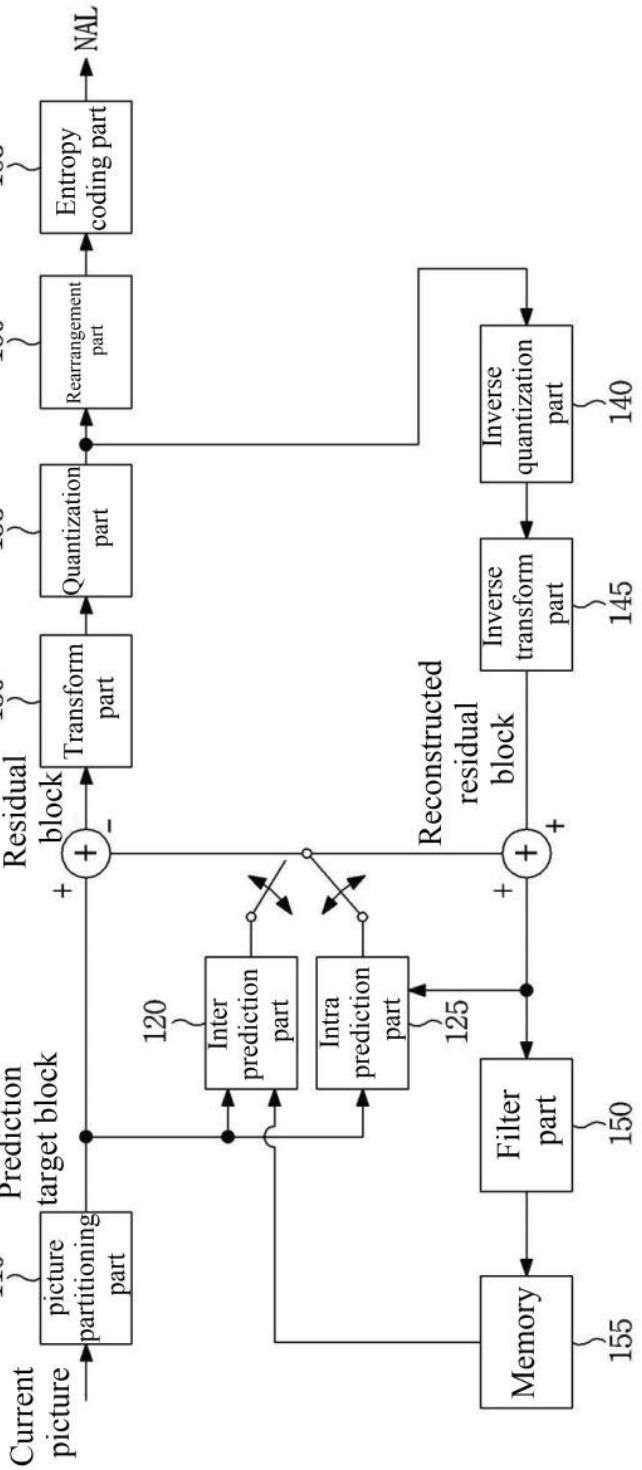

Current picture
110
picture partitioning part
Prediction target block
120
Inter prediction part
125
Intra prediction part
Residual block
130
Transform part
135
Quantization part
160
Rearrangement part
165
Entropy coding part
NAL
Reconstructed residual block
Inverse quantization part
140
Inverse transform part
145
Filter part
150
Memory
155

Fig. 1

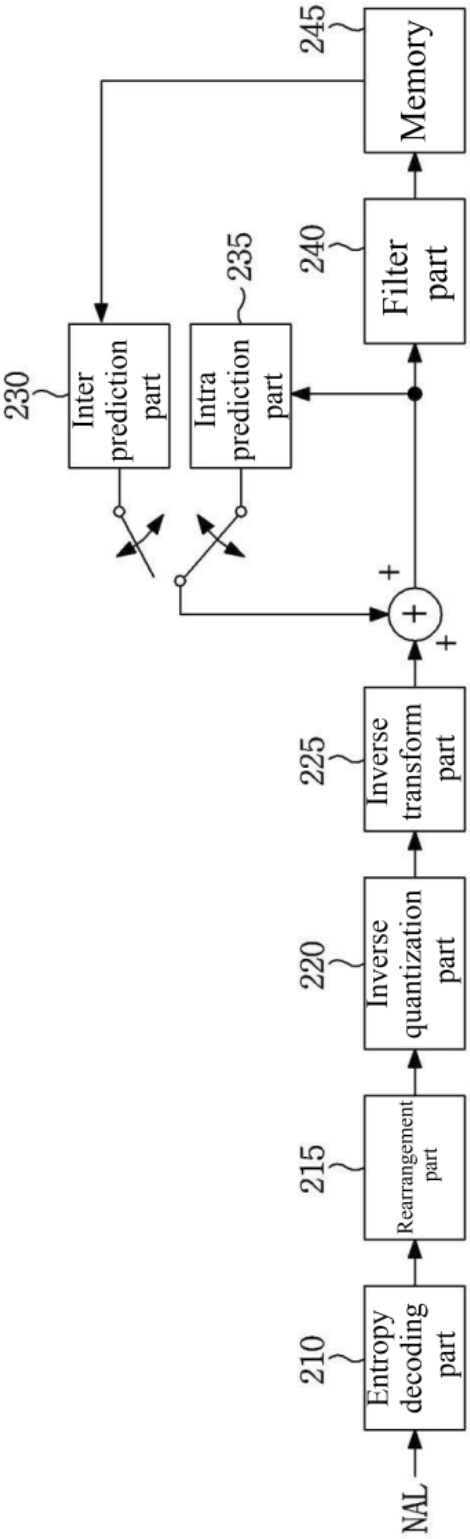

NAL
Entropy decoding part
210
Rearrangement part
215
Inverse quantization part
220
Inverse transform part
225
+
+
Inter prediction part
230
Intra prediction part
235
Filter part
240
Memory
245

Fig. 2

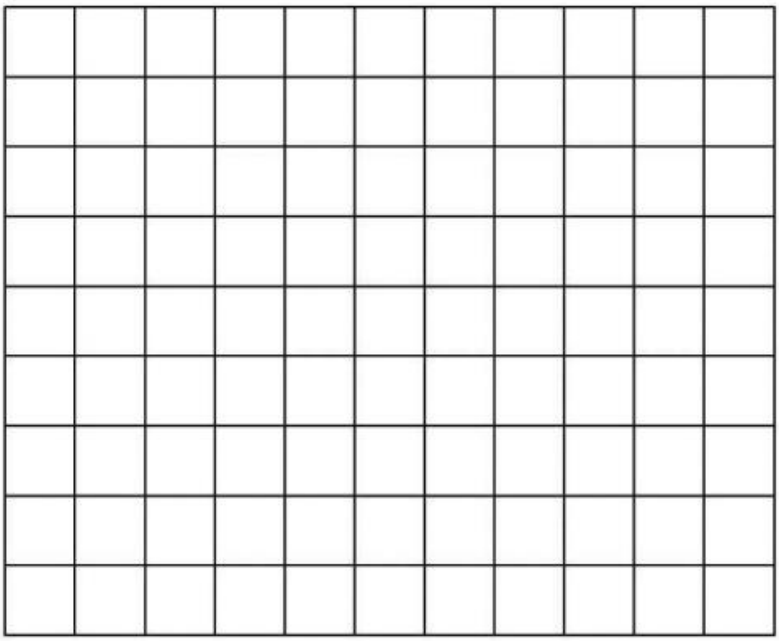


Fig. 3

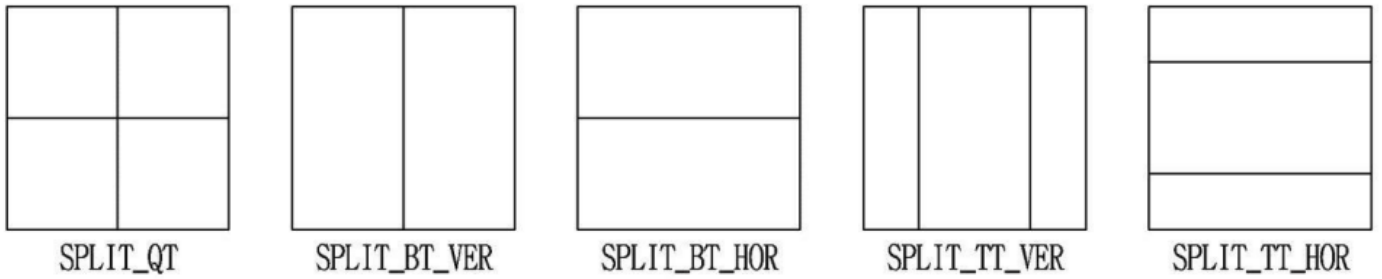


Fig. 4

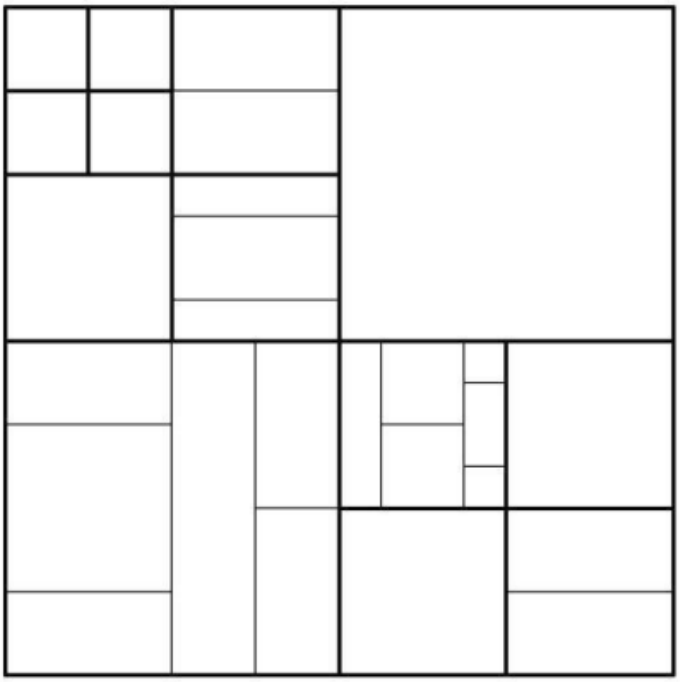


Fig. 5

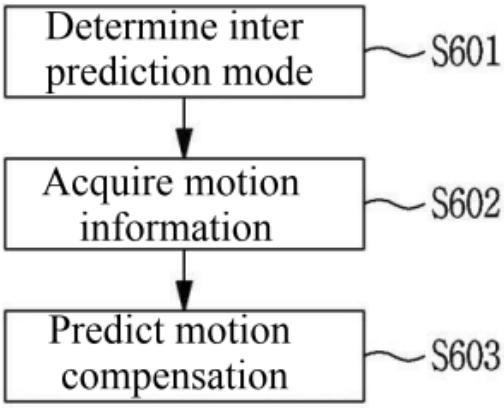

Determine inter prediction mode
S601
Acquire motion information
S602
Predict motion compensation
S603

Fig. 6

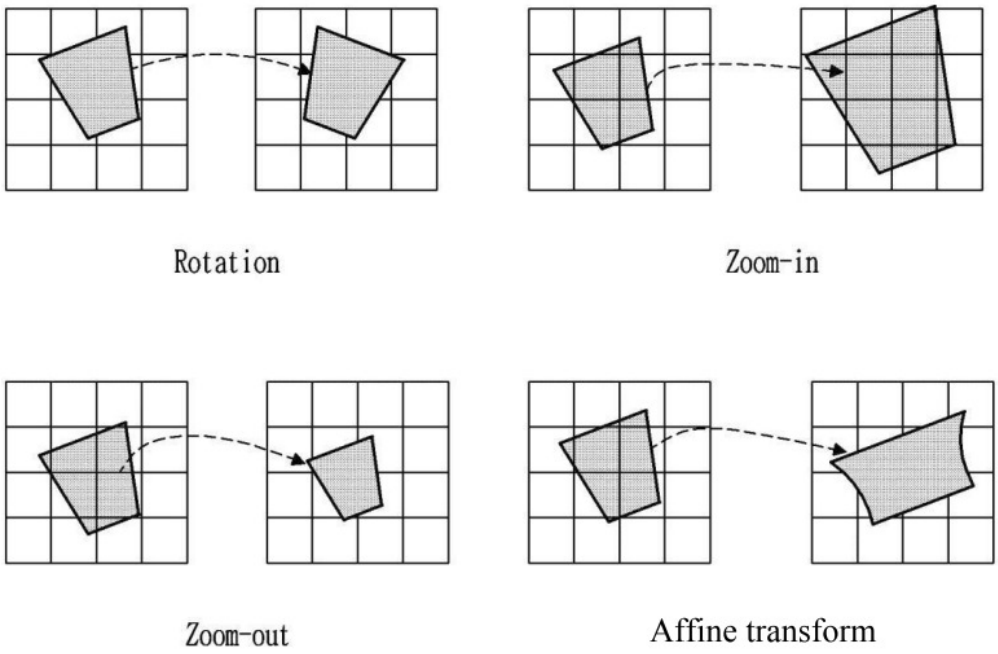

Rotation
Zoom-in
Zoom-out
Affine transform

Fig. 7

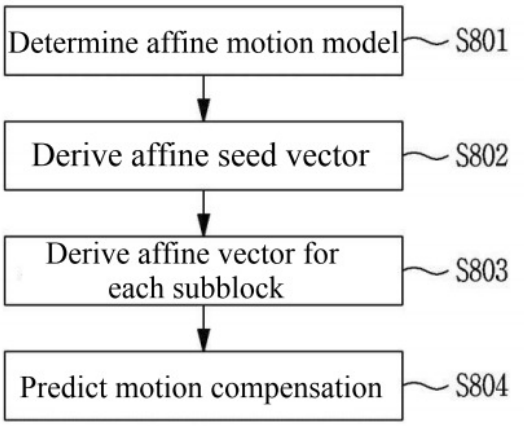

Determine affine motion model
S801
Derive affine seed vector
S802
Derive affine vector for each subblock
S803
Predict motion compensation
S804

