



- (51) **International Patent Classification:**
H04N 13/00 (2006.01)
- (21) **International Application Number:**
PCT/CN2013/074165
- (22) **International Filing Date:**
12 April 2013 (12.04.2013)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (71) **Applicant:** **MEDIATEK INC.** [CN/CN]; No.1, Dusing Road 1st, Science-Based Industrial Park, Hsin-Chu, Taiwan 300 (CN).
- (72) **Inventors:** **LIN, Jian-Liang**; No. 133, Neipi Rd., Nanjian Vil. Su'ao Township, Yilan County, Taiwan 270 (CN). **ZHANG, Kai**; A1101, Dongfang Yujinxiang Building, No. 216 Tangli Road, Chaoyang District, Beijing 100013 (CN). **AN, Jicheng**; No. 44 Zhanlanguan Road, Xicheng District, Beijing 100037 (CN).
- (74) **Agent:** **BEIJING SANYOU INTELLECTUAL PROPERTY AGENCY LTD.**; 16th Fl., Block A, Corporate Square, No. 35 Jinrong Street, Beijing 100033 (CN).

(81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) **Title:** STEREO COMPATIBILITY HIGH LEVEL SYNTAX

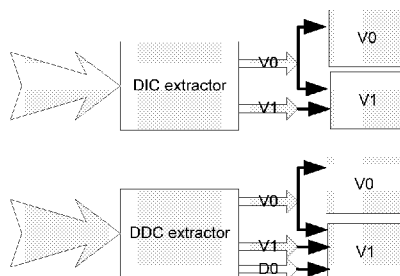


Fig.3

(57) **Abstract:** In this proposal, a high level syntax design for stereo compatibility in 3D-HEVC is proposed. By adopting several syntax elements, BVSP and DoNBVDV are modified as optional instead of compulsory, and the encoder can choose whether to pre-serve stereo compatibility adaptively.

STEREO COMPATIBILITY HIGH LEVEL SYNTAX

TECHNICAL FIELD

The invention relates generally to Three-Dimensional (3D) video processing. In particular, the present invention relates to stereo compatibility.

BACKGROUND

Backward View Synthesis Prediction (BVSP) and Depth-oriented neighboring block disparity vector (DoNBDV) has been adopted into HTM [1][2][3]. BVSP uses the neighbouring blocks to derive a depth block to perform the backward warping operation. A new merging candidate indicating the BVSP mode is added in the merging candidate list. DoNBDV can enhance the accuracy of the NBDV by utilizing the coded depth map. By referring to the NBDV and the coded depth information, the inter-view information can be predicted more accurately with DoNBDV. Fig.1 and Fig.2 depict the general mechanism of BVSP and DoNBDV respectively.

Despite in different manners, BVSP and DoNBDV both utilize the coded depth picture from the base view when a texture picture from a dependent view is being encoded. These Depth Dependent Coding (DDC) methods can take advantage of the additional information from the depth map, thus they can improve the overall coding efficiency significantly compared with the Depth Independent Coding (DIC) scheme. With the backing of a remarkable coding gain, DVSP and DoNBDV have been adopted into HTM6 [1][4] as compulsory coding tools.

Although DDC can outperform DIC in overall coding efficiency, the compulsory dependency between texture and depth pictures breaks the stereo compatibility in 3D-HEVC. In previous HTMs without DDC tools, texture pictures on dependent views can be encoded and decoded if no depth pictures are available, which means stereo compatibility is supported. In HTM6, however, texture pictures on dependent views cannot be encoded or decoded without depth pictures on the base view. Even if depth pictures are available, DDC is inefficient in the stereo application scenario. Fig. 3 shows an example, where V0 and V1 are desirable. In a DIC scheme such as HTM5, only bit-streams of V0 and V1 need to be dispatched. In a DDC scheme such as

HTM6, however, bit-stream of D0 as well as bit-streams of V0 and V1 need to be dispatched. Although D0 can contribute to the coding efficiency of V1, this contribution cannot balance the overhead bits of D0 itself.

SUMMARY

5 In light of the previously described problems, this contribution presents a high level syntax design for stereo compatibility in 3D-HEVC. In HTM6, Depth Dependent Coding (DDC) methods such as BVSP and DoNBBDV are adopted to improve the overall coding efficiency. However, the compulsory dependency between texture and depth pictures breaks the stereo compatibility in 3D-HEVC. With the
10 proposed syntax elements, DDC tools such as BVSP and DoNBBDV are modified as optional instead of compulsory. An encoder can decide whether to utilize DDC or to preserve stereo compatibility depending on the application scenario.

