

(51) International Patent Classification:
H04N 19/00 (2014.01)(21) International Application Number:
PCT/CN2015/074728(22) International Filing Date:
20 March 2015 (20.03.2015)

(25) Filing Language: English

(26) Publication Language: English

(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): **ZHU, Weijia** [CN/CN]; No.
1007, Unit 2, Building 2, Zuoanpuyuan Community,
Dongcheng District, Beijing 100061 (CN). **ZHANG, Kai**
[CN/CN]; A1101, Dongfang Yujinxiang Building, No. 216
Tangli Road, Chaoyang District, Beijing 100013 (CN).
ZHANG, Xianguo [CN/CN]; Room 305, Floor 3, Unit 1,
No. 14 Building, North Dingfuzhuang Road, Chaoyang
District, Beijing 100024 (CN).(74) Agent: **BEIJING SANYOU INTELLECTUAL PROP-
ERTY 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, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, 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, SA, 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, ST, 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, KM, ML, MR, NE, SN, TD, TG).

Published:

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

(54) Title: NON-LOCAL PREDICTION FOR PALETTE CODING

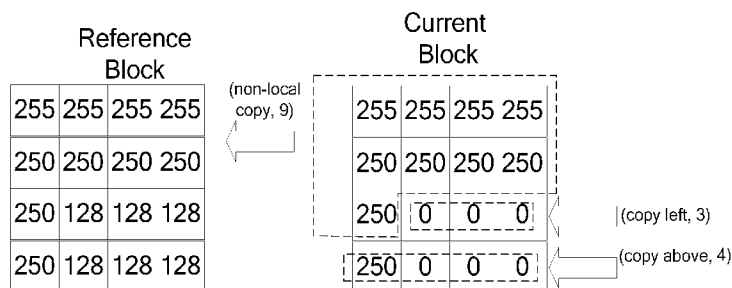


Fig.4

(57) Abstract: Non-local index prediction methods are proposed. By utilizing non-local index prediction, palette mode can exploit non-local repeated patterns in images and videos.

NON-LOCAL PREDICTION FOR PALETTE CODING

TECHNICAL FIELD

[0001] The invention relates generally to video/image processing. In particular, the presented invention relates to palette coding.

5

BACKGROUND

[0002] In the current HEVC screen content coding extensions draft specification [1], palette mode was adopted to efficiently compress the texts and graphics in screen contents. The basic idea behind a palette mode is that the samples in the CU are represented by a small set of representative color values. This set is referred to as the palette. It is also possible to indicate a sample that is outside the palette by signaling an escape symbol followed by (possibly quantized) component values. This is illustrated in Fig.1.

10

[0003] Each sample in the block is assigned the index of the nearest (in SAD) palette entry. The palette indices are coded using two main modes: 'INDEX' and 'COPY_ABOVE'. The escape symbol is also signaled as an 'INDEX' mode. It is assigned an index equal to the maximum palette size. The mode is signaled using a flag except for the top row or when the previous mode was 'COPY_ABOVE'. In the 'COPY_ABOVE' mode, the palette index of the sample in the row above is copied. In the 'INDEX' mode, the palette index is explicitly signaled. For both 'INDEX' and 'COPY_ABOVE' modes, a run value is signaled which specifies the number of subsequent samples that are also coded using the same mode. When escape symbol is part of the run in 'INDEX' or 'COPY_ABOVE' mode, the escape component values are signaled for each escape symbol. The coding of palette indices is illustrated in Fig. 2.

15

20

25

[0004] The 'COPY_ABOVE' mode in PLT mode only takes the palette index of the sample in the row above into account. There are a large number of non-local duplicated contents in screen pictures as depicted in Fig.3. Thus a lot of non-local repeated indices can be observed in the whole picture.

[0005] The 'COPY_ABOVE' mode cannot deal with non-local duplicated indexes efficiently.

SUMMARY

5 [0006] In light of the previously described problems, reformed copying (RC) methods are proposed.

[0007] 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.

10

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:

15 [0008] Fig.1 is an example of a block coded in palette mode;

[0009] Fig.2 is a diagram illustrating the coding manner of palette indices;

[0010] Fig.3 is a diagram illustrating the non-local repeated patterns in screen contents;

20 [0011] Fig.4 is a diagram illustrating current block coding with non-local copy method;

[0012] Fig.5 is a diagram illustrating index map coding with non-local copy method;

[0013] Fig.6 is a diagram illustrating non-local index prediction method;

[0014] Fig.7 is a diagram illustrating horizontal intra flipping for reference block;

[0015] Fig.8 is a diagram illustrating vertical intra flipping for reference block;

25 [0016] Fig.9 is a diagram illustrating horizontal + vertical reformed flipping for reference block;

[0017] Fig.10 is a diagram illustrating clockwise rotation flipping for reference block;

[0018] Fig.11 is a diagram illustrating counterclockwise rotation for reference block;

30 [0019] Fig.12 is a diagram illustrating transposition for reference block;

- [0020] Fig.13 is a diagram illustrating cascade transformation for reference block;
 [0021] Fig.14 is a diagram illustrating a combination of multiple candidates;
 [0022] Fig.15 is a diagram illustrating encoder decision for multiple non-local index maps.

5

DETAILED DESCRIPTION

[0023] 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.

[0024] Several non-local prediction (NP) methods are proposed. In NP methods, non-local prediction can be used to predict the samples in the current block.

[0025] In one embodiment, one non-local image block is first located, and then the samples in the current block can be reconstructed by directly copying the corresponding samples in that non-local image block.

[0026] In one embodiment, non-local index map can be used to predict the index map of the current block. The term 'index map' refers to the indices of samples in a block.

[0027] In one embodiment, each sample in the current block can copy the sample of its left neighbor, its above neighbor or its non-local prediction, which are respectively corresponding to copy left mode, copy above mode and non-local prediction mode. Encoder can decide use which copying mode for every sample. By using those copying modes, the current block can be represented by several 2-tuples (m, l) , as depicted in Fig.4, where m is the copy mode for each starting sample and l is the length which indicates how many samples copying from their reference samples by using the specific mode m . Reference sample is the left neighbor, the above neighbor or the non-local prediction of the current index. The current block I is reconstructed by $I(x + i) = I(x - l + i)$ (for copy left mode), $I(x + i) = I(x - w + i)$ (for copy above mode) or $I(x + i) = R(x + i)$ (for non-local prediction mode), where i from 0 to l , l is the second element of the current decoded 2-tuple, w is the width of the current block and R is the samples in the reference block.

