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(54) Title: METHODS AND APPARATUSES OF CONTEXT REDUCTION FOR SIGNIFICANCE FLAG CODING

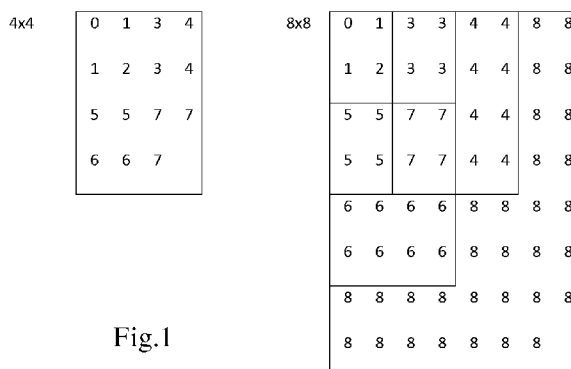


Fig.1

(57) Abstract: Methods for reducing the number of context models for coding significance flags using CABAC are disclosed, the methods comprise applying a common context model among 4x4 and 8x8 Transform Units (TUs). The complexity and the memory requirement are reduced accordingly.

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METHODS AND APPARATUSES OF CONTEXT REDUCTION FOR SIGNIFICANCE FLAG CODING

FIELD OF INVENTION

5 The invention relates generally to video processing. In particular, the present invention relates to methods and apparatuses for CABAC context selection for significance flag coding in High Efficiency Video Coding (HEVC).

BACKGROUND OF THE INVENTION

10 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, a context adaptive binary arithmetic coder (CABAC) is applied to encode coefficients of the transformed residue signal. In doing so, the selection of context model for each bin has a great impact on coding efficiency.

15 In HEVC test model version 6.0 (HM6.0), context selection for encoding the significance flag of coefficients in small transform units (TUs) of sizes 4x4 and 8x8 are position based and as follows:

luma

4x4

0	1	4	5
2	3	4	5
6	6	8	8
7	7	8	

8x8

19	9	10	10	11	11	12	12
9	9	10	10	11	11	12	12
13	13	14	14	15	15	12	12
13	13	14	14	15	15	12	12
17	17	15	15	15	15	16	16
17	17	15	15	15	15	16	16
18	18	18	18	16	16	16	16
18	18	18	18	16	16	16	

chroma

4x4

0	1	2	4
1	1	2	4
3	3	5	5
4	4	5	

8x8

16	6	7	7	8	8	9	9
6	6	7	7	8	8	9	9
10	10	11	11	12	12	9	9
10	10	11	11	12	12	9	9
14	14	12	12	12	12	13	13

14	14	12	12	12	12	13	13
15	15	15	15	13	13	13	13
15	15	15	15	13	13	13	

For this selection process, two look-up tables with 46 entries in total are required and are shown in Table 1 for 4x4 blocks and Table 2 for 8x8 blocks.

Table 1: Specification of ctxIdxMap4x4[i].

i	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ctxIdxMap4x4[i]	0	1	4	5	2	3	4	5	6	6	8	8	7	7	8
i	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
ctxIdxMap4x4[i]	0	1	2	4	1	1	2	4	3	3	5	5	4	4	5

5

Table 2: Specification of ctxIdxMap8x8[i].

i	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ctxIdxMap8x8[i]	0	1	2	3	4	5	6	3	8	6	6	7	9	9	7	7

The derivation of the context sigCtx for 4x4 blocks is as follows:

$$\text{sigCtx} = \text{ctxIdxMap4x4} [((\text{cIdx} > 0) ? 15 : 0) + (\text{yC} \ll 2) + \text{xC}]$$

10 where cIdx denotes the color component index (luma: cIdx=0, chroma: cIdx>0), xC and yC the position of the significance flag to be coded within a transform unit. The derivation of the context for 8x8 blocks is as follows:

$$\text{sigCtx} = ((\text{xC} + \text{yC}) = 0) ? 10 : \text{ctxIdxMap8x8} [((\text{yC} \gg 1) \ll 2) + (\text{xC} \gg 1)]$$

$$\text{sigCtx} += (\text{cIdx} > 0) ? 6 : 9$$

15 The number of context models is 37 in total for 4x4 and 8x8 TUs. This number can be reduced by rearranging the context models and using the same context models for 4x4 and 8x8 TUs.

SUMMARY OF THE INVENTION

20 In light of the previously described problems, there exists a need for an apparatus and method, in which significance flag coding with CABAC is performed using fewer context models in order to reduce the complexity and the memory requirement.

In one embodiment, for 4x4 and 8x8 TUs, 16 entries are added to one look-up table for context selection and the number of contexts is reduced to 16.

In one embodiment, for 4x4 and 8x8 TUs, 16 entries are added to one look-up table for context selection and the number of contexts is reduced to 15.

