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(71) Applicant (for all designated States except US): **MEDI-ATEK SINGAPORE PTE. LTD.** [SG/SG]; #03-01 Solaris, No. 1 Fusionopolis Walk, Singapore 138628 (SG).

(72) Inventors; and

(71) Applicants (for US only): **AN, Jicheng** [CN/CN]; No. 44 Zhanlanguan Road, Xicheng District, Beijing 100037 (CN). **ZHANG, Kai** [CN/CN]; A1101, Dongfang Yujinxing Building, No. 216 Tangli Road, Chaoyang District, Beijing 100013 (CN). **ZHANG, Xianguo** [CN/CN]; Room 202, Unit 4, Building 45, Zuojiashuang Beili, Chaoyang District, Beijing 100028 (CN). **HUANG, Han** [CN/CN]; No. 3 Shangyuancun, Haidian District, Beijing 100044 (CN). **LIN, Jian-Liang** [CN/CN]; No. 133 Neipi Rd., Nanjian Vil. Su'ao Township, Yilan County, Taiwan 270 (CN).(74) Agent: **BEIJING SANYOU INTELLECTUAL PROPERTY AGENCY LTD.**; 16th Fl., Block A, Corporate Square, No. 35 Jinrong Street, Beijing 100033 (CN).

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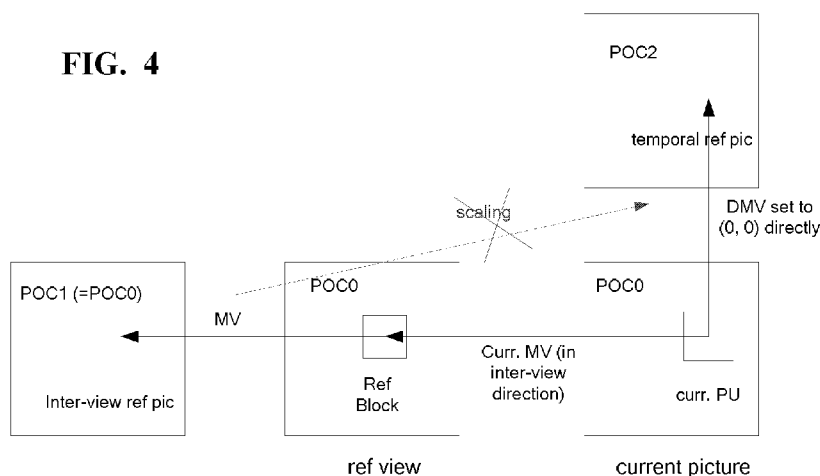
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(54) Title: METHODS FOR INTER-VIEW ADVANCED RESIDUAL PREDICTION

FIG. 4



(57) Abstract: A method of MV derivation is proposed for the inter-view advanced residual prediction. With the proposed method, one problematic MV scaling process can be avoided.

METHODS FOR INTER-VIEW ADVANCED RESIDUAL PREDICTION

FIELD OF INVENTION

The invention relates generally to Three-Dimensional (3D) video processing. In particular,
5 the present invention relates to methods for inter-view advanced residual prediction (ARP).

BACKGROUND OF THE INVENTION

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 from
10 different viewpoints, multi-view video data contains a large amount of inter-view redundancy.
To exploit the inter-view redundancy, additional tools such as advanced residual prediction
(ARP) have been integrated to conventional 3D-HEVC (High Efficiency Video Coding) or 3D-
AVC (Advanced Video Coding) codec.

There are two kinds of ARP, inter-view ARP and temporal ARP. If current motion vector
15 (MV) is in inter-view direction, the ARP is called inter-view ARP, otherwise, if current MV is
in temporal direction, the ARP is called temporal ARP. Here we only address the inter-view
ARP. The basic concept of the inter-view ARP in current 3DV-HEVC is illustrated in Fig. 1. In
inter-view ARP, the MV of the current PU is in inter-view direction, which is applied to a
corresponding block in a temporal reference picture in the same view to generate the reference
20 residual in temporal direction. The corresponding block in a temporal reference picture is
located by a derived motion vector (DMV), the DMV is a scaled MV of the reference block in
the reference view, and the reference block is located by current MV. The derivation of DMV is
illustrated in Fig. 2.

