(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
25 July 2013 (25.07.2013)

WIPO | PCT

(10) International Publication Number
WO 2013/106987 A1

(51) International Patent Classification:
H03M 7/30 (2006.01)

(21) International Application Number:
PCT/CN2012/070428

(22) International Filing Date:
16 January 2012 (16.01.2012)

(25) Filing Language: English

(26) Publication Language: English

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(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, 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, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD,

[Continued on next page]

(54) Title: METHODS AND APPARATUSES OF BYPASS CODING AND REDUCING CONTEXTS FOR SOME SYNTAX ELEMENTS

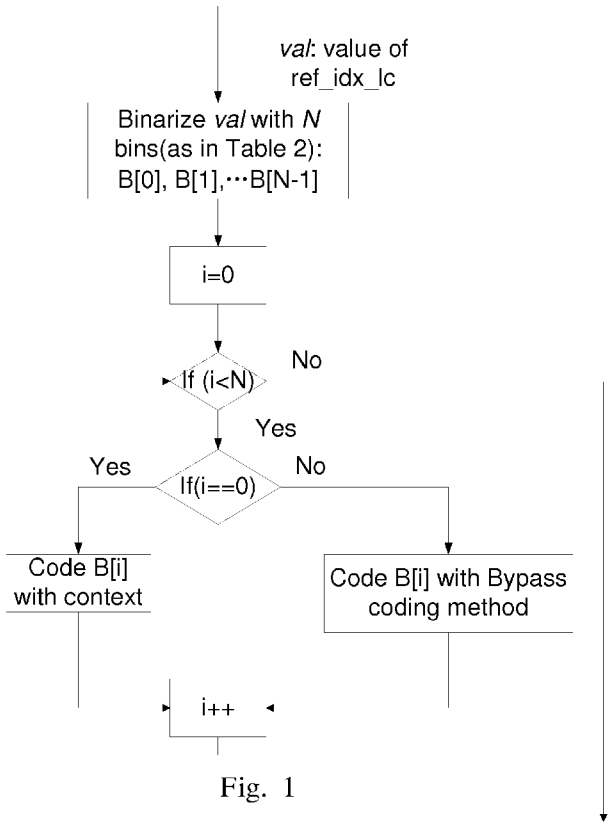

Fig. 1

(57) Abstract: Methods of reducing contexts and bypass coding applied to the syntax elements merge_flag, merge_idx, ref_idx_lc, pred_type and cu_qp_delta are disclosed. In some embodiments, several bins of one syntax element are coded with one context, while in others one bin or several bins of one syntax element are coded with bypass coding method.

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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, MD, 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))*

METHODS AND APPARATUSES OF BYPASS CODING AND REDUCING CONTEXTS FOR SOME SYNTAX ELEMENTS

TECHNICAL FIELD

The invention relates generally to video processing. In particular, the present invention relates to methods and apparatuses for bypass coding and reducing contexts in High Efficiency Video Coding (HEVC).

BACKGROUND

HEVC (High Efficiency Video Coding) is an advanced video coding system being developed under the Joint Collaborative Team on Video Coding (JCT-VC) group of video coding experts from ITU-T Study Group. In HEVC test model version 5.0 (HM-5.0), the syntax elements merge_flag, merge_idx, ref_idx_lc, pred_type, and cu_qp_delta are coded with contexts in CABAC. Merge_flag that is equal to either 0 or 1 has only one bin and uses one context. The bin strings of merge_idx, ref_idx_lc, and pred_type are shown in Table 1, Table 2 and Table 3 respectively. For merge_idx, pred_type and ref_idx_lc, one context is used for one bin. If the maximum value of ref_idx_lc is larger than 3, the additive bins share the same context as the bin with binIdx equal to 2. The bin string of cu_qp_delta is specified by a process equivalent to the following pseudo-code. The value of cu_qp_delta is denoted as synVal.

```
absV = Abs( synVal )
if( absV = = 0 ){
   put( 0 ) ----------------------------------------------------binIdx = 0
} else {
   put( 1 ) ----------------------------------------------------binIdx = 0
   signV = ( synVal > 0 ) ? 0 : 1
   put( signV )
   cMax = 24 + ( QpBdOffsetY >> 1 ) + signV
```

```
cNum = absV − 1
absVGreaterThan1Flag = ( absV = = 1 ) ? 0 : 1
put( absVGreaterThan1Flag ) ----------binIdx = 1
if( absVGreaterThan1Flag ){

        while( cNum−− )

                put( 1 ) ----------binIdx = 2……
        if( cMax > absV − 1 )
                put( 0 )
    }
}
```