5 In another embodiment, for 4x4 and 8x8 TUs, 15 entries of one look-up table for context selection are removed and the number of contexts is reduced to 18.

In another embodiment, for 4x4 and 8x8 TUs, 15 entries of one look-up table for context selection are removed and the number of contexts is reduced to 16.

10 In another embodiment, for 4x4 and 8x8 TUs, 15 entries of one look-up table for context selection are removed and the number of contexts is reduced to 14.

In another embodiment, for 4x4 and 8x8 TUs, the number of contexts is reduced to 12 and two look-up tables for context selection are utilized. One has 15 entries and the other one has 63 entries.

15 In another embodiment, a context arrangement different from [0012] is used for 4x4 and 8x8 TUs. The number of contexts is reduced to 12 and two look-up tables for context selection are utilized. One has 15 entries and the other one has 63 entries.

In another embodiment, for 4x4 and 8x8 TUs, the number of contexts is reduced to 13 and four look-up tables for context selection are utilized. Two of them have 15 entries for each and the other two have 20 entries for each.

20 In another embodiment, for 4x4 and 8x8 TUs, the number of contexts is reduced to 12 and two look-up tables for context selection are utilized. One table has 15 entries and the other one has 20 entries.

25 In another embodiment, for 4x4 and 8x8 TUs, the number of contexts is reduced to 14 and two look-up tables for context selection are utilized. One table has 15 entries and the other one has 20 entries.

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:

30 Fig. 1 is a diagram illustrating a context arrangement for 4x4 and 8x8 blocks with 9 contexts;

Fig. 2 is a diagram illustrating a context arrangement for 4x4 and 8x8 blocks with 8 contexts;

Fig. 3 is a diagram illustrating a context arrangement for 4x4 and 8x8 blocks with 7

contexts;

Fig. 4 is a diagram illustrating a context arrangement for 4x4 and 8x8 blocks with 6 contexts;

5 Fig. 5 is a diagram illustrating a modified context arrangement for 4x4 and 8x8 blocks with 6 contexts;

Fig. 6 is a diagram illustrating a diagonal position-based context arrangement for 4x4 and 8x8 blocks with 6 contexts;

Fig. 7 is a diagram illustrating a diagonal position-based context arrangement for 4x4 and 8x8 blocks with 7 contexts.

10

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.

15

In the first embodiment, 4x4 and 8x8 blocks share the same contexts with one additional context for the high frequency area of 8x8 blocks. The context arrangement is illustrated in Fig. 1 for luma and in Fig. 3 for chroma. The number of contexts is reduced from 37 to 16 (9 for luma and 7 for chroma). 16 entries are added to one look-up table. The modified look-up tables are shown in Table 3 and Table 4.

20

Table 3: Specification of ctxIdxMap4x4[i] with 16 context models.

i	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ctxIdxMap4x4[i]	0	1	3	4	1	2	3	4	5	5	7	7	6	6	7
i	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
ctxIdxMap4x4[i]	0	1	2	4	1	1	2	4	3	3	5	5	4	4	5

Table 4: Specification of ctxIdxMap8x8[i] with 16 context models.

i	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ctxIdxMap8x8[i]	1	3	4	8	5	7	4	8	6	6	8	8	8	8	8	8
I	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
ctxIdxMap8x8[i]	1	2	4	6	3	5	4	6	4	4	6	6	6	6	6	6

25

The derivation process of the context for 4x4 blocks is the same as that in HM6.0. For

derivation of the context for 8x8 blocks, the following step applies:

$$\text{sigCtx} = ((xC + yC) == 0) ? 0 : ((xC==1 \&\& yC==1 \&\& cIdx==0) ? 2 : \text{ctxIdxMap8x8}(((cIdx > 0) ? 16 : 0) + ((yC \gg 1) \ll 2) + (xC \gg 1))$$

No offset has to be added.

5 In another embodiment, the context arrangement is as illustrated in Fig. 2 for luma. The arrangement of the chroma contexts is the same as in the first embodiment. The number of context is reduced to 15. The modified look-up tables are shown in Table 5 and Table 6.