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
15 embodiments.

BRIEF DESCRIPTION OF DRAWINGS

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

Fig. 1 is a diagram illustrating the general concept of BVSP.

Fig. 2 is a diagram illustrating the general concept of DoNBBDV.

Fig. 3 is a diagram illustrating an example of the stereo application scenario.

DETAILED DESCRIPTION

25 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.

This contribution presents a high level syntax design for stereo compatibility in 3D-HEVC. An example in which related syntax elements are signalled in Video Parameter Set (VPS) is demonstrated in Table 1. DDC tools such as BVSP and DoNBDV are modified as optional instead of compulsory. An encoder can decide whether to utilize DDC or to preserve stereo compatibility depending on the application scenario. Moreover, an extractor can determine how to dispatch bit-streams according to these syntax elements.

Table 1

vps_extension2() {	Descriptor
...	
if ((layerId != 0) && !DepthLayerFlag[layerId]) {	
iv_mv_pred_flag [layerId]	u(1)
iv_res_pred_flag [layerId]	u(1)
depth_dependent_flag [layerId]	u(1)
if(depth_dependent_flag[layerId] != 0){	
view_synthesis_pred_flag [layerId]	u(1)
dv_refine_flag [layerId]	u(1)
}	
}	
if (DepthLayerFlag[layerId]) {	
if ((layerId != 0)	
view_synthesis_pred_flag [layerId]	u(1)
...	
}	

Semantics of the proposed syntax elements are as follows.

depth_dependent_flag[layerId] indicates whether depth pictures are used in the decoding process of the layer with layer_id equal to layerId. **depth_dependent_flag**[layerId] equal to 0 specifies that depth pictures are not used for the layer with layer_id equal to layerId. **depth_dependent_flag**[layerId] equal to 1 specifies that depth pictures may be used for the layer with layer_id equal to layerId. When **depth_dependent_flag**[layerId] is not present, its value shall be inferred to be equal to 0.

view_synthesis_pred_flag[layerId] indicates whether view synthesis prediction is used in the decoding process of the layer with layer_id equal to layerId. **view_synthesis_pred_flag**[layerId] equal to 0 specifies that view synthesis prediction

merging candidate is not used for the layer with layer_id equal to layerId. view_synthesis_pred_flag[layerId] equal to 1 specifies that view synthesis prediction merging candidate is used for the layer with layer_id equal to layerId. When view_synthesis_pred_flag[layerId] is not present, its value shall be inferred to be

5 equal to 0.

do_nbdv_flag[layerId] indicates whether DoNBDV is used in the decoding process of the layer with layer_id equal to layerId. do_nbdv_flag[layerId] equal to 0 specifies that DoNBDV is not used for the layer with layer_id equal to layerId. do_nbdv_flag[layerId] equal to 1 specifies that DoNBDV is used for the layer with

10 layer_id equal to layerId. When do_nbdv_flag[layerId] is not present, its value shall be inferred to be equal to 0.

CLAIMS

1. A method of preserving stereo compatibility in three-dimensional video coding (3DVC).

2. The method as claimed in claim 1, wherein an encoder is capable of
5 deciding whether to utilize coded depth pictures or not when coding a texture picture.

3. The method as claimed in claim 2, wherein the encoder informs a decoder whether the coded depth pictures are utilized when coding a texture picture.

4. The method as claimed in claim 3, wherein the decoder utilizes decoded
depth pictures when decoding a texture picture according to whether the encoder
10 utilizes coded depth pictures when coding the texture picture.

5. The method as claimed in claim 3, wherein the encoder informs the decoder by signaling information in a bit-stream.

6. The method as claimed in claim 5, wherein the information is signalled in Video parameter set (VPS).

7. The method as claimed in claim 5, wherein the information is signalled in
15 Sequence parameter set (SPS).

8. The method as claimed in claim 5, wherein the information is signalled in Picture parameter set (PPS).

9. The method as claimed in claim 8, wherein the information signaled for
20 each PPS in the same sequence is the same.

10. The method as claimed in claim 5, wherein the information is signalled for each slice in a slice header.

11. The method as claimed in claim 10, wherein the information signaled for each slice in a same picture is the same.

12. The method as claimed in claim 2, wherein Backward View Synthesis Prediction (BVSP) and Depth-oriented neighboring block disparity vector (DoNBDV)
25 are disabled if coded depth pictures are not utilized when coding a texture picture.