Fig. 8

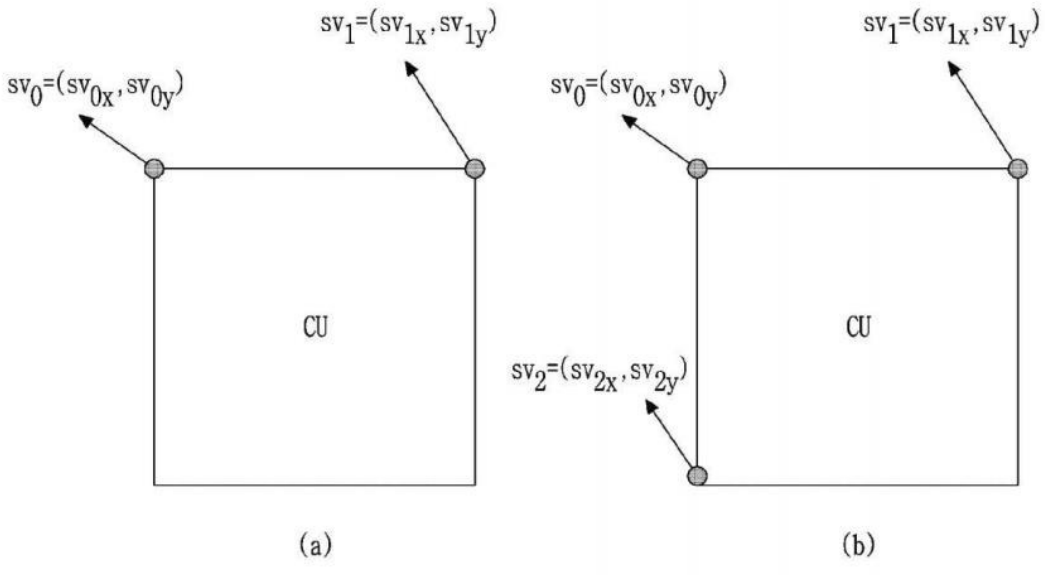

$sv_1=(sv_{1x},sv_{1y})$
$sv_0=(sv_{0x},sv_{0y})$
CU
(a)
$sv_1=(sv_{1x},sv_{1y})$
$sv_0=(sv_{0x},sv_{0y})$
CU
$sv_2=(sv_{2x},sv_{2y})$
(b)

Fig. 9

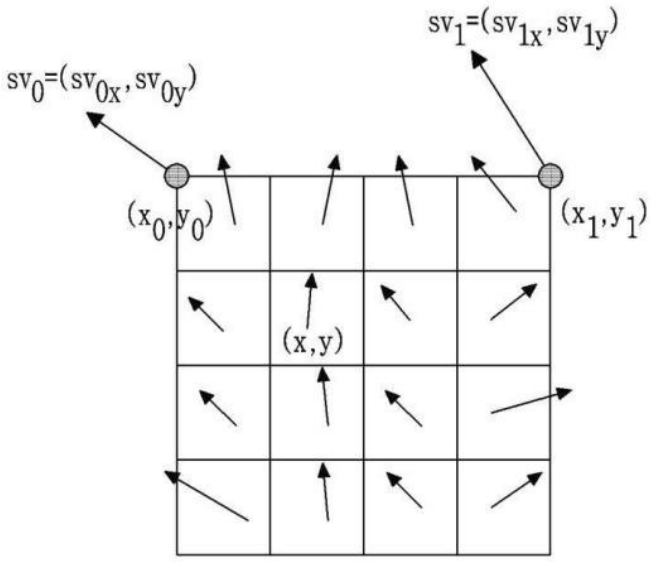

$sv_1=(sv_{1x},sv_{1y})$
$sv_0=(sv_{0x},sv_{0y})$
(x_0,y_0)
(x_1,y_1)
(x,y)

Fig. 10

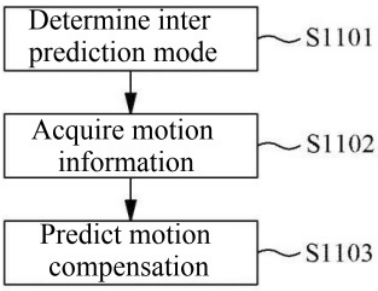

Determine inter prediction mode
S1101
Acquire motion information
S1102
Predict motion compensation
S1103

Fig. 11

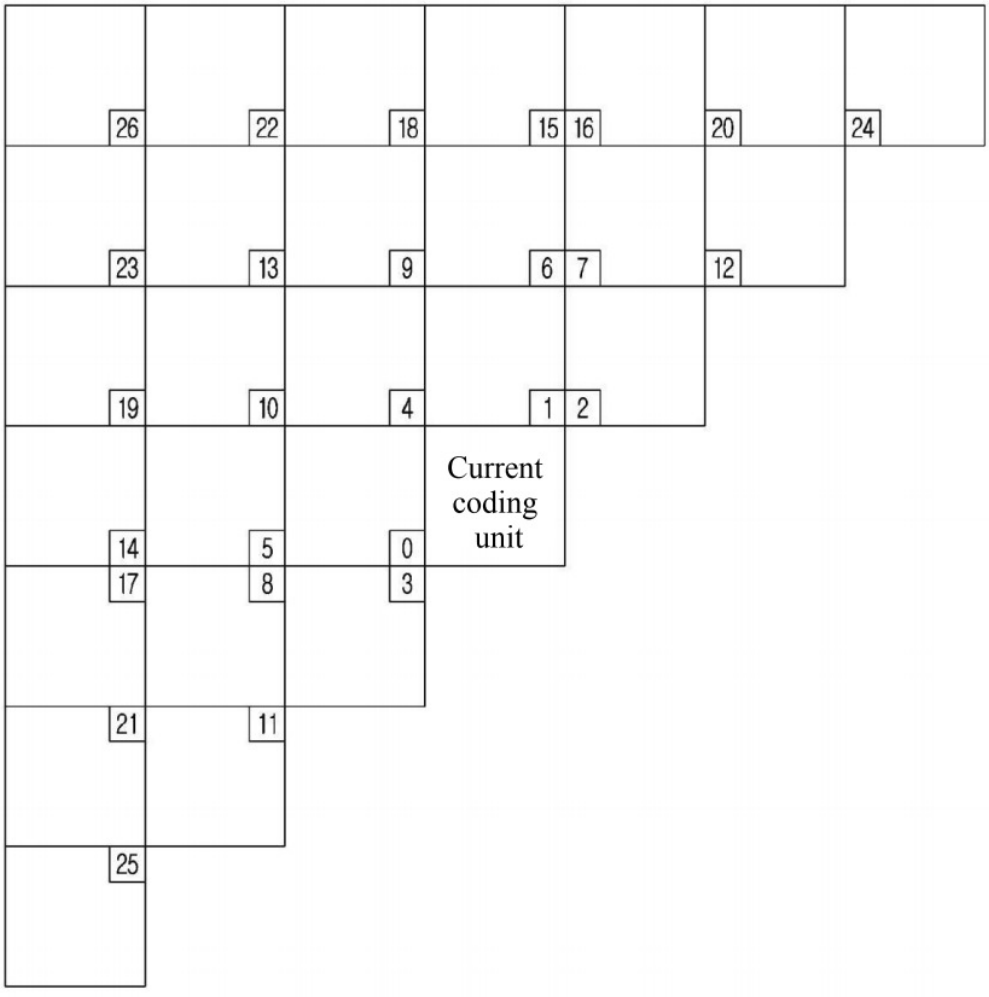

26
22
18
15
16
20
24
23
13
9
6
7
12
19
10
4
1
2
Current coding unit
14
5
0
17
8
3
21
11
25

Fig. 12

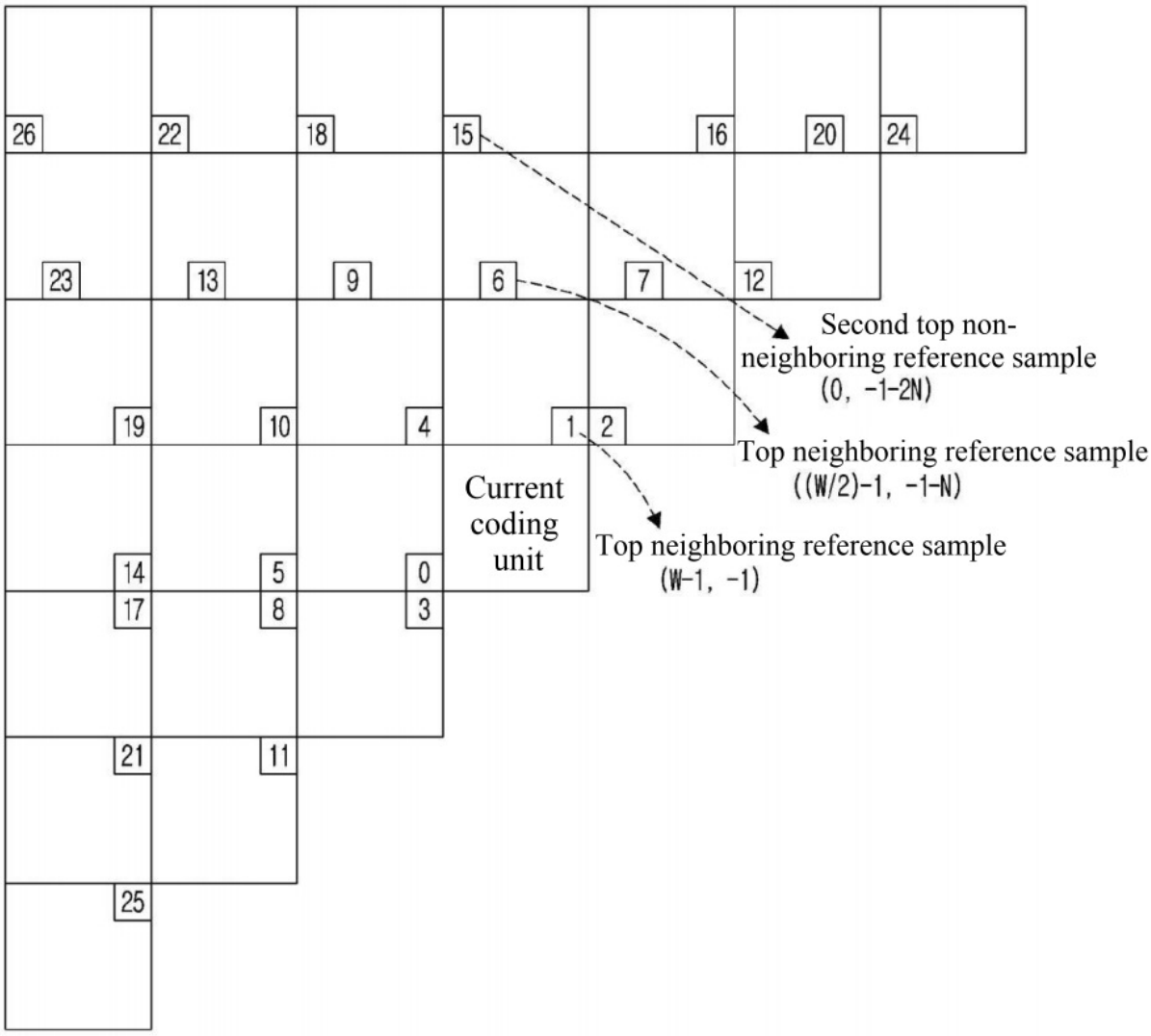

26
22
18
15
16
20
24
23
13
9
6
7
12
19
10
4
1
2
14
5
0
17
8
3
21
11
25
Current coding unit
Second top non-neighboring reference sample (0, -1-2N)
Top neighboring reference sample ((W/2)-1, -1-N)
Top neighboring reference sample (W-1, -1)

Fig. 13

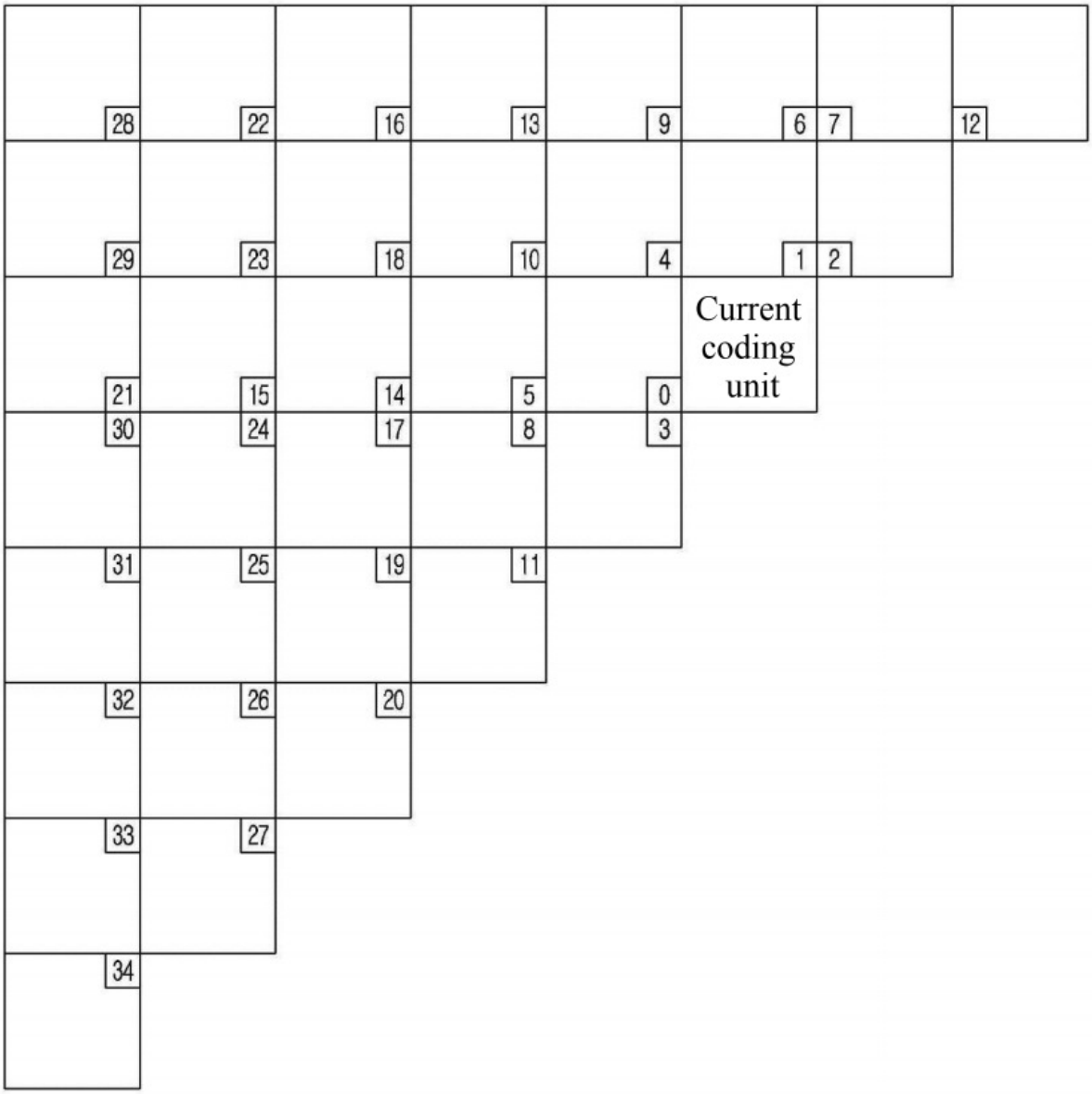

28
22
16
13
9
6
7
12
29
23
18
10
4
1
2
Current coding unit
21
15
14
5
0
30
24
17
8
3
31
25
19
11
32
26
20
33
27
34

