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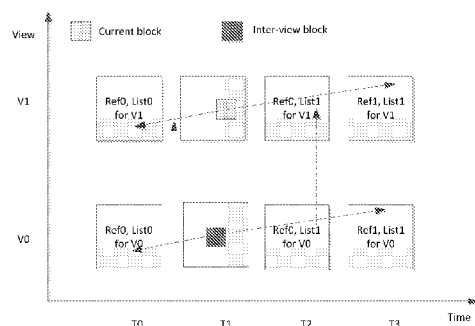
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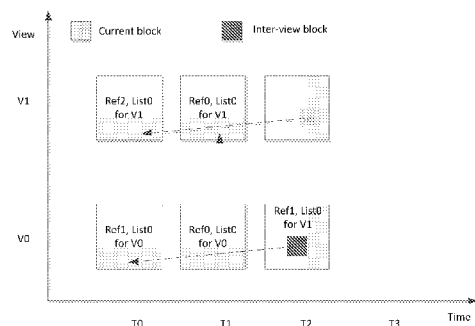
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(54) Title: METHOD AND APPARATUS TO IMPROVE AND SIMPLIFY INTER-VIEW MOTION VECTOR PREDICTION AND DISPARITY VECTOR PREDICTION



(a)



(b)

Figure 3

(57) Abstract: Methods for deriving an inter-view candidate comprise setting at least one constraint. Methods for deriving a merge inter-view candidate from a corresponding block (prediction unit) in inter-view pictures. The limitation on the inter-view candidate derivation can be applied to the selection of the inter-view pictures. The motion information of the inter-view block can be reused by the current block.



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METHOD AND APPARATUS TO IMPROVE AND SIMPLIFY INTER-VIEW MOTION VECTOR PREDICTION AND DISPARITY VECTOR PREDICTION

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to video coding. In particular, the present invention relates to inter-view motion vector prediction and disparity vector prediction.

Description of the Related Art

[0002] Three-dimensional (3D) video coding is developed for encoding and decoding videos of multiple views simultaneously captured by several cameras. Since all cameras capture the same scene from different viewpoints, a multi-view video contains a large amount of inter-view redundancy. In the reference software for High Efficiency Video Coding (HEVC) based 3D video coding v3.1 (HTM3.1), to share the previously encoded motion information of adjacent views, inter-view candidate is added as a motion vector (MV)/disparity vector (DV) candidate for Inter, Merge and Skip mode.

[0003] In HTM3.1, the basic unit for compression, termed coding unit (CU), is a $2N \times 2N$ square block, and each CU can be recursively split into four smaller CUs until the predefined minimum size is reached. Each CU contains one or multiple prediction units (PUs). In the remaining parts of this document, the used term “block” is equal to PU.

[0004] Figure 1 shows the possible prediction structure used in the common test conditions for 3D video coding. The video pictures and depth maps corresponding to a particular camera position are indicated by a view identifier (V0, V1 and V2 in Figure 1). All video pictures and depth maps that belong to the same camera position are associated with the same viewId. The view identifiers are used for specifying the coding order inside the access units and detecting missing views in error-prone environments. Inside an access unit, the video picture and, when present, the associated depth map with viewId equal to 0 are coded first, followed by the video picture and depth map with viewId equal to 1, etc. The view with viewId equal to 0 (V0 in Figure 1) is also referred to as the base view or the independent view and is coded independently of the other views and the depth data using a conventional HEVC video coder.

[0005] As can be seen in Figure 1, for the current block, motion vector predictor (MVP)/disparity vector predictor (DVP) can be derived from the inter-view blocks in the inter-view

pictures. In the following, inter-view blocks in inter-view picture may be shortened as inter-view blocks and the derived candidate is termed inter-view candidates (inter-view MVPs/ DVPs). Moreover, a corresponding block in a neighboring view, or also termed an inter-view block, is located by using the disparity vector derived from the depth information of current block in current picture.

[0006] Assuming that the view coding order is V0 (base view), V1 and V2, when coding the current block in current picture in V2, it firstly checks if the MV of corresponding blocks in V0 is valid and available. If yes, this MV will be added into the candidate list. If not, it continuously checks the MV of corresponding blocks in V1.