[0028] In one embodiment, each index in the index map of the current block can

copy the index of its left neighbor, its above neighbor or its non-local prediction, which are respectively corresponding to copy left mode, copy above mode and non-local prediction mode. Encoder can decide use which copying mode for every index. By using those copying modes, the index map can be represented by several

5 2-tuples (m, l) , as depicted in Fig.5, where m is the copy mode for each starting index and l is the length which indicates how many indexes copying from their reference indexes by using the specific mode m . Reference index is the left neighbor, the above neighbor or the non-local prediction of the current index. The index map I is reconstructed by $I(x + i) = I(x - l + i)$ (for copy left mode), $I(x + i) = I(x - w + i)$ (for

10 copy above mode) or $I(x + i) = R(x + i)$ (for non-local prediction mode), where i from 0 to $l - 1$, l is the second element of the current decoded 2-tuple, w is the width of the current block and R is the index map of the reference block.

[0029] In one embodiment, the non-local index map is first obtained, and then the indices in the current index map can be derived by directly copying the corresponding

15 indices in the non-local index map. After copying, a sample in the current block is reconstructed by using the color indicated by the corresponding index in the index map. An exemplary copying process is described as follows. Suppose the width and height of the reference block are W and H respectively, $R(x, y)$ is a index in the non-local index map with x from 0 to $W - 1$ and y from 0 to $H - 1$, then a index $R'(x, y)$

20 in the non-local index map can be derived as $R'(x, y) = R(x, y)$. After copying process, the sample $S(x, y)$ in the current block is reconstructed as $S(x, y) = P[R(x, y)]$ with $R(x, y)$ from 0 to $N - 1$, where P is the palette of the current block and N is the number of colors in the palette.

[0030] In one embodiment, each sample in the current block is reconstructed by the

25 copying method above.

[0031] In another embodiment, one or some samples in the current block are reconstructed by the copying method above. Others samples in the current block are reconstructed by other methods.

[0032] In another embodiment, the non-local index map is an index map of a

30 reference block, as depicted in Fig.6. The reference block is first obtained, and then a color quantization algorithm is used to derive the indices of the non-local index map. Color quantization is the process converting samples to indices, where each sample is assigned a corresponding index according to some criteria. For example, the corresponding index is the index of the nearest (any distance measurement) palette

entry of the current block.

[0033] In one embodiment, each sample in the current block is reconstructed by the copying method above.

5 [0034] In another embodiment, one or some samples in the current block are reconstructed by the copying method above. Others samples in the current block are reconstructed by other methods.

[0035] In still another embodiment, the palette of the current block is predicted by the palette of the reference block.

10 [0036] In still another embodiment, the palette of the current block is copied as the palette of the reference block.

[0037] In still another embodiment, the reference block can be in the same picture of the current block, or it can be in a different picture of the current block.

[0038] In still another embodiment, the reference block can be from the reconstructed image or a prediction image of the current picture.

15 [0039] In still another embodiment, the position of the reference block is signaled from the encoder to the decoder explicitly.

[0040] In still another embodiment, the position of the reference block is signaled from the encoder to the decoder explicitly in the same way as the signaling method of block vector (BV) in intra block copy (IBC).

20 [0041] In still another embodiment, the position of the reference block is derived by the decoder implicitly.

[0042] In still another embodiment, the reference block is horizontally flipped before it is used to generate the non-local index map, as depicted in Fig.7. The reference block can be in the same picture of the current block, or it can be in a different picture of the current block. An exemplary flipping process is described as follows. Suppose the width of the reference block is W , $R(x, y)$ is a sample in the reference block with x from 0 to $W-1$, then a sample $R'(x, y)$ in the flipped reference block can be derived as $R'(x, y) = R(W-1-x, y)$.

25

[0043] In still another embodiment, the reference block is vertically flipped before it is used to generate the non-local index map, as depicted in Fig.8. The reference block can be in the same picture of the current block, or it can be in a different picture of the current block. An exemplary flipping process is described as follows. Suppose the height of the reference block is H , $R(x, y)$ is a sample in the reference block with y from 0 to $H-1$, then a sample $R'(x, y)$ in the flipped reference block can be derived as

30

$$R'(x,y)=R(x, H-1-y).$$

[0044] In still another embodiment, a reference block is vertically flipped then horizontally flipped or horizontally flipped then vertically flipped before it is used to generate the non-local index map, as depicted in Fig.9. The reference block can be in the same picture of the current block, or it can be in a different picture of the current block. An exemplary flipping process is described as follows. Suppose the width of the reference block is W, the height of the reference block is H, and $R(x, y)$ is a sample in the reference block with x from 0 to $W-1$ and y from 0 to $H-1$, then a sample $R'(x,y)$ in the flipped reference block can be derived as $R'(x,y)=R(W-1-x, H-1-y)$.

[0045] In still another embodiment, a reference block is rotated clock wisely before it is used to generate the non-local index map, as depicted in Fig.10. The reference block can be in the same picture of the current block, or it can be in a different picture of the current block. An exemplary rotation process is described as follows. Suppose the height of the reference block is H, and $R(x, y)$ is a sample in the reference block with y from 0 to $H-1$, then a sample $R'(x,y)$ in the rotated reference block can be derived as $R'(x,y)=R(H-1-y, x)$.

[0046] In still another embodiment, a reference block is rotated counter clock wisely before it is used to generate the non-local index map, as depicted in Fig.11. The reference block can be in the same picture of the current block, or it can be in a different picture of the current block. An exemplary rotation process is described as follows. Suppose the width of the reference block is W, and $R(x, y)$ is a sample in the reference block with x from 0 to $W-1$, then a sample $R'(x,y)$ in the rotated reference block can be derived as $R'(x,y)=R(y, W-1-x)$.

[0047] In still another embodiment, a reference block is transposed before it is used to generate the non-local index map, as depicted in Fig.12. The reference block can be in the same picture of the current block, or it can be in a different picture of the current block. An exemplary transposition process is described as follows. Suppose $R(x, y)$ is a sample in the reference block, then a sample $R'(x,y)$ in the transposed reference block can be derived as $R'(x,y)=R(y, x)$.