Fig. 14

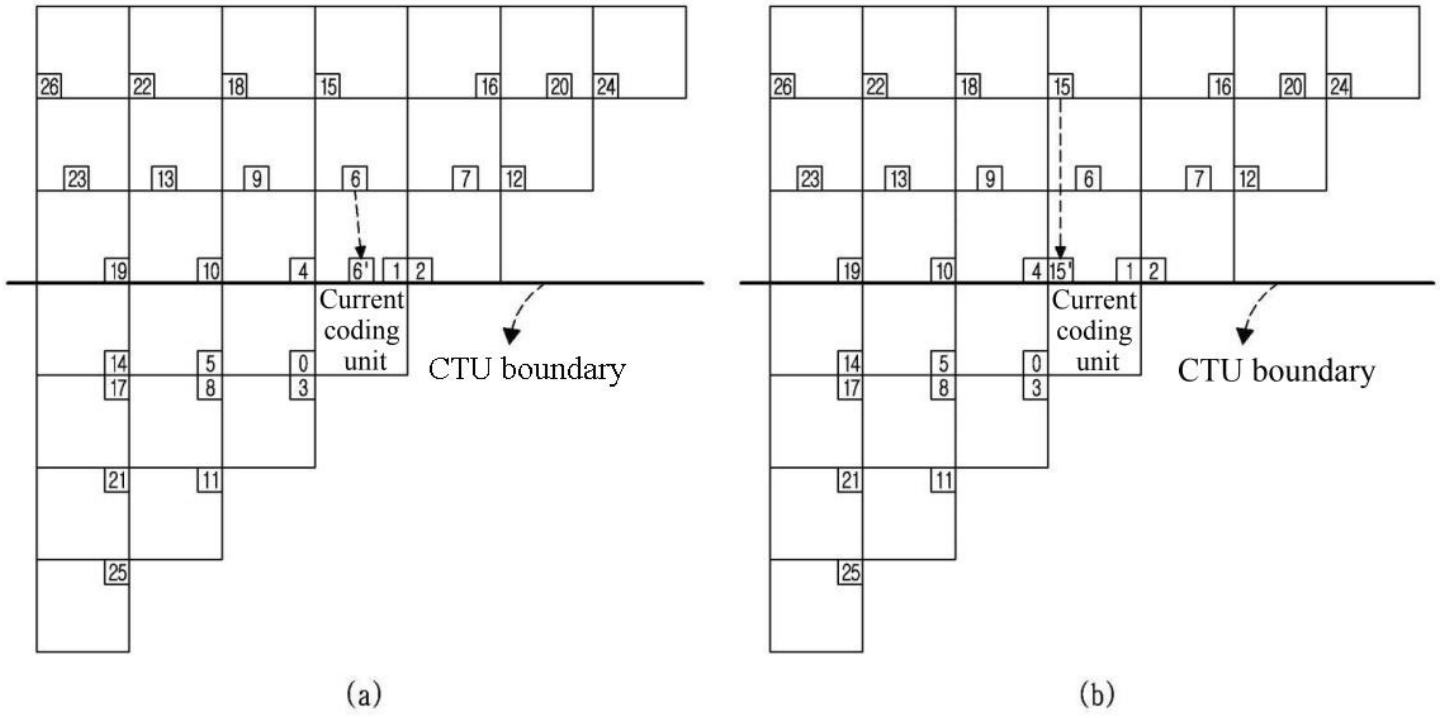

26
22
18
15
16
20
24
23
13
9
6
7
12
19
10
4
6'
1
2
Current coding unit
CTU boundary
14
17
5
8
0
3
21
11
25
(a)
26
22
18
15
16
20
24
23
13
9
6
7
12
19
10
4
15'
1
2
Current coding unit
CTU boundary
14
17
5
8
0
3
21
11
25
(b)

Fig. 15

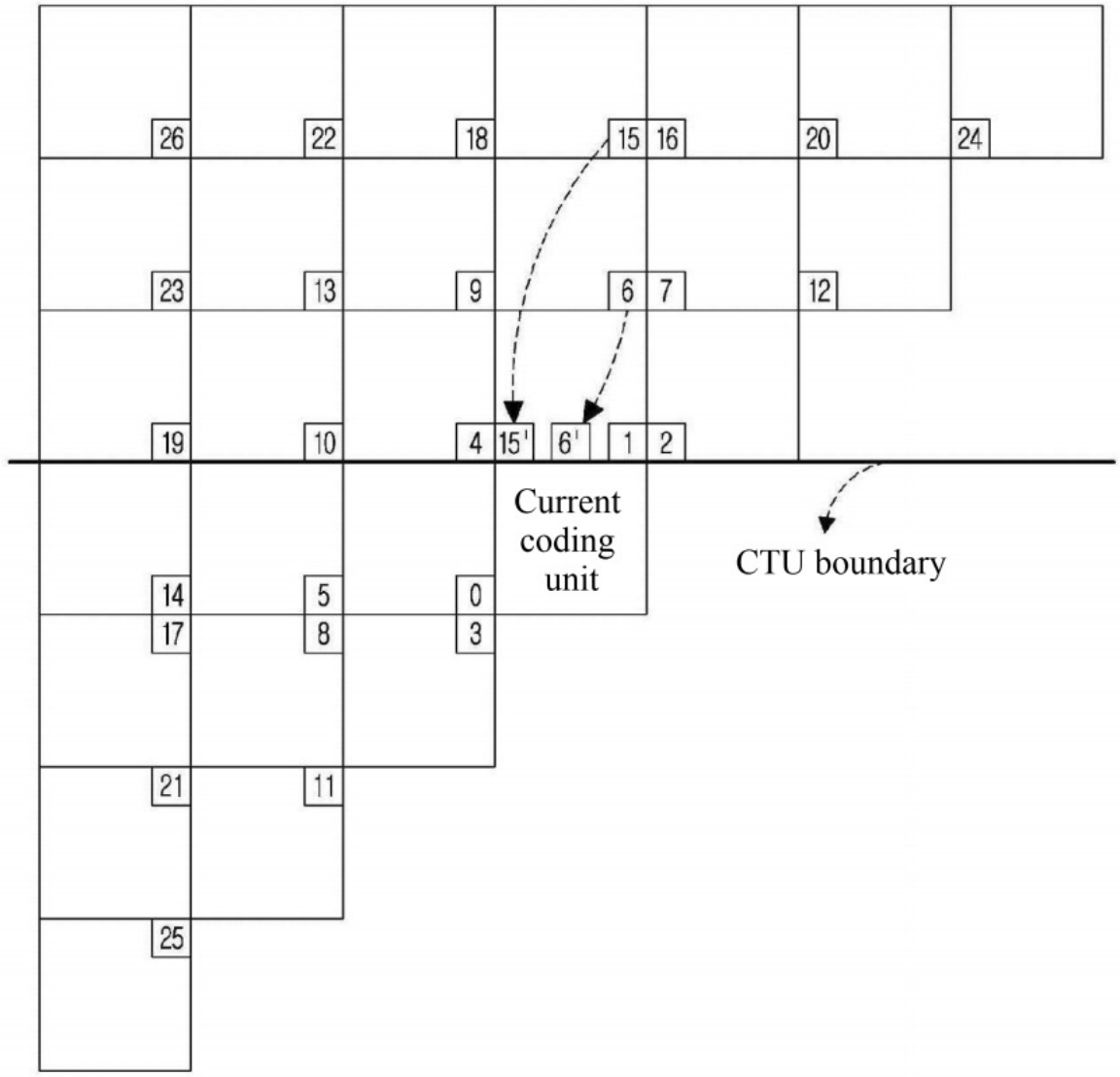

26
22
18
15
16
20
24
23
13
9
6
7
12
19
10
4
15'
6'
1
2
Current coding unit
CTU boundary
14
5
0
17
8
3
21
11
25

Fig. 16

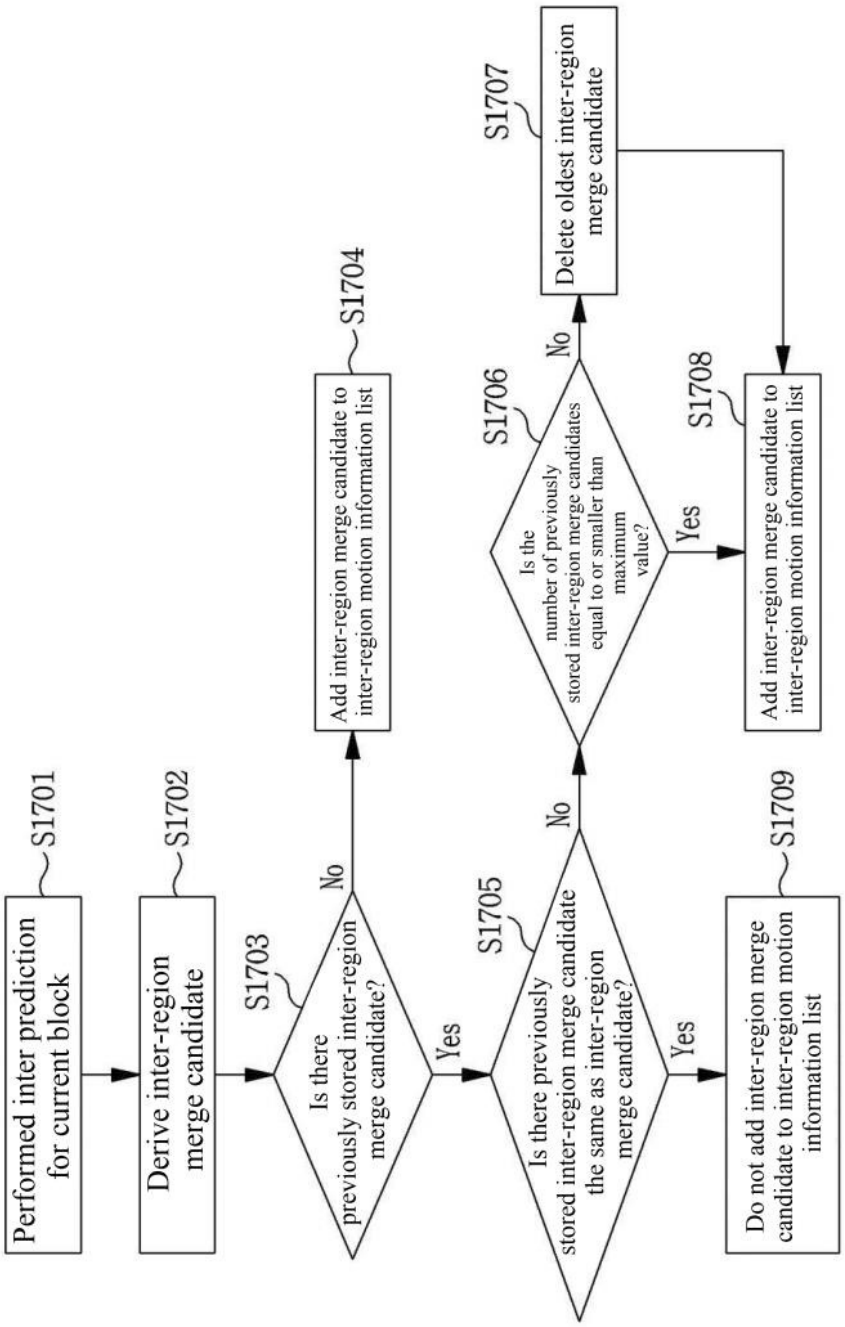

Performed inter prediction for current block
S1701
Derive inter-region merge candidate
S1702
Is there previously stored inter-region merge candidate?
S1703
No
Yes
Add inter-region merge candidate to inter-region motion information list
S1704
Is there previously stored inter-region merge candidate the same as inter-region merge candidate?
S1705
No
Yes
Do not add inter-region merge candidate to inter-region motion information list
S1709
Is the number of previously stored inter-region merge candidates equal to or smaller than maximum value?
S1706
No
Yes
Delete oldest inter-region merge candidate
S1707
Add inter-region merge candidate to inter-region motion information list
S1708