[0007] In HTM3.1, the merge inter-view motion/disparity candidate is derived as Algorithm 1:

Algorithm 1: Merge inter-view candidate derivation

1. For temporal reference picture with the smallest reference index in list 0, derive the MV by Algorithm 2;
 2. For temporal reference picture with the smallest reference index in list 1, derive the MV by Algorithm 2;
 3. If one or two of the above two reference pictures have valid MVs, go to step 8;
 Else, go to step 4;
 4. For other reference pictures in list 0, check them according to reference index in ascending order. For a given reference picture in list 0, derive the MV by Algorithm 2.
 5. If MV of list 0 is valid, go to step 6;
 Else if next reference picture in list 0 is available, go to step 4;
 Else go to step 6;
 6. For other reference pictures in list 1, check them according to reference index with ascending order. For a given reference picture in list 1, derive the MV by Algorithm 2.
 7. If MV of list 1 is valid, go to step 8;
 Else if next reference picture in list 1 is available, go to step 6;
 Else go to step 8;
 8. Done.
-

Algorithm 2: Given a reference picture of current picture, the current block MV derivation is as follows.

1. If the reference picture is temporal reference picture, from V0 to the previous coded view, the first MV of the inter-view block pointing to the corresponding view of this reference picture is used.
 2. If the reference picture is inter-view reference picture, the disparity derived from depth map is used.
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BRIEF SUMMARY OF THE INVENTION

[0008] Methods for deriving an inter-view candidate comprise setting at least one constraint. Methods for deriving a merge inter-view candidate from a corresponding block (inter-view

block) in inter-view pictures. The inter-view block is a prediction unit (PU). The limitation on the inter-view candidate derivation can be applied to the selection of the inter-view pictures. The motion information of the inter-view block can be reused by the current block. The inter-view block can be located by the disparity derived from a depth map or a global disparity vector. If the motion information of the inter-view block cannot be used by the current block, the disparity and the inter-view picture are used as motion vector (MV) and reference picture of the current block.

BRIEF DESCRIPTION OF DRAWINGS

[0009] Fig. 1 illustrates an example of prediction structure for 3D video, where the prediction comprises inter-view predictions.

[0010] Fig. 2 illustrates examples for merge inter-view candidate derivation according to Algorithm 1.

[0011] Fig. 3 illustrates examples for merge inter-view candidate derivation according to proposed Algorithm 3.

DETAILED DESCRIPTION OF THE INVENTION

[0012] In order to improve coding efficiency, embodiments according to the present invention utilize new inter-view motion vector prediction and disparity vector prediction techniques. The particular inter-view motion vector prediction and disparity vector prediction method illustrated should not be construed as limitations to the present invention. A person skilled in the art may use other prediction methods to practice the present invention.

[0013] In HTM3.1, all the motion vectors (MVs) of corresponding blocks in the previously coded views can be added as an inter-view candidate even the inter-view pictures are not in the reference picture list of current picture. In this invention, we propose to apply constraints for deriving inter-view candidate to provide better management of decoded picture buffer. The following three constraints can be applied independently. First, only the MVs of the inter-view pictures which are in the reference picture lists (List 0 or List 1) or the decoded picture buffer of current picture can be used to derive inter-view candidate. Second, only one inter-view picture can be used to derive inter-view candidate. Third, only the MVs of the inter-view pictures in base view (independent view) can be used to derive inter-view candidate.

[0014] When applying constraint 1 and 2 together, the following further constraints can be applied to select the designated inter-view reference picture for the derivation of inter-view candidate. First, only the inter-view reference pictures in List 0 with smallest reference picture

index can be used to derive inter-view candidate. If no inter-view reference exists in List0, only the inter-view reference pictures in List 1 with smallest reference picture index can be used to derive inter-view candidate. Second constraint is only the inter-view reference pictures with smallest view index (the view index here represents view coding order) can be used to derive inter-view candidate. Third, one syntax element (e.g. view id) is used to indicate which inter-view reference picture is used to derive inter-view candidate. The fourth constraint, one syntax element is signaled to indicate which reference picture list (List 0 or List 1) the utilized inter-view reference picture belongs to. Based on the fourth constraint, only the inter-view reference pictures with smallest reference picture index can be used to derive inter-view candidate. Based on the fourth constraint, one syntax element is signaled to indicate which inter-view reference picture in the reference picture list is used to derive inter-view candidate.

