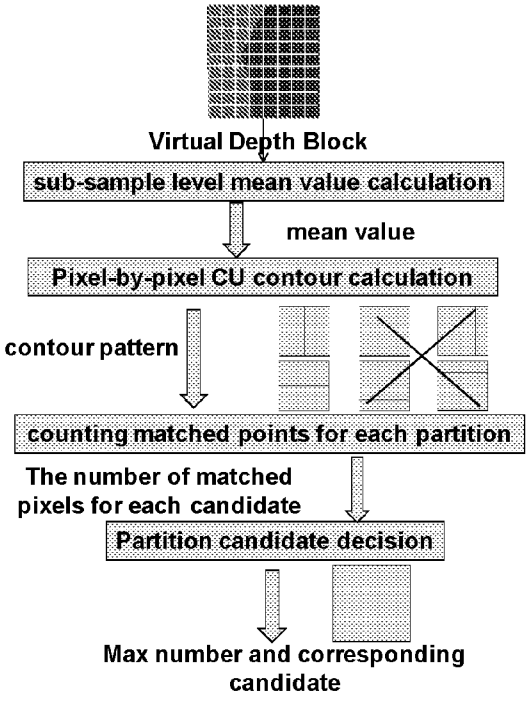

Fig. 2

(57) Abstract: Methods of depth-based block partitioning (DBBP) for multi-view video coding and 3D video coding are disclosed. Several methods are proposed to reduce the complexity of DBBP including (1) Limit the set of the DBBP derived partition candidates to be a subset of all partition candidates, such as only 2N×N and Nx2N; (2) Disable DBBP mode for several fixed CU sizes, e.g., only 8x8 CUs.

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SIMPLIFIED DEPTH BASED BLOCK PARTITIONING METHOD

TECHNICAL FIELD

[0001] The invention relates generally to Multi-view video coding and Three-Dimensional (3D) video coding. In particular, the present invention relates to simplified methods for depth-based block partitioning in 3D video coding.

BACKGROUND

[0002] 3D video coding is developed for encoding or decoding video data of multiple views simultaneously captured by several cameras. Since all cameras capture the same scene for both the input texture videos and depth videos, the depth information can be utilized to improve the motion compensation efficiency of texture videos. Especially, the corresponding depth block of the texture block can represent the pixel level object segmentation, so it is reasonable to realize pixel-level segment based motion compensation by utilizing the depth information. Therefore, a depth-based block partitioning (DBBP) is adopted for texture video coding in the current 3D-HEVC.

[0003] As shown in Fig. 1, the current depth-based block partitioning comprises steps of virtual depth derivation, block partitioning, block segmentation and bi-segment compensation. Virtual depth derivation utilizes the disparity vector from neighboring blocks (NBDV) to address a virtual block of depth from the depth picture in the dependent depth view; One partition among 2N×N, N×2N, 2N×NU, 2N×ND, nL×2N and nR×2N is selected by the block partitioning to derive two predictive motion vectors (PMVs), which are utilized for the compensation procedure for the to-be-divided two segments; Block segmentation process divides the current texture block into two segments in forms of segment mask according to the virtual depth block; Whereas the bi-segment compensation utilizes the PMVs and MVDs from block partitioning and the derived segment mask to fetch the predicted pixels, and then completes the compensation by two-time 2N×2N compensations with their

own decoded motion vectors. In the final compensation process, the compensation is completed through two 2Nx2N compensations under the control of the calculated segment mask. The basic rule is, the 1st 2N×2N predicted block's pixels with "1" in the segment mask and 2nd 2N×2N predicted block's pixels with "0" in the segment mask are selected as the predicted pixels of the decoded CU. In addition, for border positions where 1 and 0 are neighboring in the segment mask, a blending operation is utilized to average the two predicted values at the same position in the two predicted 2N×2N blocks.