The scaling process is well-known according to picture order count (POC) as follows
25 (input is MV, output is the DMV):

$$tx = (16384 + (\text{Abs}(td) \gg 1)) / td \quad (1)$$

$$\text{distScaleFactor} = \text{Clip3}(-4096, 4095, (tb * tx + 32) \gg 6) \quad (2)$$

$$\text{DMV} = \text{Clip3}(-32768, 32767, \text{Sign}(\text{distScaleFactor} * MV) * \\ ((\text{Abs}(\text{distScaleFactor} * MV) + 127) \gg 8)) \quad (3)$$

30 where td and tb are derived as:

$$td = \text{Clip3}(-128, 127, \text{POC0-POC1}) \quad (4)$$

$$tb = \text{Clip3}(-128, 127, \text{POC0-POC2}) \quad (5)$$

However, when POC0 is the same as the POC1, i.e., the MV of the reference block in the reference view is in inter-view direction as shown in Fig. 3, the scaling process becomes meaningless and would result in coder crash since the denominator td equal to 0 in (1).

5 SUMMARY OF THE INVENTION

In light of the previously described problem, a method is proposed. In the proposed method, if the POC0 is equal to POC1, i.e., the MV of reference block is in inter-view direction, the DMV is set to (0, 0) so that the MV scaling process is avoided as shown in Fig. 4.

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 THE DRAWINGS

The invention can be more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:

15 Fig. 1 is a diagram illustrating the inter-view residual prediction in current 3D-HEVC;

Fig. 2 is a diagram illustrating the DMV derivation in current 3D-HEVC;

Fig. 3 is a diagram illustrating the problematic DMV derivation in current 3D-HEVC;

Fig. 4 is a diagram illustrating the proposed solution for the problematic DMV derivation in current 3D-HEVC.

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DETAILED DESCRIPTION

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.

25

To avoid the meaningless and problematic MV scaling, based on the original method, some change is proposed as follows:

In the DMV derivation, if the MV of the reference block, which is located by current MV (in inter-view direction), is in inter-view direction, or the POC of the reference block is the same as the POC of the reference block's reference block, the DMV is directly set to the default value (0, 0) as shown in Fig. 4.

30

The related part of the draft text of current 3D-HEVC (JCT3V-H1001_v2) is in section I.8.5.3.3.7.4, which should be modified as follows (the added part is underline and the deleted part is *in brackets and italic*):

I 8.5.3.3.7.4 Derivation process for a motion vector from a reference block for residual prediction

...

When the variable CuPredMode for the coding unit refCU is equal to MODE_SKIP or
5 MODE_INTER, the following applies for X in the range of 0 to 1, inclusive:

– The variable refPredFlagLX is set equal to the prediction utilization flag predFlagLX of the prediction unit refPU.

– When availFlag is equal to 0 and refPredFlagLX is equal to 1, the following applies:

i. Let refPicListRefX be the reference picture list X of refPic.

10 ii. Let mvLX and refIdxLX be the motion vector and reference index of the prediction unit refPU corresponding to refPicListRefX, respectively.

iii. When PicOrderCnt(refPicListRefX[refIdxLX]) is not equal to PicOrderCnt(refPic) (*refPicListRefX[refIdxLX] is a temporal reference picture of refPic*) and RpRefIdxLX is not equal to -1, availFlag is set to 1, Y is set equal to X and
15 the residual prediction motion vector scaling process as specified in subclause I.8.5.3.3.7.3 is invoked with the prediction list utilization variable equal to X, the motion vector mvLX, and the reference picture refPicListRefX[refIdxLX] as inputs, and the output being mvT.

The methods 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
20 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
25 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
30 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.

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

5 modifications and similar arrangements.

CLAIMS

1. A method for MV derivation in inter-view ARP.

2. The method as claimed in claim 1, wherein a reference block in the reference view is
5 located by the current MV (in inter-view direction).

3. The method as claimed in claim 1 and claim 2, if the MV of the reference block is in inter-view direction, the MV scaling process is skipped, and the DMV for inter-view ARP is set to a default value (0, 0).

4. The method as claimed in claim 1 and claim 2, if the POC of the reference block is the
10 same as the POC of the reference block's reference block, the MV scaling process is skipped, and the DMV for inter-view ARP is set to a default value (0, 0).