The contexts used for the bin string are also given in the above pseudo-code. The first two bins of cu_qp_delta with binIdx equal to 0 and 1 use two separate contexts for each bin, while other bins with binIdx equal to or larger than 2 use one bin. When using contexts, additional memory and complexity are required at both encoder and decoder.

Table 1. Bin string of merge_idx in HM5.0

Value	Bin string			
0	0			
1	1	0		
2	1	1	0	
3	1	1	1	0
4	1	1	1	1
binIdx	0	1	2	3

Table 2. Bin string of ref_idx_lc in HM5.0

Value	Bin string		
0	0		
1	1	0	
2	1	1	0
3	1	1	1
binIdx	0	1	2

Table 3. Bin string of pred_type for inter blocks in HM5.0

Slice type	Value of pred_type	PredMode	PartMode	Bin string												
				cLog2CUSize > Log2MinCUSize					cLog2CUSize = = Log2MinCUSize							
									cLog2CUSize = = 3 && !inter_ 4x4_enabled_flag			cLog2CUSize > 3 || inter_4x4_enabled_flag				
I	0	MODE_INTRA	PART_2Nx2N	-					1			1				
	1	MODE_INTRA	PART_NxN	-					0			0				
P/B	0	MODE_INTER	PART_2Nx2N	0	1				0	1		0	1			
	1	MODE_INTER	PART_2NxN	0	0	1	1		0	0	1	0	0	1		
	2	MODE_INTER	PART_Nx2N	0	0	0	1		0	0	0	0	0	0	1	
	4	MODE_INTER	PART_2NxnU	0	0	1	0	0	-			-				
	5	MODE_INTER	PART_2NxnD	0	0	1	0	1	-			-				
	6	MODE_INTER	PART_nLx2N	0	0	0	0	0	-			-				
	7	MODE_INTER	PART_nRx2N	0	0	0	0	1	-			-				
	3	MODE_INTER	PART_NxN	-					-			0	0	0	0	
	4	MODE_INTRA	PART_2Nx2N	1					1	1		1	1			
	5	MODE_INTRA	PART_NxN	-					1	0		1	0			
binIdx				0	1	2	3	4	0	1	2	0	1	2	3	

SUMMARY

In light of the previously described problems, there exists a need for an apparatus and method, in which the number of contexts is reduced or the bypass coding without using contexts is applied to some syntax elements.

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, wherein:

Fig. 1 is a diagram illustrating an exemplary method of reducing contexts for ref_idx_lc.

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.

In the first embodiment, the syntax element merge_flag is coded with bypass coding method. No context is required for that.

In the second embodiment, as for the syntax element merge_idx, the bins with binIdx equal to 1, 2 and 3 share one context.

In the third embodiment, as for the syntax element merge_idx, the bins with binIdx equal to 2 and 3 share one context.

In the fourth embodiment, as for the syntax element merge_idx, the bin with binIdx equal to 3 is coded with bypass coding method. No context is required for that bin.

In the fifth embodiment, as for the syntax element merge_idx, the bin with binIdx equal to 2 is coded with bypass coding method. No context is required for that bin.

In the sixth embodiment, as for the syntax element merge_idx, the bin with binIdx equal to 1 is coded with bypass coding method. No context is required for that bin.

