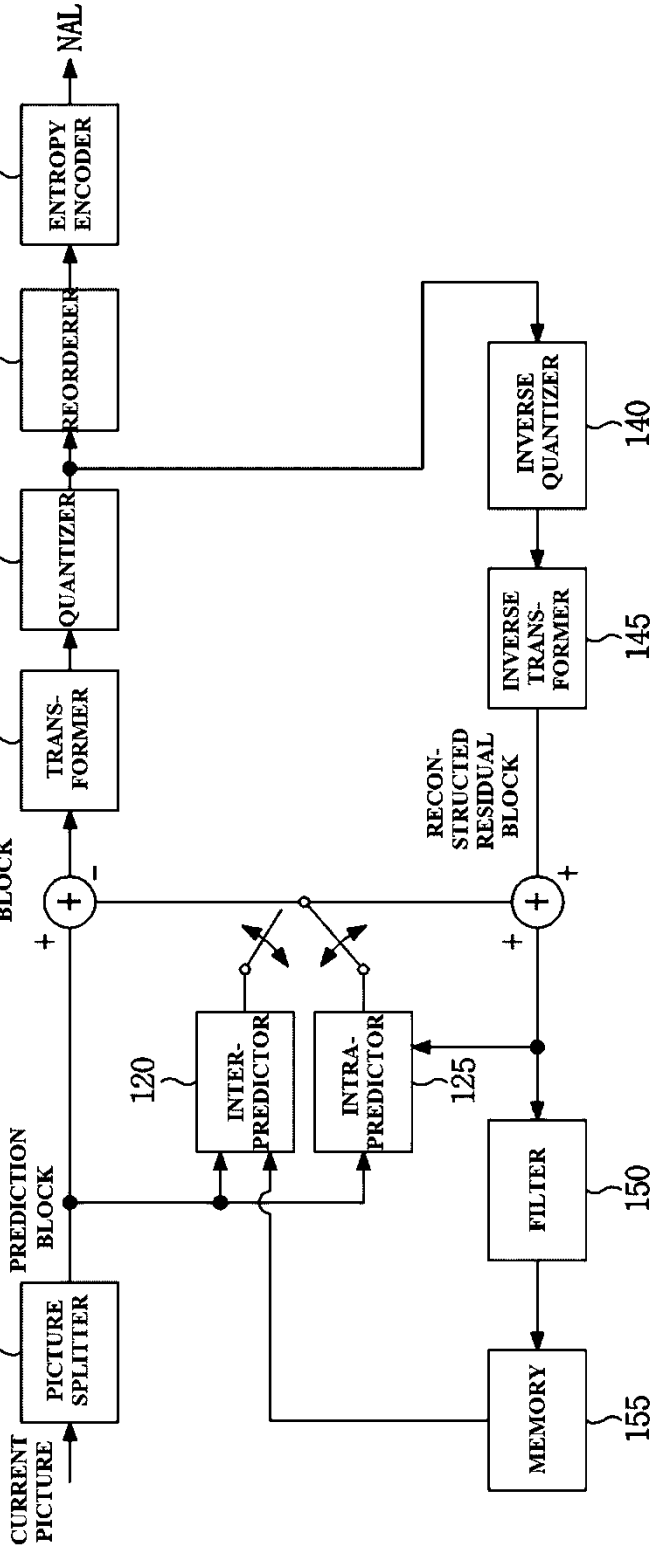

CURRENT PICTURE
110
PICTURE SPLITTER
PREDICTION BLOCK
120
INTER-PREDICTOR
INTRA-PREDICTOR
125
RESIDUAL BLOCK
130
TRANS-FORMER
135
QUANTIZER
160
REORDERER
165
ENTROPY ENCODER
NAL
RECON-STRUCTED RESIDUAL BLOCK
INVERSE QUANTIZER
140
INVERSE TRANS-FORMER
145
FILTER
150
MEMORY
155

FIG. 1

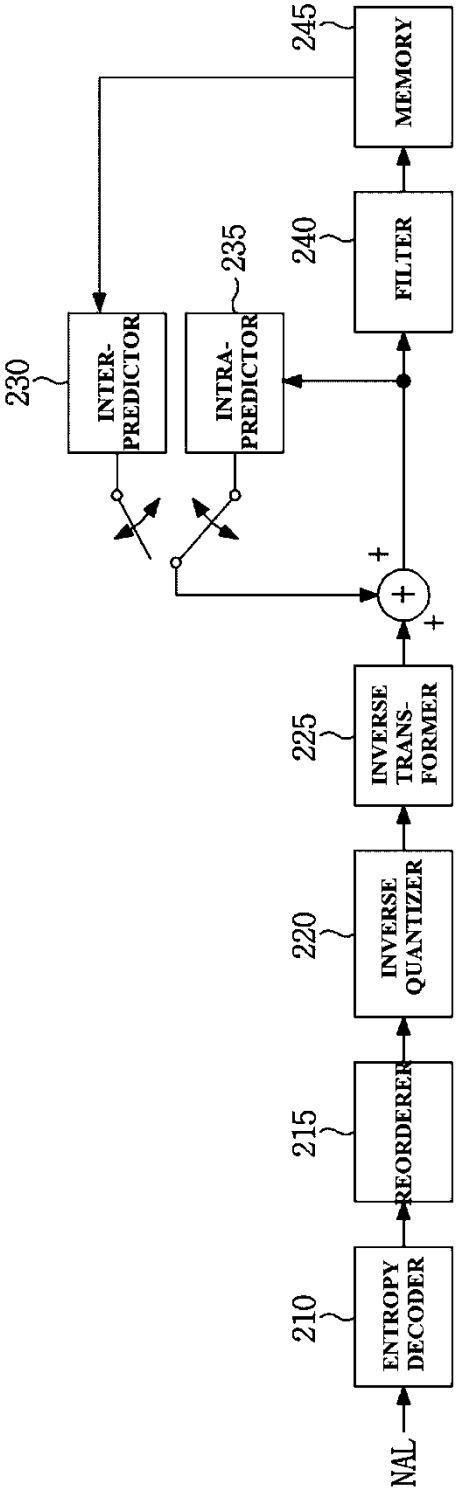

NAL
210
ENTROPY DECODER
215
REORDERER
220
INVERSE QUANTIZER
225
INVERSE TRANS-FORMER
230
INTER-PREDICTOR
235
INTRA-PREDICTOR
240
FILTER
245
MEMORY
+
+