[0048] In still another embodiment, a reference block is reformed arbitrarily before it is used to generate the non-local index map. The reference block can be in the same picture of the current block, or it can be in a different picture of the current block. An exemplary transposition process is described as follows. Suppose $R(x, y)$ is a sample

in the reference block, then a sample $R'(x,y)$ in the reformed reference block can be derived as $R'(x,y)=R(f(x,y), g(x,y))$, where f and g are any functions. Function f can depend on x only, on y only, or on both. Function g can depend on x only, on y only, or on both. Function f can depend on the size, width, height, shape or coding mode of the current block or the reference block. Function g can depend on the size, width, height, shape or coding mode of the current block or the reference block. Function f can depend on the type of the current or reference picture or slice. Function g can depend on the type of the current or reference picture or slice. Function f can be a linear or non-linear function. Function g can be a linear or non-linear function. f and g can be the same, or they can be different.

[0049] In still another embodiment, before the reference block is used to generate the non-local index map, it is reformed by a combination of two or more reforming methods, such as horizontal flipping, vertical flipping, clock wise rotation, counter clock wise rotation, transposition and any arbitrary reforms. The reforms can be done in a cascade way, in which a reference block is reformed sequentially before it is used to predict the current block as depicted in Fig.13. The output from a former reform is treated as the input to a subsequent reform.

[0050] In still another embodiment, multiple block candidates are combined together to generate the reference block, as depicted in Fig.14. The multiple candidates can be in the same picture of the current block, or they can be in a different picture of the current block. An exemplary combination process is described as follows. Suppose the width and height of each candidate are W and H respectively, N is the number of candidates, and $R(k, x, y)$ is a sample in the k^{th} candidate with x from 0 to $W-1$ and y from 0 to $H-1$, then a sample $R'(x,y)$ in the reference block can be derived as $R'(x,y) = f(R(1, x, y), R(2, x, y), \dots, R(k, x, y))$, where f can be any function. In one example, f is an average function thus $R'(x,y) = \frac{\sum_{k=1}^N R(k,x,y)}{N}$.

[0051] In still another embodiment, the non-local index map is horizontally flipped before it is used to predict the current index map. An exemplary flipping process is described as follows. Suppose the width of the non-local index map is W , $R(x, y)$ is an index in the non-local index map with x from 0 to $W-1$, then an index $R'(x,y)$ in the flipped non-local index map can be derived as $R'(x,y)=R(W-1-x, y)$.

[0052] In still another embodiment, the non-local index map is vertically flipped before it is used to predict the current index map. An exemplary flipping process is

described as follows. Suppose the height of the non-local index map is H , $R(x, y)$ is an index in the non-local index map with y from 0 to $H-1$, then an index $R'(x, y)$ in the flipped non-local index map can be derived as $R'(x, y) = R(x, H-1-y)$.

[0053] In still another embodiment, the non-local index map is vertically flipped then horizontally flipped or horizontally flipped then vertically flipped before it is used to predict the current index map. An exemplary flipping process is described as follows. Suppose the width of the non-local index map is W , the height of the non-local index map is H , and $R(x, y)$ is an index in the non-local index map with x from 0 to $W-1$ and y from 0 to $H-1$, then an index $R'(x, y)$ in the flipped non-local index map can be derived as $R'(x, y) = R(W-1-x, H-1-y)$.

[0054] In still another embodiment, the non-local index map is rotated clock wisely before it is used to predict the current index map. An exemplary rotation process is described as follows. Suppose the height of the non-local index map is H , and $R(x, y)$ is an index in the non-local index map with y from 0 to $H-1$, then an index $R'(x, y)$ in the rotated non-local index map can be derived as $R'(x, y) = R(H-1-y, x)$.

[0055] In still another embodiment, the non-local index map is rotated counter clock wisely before it is used to predict the current index map. An exemplary rotation process is described as follows. Suppose the width of the non-local index map is W , and $R(x, y)$ is an index in the non-local index map with x from 0 to $W-1$, then an index $R'(x, y)$ in the rotated non-local index map can be derived as $R'(x, y) = R(y, W-1-x)$.

[0056] In still another embodiment, the non-local index map is transposed before it is used to predict the current index map. An exemplary transposition process is described as follows. Suppose $R(x, y)$ is a index in the non-local index map, then an index $R'(x, y)$ in the transposed non-local index map can be derived as $R'(x, y) = R(y, x)$.

[0057] In still another embodiment, the non-local index map is reformed arbitrarily before it is used to generate the non-local index map. An exemplary transposition process is described as follows. Suppose $R(x, y)$ is an index in the reference block, then a index $R'(x, y)$ in the reformed reference block can be derived as $R'(x, y) = R(f(x, y), g(x, y))$, where f and g are any functions. Function f can depend on x only, on y only, or on both. Function g can depend on x only, on y only, or on both. Function f can depend on the size, width, height, shape or coding mode of the current block or the reference block. Function g can depend on the size, width, height, shape or coding

mode of the current block or the reference block. Function f can depend on the type of the current or reference picture or slice. Function g can depend on the type of the current or reference picture or slice. Function f can be a linear or non-linear function. Function g can be a linear or non-linear function. f and g can be the same, or they can be different.

[0058] In still another embodiment, an encoder can decide to use non-local index prediction method and signal the information to the decoder. The information can be signaled for a macro-block (MB), a coding tree unit (CTU) a coding unit (CU), a transform unit (TU) or a prediction unit (PU). The encoder can make the decision based on the rate-distortion optimization (RDO) criterion or other criterions.

[0059] In still another embodiment, a decoder can infer whether to use non-local index prediction method or not for the block implicitly. No information is signaled to indicate whether to apply non-local index prediction method or not from the encoder explicitly.

[0060] In still another embodiment, several non-local index maps are provided as prediction candidates. An encoder can decide to use which non-local index map and signal the information to the decoder, as depicted in Fig.15. The information can be signaled for a macro-block (MB), a coding tree unit (CTU) a coding unit (CU), a transform unit (TU) or a prediction unit (PU). The encoder can make the decision based on the rate-distortion optimization (RDO) criterion or other criterions.

[0061] In still another embodiment, several non-local index maps can be provided as prediction candidates. A decoder can infer whether to use one non-local index map or not for the current index map implicitly. No information is signaled to indicate whether to apply reformed copying or not from the encoder explicitly.

[0062] In still another embodiment, the non-local index prediction methods can be applied to palette mode and all index-based coding schemes.