[0015] In HTM3.1, the derivation of merge inter-view candidate is complex and unreasonable. For example, Fig. 2 shows two unreasonable cases.

[0016] In Fig. 2(a), the inter-view block in V0 has two MVs. One points to the reference index 0 of list 0, and the other one points to the reference index 1 of list 1. However, only the MV pointing to the reference index 0 of list 0 is used for current block in V1, and the MV pointing to reference index 1 of list 0 is not used.

[0017] In Fig. 2(b), the inter-view block in V0 has one MV pointing to the reference index 1 of list 0. The inter-view picture in V0 is inserted in list 0 of current picture as reference index 1. However, the MV of inter-view block in V0 is not used for current block in V1, instead, the disparity is used.

[0018] In this invention, we propose another merge inter-view candidate derivation method as shown in Algorithm 3:

Algorithm 3: Merge inter-view candidate derivation

1. Determine the inter-view pictures used to derive the merge inter-view candidate according to the aforementioned proposed method "limitation on inter-view candidate derivation."
 2. For a given inter-view picture determined by step 1, derive the inter-view motion candidate by Algorithm 4.
 3. If inter-view motion candidate is available, then go to step 5;
 Else if next inter-view picture is available, then go to step 2;
 Else go to step 4.
 4. Derive the inter-view disparity candidate by Algorithm 5 or Algorithm 6.
 5. Done.
-

In Algorithm 3, the checking order of inter-view pictures can be according to the viewId in ascending order, or some other fixed orders.

Algorithm 4: Merge inter-view motion candidate derivation

The motion information (includes MVs, prediction direction (L0, L1, or Bi-pred), reference pictures) of the inter-view block are totally used for current block. Specifically, the process is as follows:

1. Assume the viewId of inter-view picture is V_i , and the viewId of current picture is V_c .
 2. For each reference list of the given inter-view picture,
if there is a reference picture with view V_i used for inter prediction of the inter-view block and the view V_c of this picture is also in the same reference list of the current picture, then the reference picture and MV of current block in this list are set as view V_c of this reference picture and the MV of inter-view block pointing to view V_i of this reference picture respectively, and the inter-view motion candidate of this reference list of current block is marked as available.
 3. If the inter-view motion candidate of list 0 or list 1 is available, then the inter-view motion candidate of current block is marked as available,
Else the inter-view motion candidate of current block is marked as unavailable.
-

In Algorithm 4 step 2, if the view V_c of the reference picture of inter-view block is not in the same reference list of current picture, the inter-view motion candidate of this reference list of current block will be marked as unavailable, however, there are some alternative methods as follows:

- If the view V_c of the reference picture of inter-view block is not in the same reference list of current picture, the MV of inter-view block pointing to this reference picture is scaled to the target reference picture of current block, and the scaled MV is set as MV of current block. The target picture can be the temporal reference picture with smallest reference picture list, or the temporal reference picture which is the majority of the temporal reference pictures of spatially neighboring blocks, or the temporal reference picture which has the smallest POC distance to the reference picture of inter-view block.

Algorithm 5: Merge inter-view disparity candidate derivation

For each reference list of current picture, the reference picture which is

inter-view reference picture with the smallest reference index is used as the reference picture of this list of current block, and the disparity derived from depth map is used as MV of current block.

Algorithm 6: Merge inter-view disparity candidate derivation

1. For reference list 0 of current picture, the reference picture which is inter-view reference picture with the smallest reference index is used as the reference picture of list 0 of current block, and the disparity derived from depth map is used as MV of current block.
 2. If the MV and reference picture of list 0 of current block are valid and available, then go to step 4;
 Else, go to step 3.
 3. For reference list 1 of current picture, the reference picture which is inter-view reference picture with the smallest reference index is used as the reference picture of list 1 of current block, and the disparity derived from depth map is used as MV of current block.
 4. Done.
-

[0019] Therefore, according to the proposed Algorithm 3, the merge inter-view candidate shown in Fig. 2 is derived as shown in Figure 3.

[0020] The above description is presented to enable a person of ordinary skill in the art to practice the present invention as provided in the context of a particular application and its requirement. Various modifications to the described embodiments will be apparent to those with skill in the art, and the general principles defined herein may be applied to other embodiments. Therefore, the present invention is not intended to be limited to the particular embodiments shown and described, but is to be accorded the widest scope consistent with the principles and novel features herein disclosed. In the above detailed description, various specific details are illustrated in order to provide a thorough understanding of the present invention. Nevertheless, it will be understood by those skilled in the art that the present invention may be practiced.