FIG. 2

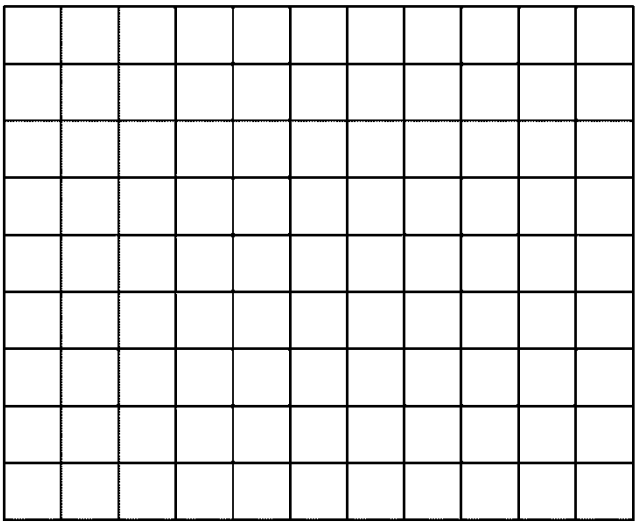


FIG. 3

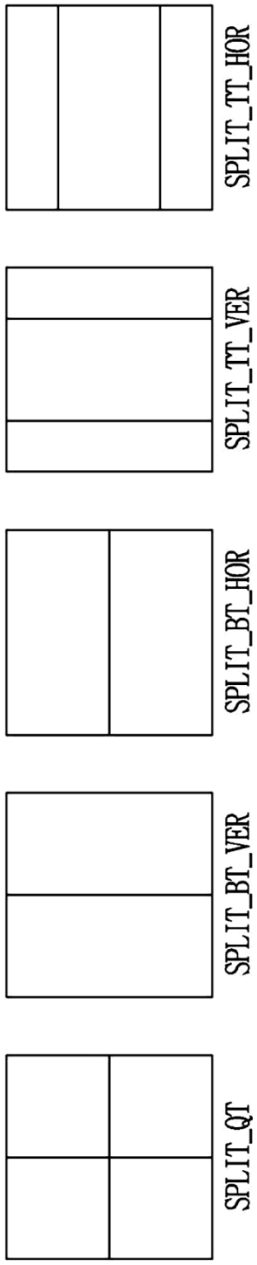


FIG. 4

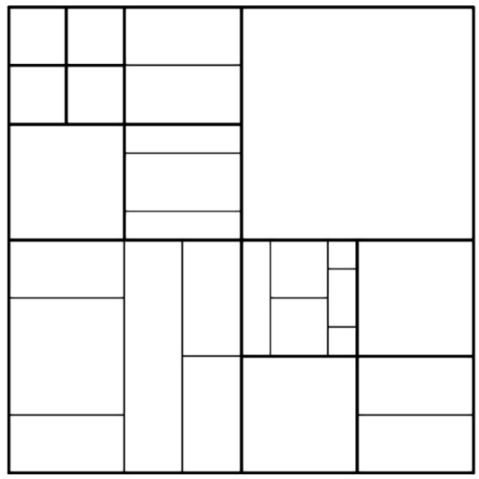


FIG. 5

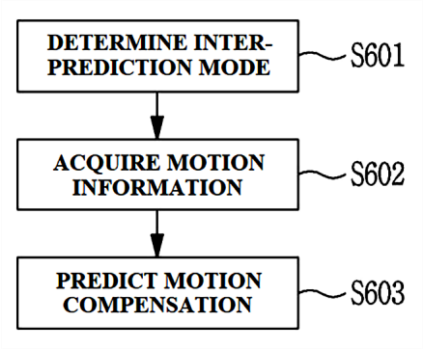


FIG. 6

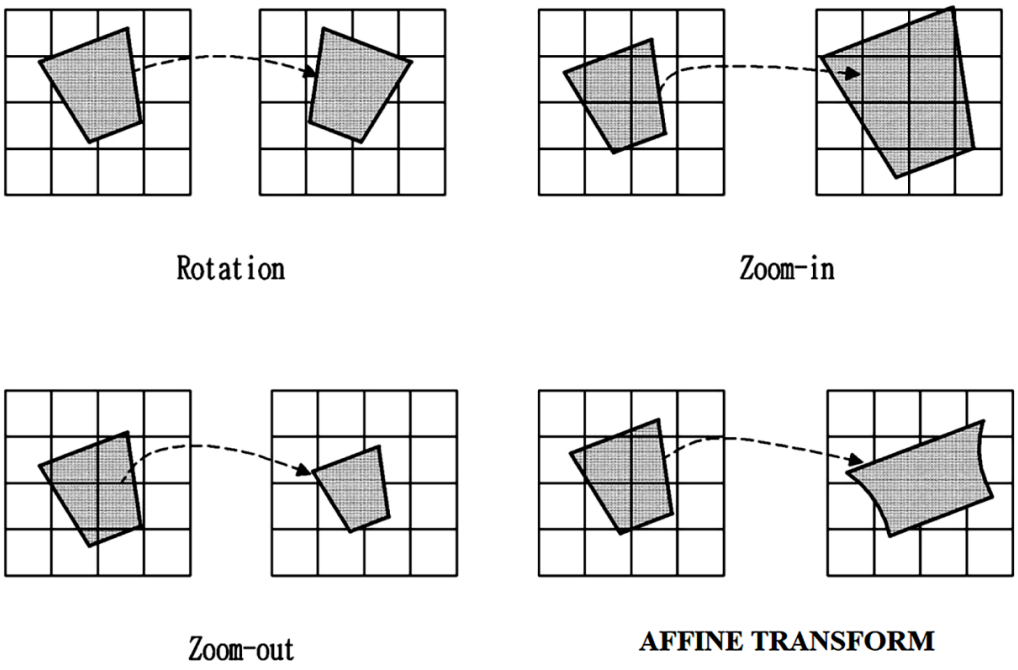


FIG. 7

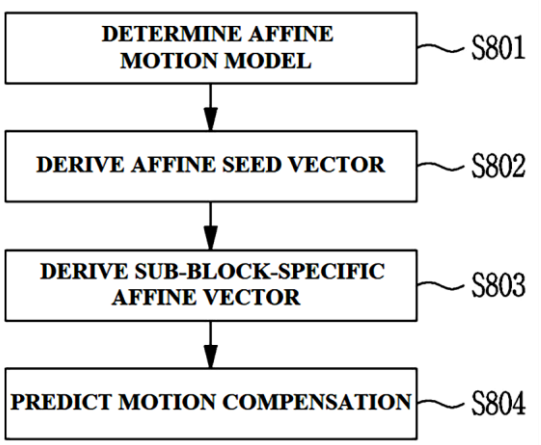


FIG. 8

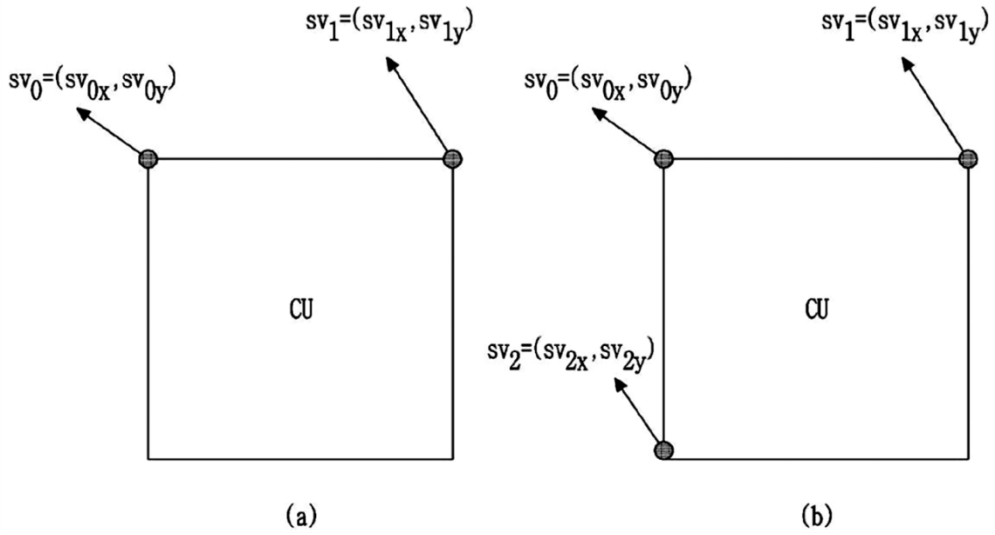


FIG. 9

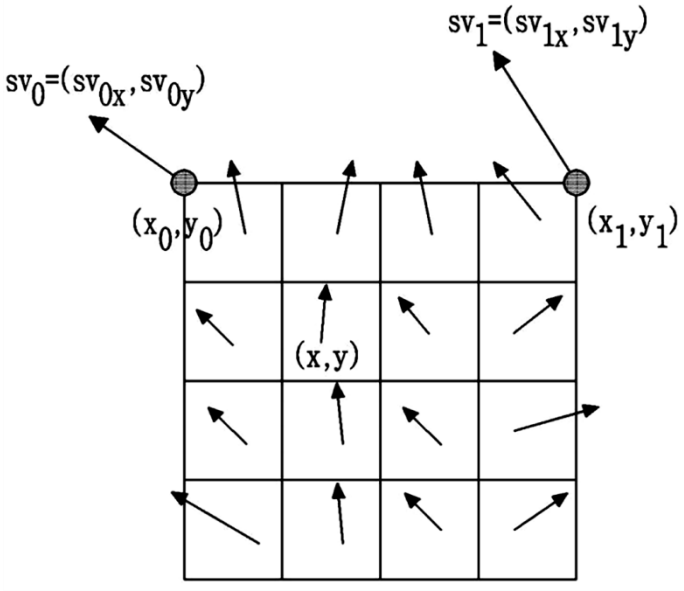


FIG. 10

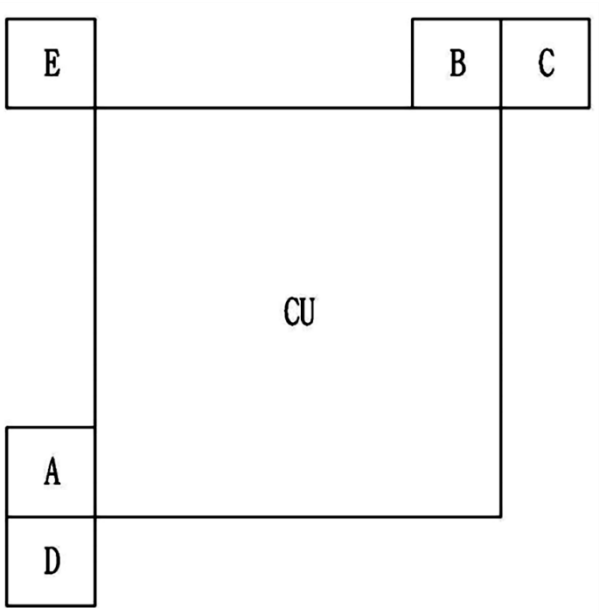

E
B
C
CU
A
D

FIG. 11

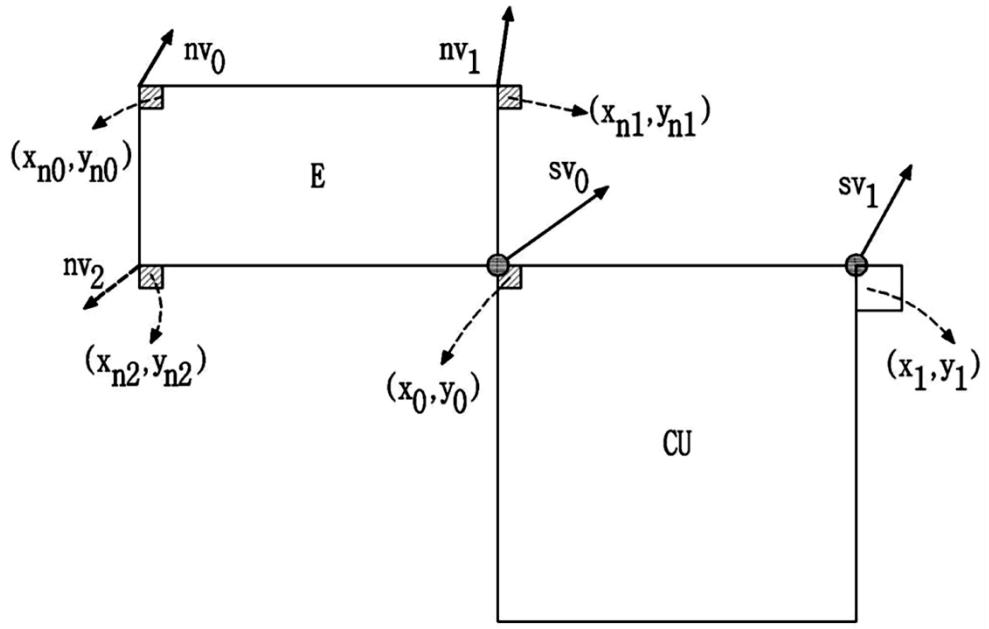

nv0
nv1
(xn1,yn1)
(xn0,yn0)
E
sv0
sv1
nv2
(xn2,yn2)
(x0,y0)
(x1,y1)
CU

FIG. 12

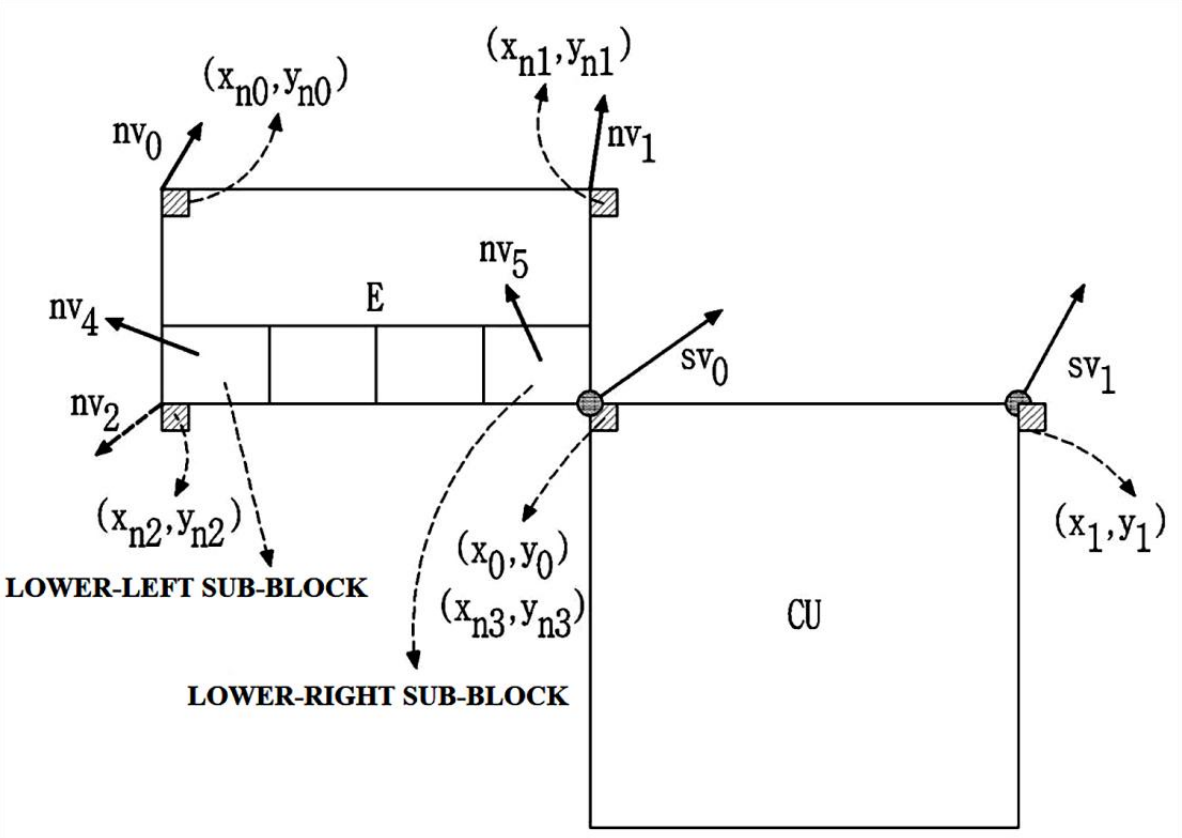

(x_{n0}, y_{n0})
(x_{n1}, y_{n1})
nv_0
nv_1
nv_5
E
nv_4
sv_0
sv_1
nv_2
(x_{n2}, y_{n2})
(x_0, y_0)
(x_1, y_1)
LOWER-LEFT SUB-BLOCK
(x_{n3}, y_{n3})
CU
LOWER-RIGHT SUB-BLOCK