[0004] However, complexity problems exist in the following two aspects. (1) The derived partition mode for DBBP is utilized to obtain the predicted MV or MV (merge mode) for the two segments of DBBP, but 6 partition candidates increase the derivation complexity and could be too many possible partition candidates for DBBP; (2) DBBP requires more data access and data compensations than N×N mode, so DBBP for 8x8 CU becomes the worst case of decoding one LCU. Smaller CUs seldom has segments with different motions, therefore, DBBP is more suitable for large CUs. Thereby, a simplified method with computational complexity will be welcome, if the performance can be maintained.

SUMMARY

[0005] In this invention, it is proposed to reduce the encoding and decoding complexity of the DBBP mode.

[0006] There are two methods proposed in this invention. (1) Limit the set of DBBP derived partition candidates to be a subset of all partition candidates, (2) Disable DBBP mode for several fixed CU sizes.

[0007] Other aspects and features of the invention will become apparent to those with ordinary skill in the art upon review of the following descriptions of specific embodiments.

BRIEF DESCRIPTION OF DRAWINGS

[0008] The invention can be more fully understood by reading the subsequent

detailed description and examples with references made to the accompanying drawings, wherein:

[0009] Fig.1 is a diagram illustrating the comprised steps of DBBP.

[0010] Fig.2 is a diagram illustrating the modified partition mode modification step of DBBP.

DETAILED DESCRIPTION

[0011] The following description is of the best-contemplated mode of carrying out the invention. This description is made for the purpose of illustrating the general principles of the invention and should not be taken in a limiting sense. The scope of the invention is best determined by reference to the appended claims.

[0012] There are two kinds of methods proposed in this invention to simplify the DBBP. (1) Limit the set of the DBBP derived partition candidates to be a subset of all partition candidates, such as only 2N×N and N×2N; (2) Disable DBBP mode for several fixed CU sizes, e.g., only 8×8 CUs.

[0013] In method 1, this invention proposes to limit the set of DBBP-derived partition candidates to fixed number of candidates, with explicit or implicit signalization in SPS(sequence parameter set), PPS(picture parameter set), Slice header, CTU(Coding Tree Unit) or CU(coding unit). The fixed number of candidates could also be a pre-specified or predefined subset of all partition candidates without signaling. For example, for each video sequence, the method can implicit forbid the AMP partitions during the derivation process of partition mode when DBBP is utilized. As shown in Fig. 2, in the new procedure of partition mode modification, after sub-sample level mean value calculation and pixel-by-pixel CU contour calculation, the available partition candidates are reduced to 2N×N and Nx2N only while counting matched points for each partition.

[0014] In method 2, this invention proposes to limit the DBBP available CU sizes to fixed number of CU sizes, with explicit or implicit signalization in SPS (sequence parameter set), PPS(picture parameter set), Slice header, CTU(Coding Tree Unit) or CU(coding unit). The fixed number of CU sizes could also be a pre-specified or predefined subset containing one or more predefined CU sizes without signaling.

For example, for each video sequence, the method can implicit forbid 8×8 CUs to utilize DBBP mode.

[0015] The proposed method described above can be used in a video encoder as well as in a video decoder. Embodiments of the method according to the present invention as described above may be implemented in various hardware, software codes, or a combination of both. For example, an embodiment of the present invention can be a circuit integrated into a video compression chip or program codes integrated into video compression software to perform the processing described herein. An embodiment of the present invention may also be program codes to be executed on a Digital Signal Processor (DSP) to perform the processing described herein. The invention may also involve a number of functions to be performed by a computer processor, a digital signal processor, a microprocessor, or field programmable gate array (FPGA). These processors can be configured to perform particular tasks according to the invention, by executing machine-readable software code or firmware code that defines the particular methods embodied by the invention. The software code or firmware codes may be developed in different programming languages and different format or style. The software code may also be compiled for different target platform. However, different code formats, styles and languages of software codes and other means of configuring code to perform the tasks in accordance with the invention will not depart from the spirit and scope of the invention.

[0016] The invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described examples are to be considered in all respects only as illustrative and not restrictive. To the contrary, it is intended to cover various modifications and similar arrangements (as would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

CLAIMS

1. A method of depth-based block partition (DBBP) for multi-view video coding or 3D video coding comprising determining a set of available derived partition candidates for DBBP mode or determining a set of avilable CU sizes for which DBBP mode can be utilized.