[0063] In still another embodiment, the non-local index prediction methods can be applied to a block with size $M \times N$, where M and N are arbitrary positive integers. M can be equal to N or M can be not equal to N . For example, M can be equal to $a \times N$ where a is a positive integer equal or larger than 2. N can be equal to $b \times M$, where b is a positive integer equal or larger than 2. Specially, M or N can be 1.

[0064] In still another embodiment, the non-local index prediction methods can be applied to all components in an image. For example, it can be applied to Y, U, or V components. It can also be applied to G, R, or B components. It can also be applied to

depth component for 3D video/image coding.

[0065] In still another embodiment, it can be done separately for each component to decide whether to apply the non-local index prediction methods or not and signal this information for a block. Or all components can be treated in the same manner and only single information is signaled for a block.

[0066] In still another embodiment, it can be done separately for each component to infer whether to use the non-local index prediction methods or not for a block at decoder implicitly. Or all components can be treated in the same manner for a block.

[0067] In still another embodiment, if multiple non-local index maps are provided, it can be done separately for each component to decide to use which non-local index map and signal this information for a block. Or all components can be treated in the same manner and only single information is signaled for a block.

[0068] In still another embodiment, if multiple non-local index maps are provided, it can be done separately for each component to infer to use which non-local index map or not for a block at decoder implicitly. Or all components can be treated in the same manner for a block.

[0069] In still another embodiment, it depends on the size, shape or coding mode of the current block or the current CUVTUPU to decide or infer whether to apply non-local index prediction or not.

[0070] In still another embodiment, if multiple non-local index maps are provided, it depends on the size, shape or coding mode of the current block or the current CUVTUPU to decide or infer which prediction index map is used.

[0071] In still another embodiment, non-local index prediction is only allowed for CU with palette mode.

[0072] In still another embodiment, non-local index prediction is only allowed for CU with partition size $2N \times 2N$.

[0073] In still another embodiment, a flag is coded by context adaptive binarized arithmetic coding (CABAC) for a CU, TU or PU to indicate whether non-local index prediction is used for the current index map. The flags in its neighboring blocks are used to determine the context model to code the flag for the current block. The flag is treated as 0 if it is not signaled. Or it is treated as 1 if it is not signaled.

[0074] In still another embodiment, if multiple non-local index maps are provided, several flags are coded by context adaptive binarized arithmetic coding (CABAC) for a CU, TU or PU to indicate which non-local index map is used for the current index

map. The flags in its neighboring blocks are used to determine the context model to code the flag for the current block. The flag is treated as 0 if it is not signaled. Or it is treated as 1 if it is not signaled.

[0075] The methods described above can be used in a video encoder as well as in a

5 video decoder. Embodiments of disparity vector derivation 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
10 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 processors can be configured to perform
15 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 of
20 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.

[0076] The methods described above can be used in a video encoder as well as in a

25 video decoder. Embodiments of disparity vector derivation 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
30 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 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 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.

[0077] 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 modifications and similar arrangements.

CLAIMS

1. A method of non-local prediction, wherein non-local samples are used to predict the samples in the current block.

5 2. The method as claimed in claim 1, non-local index map of a reference block can be used to predict the index map of the current block.

3. The method as claimed in claim 1, one non-local image block is first located, and then the samples in the current block can be reconstructed by directly copying the corresponding samples in that non-local image block.

10 4. The method as claimed in claim 2, wherein indices in the current index map can be derived by directly copying the corresponding indices in the non-local index map; after copying, a sample in the current block is reconstructed by using the color indicated by the corresponding index in the index map.

15 5. The method as claimed in claim 3, wherein each sample in the current block is reconstructed by the copying method.

6. The method as claimed in claim 3, wherein one or some samples in the current block are reconstructed by the copying method above; others samples in the current block are reconstructed by other methods.

20 7. The method as claimed in claim 2, wherein the reference block is first obtained, and then a color quantization algorithm is used to derive the indices of the non-local index map; color quantization is the process converting samples to indices, where each sample is assigned a corresponding index according to some criteria.

8. The method as claimed in claim 7, wherein the corresponding index is the index of the nearest (any distance measurement) palette entry of the current block.

25 9. The method as claimed in claim 6, wherein each sample in the current block is reconstructed by the copying method.

10. The method as claimed in claim 6, wherein one or some samples in the current block are reconstructed by the copying method; others samples in the current block are reconstructed by other methods.

30 11. The method as claimed in claim 2, wherein the palette of the current block is predicted by the palette of the reference block.

12. The method as claimed in claim 2, wherein the palette of the current block is copied as the palette of the reference block.

13. The method as claimed in claim 2, wherein the reference block can be in the same picture of the current block, or it can be in a different picture of the current block.

14. The method as claimed in claim 2, wherein the reference block can be from
5 the reconstructed image or a prediction image of the current picture.

15. The method as claimed in claim 1, wherein the position of the reference block is signaled from the encoder to the decoder explicitly.

16. The method as claimed in claim 14, wherein the position of the reference block is signaled from the encoder to the decoder explicitly in the same way as the
10 signaling method of block vector (BV) in intra block copy (IBC).

17. The method as claimed in claim 2, wherein the position of the reference block is derived by the decoder implicitly.

18. The method as claimed in claim 2, wherein a reference block is reformed arbitrarily; suppose $R(x, y)$ is a sample in the reference block, then a sample $R'(x, y)$
15 in the reformed reference block can be derived as $R'(x, y) = R(f(x, y), g(x, y))$, where f and g are any functions.

19. The method as claimed in claim 2, wherein a non-local index map is reformed arbitrarily; suppose $R(x, y)$ is an index in the reference block, then an index $R'(x, y)$ in the reformed non-local index map can be derived as $R'(x, y) = R(f(x, y),$
20 $g(x, y))$, where f and g are any functions.

20. The method as claimed in claim 18 and claim 19, wherein Function f can depend on x only, on y only, or on both; function g can depend on x only, on y only, or on both; function f can depend on the size, width, height, shape or coding mode of the current block or the reference block; function g can depend on the size, width, height,
25 shape or coding mode of the current block or the reference block; function f can depend on the type of the current or reference picture or slice; function g can depend on the type of the current or reference picture or slice; function f can be a linear or non-linear function; function g can be a linear or non-linear function; f and g can be the same, or they can be different.

21. The method as claimed in claim 2, wherein an encoder can decide to apply non-local index prediction or not for a block or an index string and signal the information to the decoder.