FIG. 13

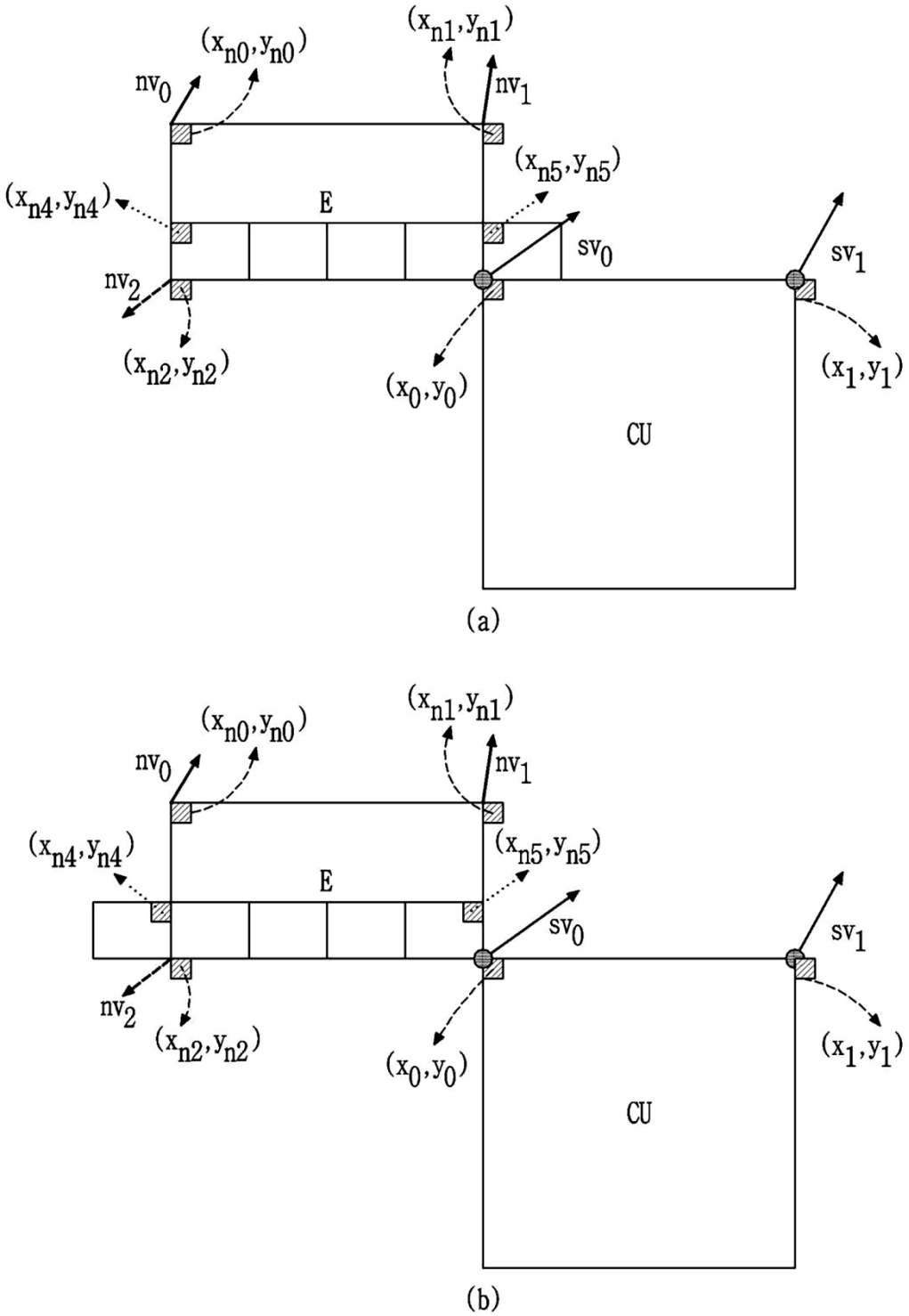

(a)
(b)
(x_{n0}, y_{n0})
(x_{n1}, y_{n1})
nv_0
nv_1
(x_{n4}, y_{n4})
(x_{n5}, y_{n5})
E
sv_0
sv_1
nv_2
(x_{n2}, y_{n2})
(x_0, y_0)
(x_1, y_1)
CU

FIG. 14

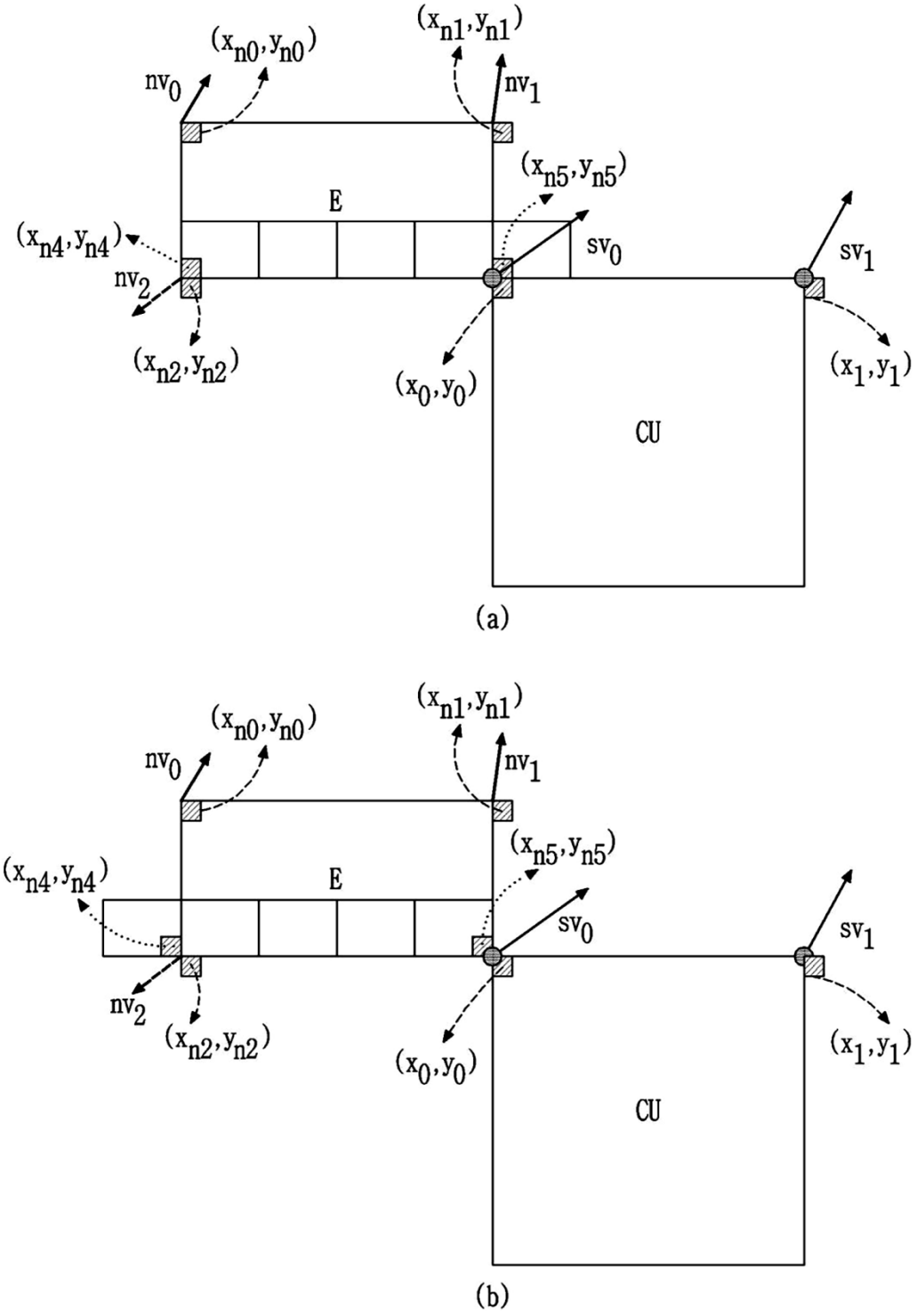

(x_{n0}, y_{n0})
(x_{n1}, y_{n1})
nv_0
nv_1
E
(x_{n5}, y_{n5})
(x_{n4}, y_{n4})
sv_0
sv_1
nv_2
(x_{n2}, y_{n2})
(x_0, y_0)
(x_1, y_1)
CU
(a)
(x_{n0}, y_{n0})
(x_{n1}, y_{n1})
nv_0
nv_1
(x_{n5}, y_{n5})
(x_{n4}, y_{n4})
E
sv_0
sv_1
nv_2
(x_{n2}, y_{n2})
(x_0, y_0)
(x_1, y_1)
CU
(b)