In the seventh embodiment, as for the syntax element merge_idx, the bins with binIdx equal to 1, 2 and 3 are coded with bypass coding method. No context is required for those bins.

In the eighth embodiment, as for the syntax element ref_idx_lc, the bins with

binIdx equal to 1 and 2 share one context, as shown in Fig. 1.

In the ninth embodiment, as for the syntax element ref_idx_lc, the bin with binIdx equal to 2 is coded with bypass coding method. No context is required for those bins.

In the tenth embodiment, as for the syntax element ref_idx_lc, the bin with binIdx equal to 1 is coded with bypass coding method. No context is required for those bins.

In the eleventh embodiment, as for the syntax element ref_idx_ld, the bins with binIdx equal to 1 and 2 are coded with bypass coding method. No context is required for those bins.

In the twelfth embodiment, as for the syntax element pred_type, the bin with binIdx equal to 4 is coded with bypass coding method. No context is required for that bin.

In the thirteenth embodiment, as for the syntax element pred_type, the bin with binIdx equal to 3 is coded with bypass coding method. No context is required for that bin.

In the forteenth embodiment, as for the syntax element pred_type, the bin with binIdx equal to 2 is coded with bypass coding method. No context is required for that bin.

In the fifteenth embodiment, as for the syntax element pred_type, the bins with binIdx equal to 4, 3, and 2 are coded with bypass coding method, as shown in Fig. 1. No context is required for those bins.

In the sixteenth embodiment, as for the syntax element pred_type, the bins with binIdx equal to 4, 3, and 2 share one context.

In the seventeenth embodiment, as for the syntax element pred_type, the bins with binIdx equal to 4 and 3 share one context.

In the eighteenth embodiment, as for the syntax element pred_type, the bins with binIdx equal to 3 and 2 share one context.

In the nineteenth embodiment, as for the syntax element cu_qp_delta, the bins with binIdx equal to or larger than 2 are coded with bypass coding method. No context is required for those bins.

In the twentieth embodiment, as for the syntax element cu_qp_delta, the bin with binIdx equal to 1 is coded with bypass coding method. No context is required for that bin.

In the twenty-first embodiment, as for the syntax element cu_qp_delta, the bin with binIdx equal to 1 and the bins with binIdx equal to or larger than 2 are coded with bypass coding method. No context is required for those bins.

In the twenty-second embodiment, as for the syntax element cu_qp_delta, the bin with binIdx equal to 1 and the bins with binIdx equal to or larger than 2 use one context.

CLAIMS

1. A method of entropy coding method of syntax elements merge_flag, merge_idx, ref_idx_lc, pred_type, and cu_qp_delta in video coding , comprising:

coding a plurality of bins of one syntax element with one context ; and

coding at least one bin of one syntax element with a bypass coding method.

2. The method as claimed in claim 1, wherein the syntax element merge_flag is coded with the bypass coding method and context is not needed.

3. The method as claimed in claim 1, wherein the bins with binIdx equal to 1, 2 and 3 of syntax element merge_idx shares one context.

4. The method as claimed in claim 1, wherein the bins with binIdx equal to 2 and 3 of syntax element merge_idx shares one context.

5. The method as claimed in claim 1, wherein the bin with binIdx equal to 3 of syntax element merge_idx is coded with the bypass coding method and context is not needed.

6. The method as claimed in claim 1, wherein the bin with binIdx equal to 2 of syntax element merge_idx is coded with the bypass coding method and context is not needed.

7. The method as claimed in claim 1, wherein the bin with binIdx equal to 1 of syntax element merge_idx is coded with the bypass coding method and context is not needed.

8. The method as claimed in claim 1, wherein the bins with binIdx equal to 1, 2 and 3 of syntax element merge_idx are coded with the bypass coding method and context is not needed.

9. The method as claimed in claim 1, wherein the bins with binIdx equal to 1, and 2 of syntax element ref_idx_lc shares one context.