Table 5: Specification of ctxIdxMap4x4[i] with 15 context models.

i	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ctxIdxMap4x4[i]	0	1	2	3	1	1	2	3	4	4	6	6	5	5	6
i	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
ctxIdxMap4x4[i]	0	1	2	4	1	1	2	4	3	3	5	5	4	4	5

10 Table 6: Specification of ctxIdxMap8x8[i] with 15 context models.

i	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ctxIdxMap8x8[i]	1	2	3	7	4	6	3	7	5	5	7	7	7	7	7	7
i	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
ctxIdxMap8x8[i]	1	2	4	6	3	5	4	6	4	4	6	6	6	6	6	6

The derivation of the context is derived as follows:

$$\text{sigCtx} = ((xC + yC) == 0) ? 0 : \text{ctxIdxMap8x8}(((cIdx > 0) ? 16 : 0) + ((yC \gg 1) \ll 2) + (xC \gg 1))$$

15 In another embodiment, the same context arrangement is used for luma and chroma and is illustrated in Fig. 1. This way, only two look-up tables with 15 and 16 entries are needed and the number of contexts is 18. The modified look-up tables are shown in Table 7 and Table 8. The derivation of the context for 4x4 blocks is simplified as follows:

$$\text{sigCtx} = \text{ctxIdxMap4x4}[(yC \ll 2) + xC]$$

20 For derivation of the context for 8x8 blocks, the following step applies:

$$\text{sigCtx} = ((xC + yC) == 0) ? 0 : ((xC==1 \&\& yC==1) ? 2 : \text{ctxIdxMap8x8}[(yC \gg 1) \ll 2] + (xC \gg 1))$$

Table 7: Specification of ctxIdxMap4x4[i] with 18 context models.

i	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ctxIdxMap4x4[i]	0	1	3	4	1	2	3	4	5	5	7	7	6	6	7

Table 8: Specification of ctxIdxMap8x8[i] with 18 context models.

i	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ctxIdxMap8x8[i]	1	3	4	8	5	7	4	8	6	6	8	8	8	8	8	8

5 In another embodiment, the same context arrangement is used for luma and chroma and is illustrated in Fig. 2. This way, only two look-up tables with 15 and 16 entries are needed and the number of contexts is 16. The modified look-up tables are shown in Table 9 and Table 10. The derivation of the context for 4x4 blocks is simplified as follows:

$$\text{sigCtx} = \text{ctxIdxMap4x4}[(yC \ll 2) + xC]$$

10 and for 8x8 blocks:

$$\text{sigCtx} = ((xC + yC) == 0) ? 0 : \text{ctxIdxMap8x8}(((yC \gg 1) \ll 2) + (xC \gg 1))$$

Table 9: Specification of ctxIdxMap4x4[i] with 16 context models and unified luma and chroma.

I	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ctxIdxMap4x4[i]	0	1	2	3	1	1	2	3	4	4	6	6	5	5	6

15

Table 10: Specification of ctxIdxMap8x8[i] with 16 context models and unified luma and chroma.

i	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ctxIdxMap8x8[i]	1	2	3	7	4	6	3	7	5	5	7	7	7	7	7	7

20 In another embodiment, the same context arrangement is used for luma and chroma and is illustrated in Fig. 3. The number of contexts is reduced to 14. The modified look-up tables are shown in Table 11 and Table 12. The derivation of the context for 4x4 blocks is as follows:

sigCtx = ctxIdxMap4x4[(yC << 2) + xC]

and for 8x8 blocks:

sigCtx = ((xC + yC) == 0) ? 0 : ctxIdxMap8x8[((yC >> 1) << 2) + (xC >> 1)]

5 Table 11: Specification of ctxIdxMap4x4[i] with 14 context models and unified luma and chroma.

I	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ctxIdxMap4x4[i]	0	1	2	4	1	1	2	4	3	3	5	5	4	4	5

Table 12: Specification of ctxIdxMap8x8[i] with 14 context models and unified luma and chroma.

i	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ctxIdxMap8x8[i]	1	2	4	6	3	5	4	6	4	4	6	6	6	6	6	6

10

In another embodiment, the same context arrangement is used for luma and chroma and is illustrated in Fig. 4. Two look-up tables with 15 and 63 entries are needed and the number of contexts is reduced to 12.

15 In another embodiment, the same context arrangement is used for luma and chroma and is illustrated in Fig. 5. Two look-up tables with 15 and 63 entries are needed and the number of contexts is reduced to 12.

In another embodiment, the context arrangement is illustrated in Fig. 6 for luma and in Fig. 7 for chroma. For the 4x4 blocks, two look-up tables with 15 entries are needed for luma and chroma. The context selection for 8x8 blocks depends on the diagonal position of the 4x4 subset and the diagonal position within the subset and can be calculated as follows:

20

diagSubset = (posX>>2) + (posY>>2);

diagPosWithinSubset = (posX%4) + (posY%4);

context = tableX[diagSubset*7 + diagPosWithinSubset];

with X = {Luma, Chroma} and tableX specified in Table 13.