FIG. 15

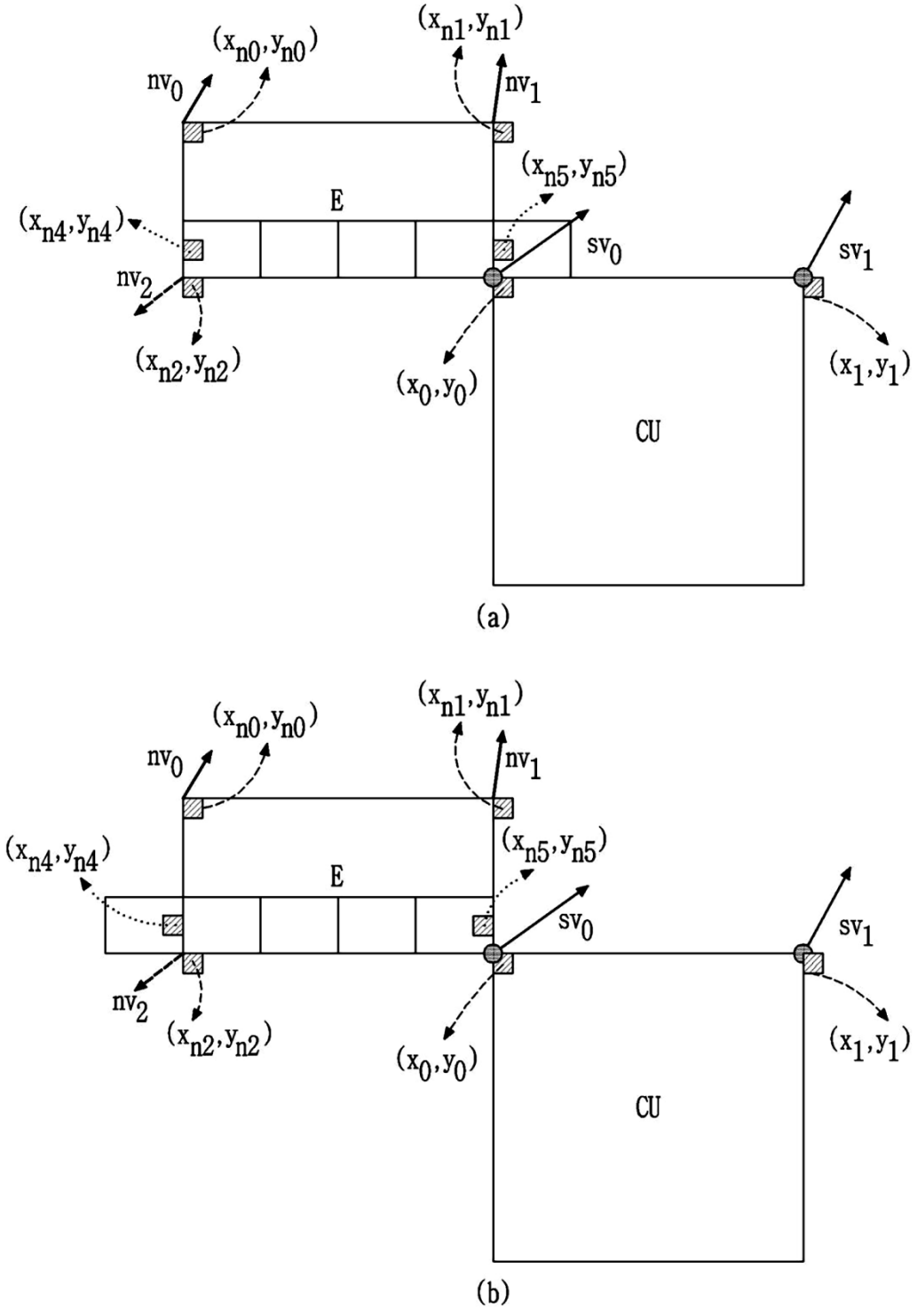

(a)
(b)
E
CU
nv0
nv1
nv2
sv0
sv1
(xn0,yn0)
(xn1,yn1)
(xn2,yn2)
(xn4,yn4)
(xn5,yn5)
(x0,y0)
(x1,y1)

FIG. 16

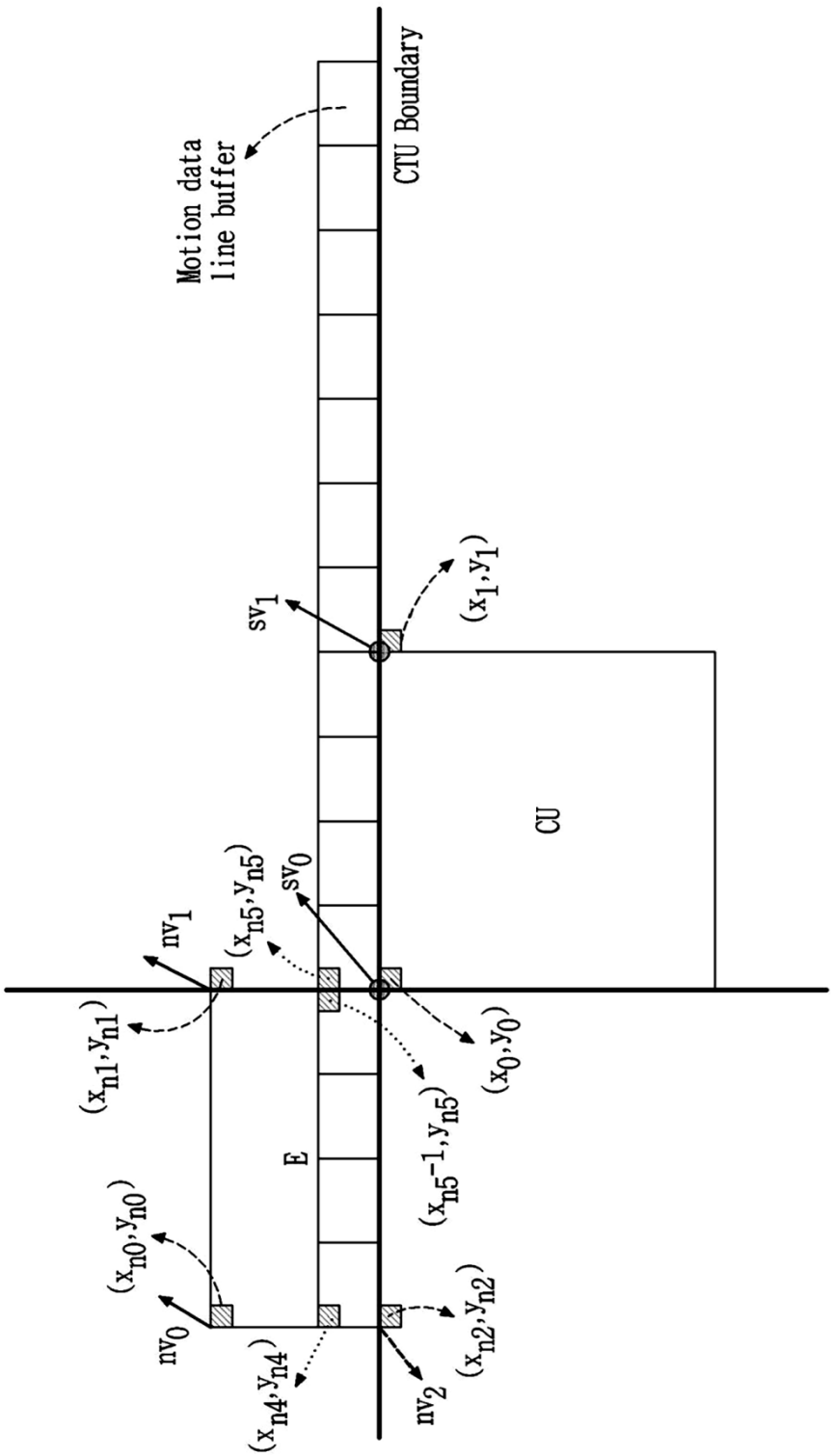

Motion data
line buffer
CTU Boundary
sv_1
(x_1, y_1)
CU
sv_0
(x_{n5}, y_{n5})
nv_1
(x_{n1}, y_{n1})
(x_0, y_0)
$(x_{n5}-1, y_{n5})$
E
(x_{n0}, y_{n0})
nv_0
(x_{n4}, y_{n4})
(x_{n2}, y_{n2})
nv_2

FIG. 17

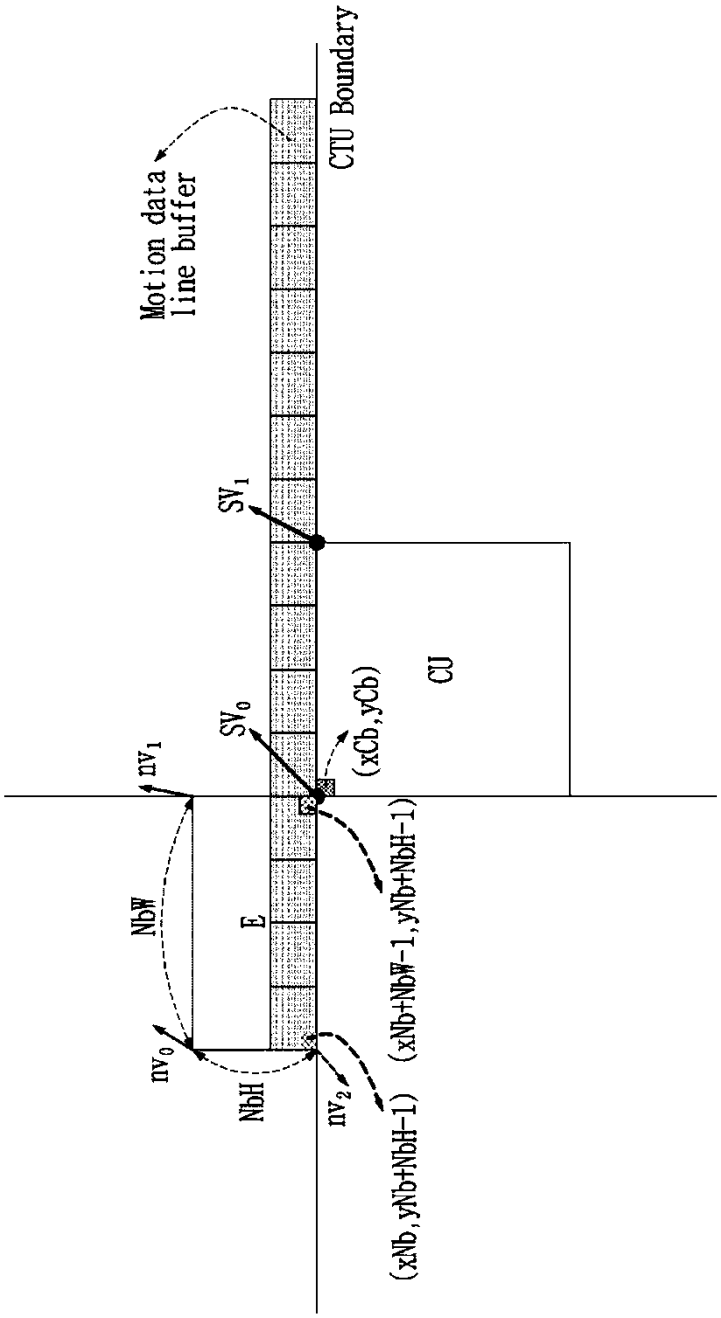

Motion data
line buffer
CTU Boundary
SV1
SV0
(xCb,yCb)
CU
nv1
NbW
E
nv0
NbH
nv2
(xNb,yNb+NbH-1)
(xNb+NbW-1,yNb+NbH-1)