10. The method as claimed in claim 1, wherein the bin with binIdx equal to 1 of syntax element ref_idx_lc is coded with the bypass coding method and context is not needed.

11. The method as claimed in claim 1, wherein the bin with binIdx equal to 2 of syntax element ref_idx_lc is coded with the bypass coding method and context is not needed.

12. The method as claimed in claim 1, wherein the bins with binIdx equal to 1 and 2 of syntax element ref_idx_lc are coded with the bypass coding method and

context is not needed.

13. The method as claimed in claim 1, wherein the bin with binIdx equal to 4 of syntax element pred_type is coded with the bypass coding method and context is not needed.

14. The method as claimed in claim 1, wherein the bin with binIdx equal to 3 of syntax element pred_type is coded with the bypass coding method and context is not needed.

15. The method as claimed in claim 1, wherein the bin with binIdx equal to 2 of syntax element pred_type is coded with the bypass coding method and context is not needed.

16. The method as claimed in claim 1, wherein the bins with binIdx equal to 4, 3 and 2 of syntax element pred_type are coded with the bypass coding method and context is not needed.

17. The method as claimed in claim 1, wherein the bins with binIdx equal to 4, 3 and 2 of syntax element pred_type shares one context.

18. The method as claimed in claim 1, wherein the bins with binIdx equal to 3 and 2 of syntax element pred_type are coded with the bypass coding method and context is not needed.

19. The method as claimed in claim 1, wherein the bins with binIdx equal to 4 and 3 of syntax element pred_type are coded with the bypass coding method and context is not needed.

20. The method as claimed in claim 1, wherein the bins with binIdx equal to or larger than 2 of the syntax element cu_qp_delta are coded with the bypass coding method, and no context is required for the bins.

21. The method as claimed in claim 1, wherein the bin with binIdx equal to 1 of the syntax element cu_qp_delta is coded with the bypass coding method, and no context is required for the bin.

22. The method as claimed in claim 1, wherein the bins with binIdx equal to 1 and the bins with binIdx equal to or larger than 2 of the syntax element cu_qp_delta are coded with the bypass coding method, and no context is required for the bins.

23. The method as claimed in claim 1, wherein the bins with binIdx equal to 1 and the bins with binIdx equal to or larger than 2 of the syntax element cu_qp_delta uses one context.