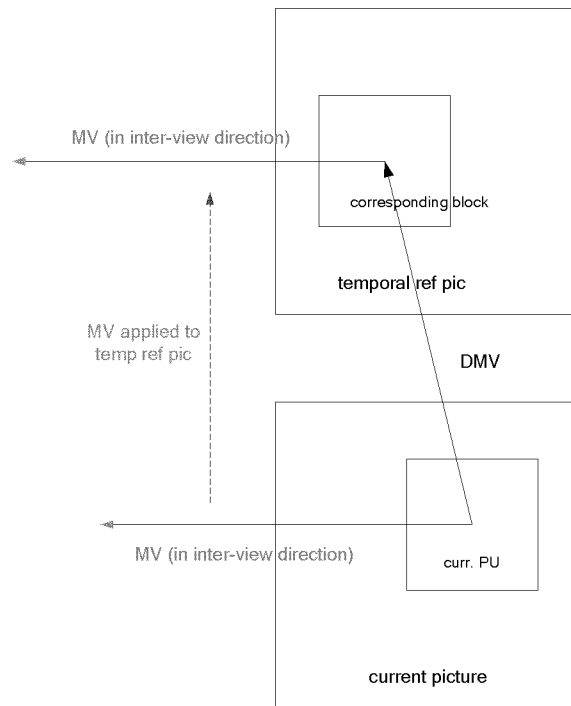


FIG. 1

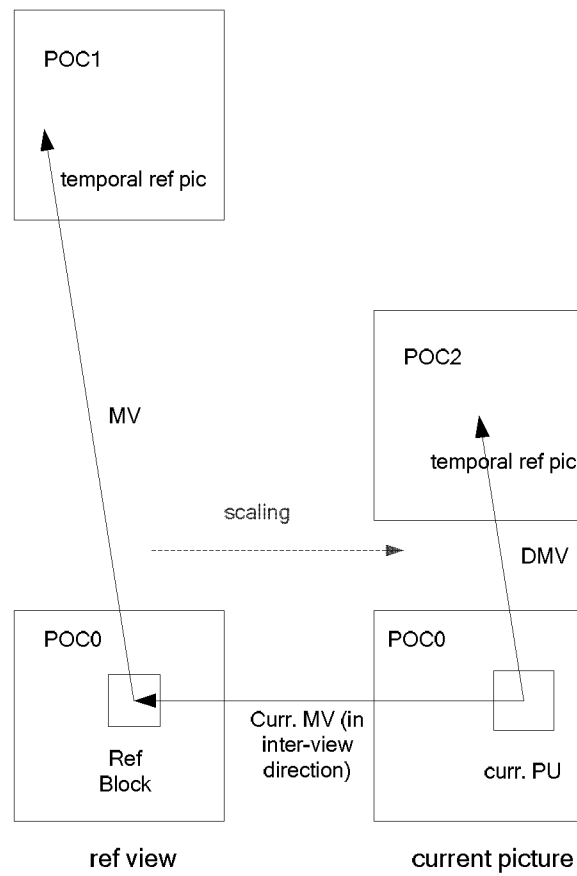


FIG. 2

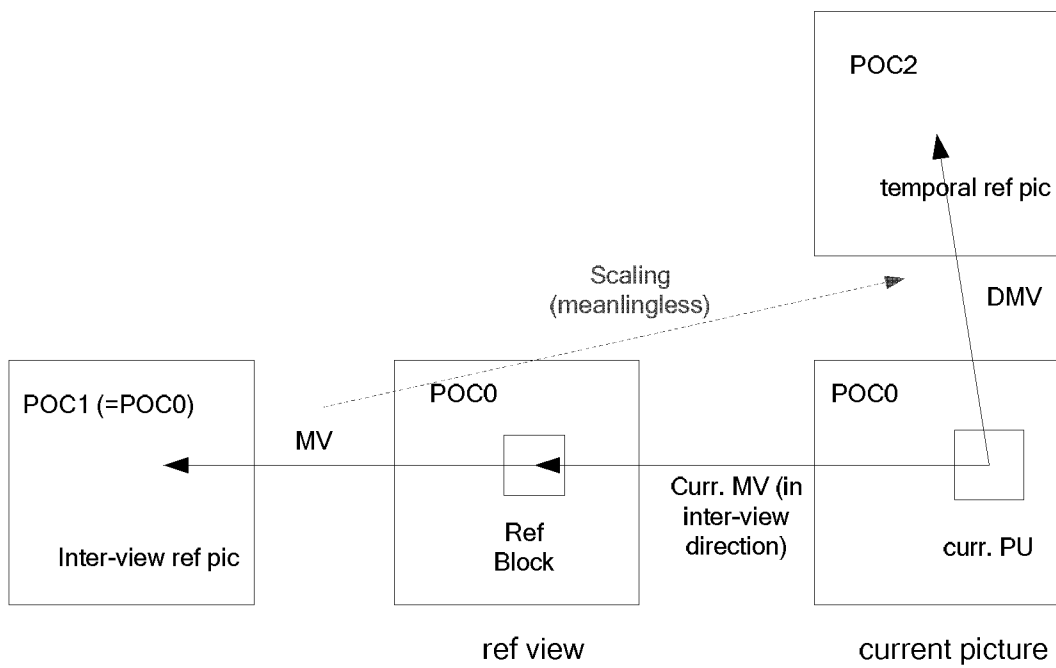


FIG. 3

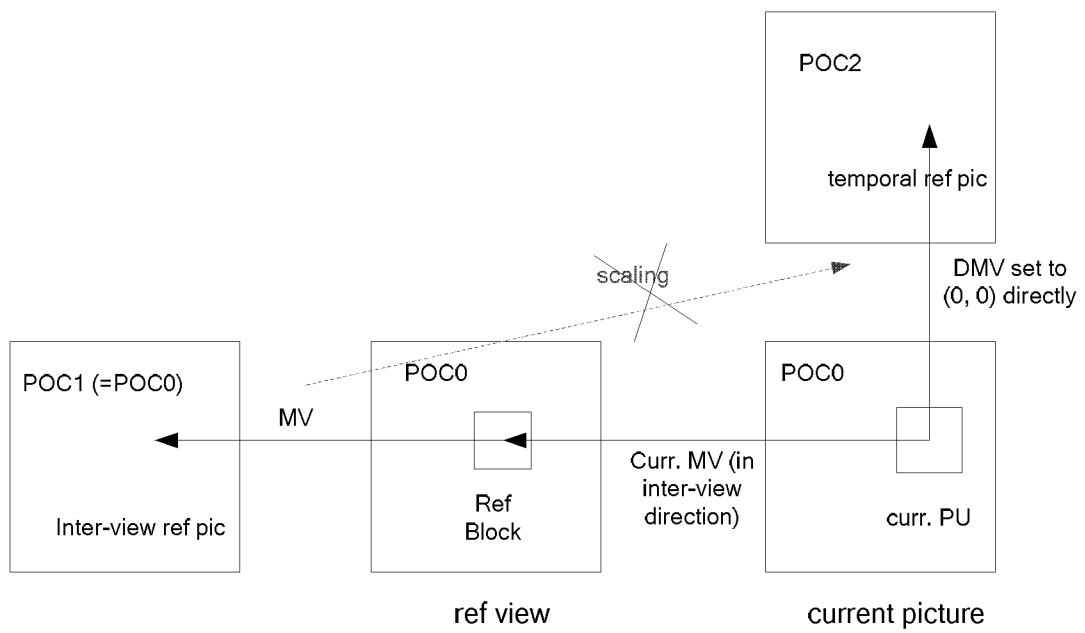


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2014/080615

A. CLASSIFICATION OF SUBJECT MATTER

H04N 13/00(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)

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, CNKI, WPI, EPODOC: advanced, residual, prediction, ARP, redundant, inter-view, MV, dmv, deriv+, motion, vector

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2014078250 A1 (QUALCOMM INC.) 20 March 2014 (2014-03-20) paragraphs [0024], [0058], [0089], and figures 2B, 6	1,2
A	WO 2014075236 A1 (MEDIATEK SINGAPORE PTE. LTD. ET AL.) 22 May 2014 (2014-05-22) the whole document	1-4
A	WO 2014056423 A1 (MEDIATEK INC.) 17 April 2014 (2014-04-17) the whole document	1-4
A	US 2014161175 A1 (QUALCOMM INC.) 12 June 2014 (2014-06-12) the whole document	1-4
A	CN 103597837 A (MEDIATEK INC.) 19 February 2014 (2014-02-19) the whole document	1-4



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 but 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 publication date of another citation or other 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

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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

Authorized officer

YU,Lina

Facsimile No. (86-10)62019451

Telephone No. (86-10)82245067

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2014/080615

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
US	2014078250	A1	20 March 2014	WO	2014047188	A1	27 March 2014
WO	2014075236	A1	22 May 2014	WO	2014075615	A1	22 May 2014
WO	2014056423	A1	17 April 2014	None			
US	2014161175	A1	12 June 2014	TW	201440496	A	16 October 2014
				WO	2014089453	A1	12 June 2014
				TW	201440494	A	16 October 2014
				WO	2014089469	A1	12 June 2014
				TW	201440492	A	16 October 2014
				TW	201440497	A	16 October 2014
				US	2014161189	A1	12 June 2014
				WO	2014089461	A1	12 June 2014
				US	2014161188	A1	12 June 2014
				WO	2014089445	A1	12 June 2014
				US	2014161187	A1	12 June 2014
CN	103597837	A	19 February 2014	EP	2721825	A1	23 April 2014
				US	2014078254	A1	20 March 2014
				AU	2012269583	A1	17 October 2013
				KR	20140011481	A	28 January 2014
				WO	2012171442	A1	20 December 2012