25

Table 13: Reduced look-up tables for 8x8 blocks.

i	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
---	---	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----

tableLuma[i]	0	1	2	3	3	4	4	3	4	4	4	5	5	5	4	4	5	5	5	5
tableChroma[i]	0	2	3	3	5	4	6	3	5	5	4	6	6	6	5	4	4	6	6	6

In another embodiment, the same context arrangement is used for luma and chroma and is illustrated in Fig. 6. Two look-up tables with 15 entries and 20 entries are needed for 4x4 and 8x8 blocks. The number of context is reduced to 12. The context selection for 8x8 blocks depends on the diagonal position of the 4x4 subset and the diagonal position within the subset and can be calculated as follows:

$$\begin{aligned} \text{diagSubset} &= (\text{posX} \gg 2) + (\text{posY} \gg 2); \\ \text{diagPosWithinSubset} &= (\text{posX} \% 4) + (\text{posY} \% 4); \\ \text{sigCtx} &= \text{ctxIdxMap8x8}[\text{diagSubset} * 7 + \text{diagPosWithinSubset}]; \end{aligned}$$

The look-up table for 8x8 blocks is given in Table 14.

Table 14: Reduced look-up tables for 8x8 blocks.

i	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
ctxIdxMap8x8 [i]	0	1	2	3	3	4	4	3	4	4	4	5	5	5	4	4	5	5	5	5

In another embodiment, the same context arrangement is used for luma and chroma and is illustrated in Fig. 7. Two look-up tables with 15 entries and 20 entries are needed for 4x4 and 8x8 blocks. The number of context is reduced to 14. The context selection for 8x8 blocks depends on the diagonal position of the 4x4 subset and the diagonal position within the subset and can be calculated as follows:

$$\begin{aligned} \text{diagSubset} &= (\text{posX} \gg 2) + (\text{posY} \gg 2); \\ \text{diagPosWithinSubset} &= (\text{posX} \% 4) + (\text{posY} \% 4); \\ \text{sigCtx} &= \text{ctxIdxMap8x8}[\text{diagSubset} * 7 + \text{diagPosWithinSubset}]; \end{aligned}$$

The look-up table for 8x8 blocks is given in Table 15.

Table 15: Reduced look-up tables for 8x8 blocks.

i	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
ctxIdxMap8x8[i]	0	2	3	3	5	4	6	3	5	5	4	6	6	6	5	4	4	6	6	6

The methods described above can be used in a video encoder as well as in a video decoder. Embodiments of the methods 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
5 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
10 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
15 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 reducing the number of context models for significance flag coding using CABAC, comprising:

5 applying a common context model among 4x4 and 8x8 Transform Units (TUs).

2. The method as claimed in claim 1, wherein 4x4 and 8x8 TUs use the context arrangement as illustrated in Fig. 1 for luma and the context arrangement in Fig. 3 for chroma, and there are 16 contexts in total.

3. The method as claimed in claim 2, wherein the context is derived with two look-up tables in Table 3 and Table 4, which have 30 and 32 entries respectively, and the derivation of the context for 8x8 blocks follows

$$\text{sigCtx} = ((x_C + y_C) == 0) ? 0 : ((x_C == 1 \ \&\& \ y_C == 1 \ \&\& \ cIdx == 0) ? 2 : \text{ctxIdxMap8x8}(((cIdx > 0) ? 16 : 0) + ((y_C \gg 1) \ll 2) + (x_C \gg 1)),$$

15 where x_C and y_C denote the position of the significance flag to be coded within a transform unit, and $cIdx$ denotes the color component index (luma: $cIdx=0$, chroma: $cIdx>0$).

4. The method as claimed in claim 1, wherein 4x4 and 8x8 TUs use the context arrangement as illustrated in Fig. 2 for luma and the context arrangement in Fig. 3 for chroma, and there are 15 contexts in total.

5. The method as claimed in claim 4, wherein the context is derived with two look-up tables in Table 5 and Table 6, which have 30 and 32 entries respectively, and the derivation of the context for 8x8 blocks follows

$$\text{sigCtx} = ((x_C + y_C) == 0) ? 0 : \text{ctxIdxMap8x8}(((cIdx > 0) ? 16 : 0) + ((y_C \gg 1) \ll 2) + (x_C \gg 1)),$$

25 where x_C and y_C denote the position of the significance flag to be coded within a transform unit.

6. The method as claimed in claim 1, wherein 4x4 and 8x8 TUs use the context arrangement in Fig. 1 for luma and chroma, and using 18 contexts in total.

7. The method as claimed in claim 6, wherein the context is derived with two look-up tables in Table 7 and Table 8, which have 15 and 16 entries respectively, and the derivation of the context for 4x4 blocks is simplified as follows:

$$\text{sigCtx} = \text{ctxIdxMap4x4}[(y_C \ll 2) + x_C]$$

For derivation of the context for 8x8 blocks, the following step applies:

$$\text{sigCtx} = ((x_C + y_C) == 0) ? 0 : ((x_C == 1 \ \&\& \ y_C == 1) ? 2 : \text{ctxIdxMap8x8}[(y_C \gg 1) \ll 2) + (x_C \gg 1)).$$

30

8. The method as claimed in claim 1, wherein wherein 4x4 and 8x8 TUs use the context arrangement in Fig. 2 for both luma and chroma using 16 contexts in total.