FIG. 18

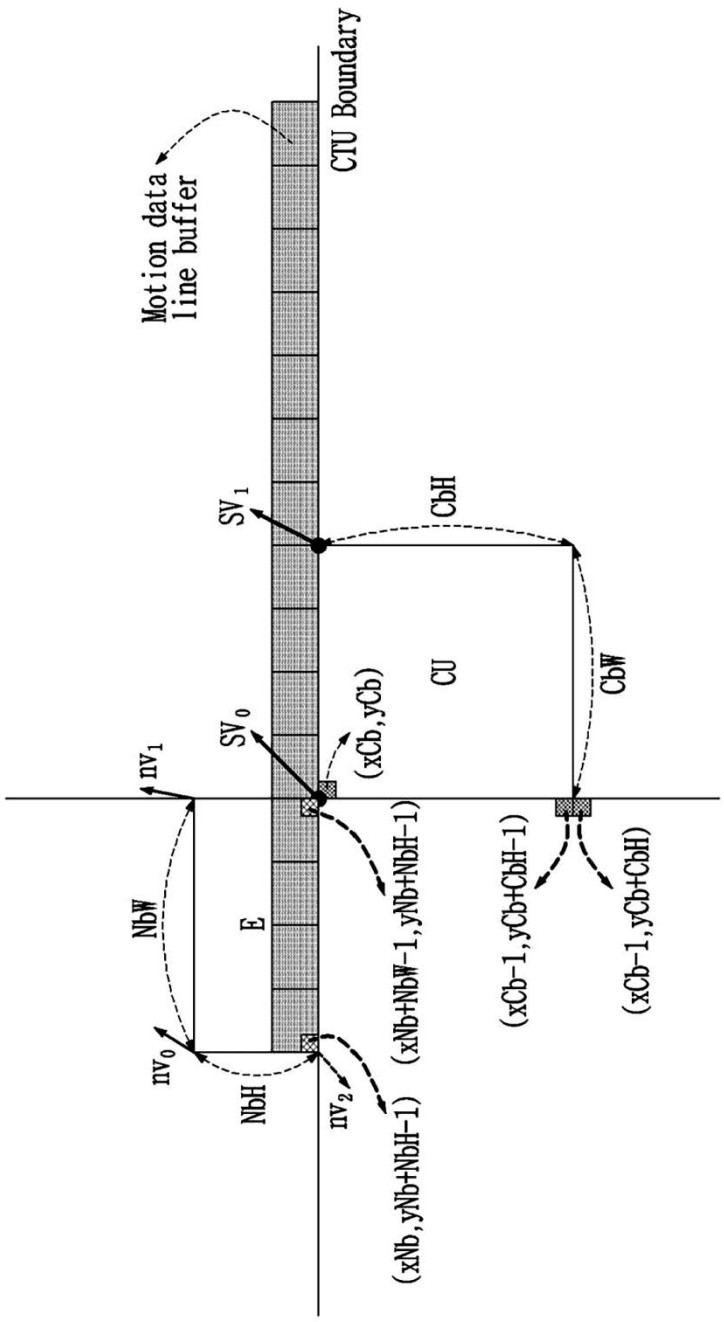

CTU Boundary
Motion data line buffer
SV1
CbH
SV0
(xCb,yCb)
CU
CbW
nv1
NbW
E
nv0
NbH
nv2
(xNb,yNb+NbH-1)
(xNb+NbW-1,yNb+NbH-1)
(xCb-1,yCb+CbH-1)
(xCb-1,yCb+CbH)

FIG. 19

Motion data line buffer
CTU Boundary
SV1
CbH
SV0
(xCb,yCb)
CU
CbW
(a)
nv1
NbW
E
nv0
NbH
nv2
(xNb,yNb+NbH-1)
(xNb+NbW-1,yNb+NbH-1)
(xNb,yCb+CbH-1)
(xNb,yCb+CbH)
Motion data line buffer
CTU Boundary
nv1
SV0
(xNb+NbW-1,yNb+NbH-1)
CbH
NbW
SV0
(xCb,yCb)
CU
CbW
(b)
nv0
NbH
(xCb,yNb+NbH-1)
(xCb-1,yCb+CbH-1)
(xCb-1,yCb+CbH)

FIG. 20

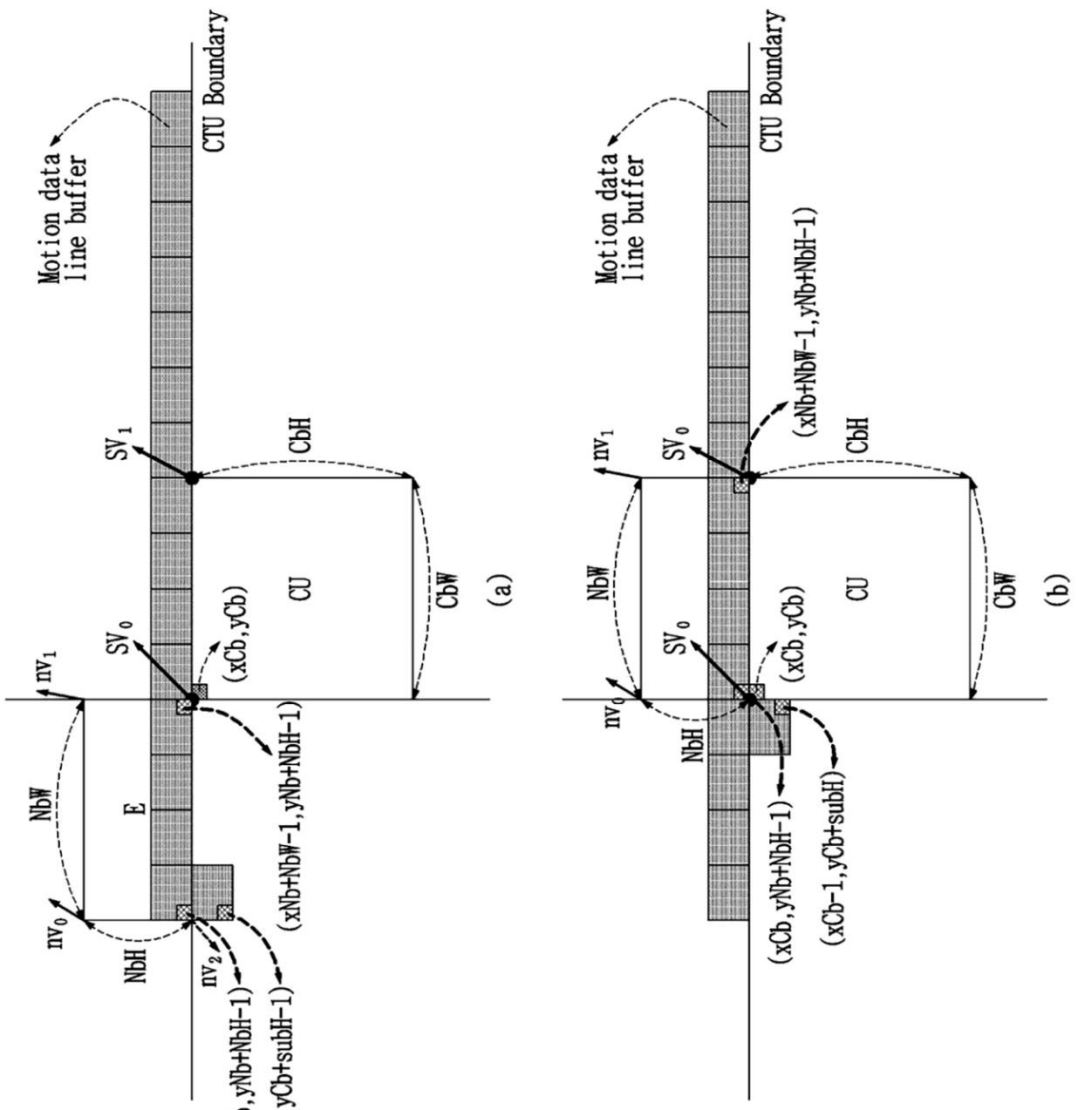

Motion data line buffer
CTU Boundary
SV1
CbH
SV0
(xCb,yCb)
CU
CbW
(a)
nv1
NbW
E
nv0
NbH
nv2
(xNb+NbW-1,yNb+NbH-1)
(xNb,yNb+NbH-1)
(xNb,yCb+subH-1)
Motion data line buffer
CTU Boundary
nv1
SV0
(xNb+NbW-1,yNb+NbH-1)
CbH
NbW
SV0
(xCb,yCb)
CU
CbW
(b)
nv0
NbH
(xCb,yNb+NbH-1)
(xCb-1,yCb+subH)