13. The method as claimed in claim 2, wherein the encoder is capable of deciding whether to use BVSP or not if coded depth pictures are utilized when coding
30 a texture picture.

14. The method as claimed in claim 13, wherein the encoder informs the decoder whether BVSP is used or not; and the decoder uses BVSP according to whether the encoder uses BVSP.

15. The method as claimed in claim 13, wherein the encoder is capable of informing the decoder by signaling information in a bit-stream.

16. The method as claimed in claim 15, wherein the information is signalled in VPS, SPS, PPS, or slice header.

5 17. The method as claimed in claim 2, wherein the encoder is capable of deciding whether to use DoNBDV if coded depth pictures are utilized when coding a texture picture.

18. The method as claimed in claim 17, wherein the encoder informs the decoder whether DoNBDV is used; and the decoder uses DoNBDV according to
10 whether the encoder uses DoNBDV.

19. The method as claimed in claim 18, wherein the encoder is capable of informing the decoder by signaling information in a bit-stream.

20. The method as claimed in claim 19, wherein the information is signalled in VPS, SPS, PPS, or slice header.

15 21. The method as claimed in claim 1, wherein an encoder does not inform a decoder whether BVSP or DoNBDV is used if coded depth pictures are not utilized to code a texture picture as indicated by the encoder.

22. The method as claimed in claim 13, wherein the encoder informs the decoder whether BVSP or DoNBDV is used to code a depth picture.