Fig. 17

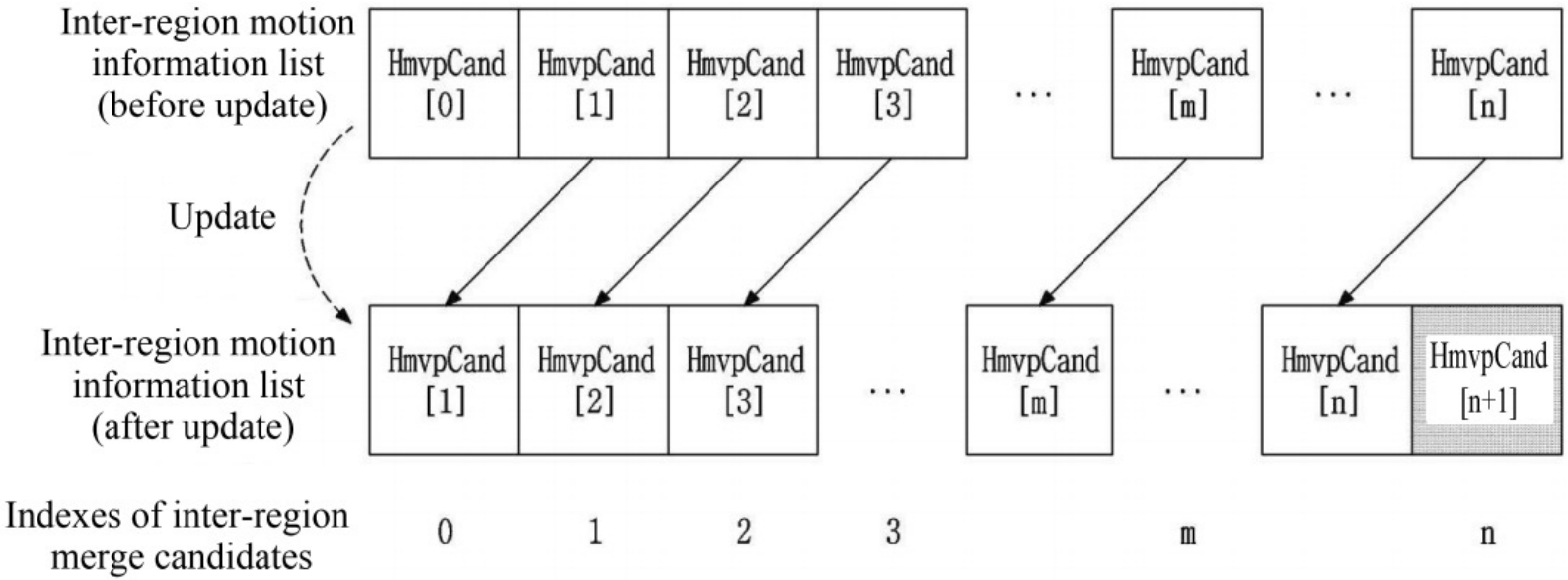

Inter-region motion information list (before update)
HmvpCand [0]
HmvpCand [1]
HmvpCand [2]
HmvpCand [3]
HmvpCand [m]
HmvpCand [n]
Update
Inter-region motion information list (after update)
HmvpCand [1]
HmvpCand [2]
HmvpCand [3]
HmvpCand [m]
HmvpCand [n]
HmvpCand [n+1]
Indexes of inter-region merge candidates
0
1
2
3
m
n

Fig. 18

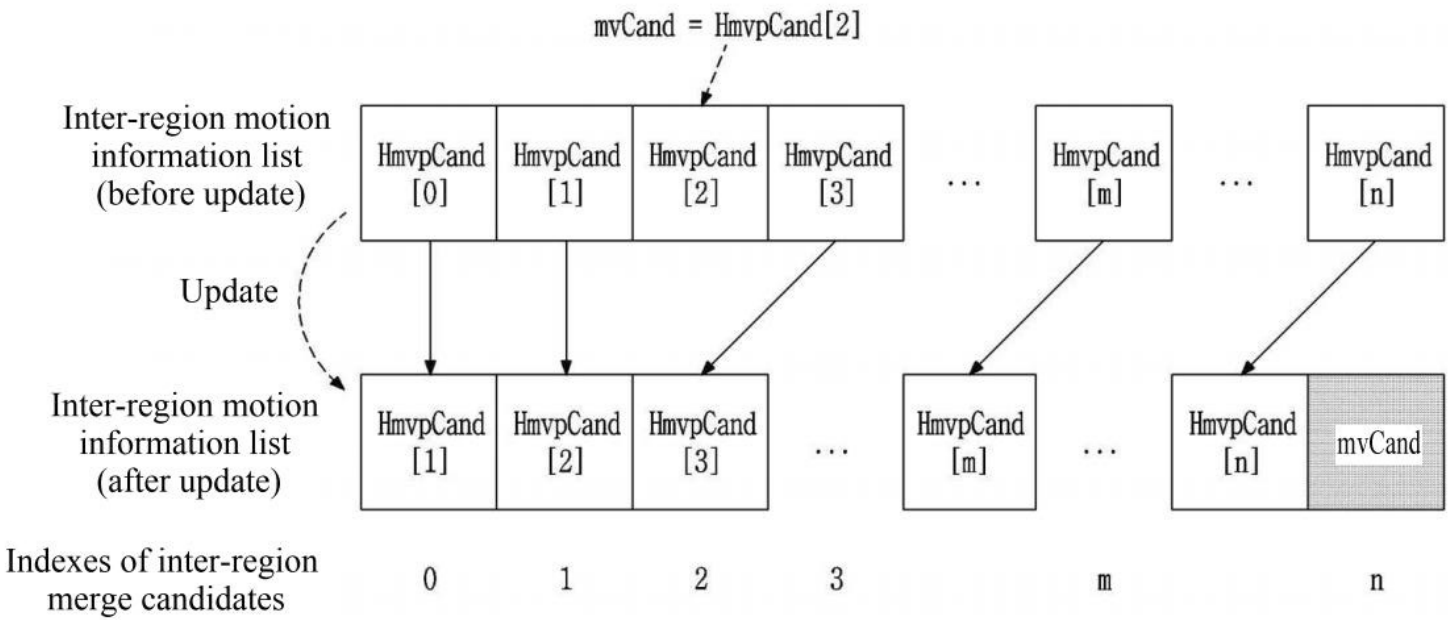

mvCand = HmvpCand[2]
Inter-region motion information list (before update)
HmvpCand [0]
HmvpCand [1]
HmvpCand [2]
HmvpCand [3]
HmvpCand [m]
HmvpCand [n]
Update
Inter-region motion information list (after update)
HmvpCand [1]
HmvpCand [2]
HmvpCand [3]
HmvpCand [m]
HmvpCand [n]
mvCand
Indexes of inter-region merge candidates
0
1
2
3
m
n

Fig. 19

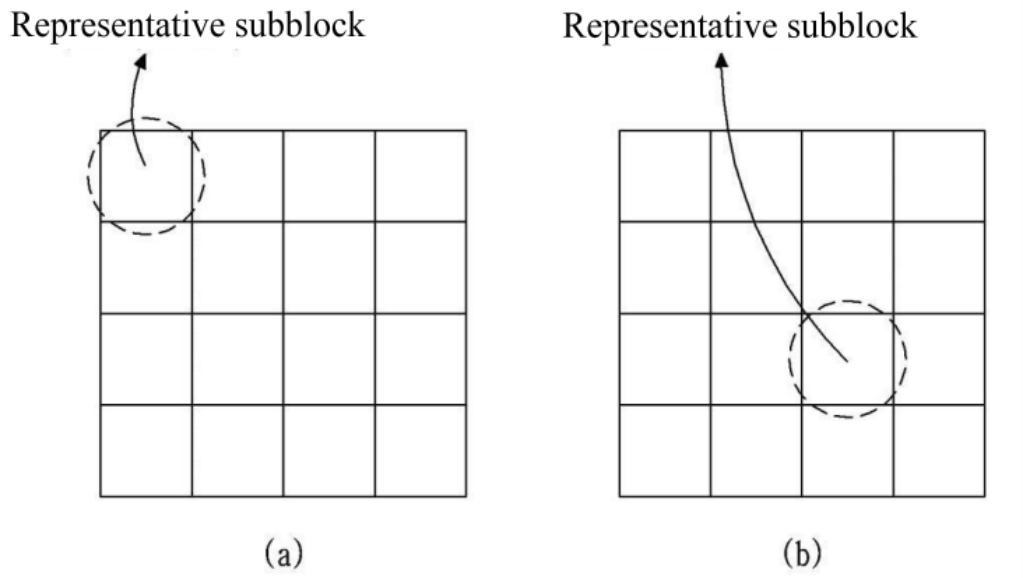


Fig. 20

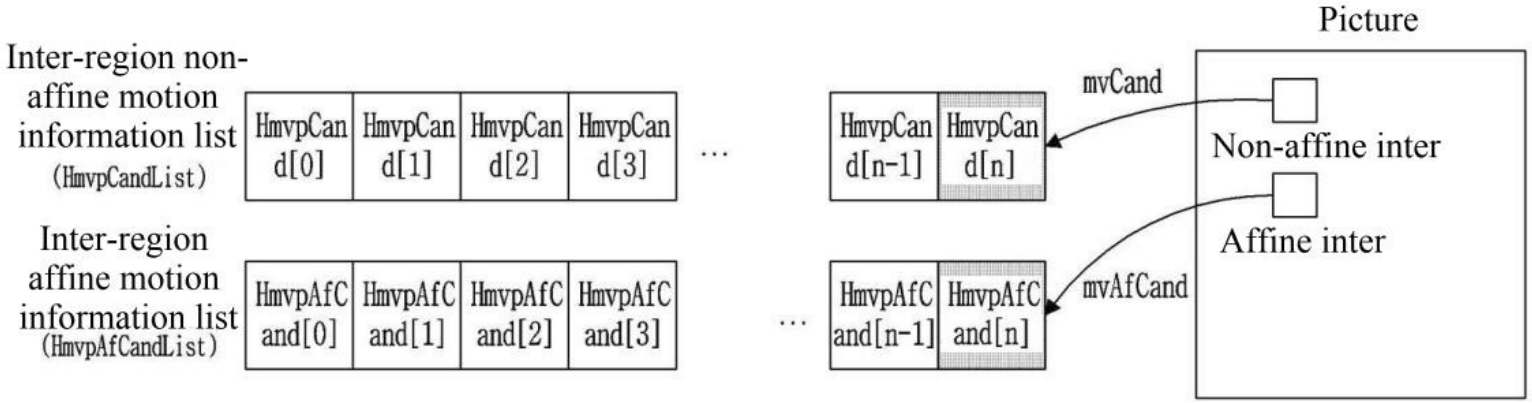

Inter-region non-affine motion information list
(HmvpCandList)
HmvpCand[0]
HmvpCand[1]
HmvpCand[2]
HmvpCand[3]
...
HmvpCand[n-1]
HmvpCand[n]
Inter-region affine motion information list
(HmvpAfCandList)
HmvpAfCand[0]
HmvpAfCand[1]
HmvpAfCand[2]
HmvpAfCand[3]
...
HmvpAfCand[n-1]
HmvpAfCand[n]
mvCand
mvAfCand
Picture
Non-affine inter
Affine inter

Fig. 21

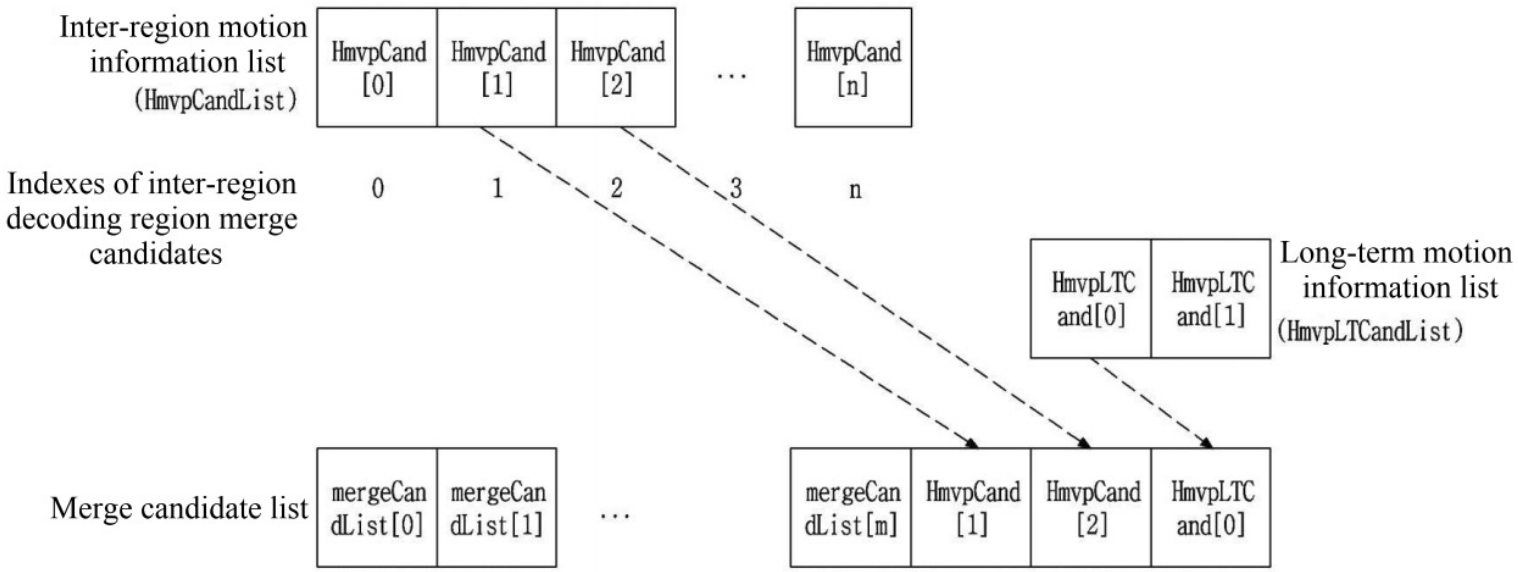

Inter-region motion information list (HmvpCandList)
HmvpCand [0]
HmvpCand [1]
HmvpCand [2]
...
HmvpCand [n]
Indexes of inter-region decoding region merge candidates
0
1
2
3
n
HmvpLTCand[0]
HmvpLTCand[1]
Long-term motion information list (HmvpLTCandList)
Merge candidate list
mergeCandList[0]
mergeCandList[1]
...
mergeCandList[m]
HmvpCand [1]
HmvpCand [2]
HmvpLTCand[0]