2. The method as claimed in claim 1, wherein the set of available derived partition candidates, which DBBP derives from virtual depth, is predefined.

3. The method as claimed in claim 1, wherein the set of available derived partition candidates, which DBBP derives from the virtual depth, is explicitly signaled at transform unit (TU) level, prediction unit (PU) level, coding unit (CU) level, largest coding unit (LCU) level, coding tree unit (CTU) level, coding tree block (CTB) level, slice level, slice header, picture level, picture parameter set (PPS), sequence parameter set (SPS) or video parameter set (VPS).

4. The method as claimed in claim 1, wherein the set of available CU sizes, for which DBBP is not disabled, is predefined.

5. The method as claimed in claim 1, wherein the set of available CU sizes, for which DBBP is not disabled, is explicitly signaled at TU level, PU level, CU level, LCU level, CTU level, CTB level, slice level, slice header, picture level, PPS, SPS or VPS.

6. The method as claimed in claim 1, wherein a significant map, significant table, or a set of significant flags is transmitted at TU level, PU level, CU level, LCU level, CTU level, CTB level, slice level, slice header, picture level, PPS, SPS or VPS to indicate which subset of {2N×N, Nx2N, 2N×NU, 2N×ND, nLx2N, nRx2N} is the group of partition candidates for DBBP to derive.

7. The method as claimed in claim 1, wherein a significant map, significant table, or a set of significant flags is transmitted at TU level, PU level, CU level, LCU level, CTU level, CTB level, slice level, slice header, picture level, PPS, SPS or VPS to indicate which subset of {64×64, 32×32, 16×16, 8x8} is the group of CU sizes for DBBP can be utilized for.

8. The method as claimed in claim 1, wherein the available set of CU sizes, for which DBBP is not disabled, is {64×64, 32×32, 16×16} for all slices.

9. The method as claimed in claim 1, wherein the DBBP mode is applied on a CU larger than N×N, where N is predefined or explicitly signaled into a bitstream,

and is disabled for a CU equal to or smaller than N×N.

10. The method as claimed in claim 9, wherein the predefined N equal to 8.

11. The method as claimed in claim 1, wherein the set of available derived partition candidates, which DBBP derives from the virtual depth, is {2N×N, N×2N} for all slices.

12. The method as claimed in claim 1, wherein the set of available derived partition candidates, which DBBP derives from virtual depth, compirses AMP partitions of 2N×NU, 2N×ND, nL×2N and nRx2N only when AMP partition is utilized to encode texture video.

13. The method as claimed in claim 1, wherein the set of available derived partition candidates, which DBBP derives from virtual depth, excludes AMP partitions of 2N×NU, 2N×ND, nL×2N and nR×2N under a set of CU sizes containing one or more than one CU sizes.

14. The method as claimed in claim 13, wherein the set of CU sizes which forbid AMP partitions for DBBP are predefined or signaled by a significant map, significant table, or a set of significant flags is transmitted at TU level, PU level, CU level, LCU level, CTU level, CTB level, slice level, slice header, picture level, PPS, SPS or VPS.

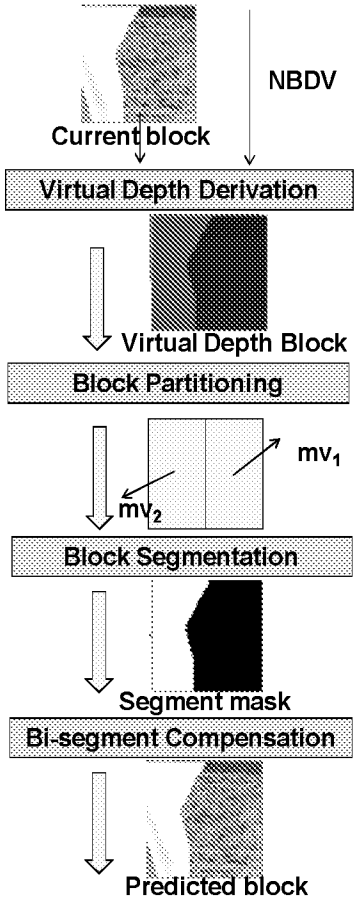
NBDV
Current block
Virtual Depth Derivation
Virtual Depth Block
Block Partitioning
mv1
mv2
Block Segmentation
Segment mask
Bi-segment Compensation
Predicted block