FIG. 21

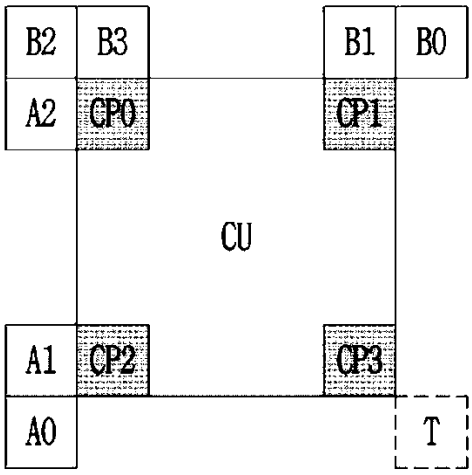


FIG. 22

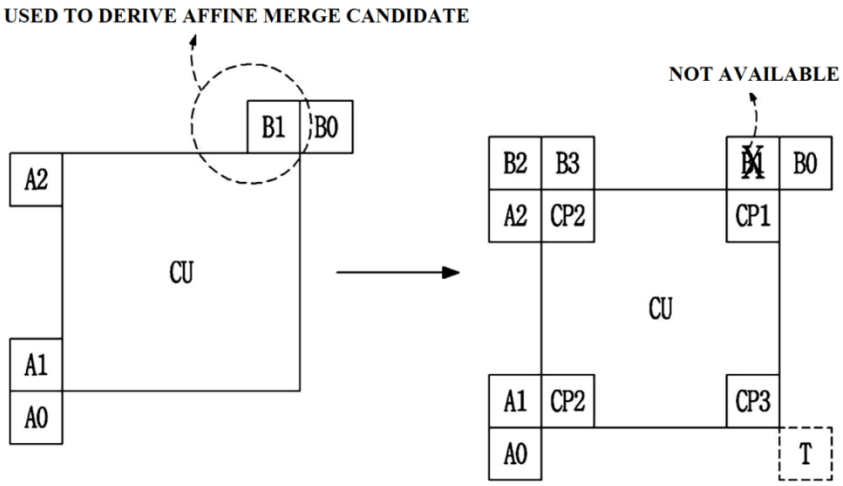


FIG. 23

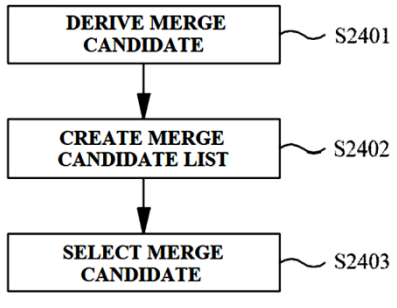


FIG. 24

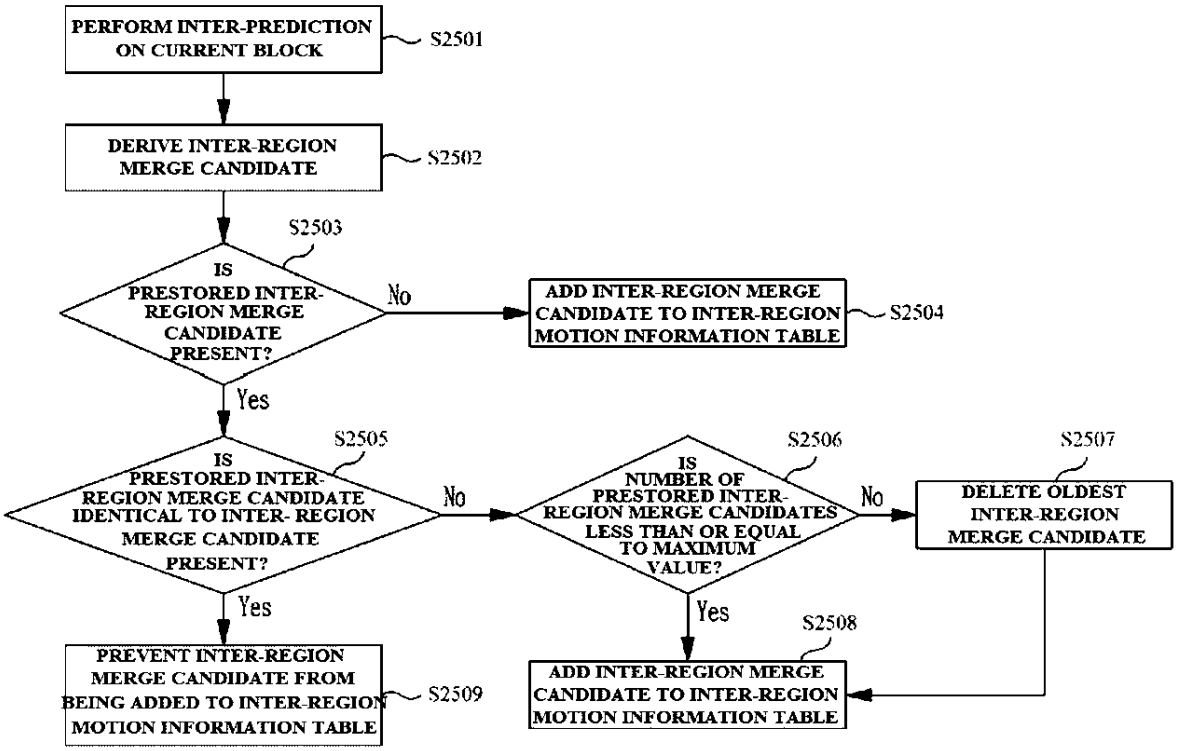

PERFORM INTER-PREDICTION ON CURRENT BLOCK
S2501
DERIVE INTER-REGION MERGE CANDIDATE
S2502
S2503
IS PRESTORED INTER-REGION MERGE CANDIDATE PRESENT?
No
ADD INTER-REGION MERGE CANDIDATE TO INTER-REGION MOTION INFORMATION TABLE
S2504
Yes
S2505
IS PRESTORED INTER-REGION MERGE CANDIDATE IDENTICAL TO INTER- REGION MERGE CANDIDATE PRESENT?
No
S2506
IS NUMBER OF PRESTORED INTER-REGION MERGE CANDIDATES LESS THAN OR EQUAL TO MAXIMUM VALUE?
No
S2507
DELETE OLDEST INTER-REGION MERGE CANDIDATE
Yes
Yes
S2508
PREVENT INTER-REGION MERGE CANDIDATE FROM BEING ADDED TO INTER-REGION MOTION INFORMATION TABLE
S2509
ADD INTER-REGION MERGE CANDIDATE TO INTER-REGION MOTION INFORMATION TABLE

FIG. 25

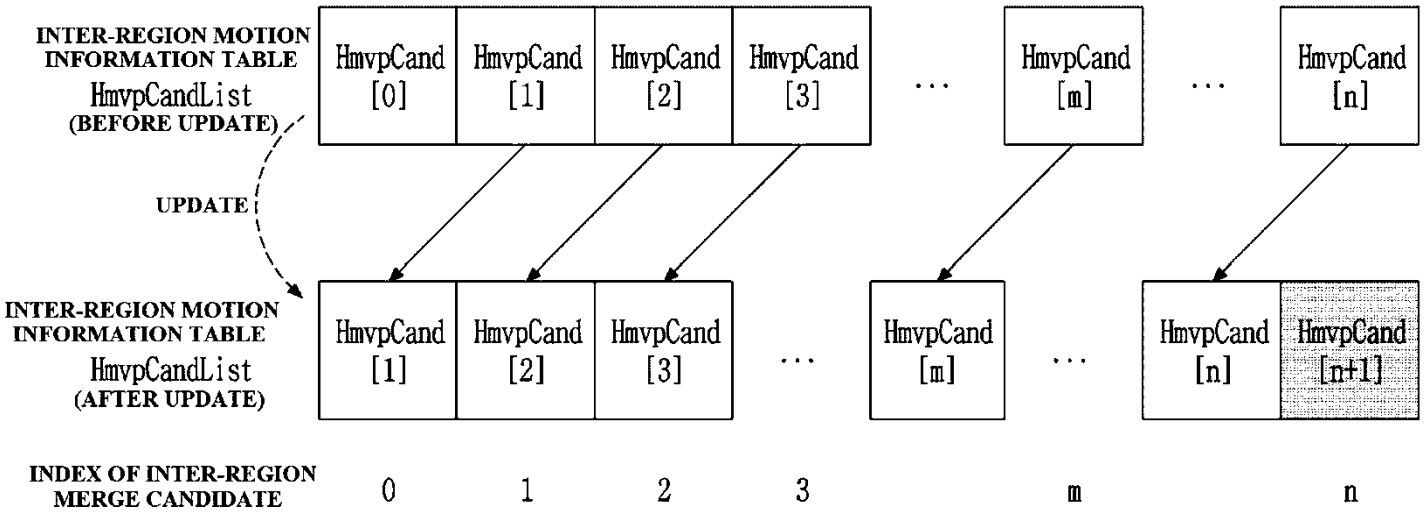

INTER-REGION MOTION INFORMATION TABLE
HmvpCandList
(BEFORE UPDATE)
UPDATE
INTER-REGION MOTION INFORMATION TABLE
HmvpCandList
(AFTER UPDATE)
INDEX OF INTER-REGION MERGE CANDIDATE
HmvpCand [0]
HmvpCand [1]
HmvpCand [2]
HmvpCand [3]
HmvpCand [m]
HmvpCand [n]
HmvpCand [n+1]
0
1
2
3
m
n

FIG. 26

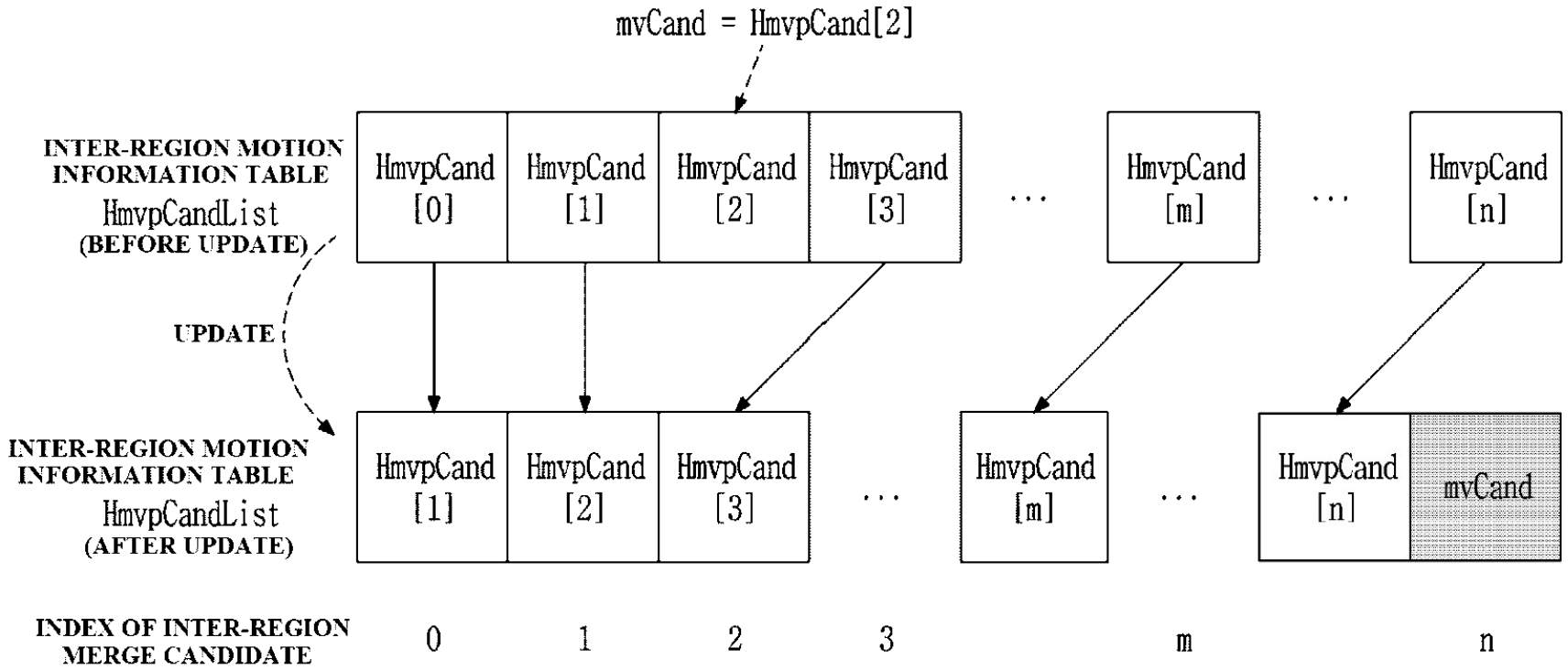

mvCand = HmvpCand[2]
INTER-REGION MOTION INFORMATION TABLE HmvpCandList (BEFORE UPDATE)
HmvpCand [0]
HmvpCand [1]
HmvpCand [2]
HmvpCand [3]
HmvpCand [m]
HmvpCand [n]
UPDATE
INTER-REGION MOTION INFORMATION TABLE HmvpCandList (AFTER UPDATE)
HmvpCand [1]
HmvpCand [2]
HmvpCand [3]
HmvpCand [m]
HmvpCand [n]
mvCand
INDEX OF INTER-REGION MERGE CANDIDATE
0
1
2
3
m
n