Fig. 22

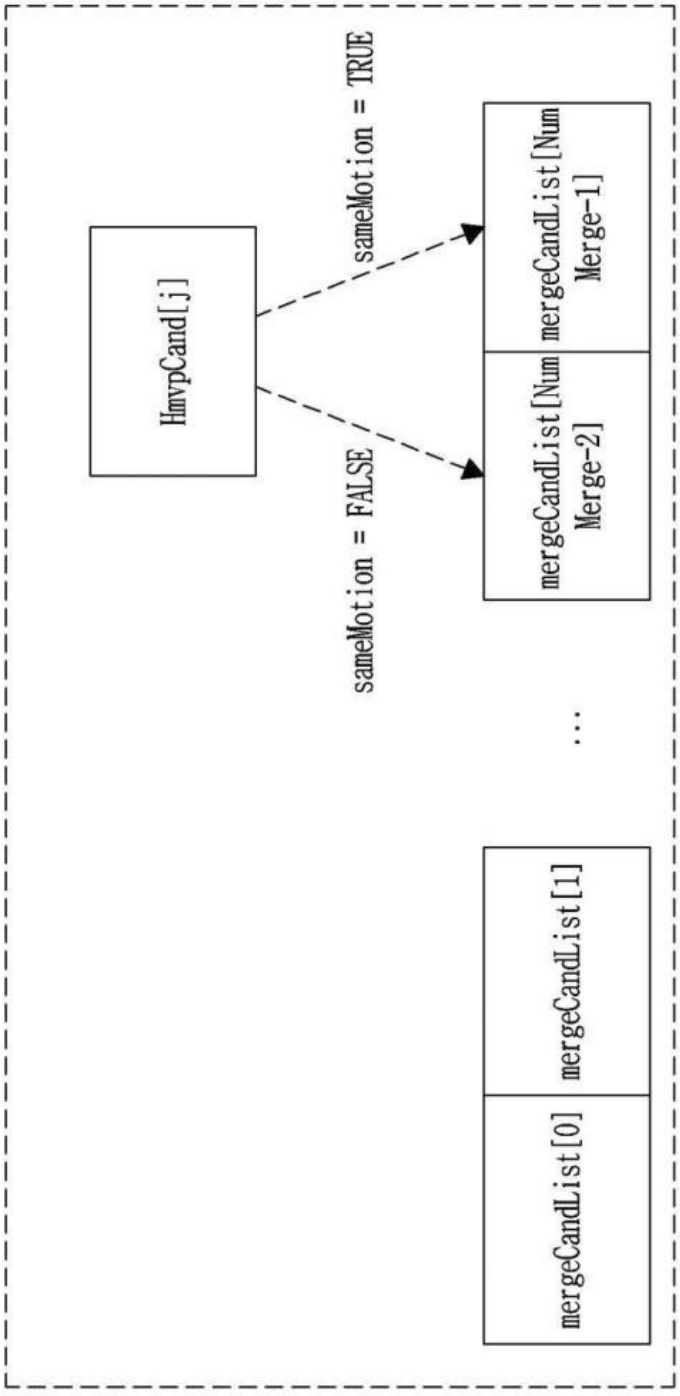

HmvpCand[j]
sameMotion = TRUE
sameMotion = FALSE
mergeCandList[Num Merge-1]
mergeCandList[Num Merge-2]
...
mergeCandList[1]
mergeCandList[0]

Fig. 23

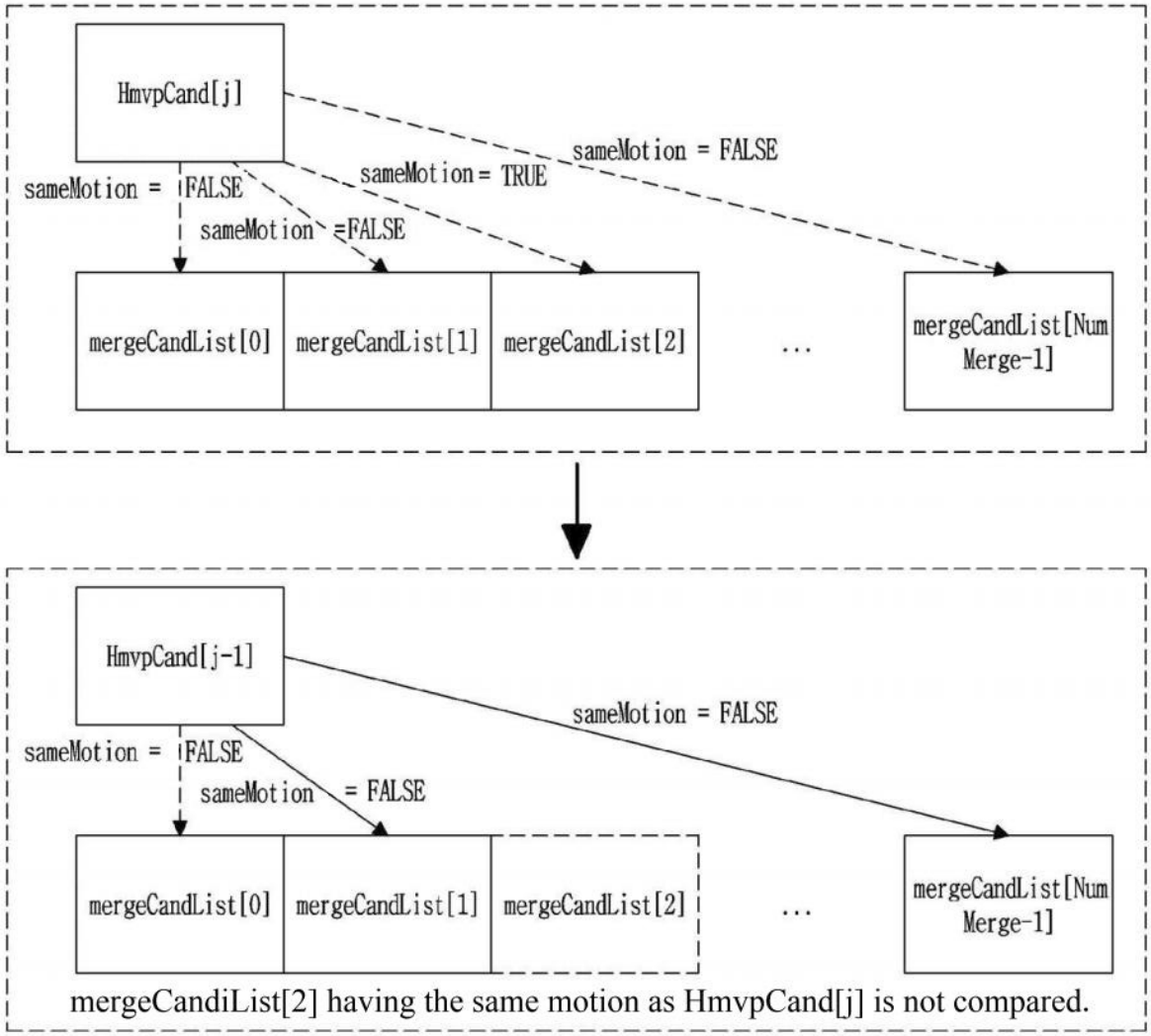

HmvpCand[j]
sameMotion = FALSE
sameMotion = FALSE
sameMotion = TRUE
sameMotion = FALSE
mergeCandList[0]
mergeCandList[1]
mergeCandList[2]
...
mergeCandList[NumMerge-1]
HmvpCand[j-1]
sameMotion = FALSE
sameMotion = FALSE
sameMotion = FALSE
mergeCandList[0]
mergeCandList[1]
mergeCandList[2]
...
mergeCandList[NumMerge-1]
mergeCandiList[2] having the same motion as HmvpCand[j] is not compared.

Fig. 24

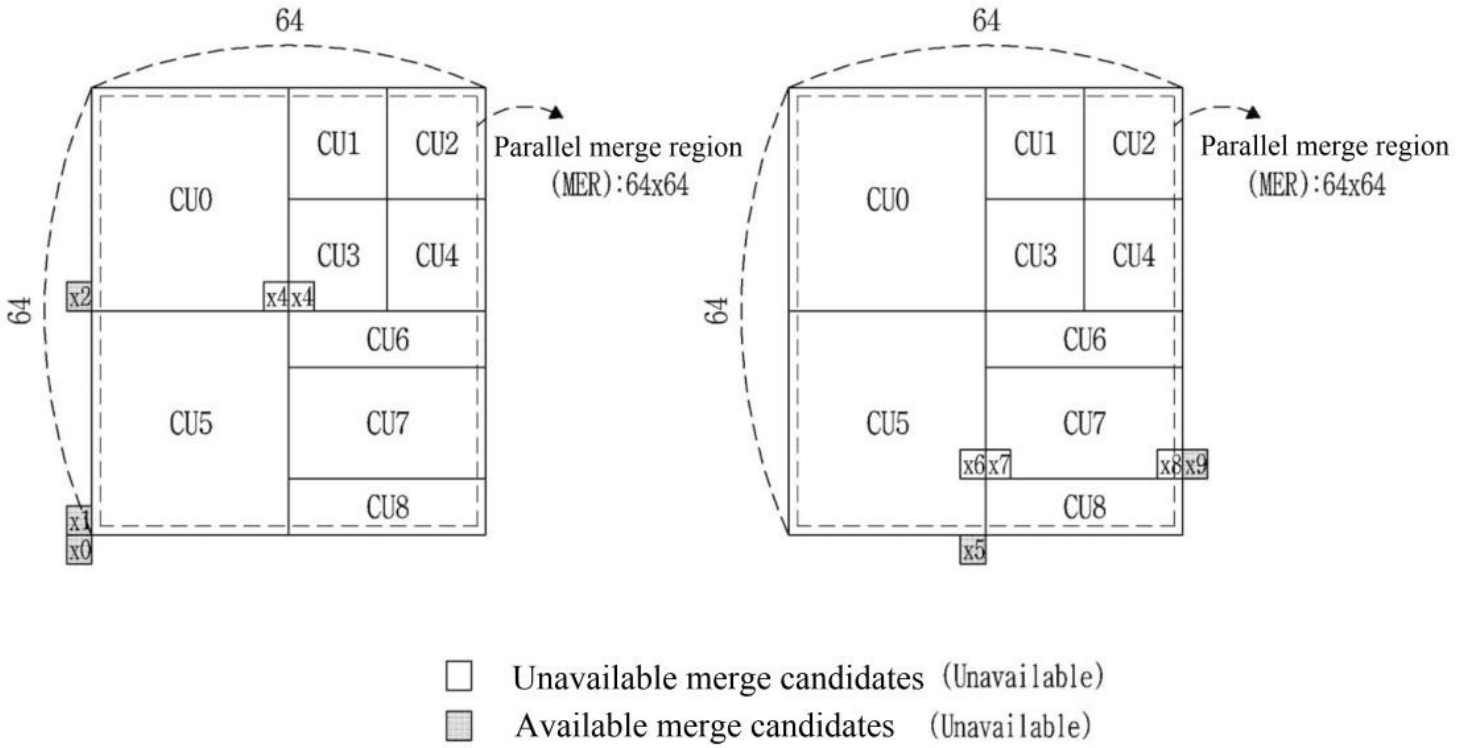

64
64
CU0
CU1
CU2
CU3
CU4
CU5
CU6
CU7
CU8
Parallel merge region
(MER):64x64
x0
x1
x2
x4
x4
x5
x6
x7
x8
x9
Unavailable merge candidates (Unavailable)
Available merge candidates (Unavailable)

Fig. 25

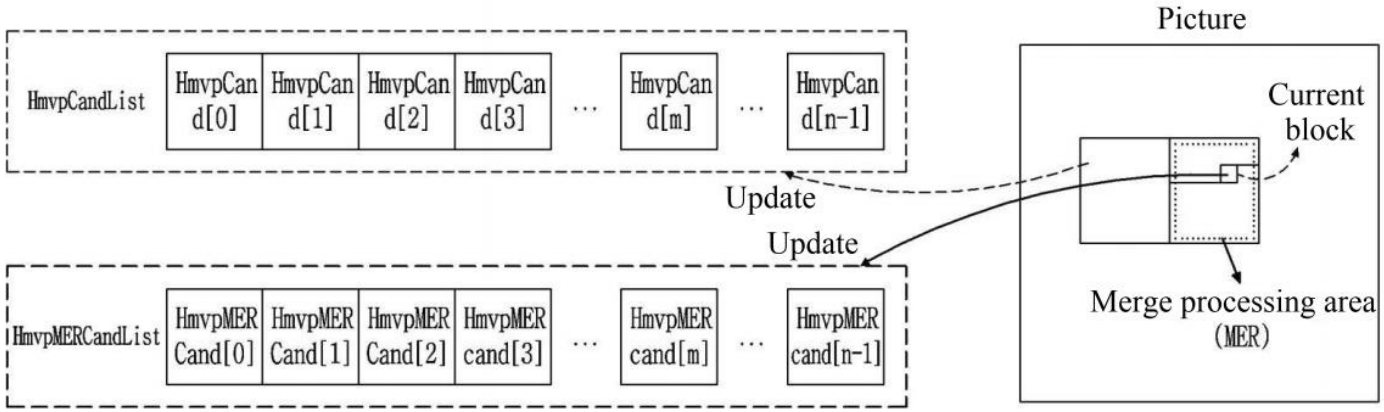

HmvpCandList
HmvpCand d[0]
HmvpCand d[1]
HmvpCand d[2]
HmvpCand d[3]
HmvpCand d[m]
HmvpCand d[n-1]
Update
Update
HmvpMERCandList
HmvpMER Cand[0]
HmvpMER Cand[1]
HmvpMER Cand[2]
HmvpMER cand[3]
HmvpMER cand[m]
HmvpMER cand[n-1]
Picture
Current block
Merge processing area (MER)