9. The method as claimed in claim 8, wherein the context is derived with two look-up tables in Table 9 and Table 10 with 15 and 16 entries respectively, and the derivation of the
5 context for 4x4 blocks is simplified as follows:

$$\text{sigCtx} = \text{ctxIdxMap4x4}[(yC \ll 2) + xC]$$

and for 8x8 blocks:

$$\text{sigCtx} = ((xC + yC) = 0) ? 0 : \text{ctxIdxMap8x8}(((yC \gg 1) \ll 2) + (xC \gg 1)).$$

10. The method as claimed in claim 1, wherein 4x4 and 8x8 TUs use the context
10 arrangement in Fig. 3 for both luma and chroma using 14 contexts in total.

11. The method as claimed in claim 10, wherein the context is derived with two look-up tables in Table 11 and Table 12 with 15 and 16 entries respectively, and the derivation of the context for 4x4 blocks is as follows:

$$\text{sigCtx} = \text{ctxIdxMap4x4}[(yC \ll 2) + xC]$$

15 and for 8x8 blocks:

$$\text{sigCtx} = ((xC + yC) = 0) ? 0 : \text{ctxIdxMap8x8}(((yC \gg 1) \ll 2) + (xC \gg 1)).$$

12. The method as claimed in claim 1, wherein 4x4 and 8x8 TUs use the context arrangement in Fig. 4 for both luma and chroma using 12 contexts in total.

13. The method as claimed in claim 12, wherein the context is derived with two look-up
20 tables with 15 and 63 entries for each.

14. The method as claimed in claim 1, wherein 4x4 and 8x8 TUs use the context arrangement in Fig. 5 for both luma and chroma using 12 contexts in total.

15. The method as claimed in claim 14, wherein the context is derived with two look-up tables with 15 and 63 entries for each.

25 16. The method as claimed in claim 1, wherein 4x4 and 8x8 TUs use the context arrangement in Fig. 6 for luma and the context arrangement in Fig. 7 for chroma, and there are 13 contexts in total.

17. The method as claimed in claim 16, wherein the context of 4x4 TU is derived with two look-up tables with 15 entries each for luma and chroma, and the context selection for 8x8 TU
30 depends on the diagonal position of the 4x4 subset (denoted as diagSubset) and the diagonal position within the subset (denoted as diagPosWithinSubset) and can be calculated as follows:

$$\text{diagSubset} = (\text{posX} \gg 2) + (\text{posY} \gg 2);$$

$$\text{diagPosWithinSubset} = (\text{posX} \% 4) + (\text{posY} \% 4);$$

$$\text{context} = \text{tableX}[\text{diagSubset} * 7 + \text{diagPosWithinSubset}];$$

with $X = \{\text{Luma, Chroma}\}$ and tableX is given in Table 13.

18. The method as claimed in claim 1, wherein 4x4 and 8x8 TUs use the context arrangement in Fig. 6 for both luma and chroma using 12 contexts in total.

19. The method as claimed in claim 18, wherein the context is derived with two look-up
5 tables with 15 and 20 entries respectively, and the context selection for 8x8 blocks depends on the diagonal position of the 4x4 subset and the diagonal position within the subset and can be calculated as follows:

$$\text{diagSubset} = (\text{posX} \gg 2) + (\text{posY} \gg 2);$$

$$\text{diagPosWithinSubset} = (\text{posX} \% 4) + (\text{posY} \% 4);$$

10 $\text{sigCtx} = \text{ctxIdxMap8x8}[\text{diagSubset} * 7 + \text{diagPosWithinSubset}],$

where the table ctxIdxMap8x8 is given in Table 14.

20. The method as claimed in claim 1, wherein 4x4 and 8x8 TUs use the context arrangement in Fig. 7 for both luma and chroma using 14 contexts in total.

21. The method as claimed in claim 20, wherein the context is derived with two look-up
15 tables with 15 and 20 entries respectively, and the context selection for 8x8 blocks depends on the diagonal position of the 4x4 subset and the diagonal position within the subset and can be calculated as follows:

$$\text{diagSubset} = (\text{posX} \gg 2) + (\text{posY} \gg 2);$$

$$\text{diagPosWithinSubset} = (\text{posX} \% 4) + (\text{posY} \% 4);$$

20 $\text{sigCtx} = \text{ctxIdxMap8x8}[\text{diagSubset} * 7 + \text{diagPosWithinSubset}];$

where the table ctxIdxmap8x8 is given in Table 15.