22. The method as claimed in claim 2, wherein multiple non-local index maps can be provided, an encoder can decide to use which prediction index map for a block

or an index string and signal the information to the decoder.

23. The method as claimed in claim 2, wherein a decoder can infer whether to apply non-local index prediction or not for a block or an index string implicitly; no information is signaled to indicate whether to non-local index prediction or not from the encoder explicitly.

24. The method as claimed in claim 2, wherein multiple non-local index maps can be provided, wherein a decoder can infer to apply which non-local index map for a block implicitly; no information is signaled to indicate which non-local index map is applied from the encoder explicitly.

25. The method as claimed in claim 2, wherein the non-local index prediction methods can be applied to a block with size $M \times N$, where M and N are arbitrary positive integers; M can be equal to N or M can be not equal to N ; for example, M can be equal to $a \times N$ where a is a positive integer equal or larger than 2; N can be equal to $b \times M$, where b is a positive integer equal or larger than 2; specially, M or N can be 1.

26. The method as claimed in claim 2, wherein the non-local index prediction methods can be applied to all components in an image; for example, it can be applied to Y, U, or V components; it can also be applied to G, R, or B components; it can also be applied to depth component for 3D video/image coding.

27. The method as claimed in claim 2, wherein it depends on the size, shape, coding mode, MV information or BV information of the current block, the current CU, the current PU or the current TU to decide or infer whether to apply non-local index prediction or not.

28. The method as claimed in claim 2, wherein it depends on the size, shape, coding mode, MV information or BV information of the current block, the current CU, the current PU or the current TU to decide or infer which non-local index map is applied if multiple non-local index maps are provided.

29. The method as claimed in claim 2, wherein non-local index prediction is allowed only when one or any logical combination of the conditions below is true; non-local index prediction can be used only if it is allowed; the information about reformed copying for a block is only signaled if reformed copying is allowed;

- The current CU is coded with palette mode;
- The current CU is coded with partition mode $2N \times 2N$;
- The current CU is coded with a size smaller than $M \times M$, M can be any integer

such as 64, 32, 16, 8, and 4;

- The current PU is coded with a size smaller than $M \times M$, M can be any integer such as 64, 32, 16, 8, and 4;

- The current TU is coded with a size smaller than $M \times M$, M can be any integer such as 64, 32, 16, 8, and 4;

- The current CU is coded with a size larger than $M \times M$, M can be any integer such as 64, 32, 16, 8, and 4;

- The current PU is coded with a size larger than $M \times M$, M can be any integer such as 64, 32, 16, 8, and 4;

- The current TU is coded with a size larger than $M \times M$, M can be any integer such as 64, 32, 16, 8, and 4;

- The current PU size is $2N \times 2N$;

- The current PU size is $N \times N$;

- The current PU size is $2N \times N$;

- The current PU size is $N \times 2N$.

30. The method as claimed in claim 2, wherein a flag is coded by context adaptive binarized arithmetic coding (CABAC) for a CU, TU or PU to indicate whether non-local index map is used for the current block.

31. The method as claimed in claim 30, wherein the flags in its neighboring blocks are used to determine the context model to code the flag for the current block.

32. The method as claimed in claim 30, wherein the flag is treated as 0 if it is not signaled; or it is treated as 1 if it is not signaled.

33. The method as claimed in claim 2, wherein the indices in the current index map are coded in the same way as the case where non-local index prediction is not used when non-local index prediction is used for the current block.

34. The method as claimed in claim 2, wherein the indices in the current index map are coded a different way to the case where non-local index prediction is not used when non-local index prediction is used for the current block.

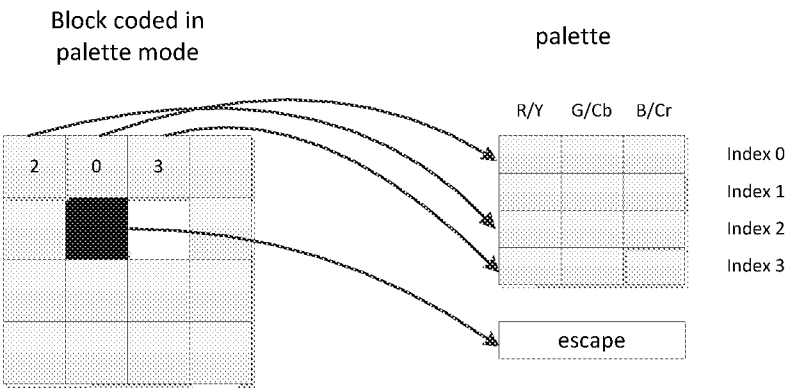


Fig.1

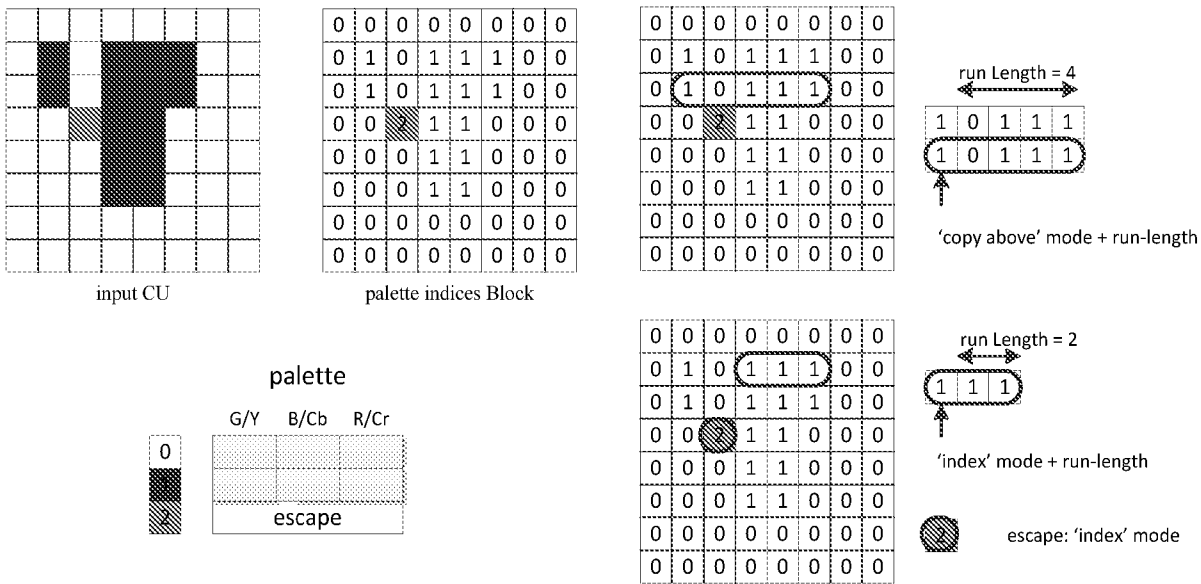


Fig.2

Abstract

This contribution consists of a submission of six Video Test Material for 'Screen Content' Coding description of the sequences and the creation of content of camera-view content with text overlaid on the content. It was also noted that, compared to sequences leads to quite varied results, including:

Position Offset (0, 268)

1 Introduction

This contribution is submitted in response to [1], :

Fig.3

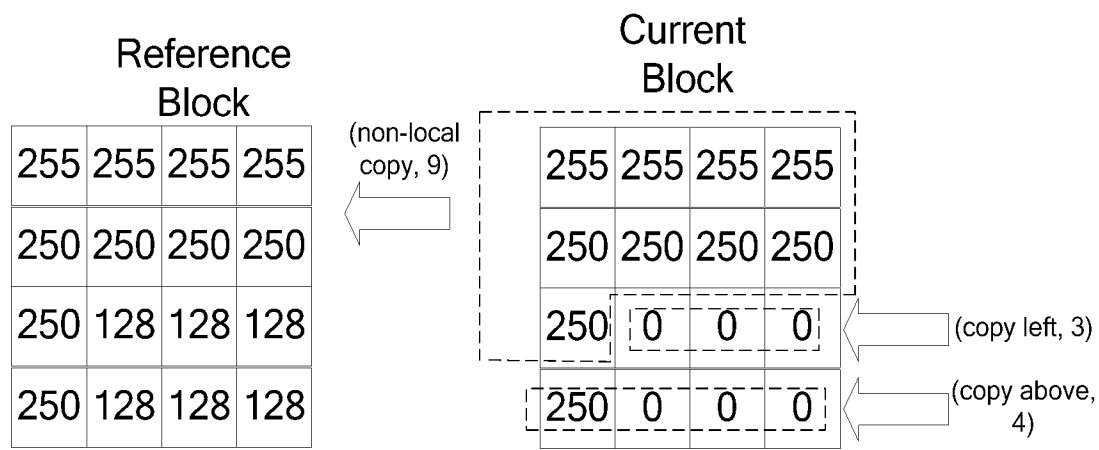


Fig.4

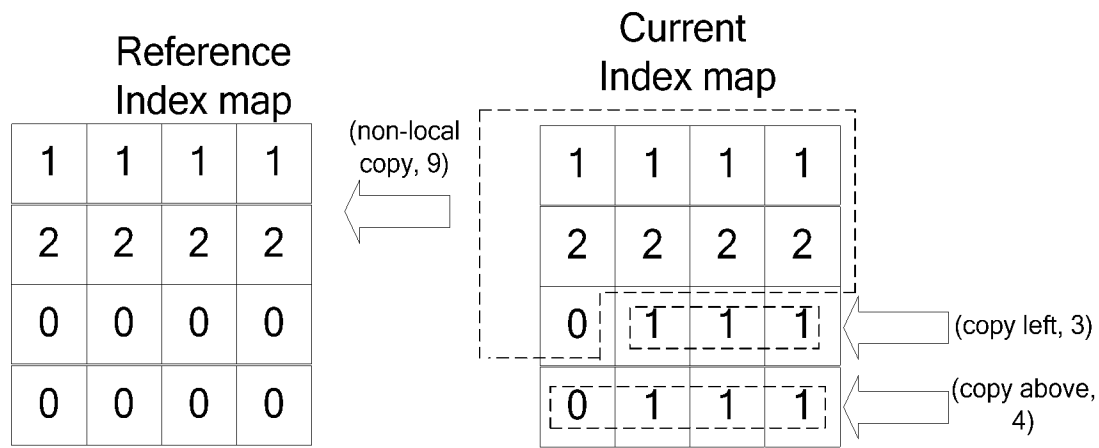


Fig.5



Fig.6

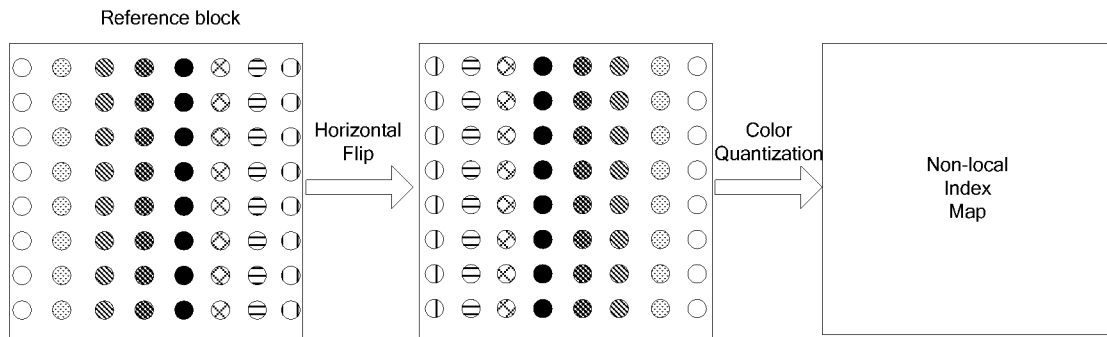


Fig.7

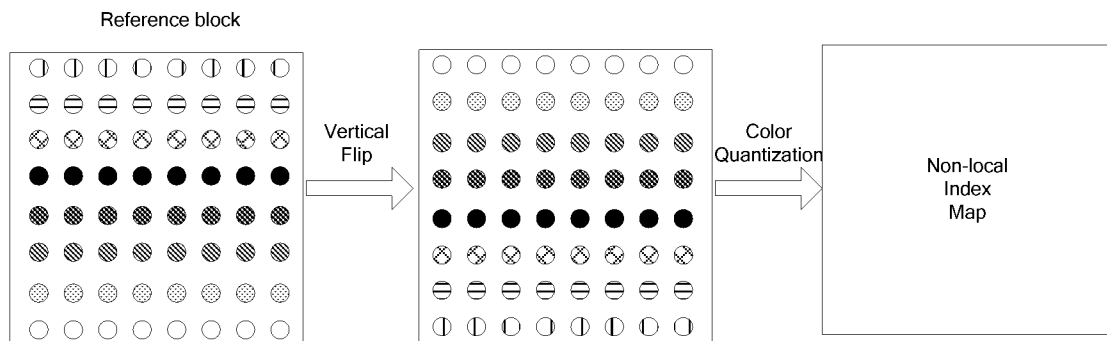


Fig.8

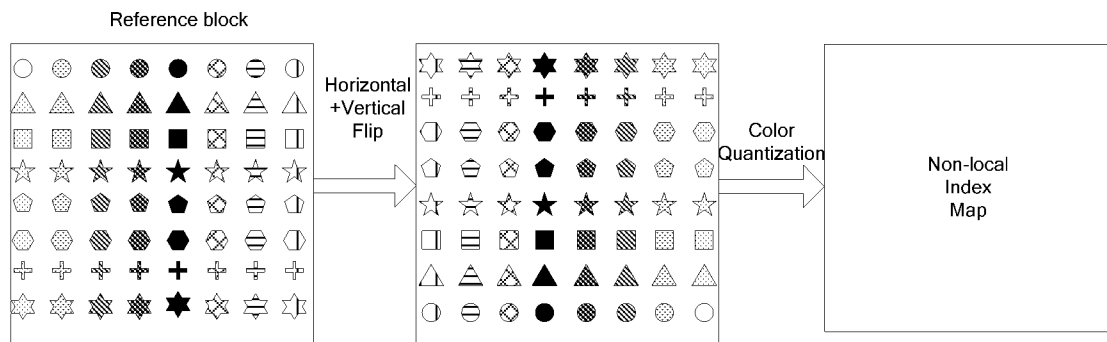


Fig.9

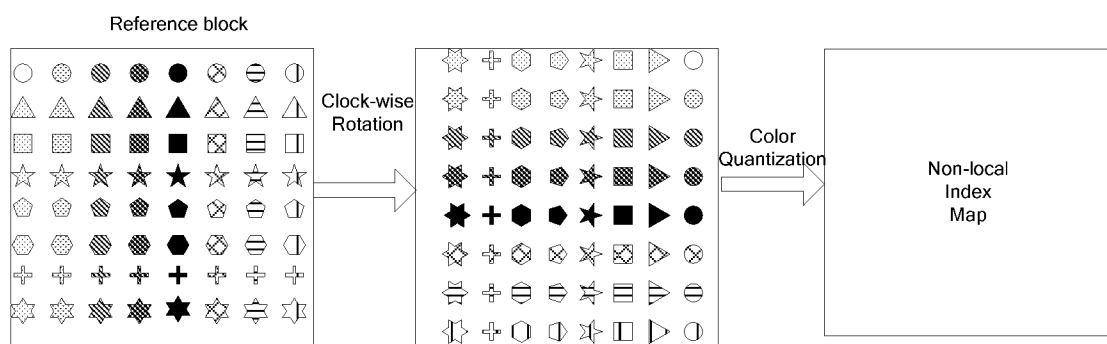


Fig.10

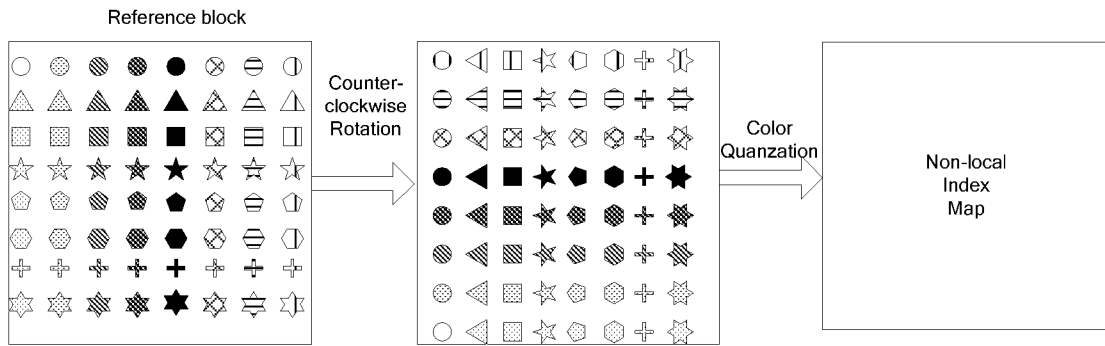


Fig.11

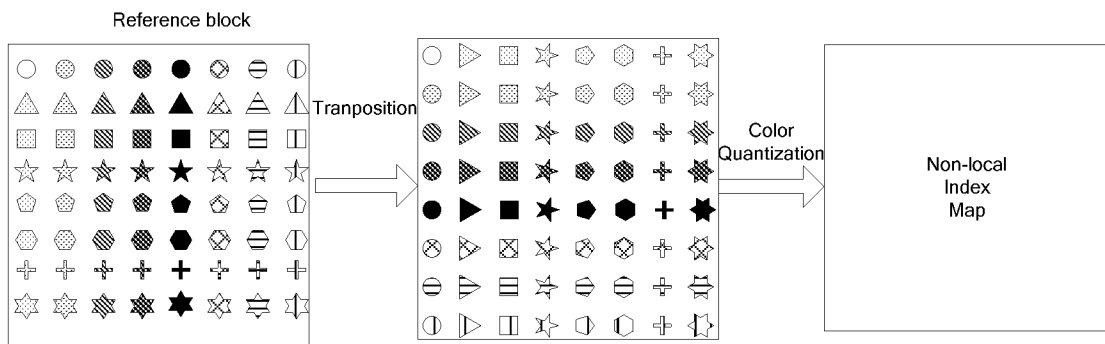


Fig.12

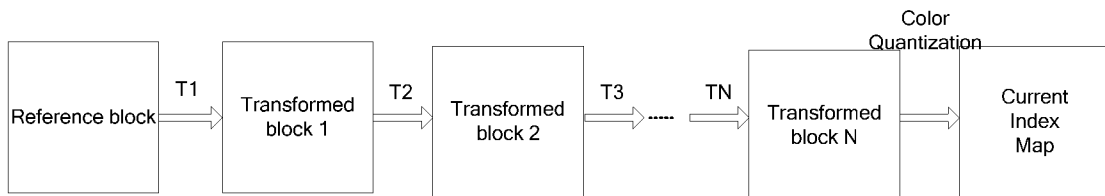
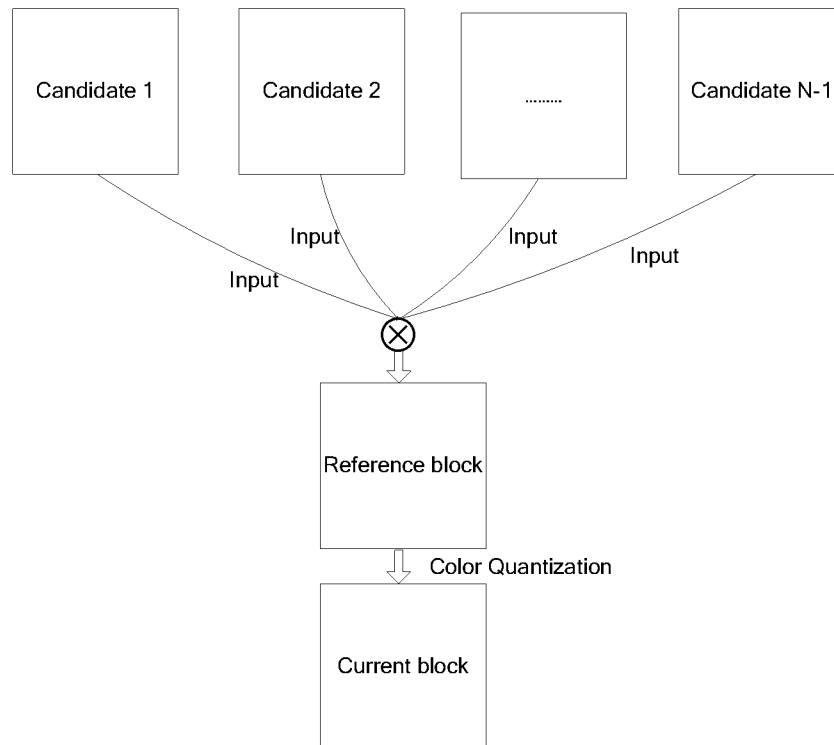
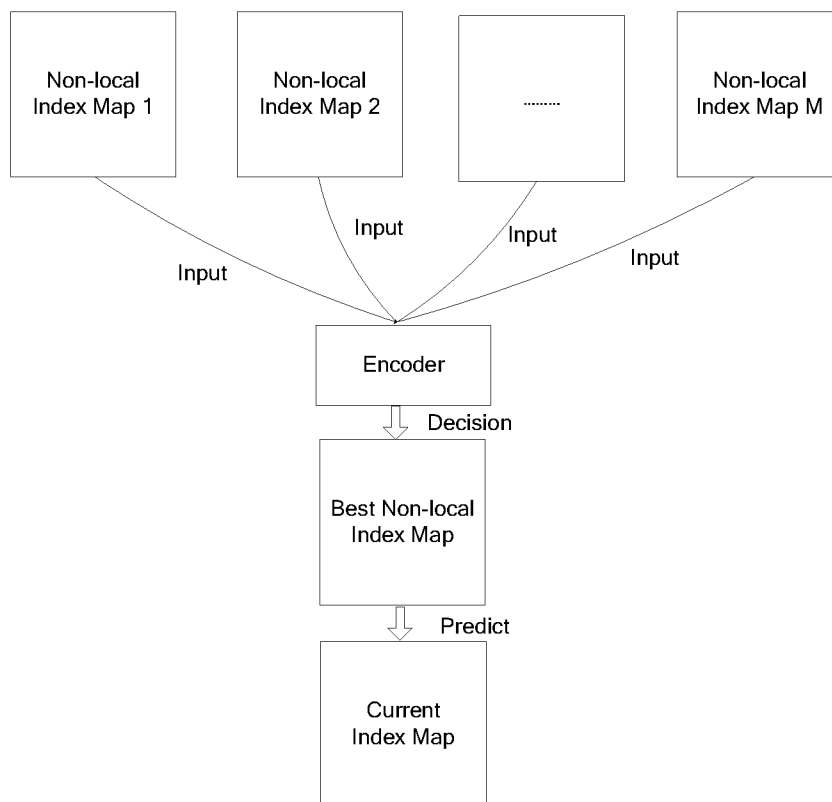


Fig.13

**Fig.14****Fig.15**

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2015/074728

A. CLASSIFICATION OF SUBJECT MATTER

H04N 19/00(2014.01)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)