Fig. 26

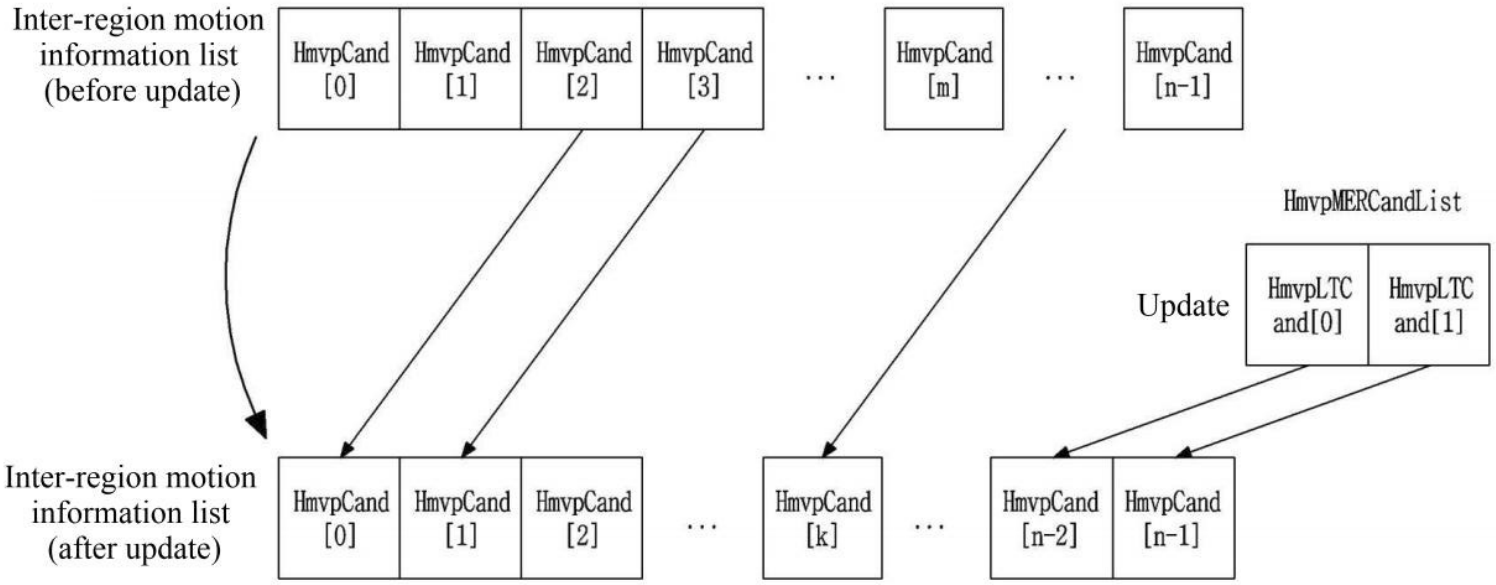

Inter-region motion information list (before update)
HmvpCand [0]
HmvpCand [1]
HmvpCand [2]
HmvpCand [3]
HmvpCand [m]
HmvpCand [n-1]
HmvpMERCandList
Update
HmvpLTC and[0]
HmvpLTC and[1]
Inter-region motion information list (after update)
HmvpCand [0]
HmvpCand [1]
HmvpCand [2]
HmvpCand [k]
HmvpCand [n-2]
HmvpCand [n-1]

Fig. 27

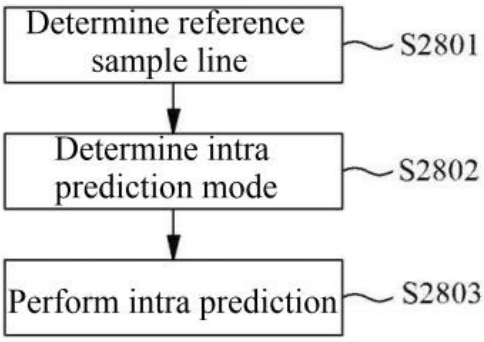

Determine reference sample line
S2801
Determine intra prediction mode
S2802
Perform intra prediction
S2803

Fig. 28

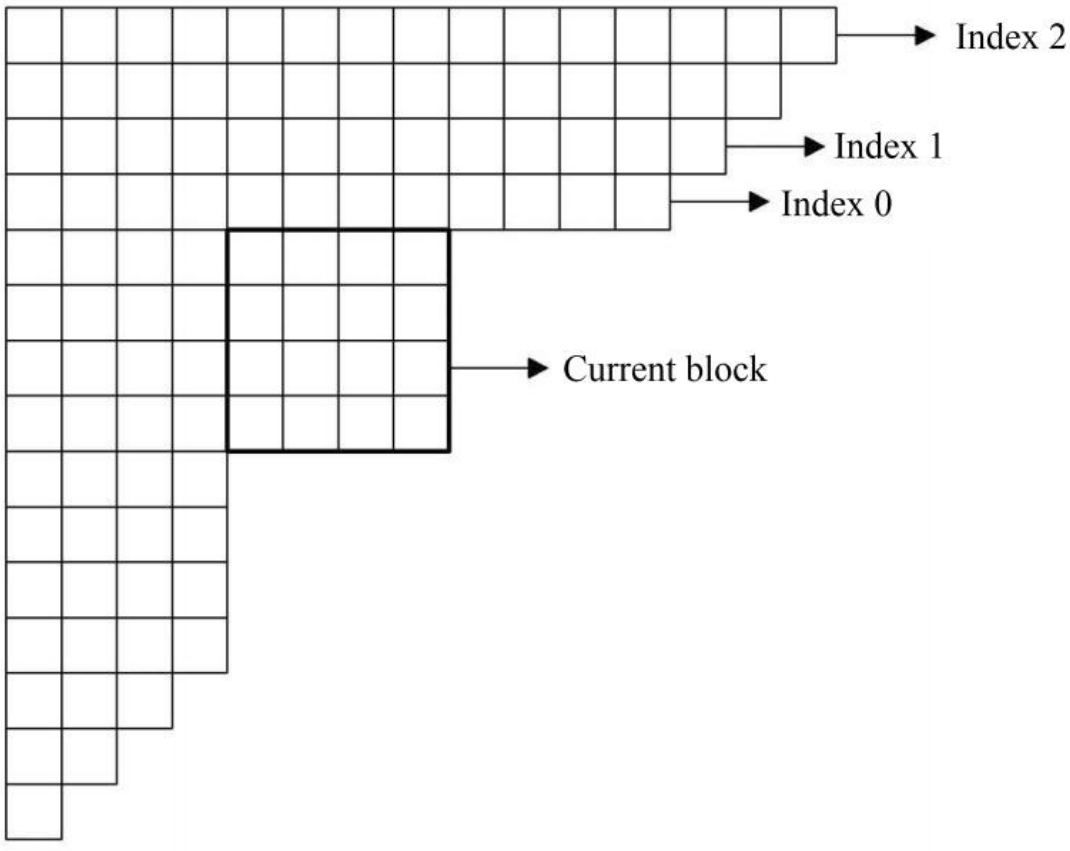

Index 2
Index 1
Index 0
Current block

Fig. 29

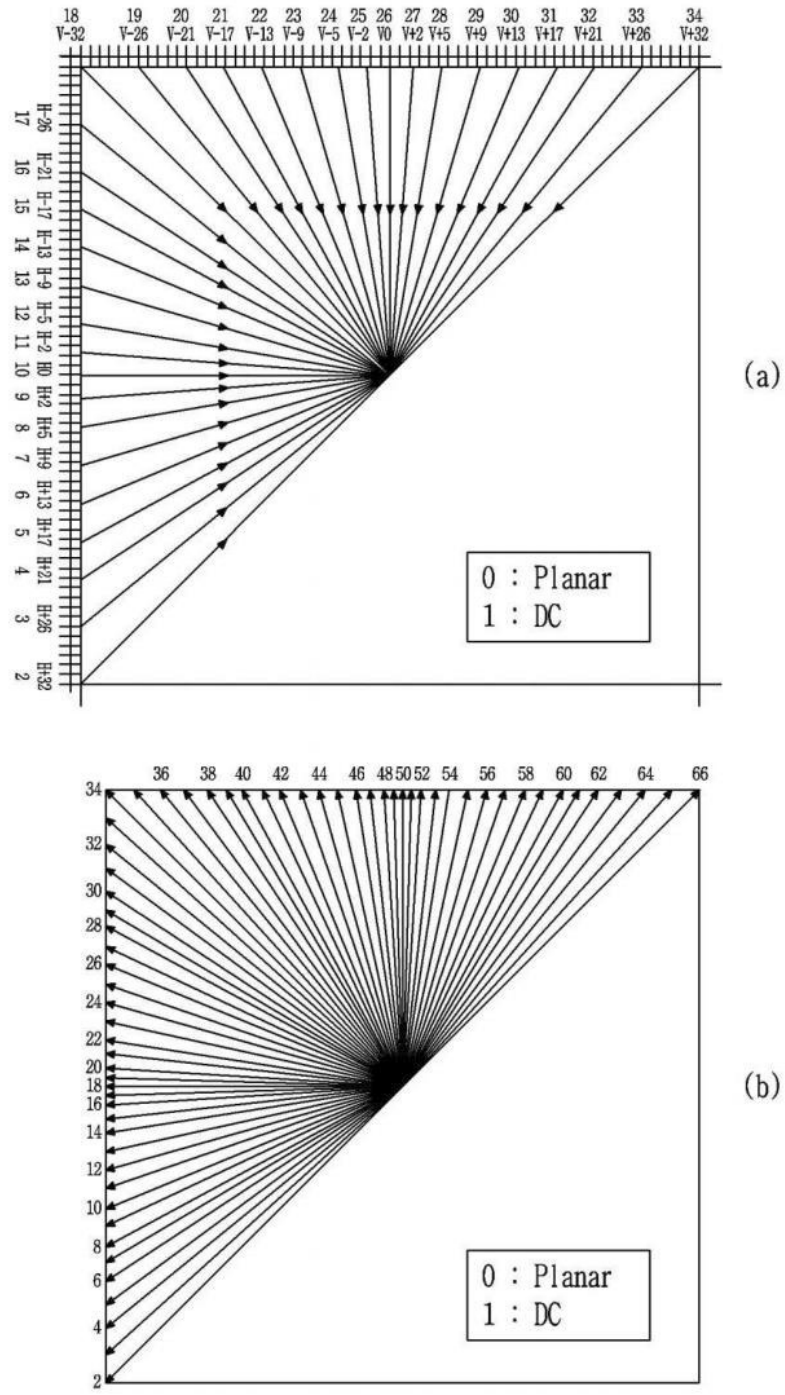

18 V-32
19 V-26
20 V-21
21 V-17
22 V-13
23 V-9
24 V-5
25 V-2
26 V0
27 V+2
28 V+5
29 V+9
30 V+13
31 V+17
32 V+21
33 V+26
34 V+32
17 H-26
16 H-21
15 H-17
14 H-13
13 H-9
12 H-5
11 H-2
10 H0
9 H+2
8 H+5
7 H+9
6 H+13
5 H+17
4 H+21
3 H+26
2 H+32
0 : Planar
1 : DC
(a)
36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66
34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2
0 : Planar
1 : DC
(b)

Fig. 30

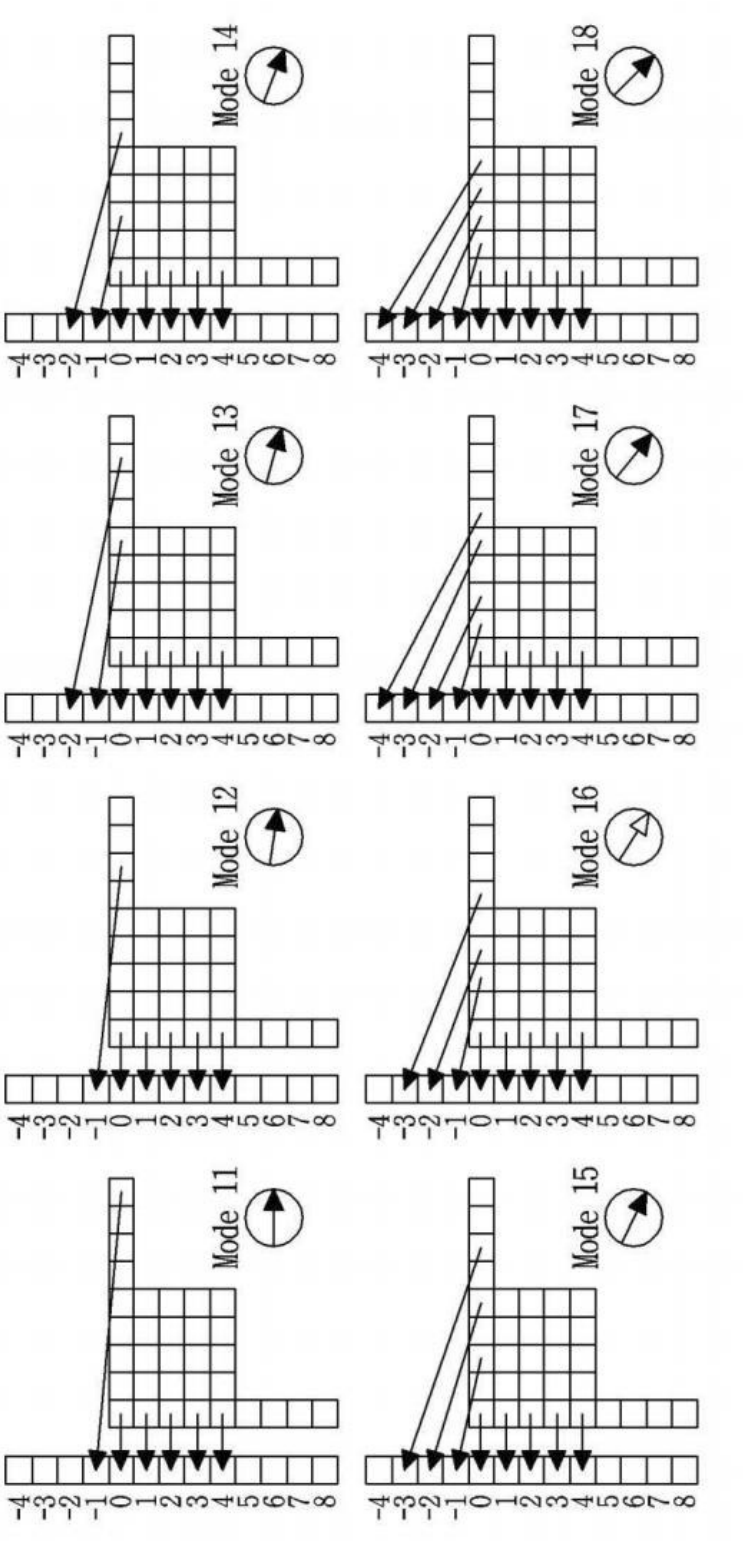

Mode 11
Mode 12
Mode 13
Mode 14
Mode 15
Mode 16
Mode 17
Mode 18
-4 -3 -2 -1 0 1 2 3 4 5 6 7 8