FIG. 27

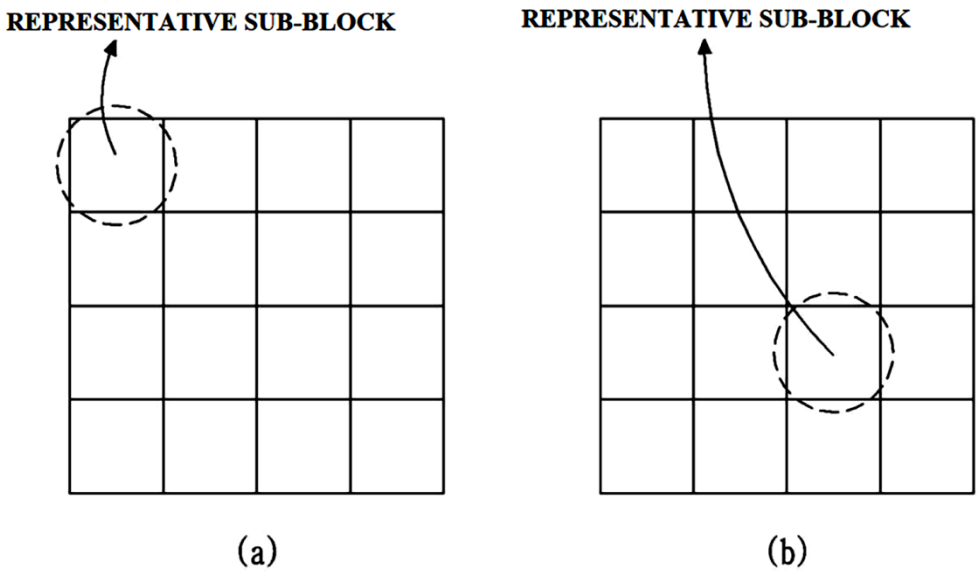


FIG. 28

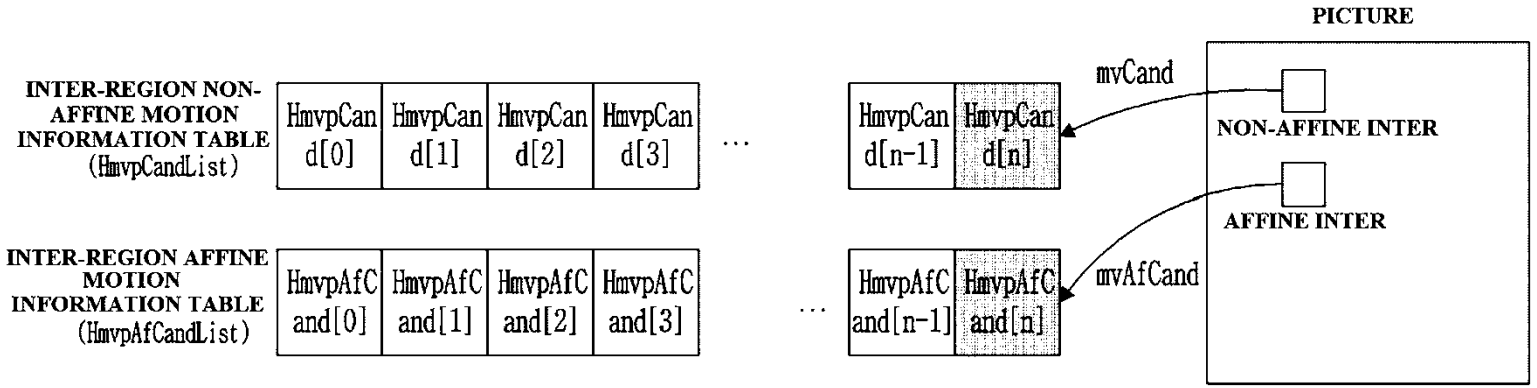

PICTURE
INTER-REGION NON-AFFINE MOTION INFORMATION TABLE (HmvpCandList)
HmvpCand[0]
HmvpCand[1]
HmvpCand[2]
HmvpCand[3]
HmvpCand[n-1]
HmvpCand[n]
mvCand
NON-AFFINE INTER
AFFINE INTER
INTER-REGION AFFINE MOTION INFORMATION TABLE (HmvpAfCandList)
HmvpAfCand[0]
HmvpAfCand[1]
HmvpAfCand[2]
HmvpAfCand[3]
HmvpAfCand[n-1]
HmvpAfCand[n]
mvAfCand

FIG. 29

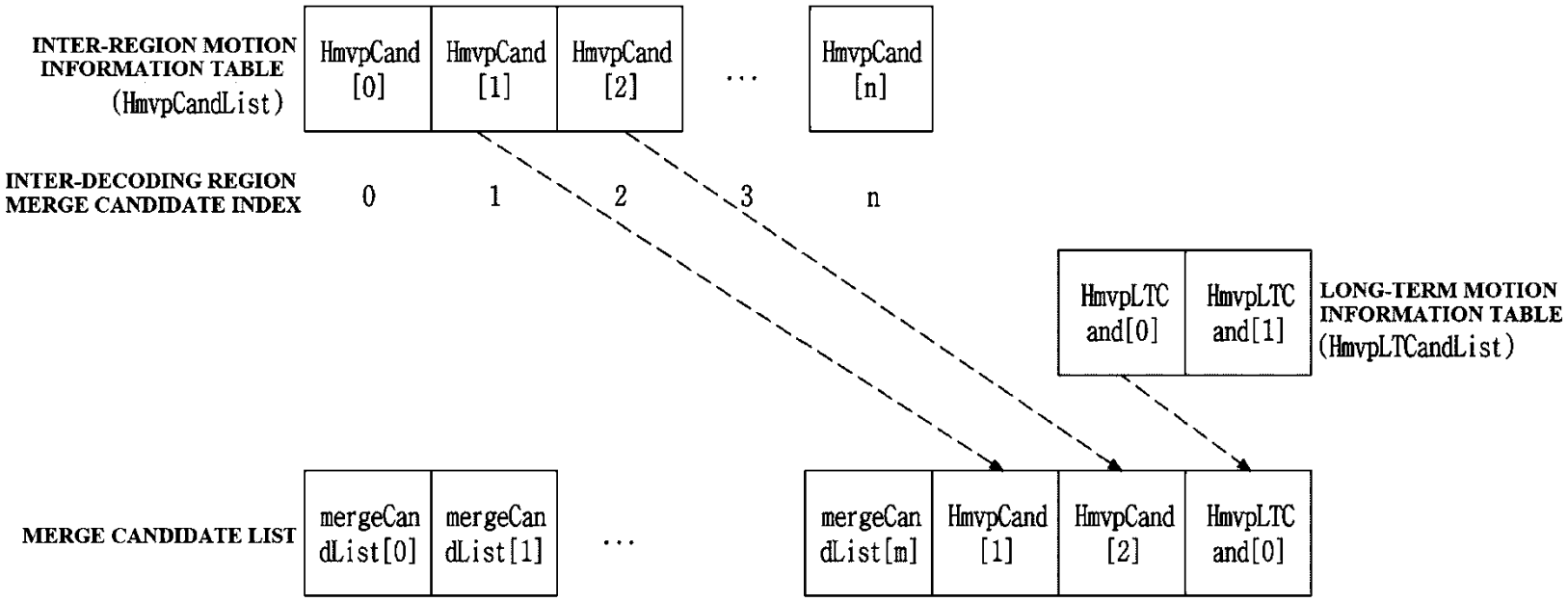

INTER-REGION MOTION INFORMATION TABLE (HmvpCandList)
HmvpCand [0]
HmvpCand [1]
HmvpCand [2]
...
HmvpCand [n]
INTER-DECODING REGION MERGE CANDIDATE INDEX
0
1
2
3
n
HmvpLTCand[0]
HmvpLTCand[1]
LONG-TERM MOTION INFORMATION TABLE (HmvpLTCandList)
MERGE CANDIDATE LIST
mergeCandList[0]
mergeCandList[1]
...
mergeCandList[m]
HmvpCand [1]
HmvpCand [2]
HmvpLTCand[0]

FIG. 30

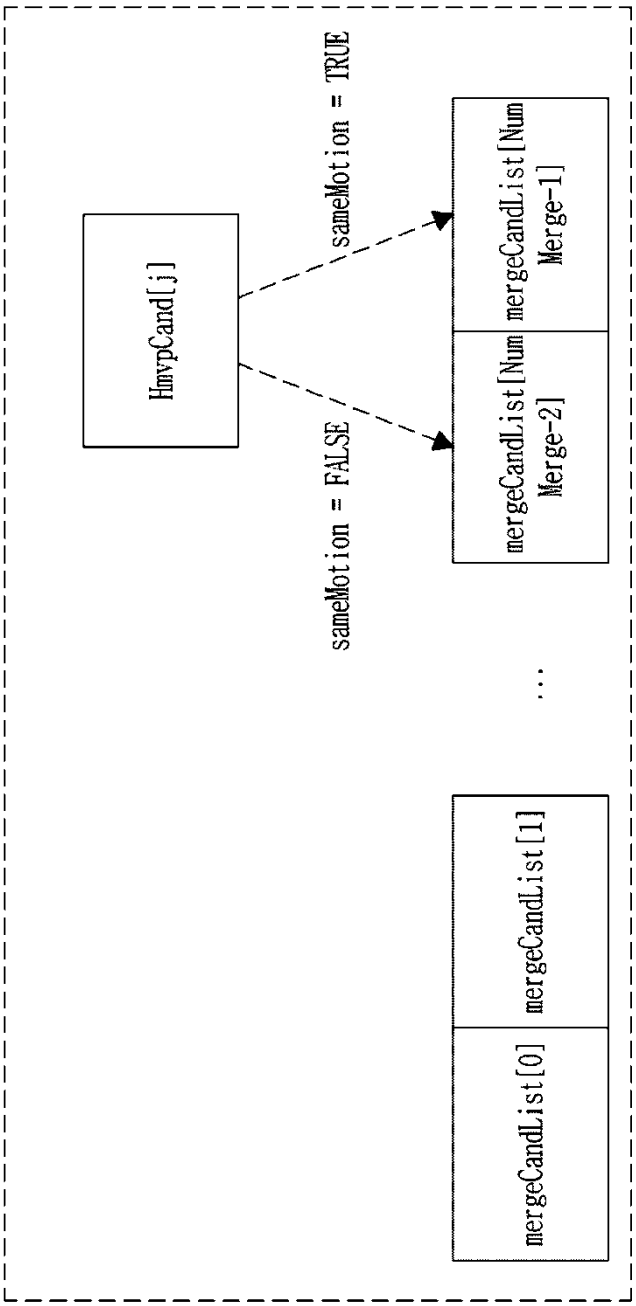

HmvpCand[j]
sameMotion = TRUE
sameMotion = FALSE
mergeCandList[0]
mergeCandList[1]
...
mergeCandList[NumMerge-2]
mergeCandList[NumMerge-1]