[0021] Embodiment of the present invention as described above may be implemented in various hardware, software code, 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 code integrated into video compression software to perform the processing described herein. An embodiment of the present invention may also be program code 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 code may be developed in different programming languages and different formats or styles. The software code may also be compiled for different target platforms. 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.

[0022] 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. The scope of the invention is therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

CLAIMS

1. A method of deriving merge inter-view candidate for a block of a current picture in three-dimensional video coding, the method comprising:

deriving a merge inter-view candidate from a corresponding block in an inter-view picture,
5 wherein the corresponding block is an inter-view block;
providing the merge inter-view candidate to the block.

2. The method of Claim 1, wherein the inter-view picture selection for deriving the merge inter-view candidate is limited.

10 3. The method of Claim 1, wherein the inter-view block is located by a disparity derived from a depth map or a global disparity vector.

4. The method of Claim 1, wherein motion information of the inter-view block is reused
15 by the current block, and the motion information comprises prediction direction, reference pictures, and motion vectors; the motion information is not used by the current block or is scaled to a target picture of the current block if the reference picture of the inter-view block is not in the reference picture list of the current block.

20 5. The method of Claim 4, wherein the target picture is a temporal reference picture with smaller reference picture list.

6. The method of Claim 4, wherein the target picture is a temporal reference picture which is the majority of the temporal reference pictures of spatially neighboring blocks.

25 7. The method of Claim 4, wherein the target picture is a temporal reference picture which has the smallest POC distance to the reference picture of the inter-view block.

8. The method of Claim 1, wherein the disparity and the inter-view picture are used as
30 motion vector (MV) and reference picture of the current block if motion information of the inter-view block cannot be used by the current block.

9. The method of Claim 8, wherein the inter-view picture is the inter-view reference

picture with the smallest index within the reference list of the current block.

10. The method of Claim 8, wherein the inter-view picture is the inter-view picture in a base view.

5

11. The method of Claim 2, wherein only MVs of the inter-view picture in the reference picture list of the current picture is used to derive the inter-view candidate.

12. The method of Claim 2, wherein only MVs of the inter-view pictures in a decoded picture buffer is used to derive the inter-view candidate.

10

13. The method of Claim 2, wherein only one inter-view picture is used to derive the inter-view candidate.

14. The method of Claim 2, wherein only MVs of the inter-view pictures in a base view or independent view is used to derive the inter-view candidate.

15

15. The method of Claim 11 or 13, wherein only the inter-view reference pictures in List 0 with smallest reference picture index is used to derive the inter-view candidate; if no inter-view reference exists in List0, only the inter-view reference pictures in List 1 with smallest reference picture index is used to derive the inter-view candidate.

20

16. The method of Claim 11 or 13, only the inter-view reference pictures with smallest view index (the view index here represents view coding order) can be is used to derive the inter-view candidate.

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17. The method of Claim 11 or 13, one syntax element is used to indicate which inter-view reference picture is used to derive the inter-view candidate.

18. The method of Claim 11 or 13, one syntax element is signaled to indicate which reference picture list the utilized inter-view reference picture belongs to.

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19. The method of Claim 18, only the inter-view reference pictures with smallest reference picture index is used to derive the inter-view candidate.

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20. The method of Claim 18, one syntax element is signaled to indicate which inter-view reference picture in the reference picture list is used to derive the inter-view candidate.