Fig. 31

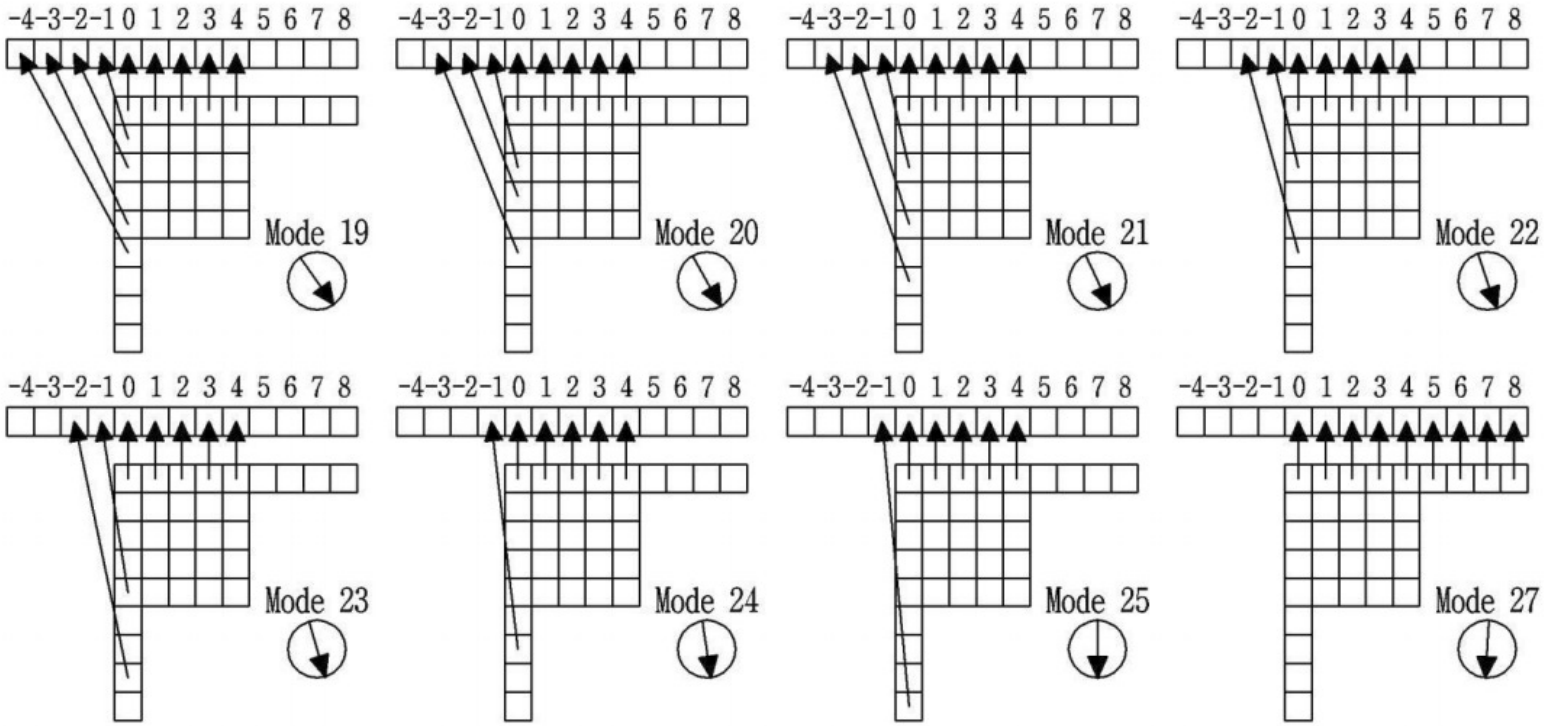

-4-3-2-1 0 1 2 3 4 5 6 7 8
Mode 19
Mode 20
Mode 21
Mode 22
Mode 23
Mode 24
Mode 25
Mode 27

Fig. 32

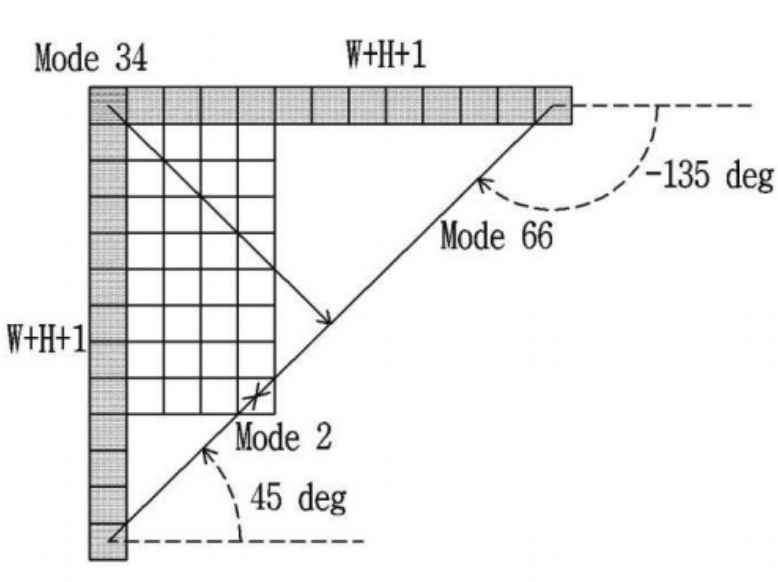


Fig. 33

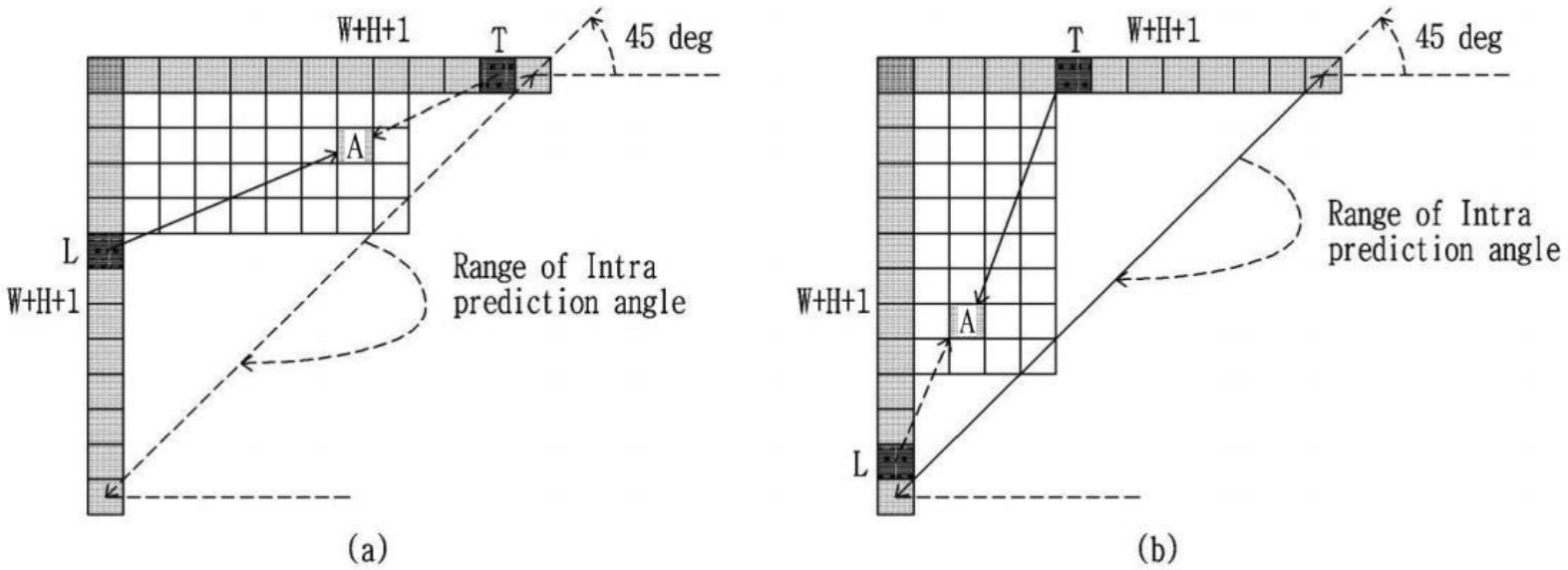

W+H+1
T
45 deg
A
L
W+H+1
Range of Intra
prediction angle
(a)
T
W+H+1
45 deg
Range of Intra
prediction angle
W+H+1
A
L
(b)

Fig. 34

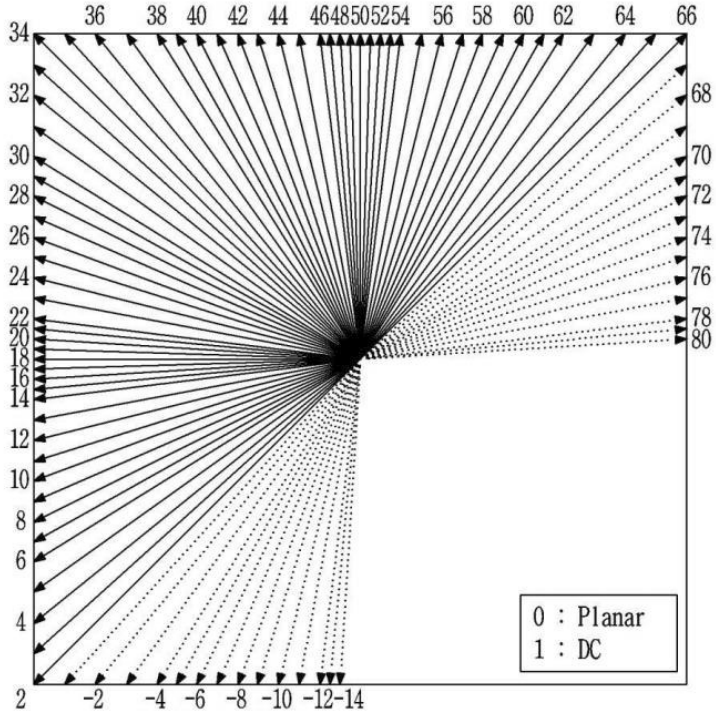

36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66
34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2
68 70 72 74 76 78 80
-2 -4 -6 -8 -10 -12 -14
0 : Planar
1 : DC

Fig. 35

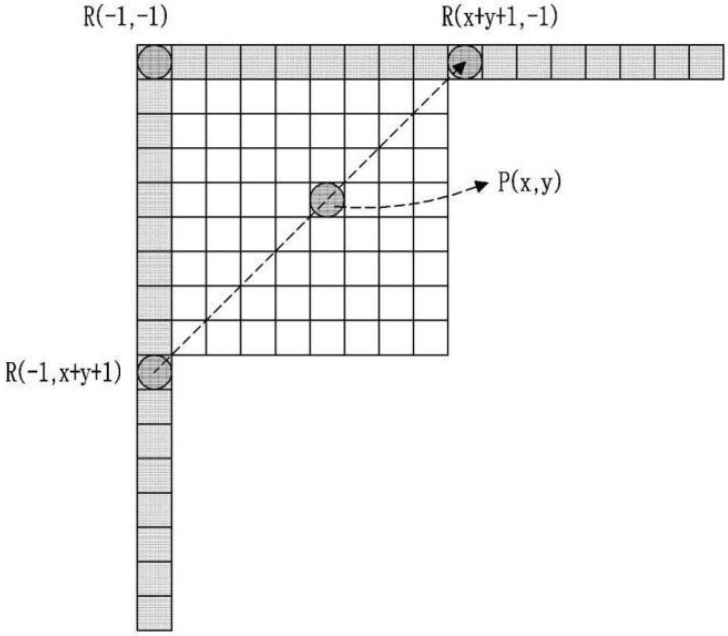

R(-1,-1)
R(x+y+1,-1)
P(x,y)
R(-1,x+y+1)