Fig. 1

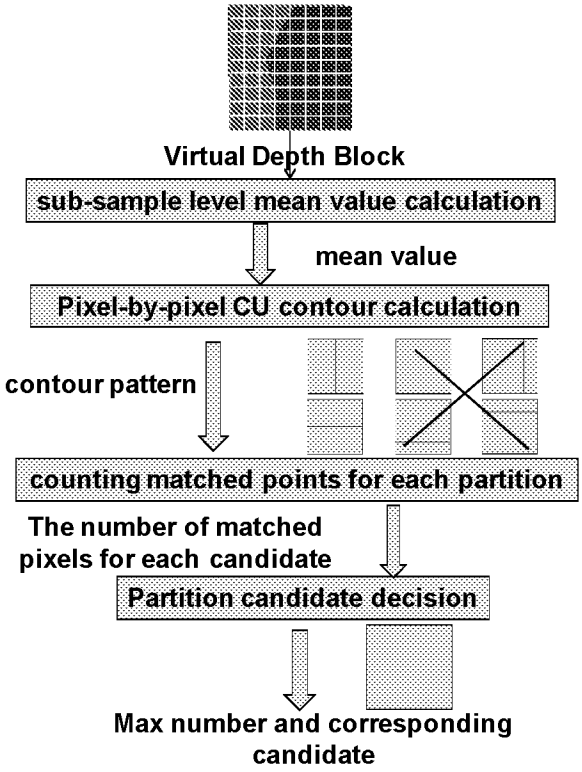
Virtual Depth Block
sub-sample level mean value calculation
mean value
Pixel-by-pixel CU contour calculation
contour pattern
counting matched points for each partition
The number of matched pixels for each candidate
Partition candidate decision
Max number and corresponding candidate

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2014/073360

A. CLASSIFICATION OF SUBJECT MATTER

H04N 19/176 (2014.01) 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)

H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT,WPI,EPODOC,CNKI,IEEE: partition+, divid+, segment+, carv+, block?,unit?, depth, 3D, three dimension+, stereo+, size, dimension, measure,disable, forbid+, prohibit+, flag?, identification,ID

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013128965 A1 (QUALCOMM INCORPORATED) 23 May 2013 (2013-05-23) description, paragraphs [0027], [0100], [0142]-[0166], and claims 1-16	1-8, 11-12
A	CN 102714741 A (THOMSON LICENSING) 03 October 2012 (2012-10-03) the whole document	1-14
A	CN 103053158 A (PANASONIC CORPORATION) 17 April 2013 (2013-04-17) the whole document	1-14
A	CN 102792692 A (SAMSUNG ELECTRONICS CO., LTD.) 21 November 2012 (2012-11-21) the whole document	1-14
A	WO 2013068564 A1 (FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.) 16 May 2013 (2013-05-16) the whole document	1-14

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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"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	Date of mailing of the international search report
12 October 2014	**13 November 2014**
Name and mailing address of the ISA/CN **STATE INTELLECTUAL PROPERTY OFFICE OF THE P.R.CHINA(ISA/CN)** **6,Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088 China** Facsimile No. **(86-10)62019451**	Authorized officer **XIA,Kan** Telephone No. **(86-10)61648255**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2014/073360

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
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				EP	2499829	A2	19 September 2012
				US	2012200669	A1	09 August 2012
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				WO	2012077332	A1	14 June 2012
				US	2013148729	A1	13 June 2013
				EP	2651128	A4	06 August 2014
				MX	2013002086	A	03 April 2013
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				KR	20110083369	A	20 July 2011
				US	2011170610	A1	14 July 2011
				US	2014294077	A1	02 October 2014
WO	2013068564	A1	16 May 2013	EP	2777284	A1	17 September 2014