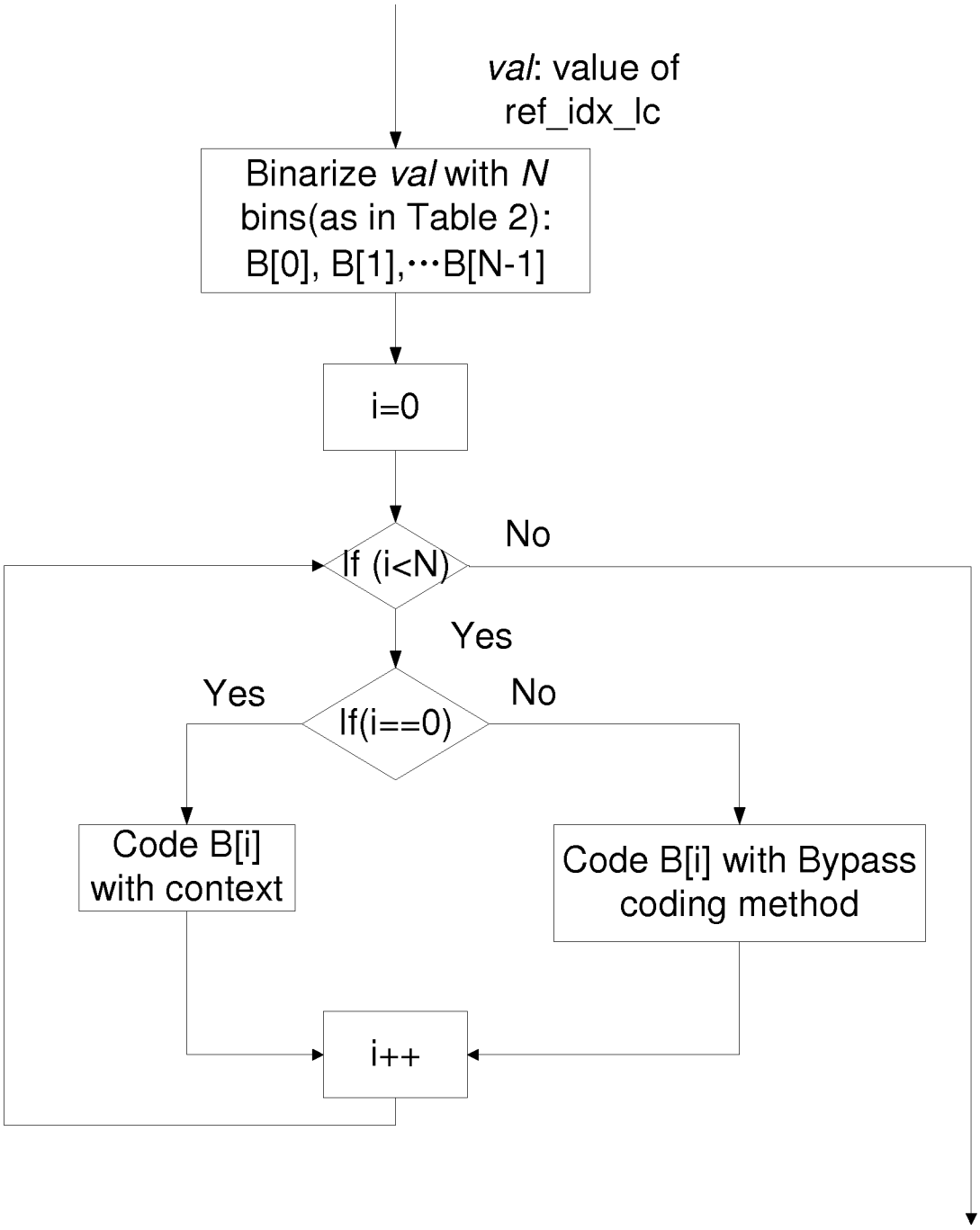
val: value of ref_idx_lc
Binarize val with N bins(as in Table 2): B[0], B[1],…B[N-1]
i=0
If (i<N)
No
Yes
If(i==0)
Yes
No
Code B[i] with context
Code B[i] with Bypass coding method
i++

Fig. 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2012/070428

A. CLASSIFICATION OF SUBJECT MATTER

H03M 7/30 (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: H03M, H04N, G06F

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, IEEE: video, cod???, entropy, syntax, element?, bin?, context, bypass, CABAC, context w (based w) adaptive w binary w arithmetic w coding, sav???, High w Efficiency w Video w Coding, HEVC.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN101076114A (SHANGHAI FUHAO MICRO ELECTRON LTD.) 21 Nov. 2007(21.11.2007) the whole document	1-23
A	CN101562455A (REALTEK SEMICONDUCTOR CORP.) 21 Oct. 2009(21.10.2009) the whole document	1-23
A	US2007/0040711A1(STREAMING NETWORKS (PVT.) LTD.) 22 Feb. 2007(22.02.2007) the whole document	1-23
A	US2009/0141803A1(FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.) 04 Jun. 2009(04.06.2009) the whole document	1-23

☐ 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

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"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	Date of mailing of the international search report
28 Sep. 2012(28.09.2012)	**25 Oct. 2012 (25.10.2012)**
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 JI, Zhangyuan Telephone No. (86-10)62413659

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2012/070428

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN101076114A	21.11.2007	None	
CN101562455A	21.10.2009	US7557740B1	07.07.2009
		TW200945798A	01.11.2009
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