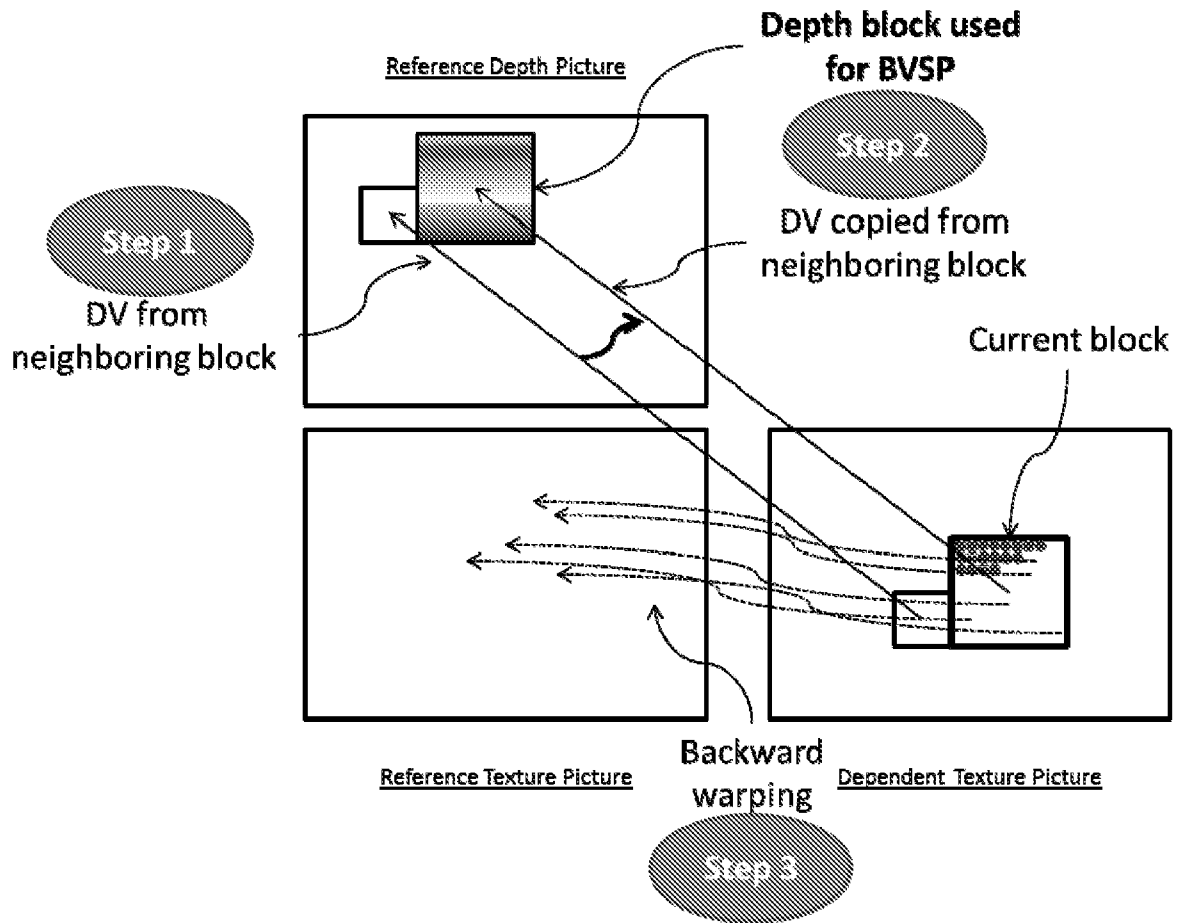


Fig.1

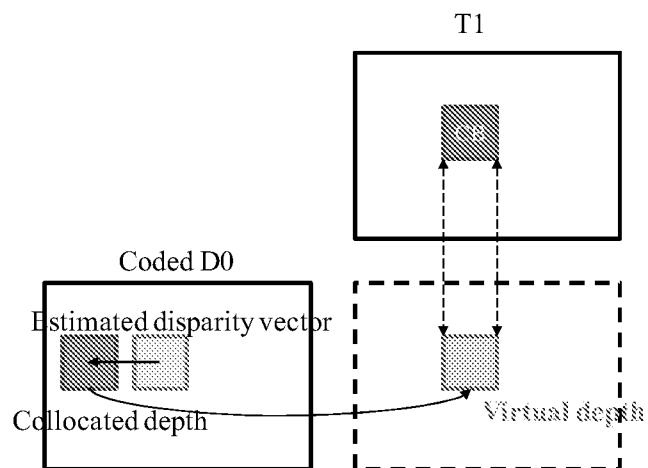


Fig.2

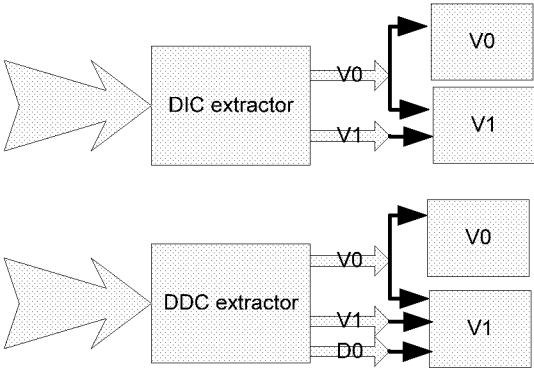


Fig.3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2013/074165

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)

IPC: H04N 13/-, H04N 7/-, H04N 19/-, H04N 9/-

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)

CNKI, CNPAT, WPI, EPODOC: video, 3D, three-dimension, 3DVC, encod+, cod+, decod+, depth, texture, utilize+, refer+, decide+, VPS, SPS, PPS, parameter set, sequence, picture, image, BVSP, NoNBDV, view?, Syntax, stereo, compat+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 102792699 A (GENERAL INSTRUMENT CORPORATION) 21 November 2012 (21.11.2012) the abstract, description, paragraphs [0025]-[0080] and figures 1-6	1-22
A	CN 102246529 A (KONINKLIJKE PHILIPS ELECTRONICS N.V.) 16 November 2011 (16.11.2011) the whole document	1-22
A	WO 2005/017619 A1 (EASTMAN KODAK COMPANY) 24 February 2005 (24.02.2005) the whole document	1-22
A	WO 2010/095410 A1 (PANASONIC CORPORATION) 26 August 2010 (26.08.2010) the whole document	1-22

☐ 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	
“E” earlier application or patent but published on or after the international filing date	“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
“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)	“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
“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	“&” document member of the same patent family

Date of the actual completion of the international search
26 December 2013 (26.12.2013)Date of mailing of the international search report
16 Jan. 2014 (16.01.2014)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. 86-10-62019451Authorized officer
LI, Ping
Telephone No. (86-10) 62413229

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2013/074165

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 102792699 A	21.11.2012	US 2011122225 A1	26.05.2011
		WO 2011063397 A1	26.05.2011
		KR 20120085326 A	31.07.2012
CN 102246529 A	16.11.2011	EP 2197217 A1	16.06.2010
		WO 2010070545 A1	24.06.2010
		KR 20110106367 A	28.09.2011
		US 2011242279 A1	06.10.2011
		EP 2377325 A1	19.10.2011
		JP 2012512554 A	31.05.2012
		INCHENP 201104889 E	16.11.2012
WO 2005/017619 A1	24.02.2005	US 2005031983 A1	10.02.2005
WO 2010/095410 A1	26.08.2010	US 2010215347 A1	26.08.2010