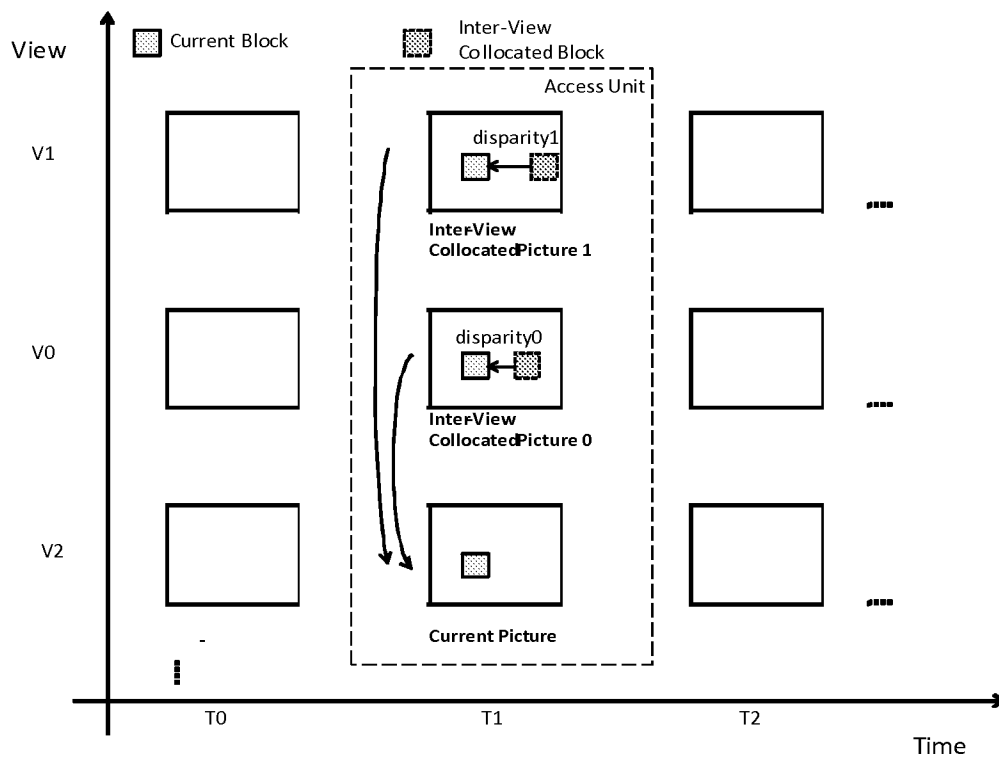
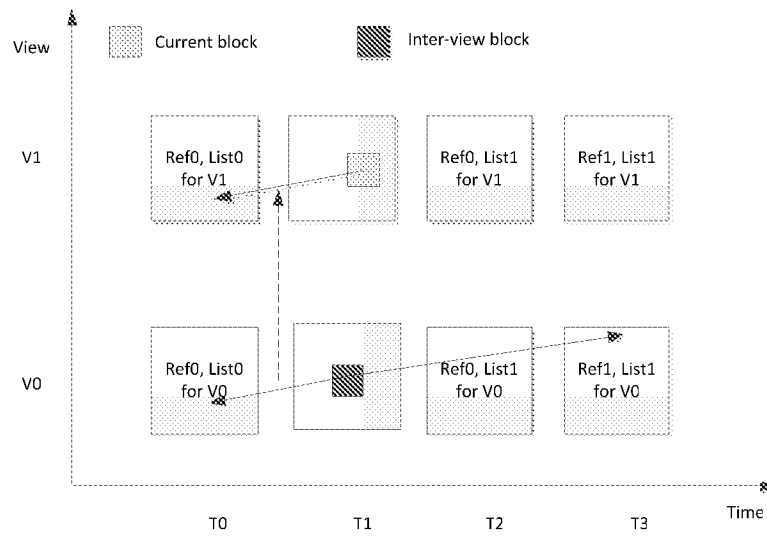
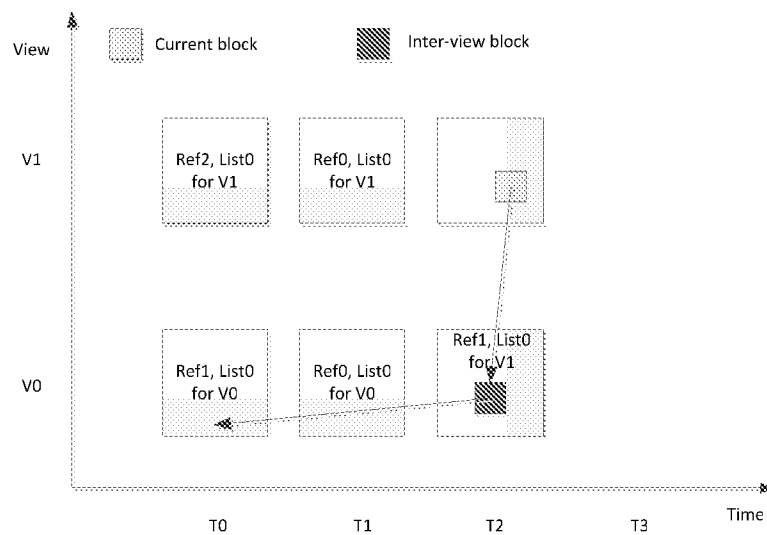