Fig. 36

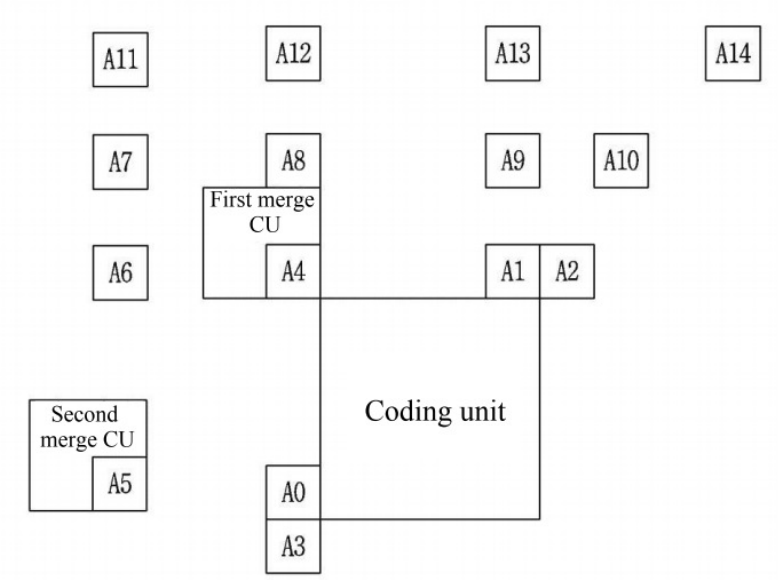


Fig. 37

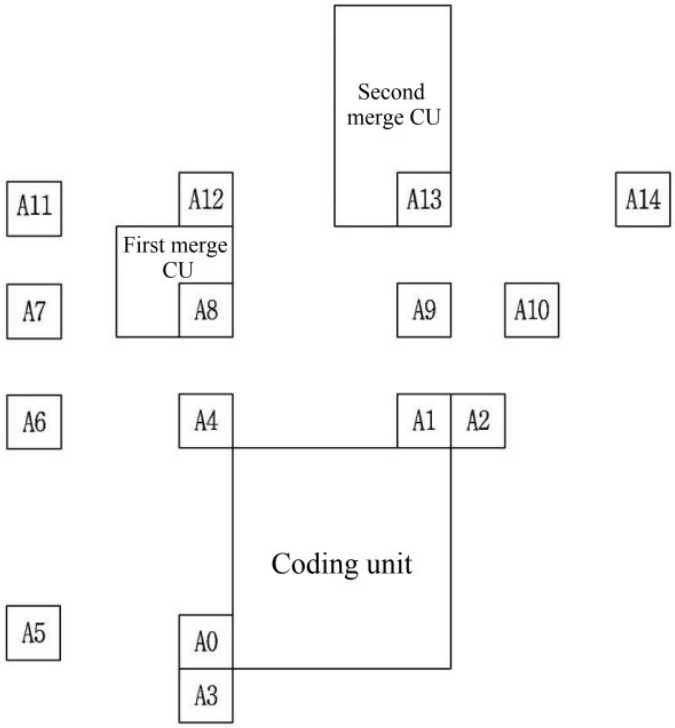


Fig. 38

z

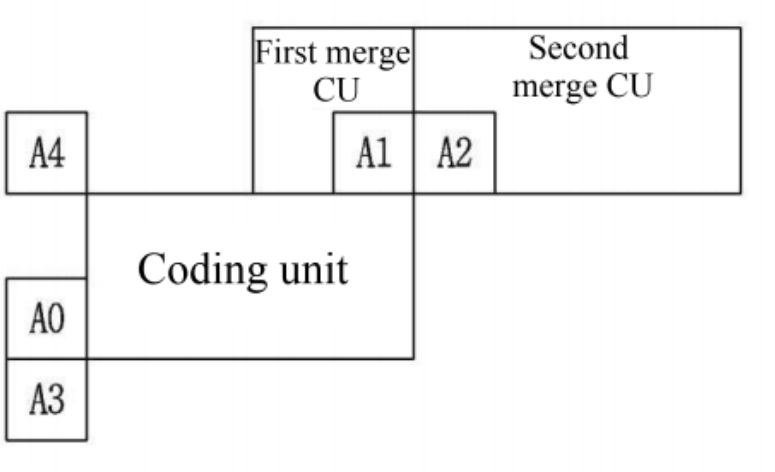


Fig. 39

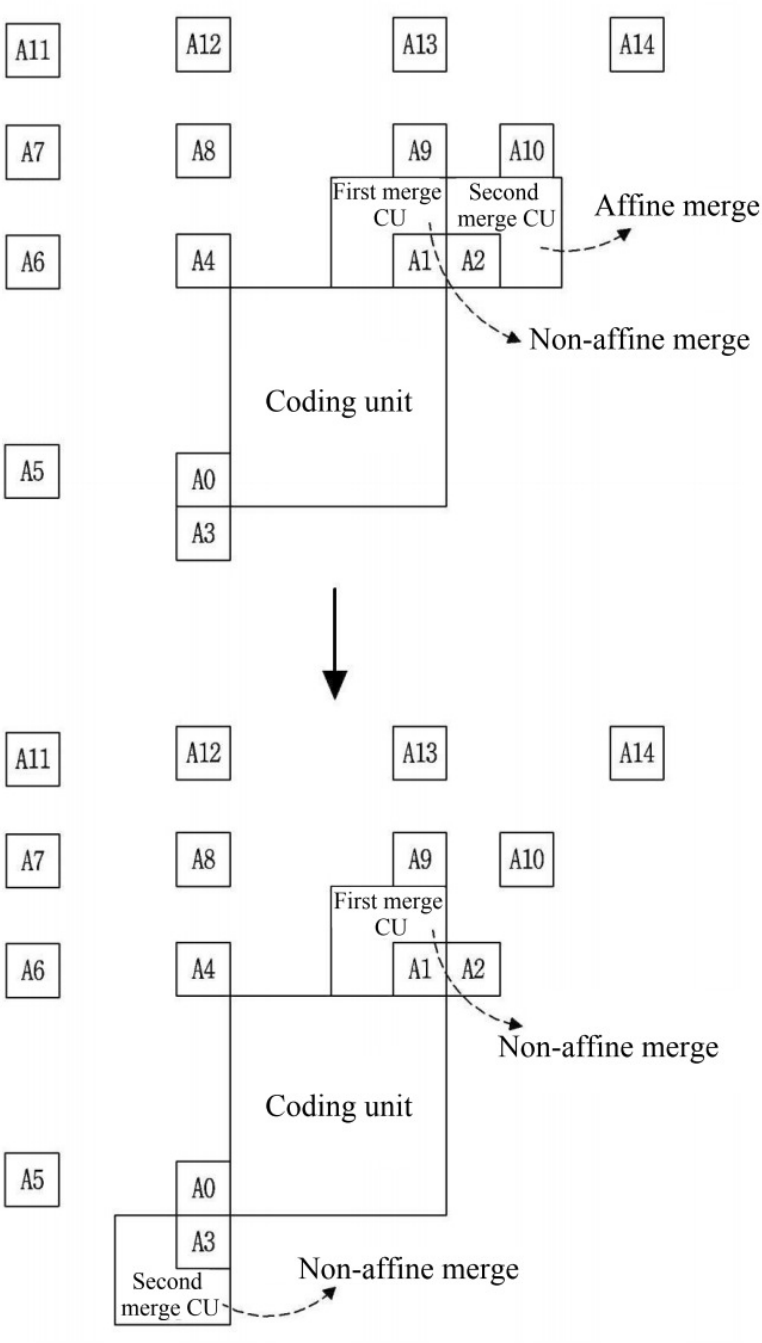

A11
A12
A13
A14
A7
A8
A9
A10
First merge CU
Second merge CU
Affine merge
A6
A4
A1
A2
Non-affine merge
Coding unit
A5
A0
A3
A11
A12
A13
A14
A7
A8
A9
A10
First merge CU
A6
A4
A1
A2
Non-affine merge
Coding unit
A5
A0
A3
Second merge CU
Non-affine merge

Fig. 40

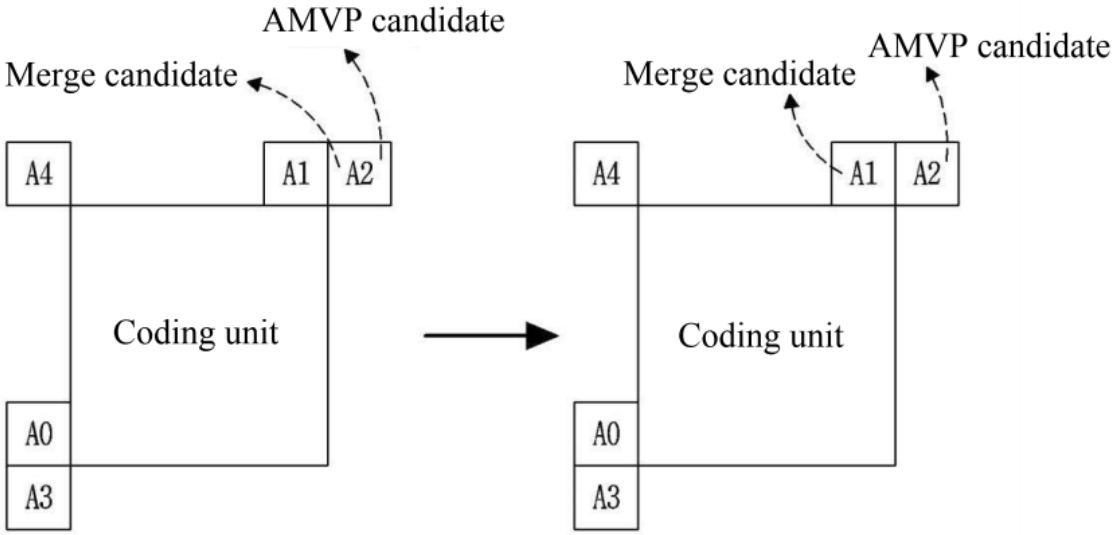

AMVP candidate
Merge candidate
A4
A1
A2
Coding unit
A0
A3
AMVP candidate
Merge candidate
A4
A1
A2
Coding unit
A0
A3

Fig. 41

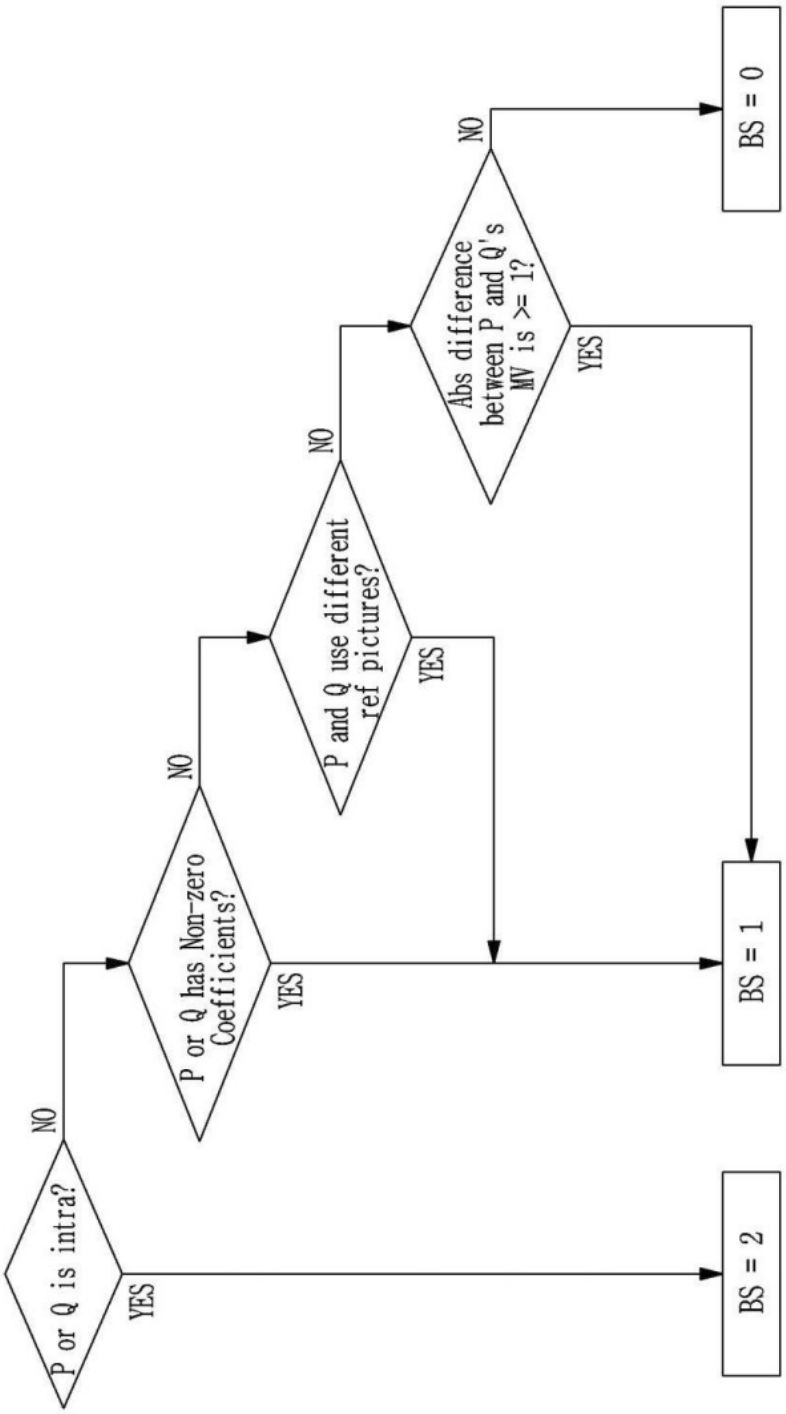

P or Q is intra?
NO
YES
BS = 2
P or Q has Non-zero Coefficients?
NO
YES
BS = 1
P and Q use different ref pictures?
NO
YES
Abs difference between P and Q's MV is >= 1?
NO
YES
BS = 0

Fig. 42

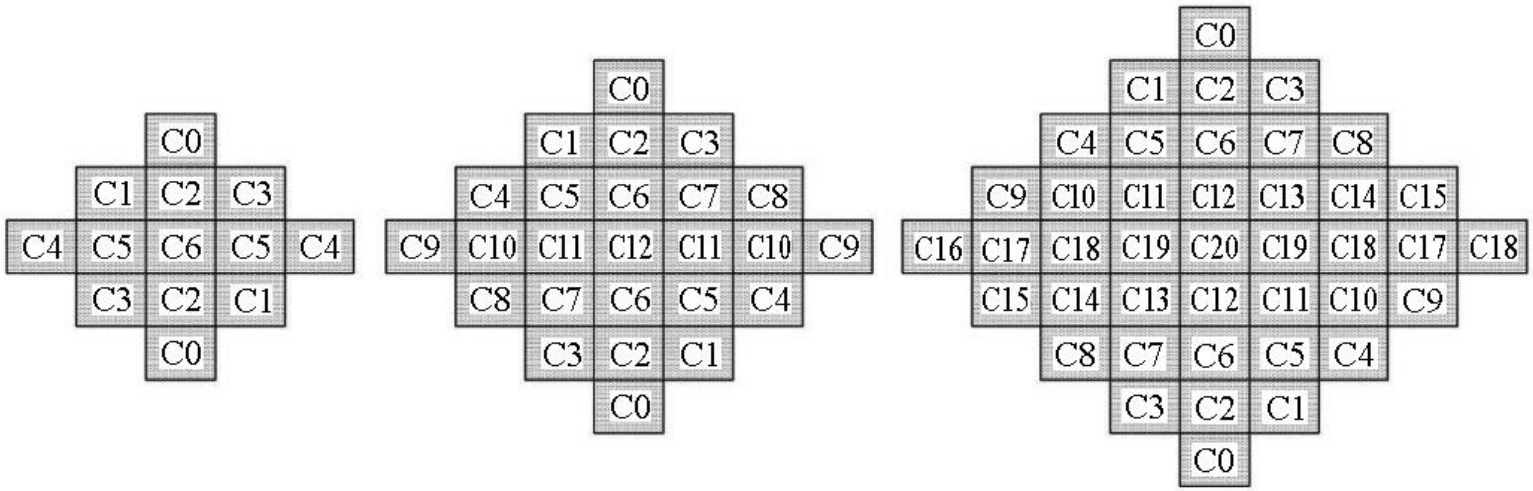

C0
C1 C2 C3
C4 C5 C6 C5 C4
C3 C2 C1
C0
C0
C1 C2 C3
C4 C5 C6 C7 C8
C9 C10 C11 C12 C11 C10 C9
C8 C7 C6 C5 C4
C3 C2 C1
C0
C0
C1 C2 C3
C4 C5 C6 C7 C8
C9 C10 C11 C12 C13 C14 C15
C16 C17 C18 C19 C20 C19 C18 C17 C18
C15 C14 C13 C12 C11 C10 C9
C8 C7 C6 C5 C4
C3 C2 C1
C0

Fig. 43