4x4

0	1	3	4
1	2	3	4
5	5	7	7
6	6	7	

8x8

0	1	3	3	4	4	8	8
1	2	3	3	4	4	8	8
5	5	7	7	4	4	8	8
5	5	7	7	4	4	8	8
6	6	6	6	8	8	8	8
6	6	6	6	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8

Fig.1

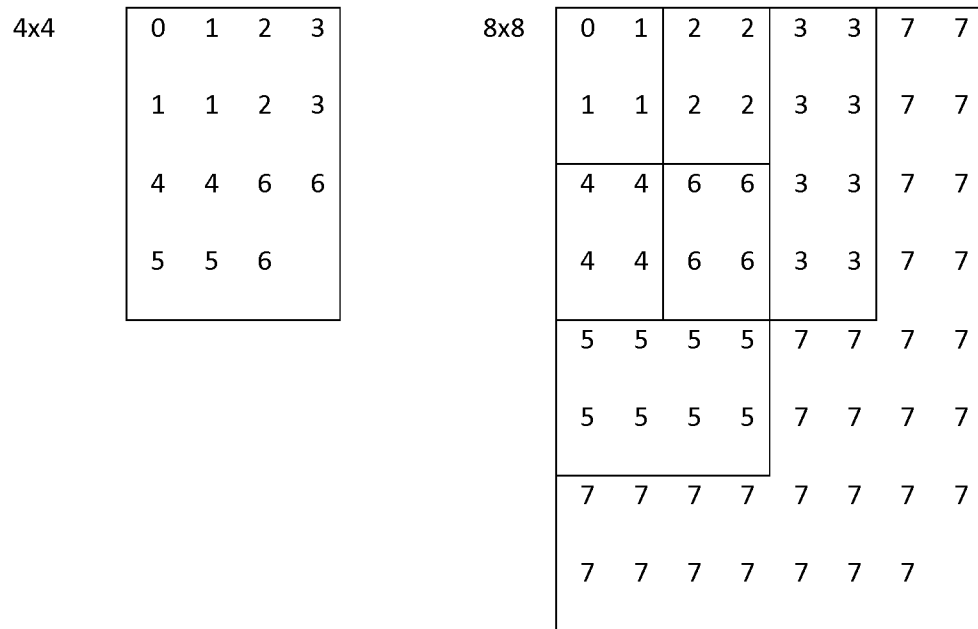


Fig.2

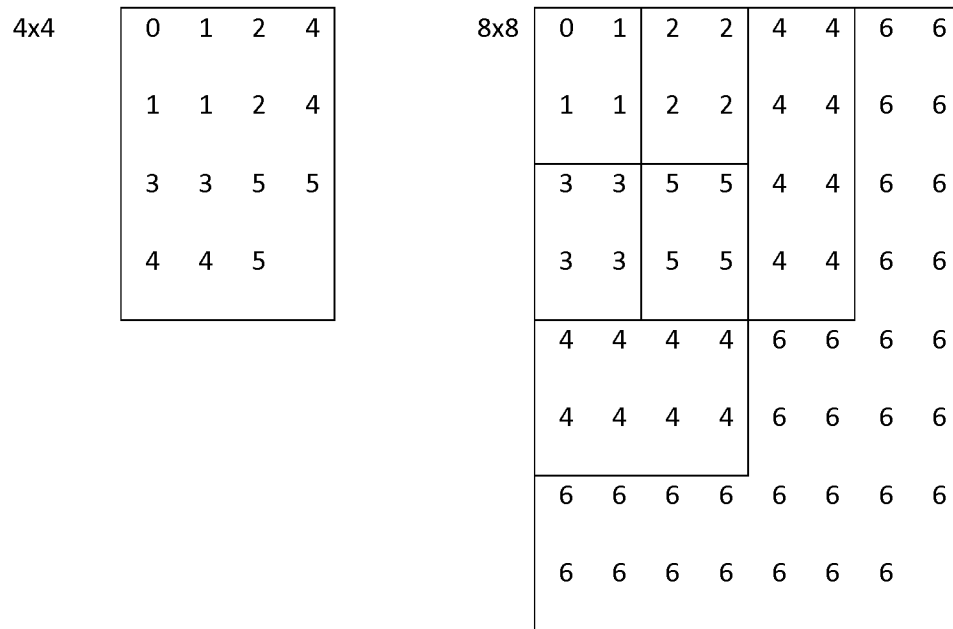


Fig.3

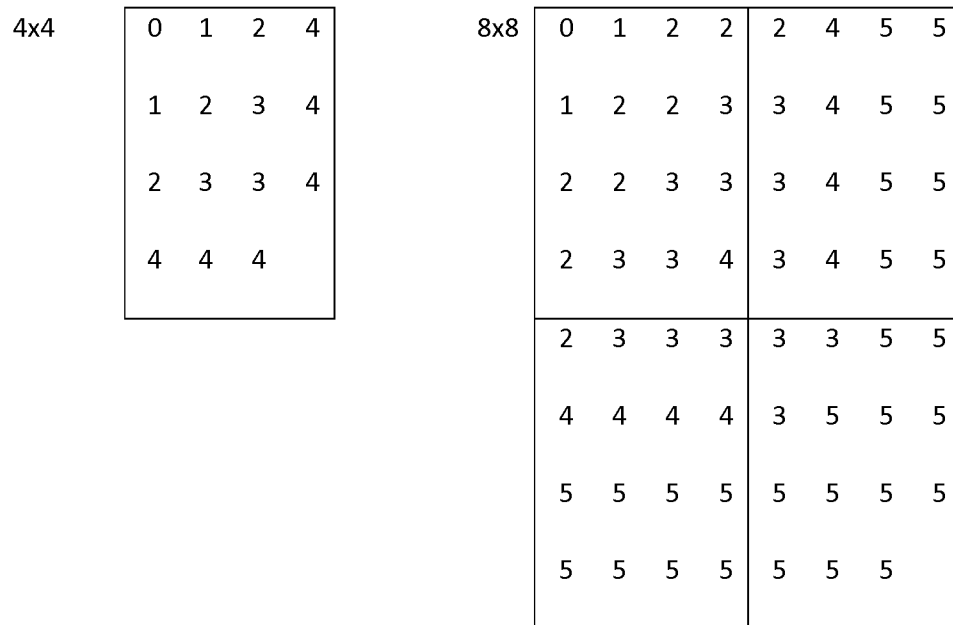


Fig.4

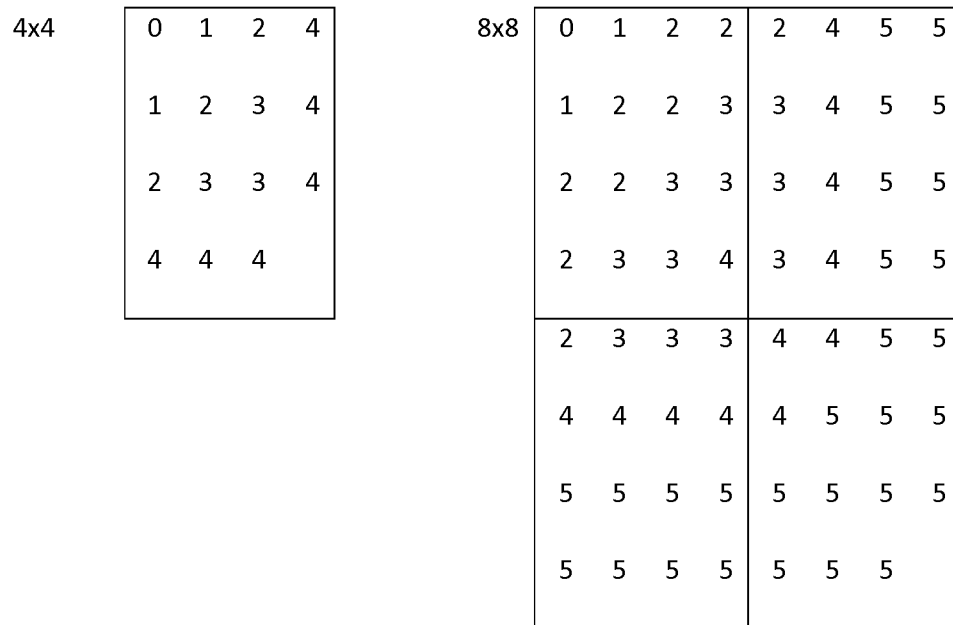


Fig.5

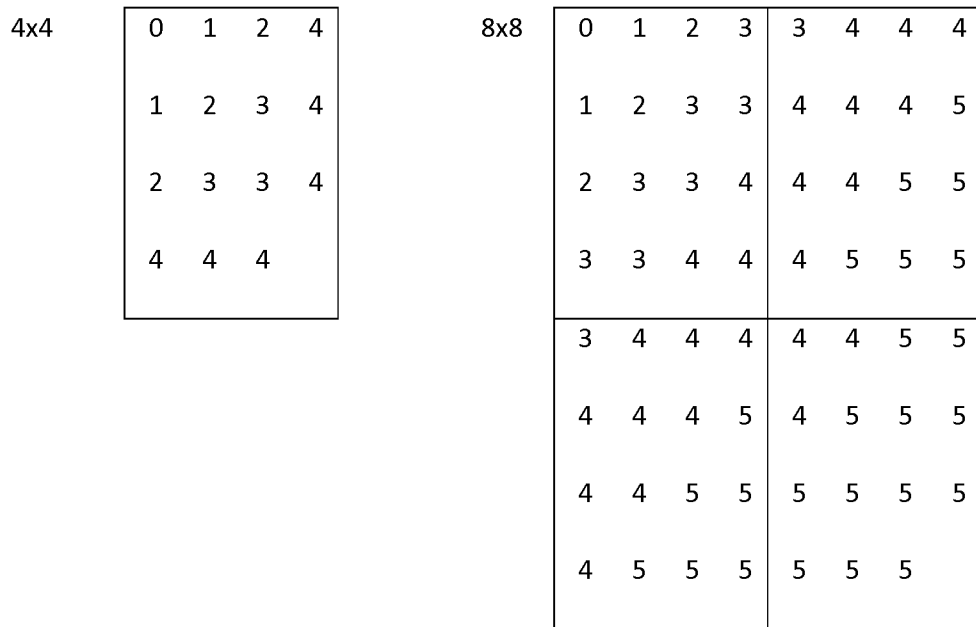


Fig.6

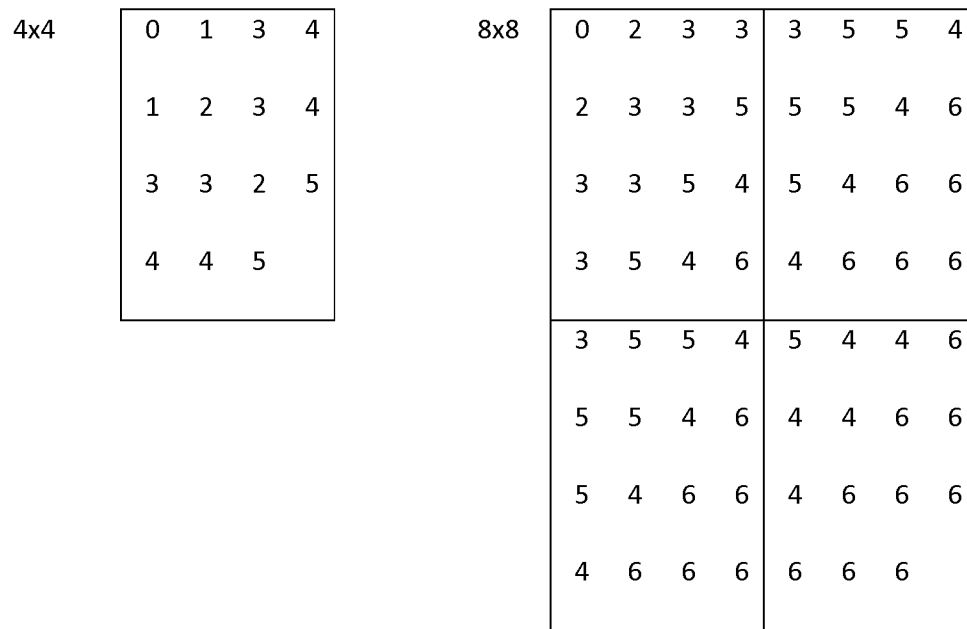


Fig.7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2012/074123

A. CLASSIFICATION OF SUBJECT MATTER

H04N 7/24 (2011.01) 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)

CNTXT, CNKI, IEEE, EPTXT, USTXT, WOTXT, CATXT: number, context, model+, significan+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2011142817 A1 (THOMSON LICENSING et al.) 17 November 2011 (17.11.2011) the description page 13, line 17-page 14, line 22	1
A		2-21
A	WO 2007114588 A1 (SAMSUNG ELECTRONICS CO LTD et al.) 11 October 2007 (11.10.2007) the whole document	1-21
A	US 2008080620 A1 (SAMSUNG ELECTRONICS CO LTD) 03 April 2008 (03.04.2008) the whole document	1-21

Further documents are listed in the continuation of Box C.

See patent family annex.

<p>* Special categories of cited documents:</p> <p>“A” document defining the general state of the art which is not considered to be of particular relevance</p> <p>“E” earlier application or patent but published on or after the international filing date</p> <p>“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)</p> <p>“O” document referring to an oral disclosure, use, exhibition or other means</p> <p>“P” document published prior to the international filing date but later than the priority date claimed</p>	<p>“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</p> <p>“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</p> <p>“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</p> <p>“&” document member of the same patent family</p>
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07 December 2012 (07.12.2012)

Date of mailing of the international search report
27 Dec. 2012 (27.12.2012)

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2012/074123

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
WO 2011142817 A1	17.11.2011	NONE	
WO 2007114588 A1	11.10.2007	US 2007237240 A1	11.10.2007
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