Figure 1

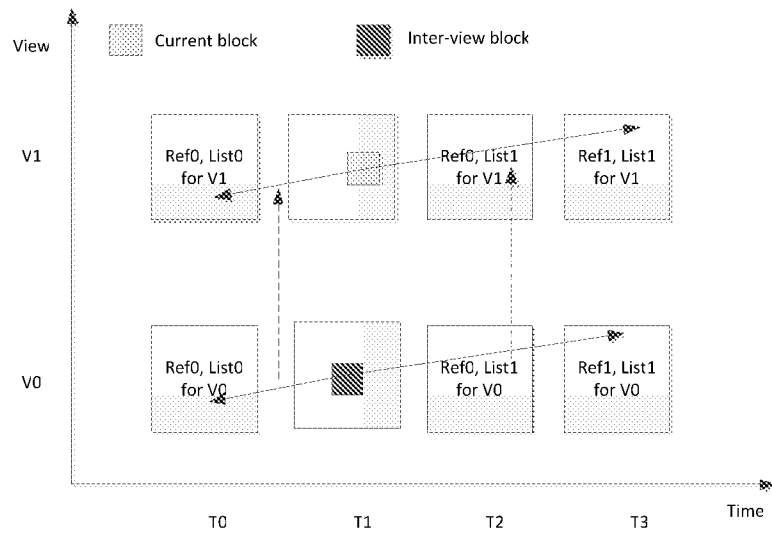


(a)

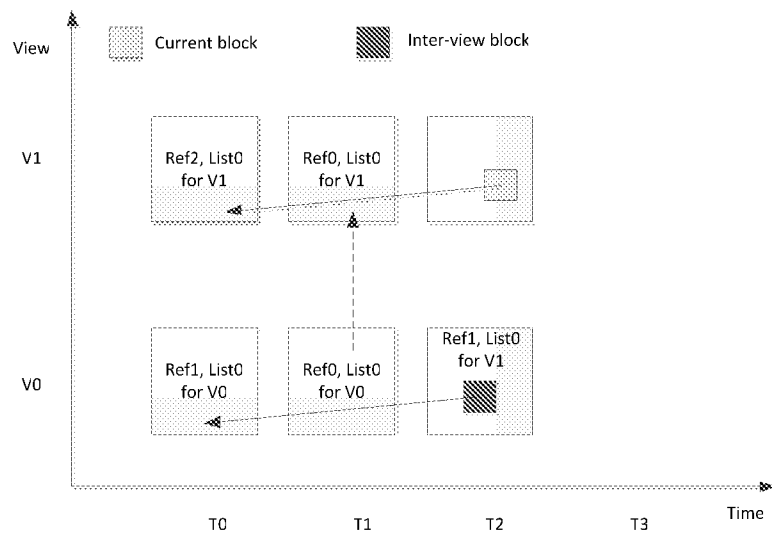


(b)

Figure 2



(a)



(b)

Figure 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2012/078103

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: 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)

CPRSABS, CNKI, DWPI, SIPOABS, video, code, encode, encipher, encrypt, coding, compile, codify, codification, transcode, decipher, vector, merge, unify, coalesce, derive, deriving, candidate, alternate, predict, predicting, forecast, disparity

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US2012008688A1 (MEDIATEK INC) 12 Jan. 2012(12.01.2012) the whole document	1-20
A	CN101601304A (SAMSUNG ELECTRONICS CO., LTD.) 09 Dec. 2009(09.12.2009) the whole document	1-20
A	CN101917619A (UNIV ZHEJIANG) 15 Dec. 2010(15.12.2010) the whole document	1-20
A	US2012134416A1 (MEDIATEK INC) 31 May 2012(31.05.2012) the whole document	1-20

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

* Special categories of cited documents:	“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
“A” document defining the general state of the art which is not considered to be of particular relevance	“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
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“P” document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 27 Mar. 2013(27.03.2013)	Date of mailing of the international search report 11 Apr. 2013 (11.04.2013)
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer Deng,Jun Telephone No. (86-10)62411644

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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