CNABS; CNTXT; CNKI; VEN; USTXT: HEVC, H.265, cod+, predict+, non w local, sampl+, reference, block, index, indices, map, reconstruct+, copy, color, palette

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 102090062 A (THOMSON LICENSING) 08 June 2011 (2011-06-08) description, paragraphs [0124]-[0137]	1
X	CN 102595140 A (UNIV BEIJING POSTS & TELECOMM) 18 July 2012 (2012-07-18) description, paragraphs [0069]-[0077]	1
A	CN 102063708 A (UNIV XIDIAN) 18 May 2011 (2011-05-18) the whole document	1-34
A	CN 103686194 A (UNIV BEIJING ET AL.) 26 March 2014 (2014-03-26) the whole document	1-34
A	US 2014092975 A1 (GEN INSTRUMENT CORP.) 03 April 2014 (2014-04-03) the whole document	1-34

☐ 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

17 December 2015

Date of mailing of the international search report

24 December 2015

Name and mailing address of the ISA/CN

STATE INTELLECTUAL PROPERTY OFFICE OF THE
P.R.CHINA
6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing
100088, China

Facsimile No. (86-10)62019451

Authorized officer

YANG,Hao

Telephone No. (86-10)62411449

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2015/074728

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	102090062	A	08 June 2011	CN	102090062	B	11 December 2013
				WO	2009126299	A1	15 October 2009
				JP	5413923	B2	12 February 2014
				JP	2011517230	A	26 May 2011
				EP	2263381	A1	22 December 2010
				KR	20100132973	A	20 December 2010
				US	2012189051	A1	26 July 2012
CN	102595140	A	18 July 2012	CN	102595140	B	28 May 2014
CN	102063708	A	18 May 2011	CN	102063708	B	27 June 2012
CN	103686194	A	26 March 2014	US	2014064615	A1	06 March 2014
				WO	2014036950	A1	13 March 2014
				US	2015178899	A1	25 June 2015
US	2014092975	A1	03 April 2014	WO	2014055231	A1	10 April 2014