FIG. 31

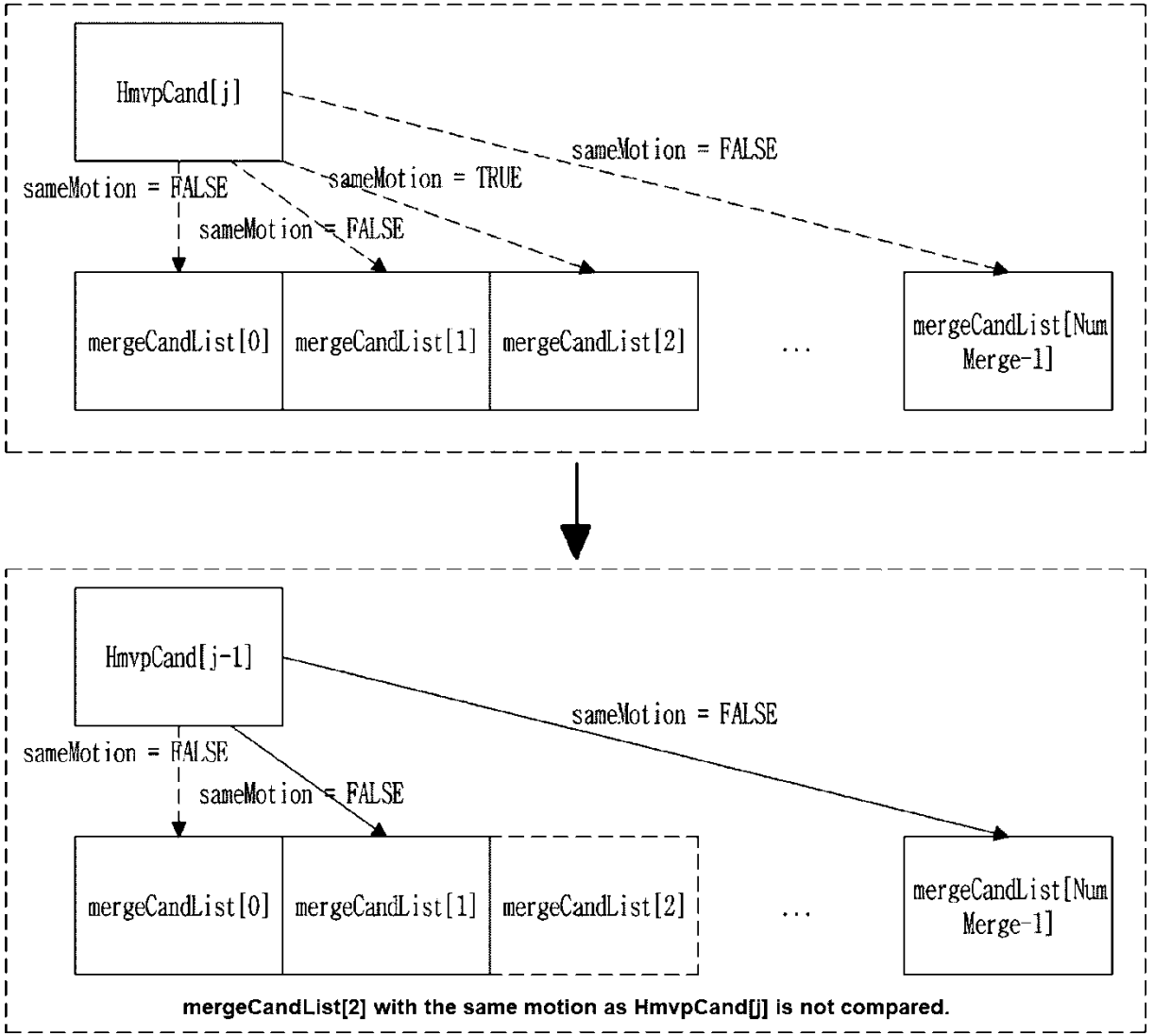

HmvpCand[j]
sameMotion = FALSE
sameMotion = FALSE
sameMotion = TRUE
sameMotion = FALSE
mergeCandList[0]
mergeCandList[1]
mergeCandList[2]
...
mergeCandList[NumMerge-1]
HmvpCand[j-1]
sameMotion = FALSE
sameMotion = FALSE
sameMotion = FALSE
mergeCandList[0]
mergeCandList[1]
mergeCandList[2]
...
mergeCandList[NumMerge-1]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

FIG. 32

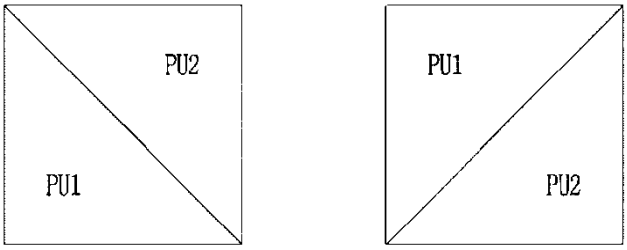


FIG. 33

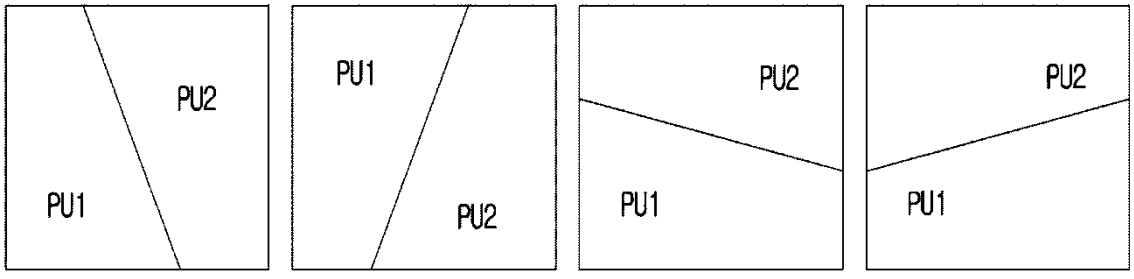


FIG. 34

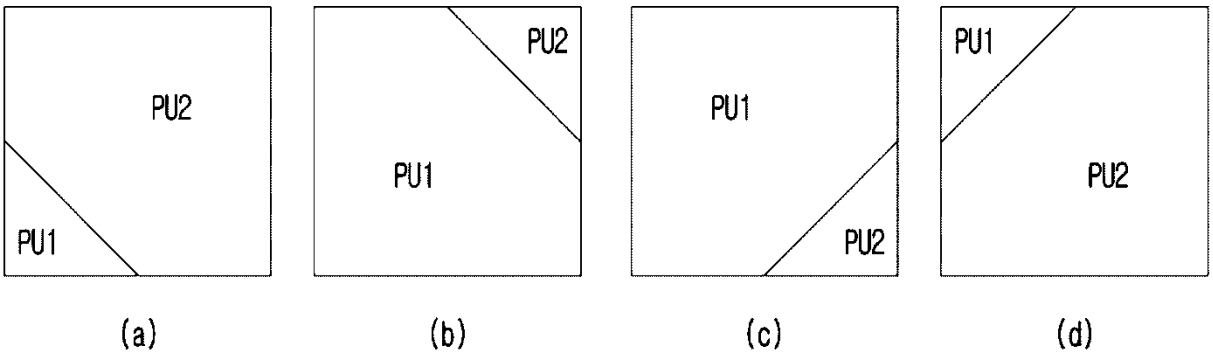


FIG. 35

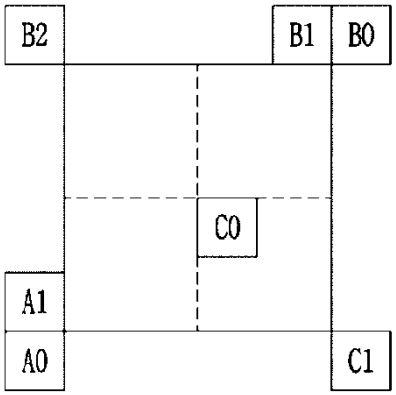
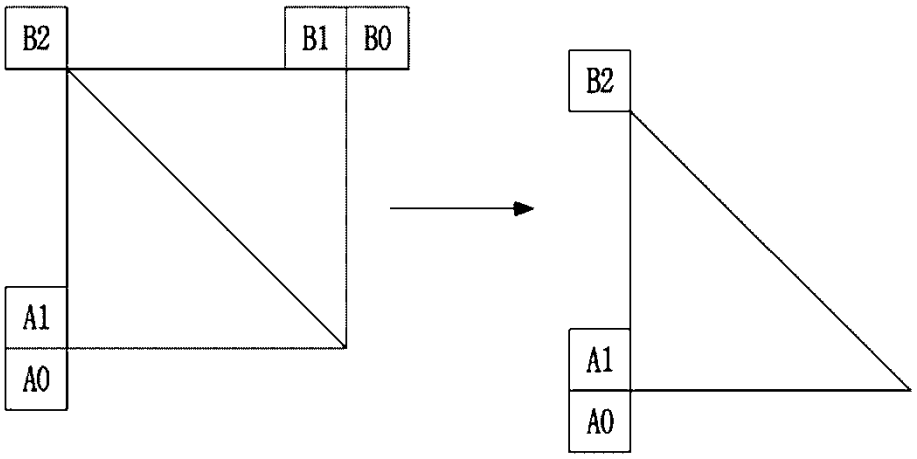
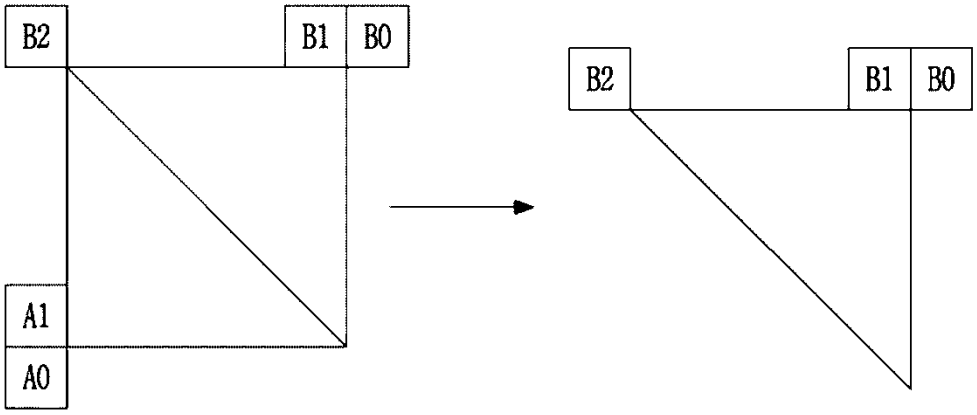


FIG. 36



(a)



(b)

FIG. 37

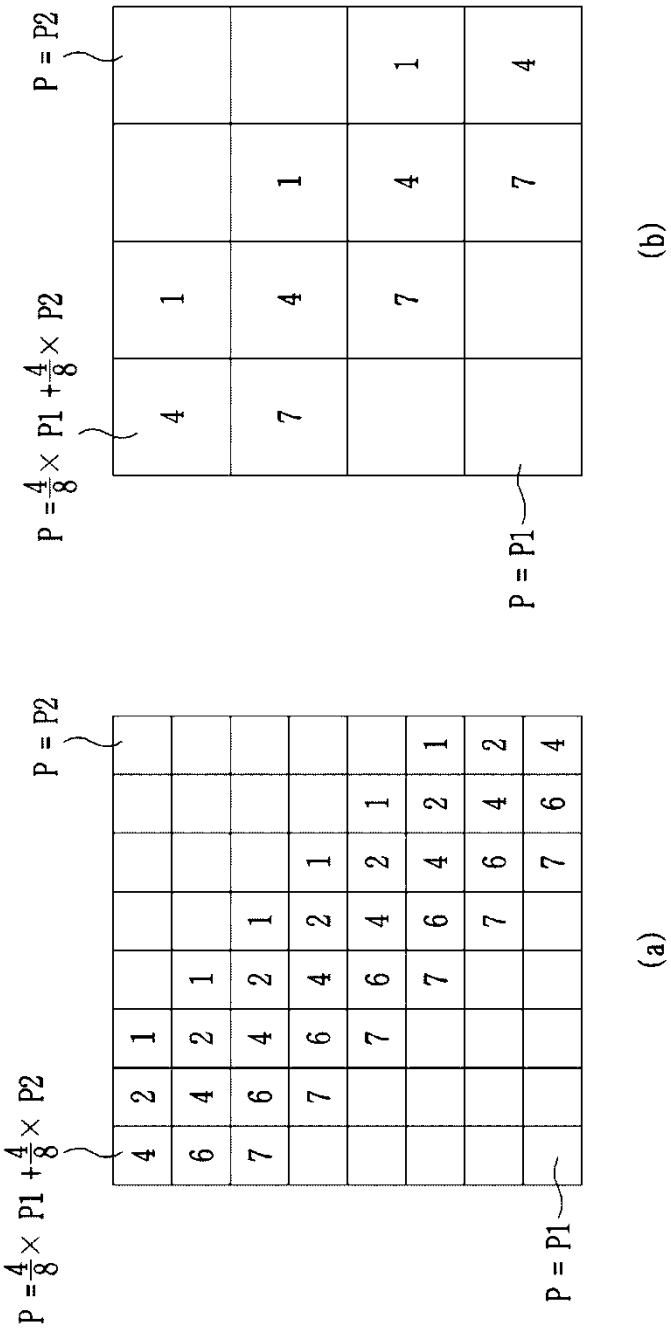


FIG. 38

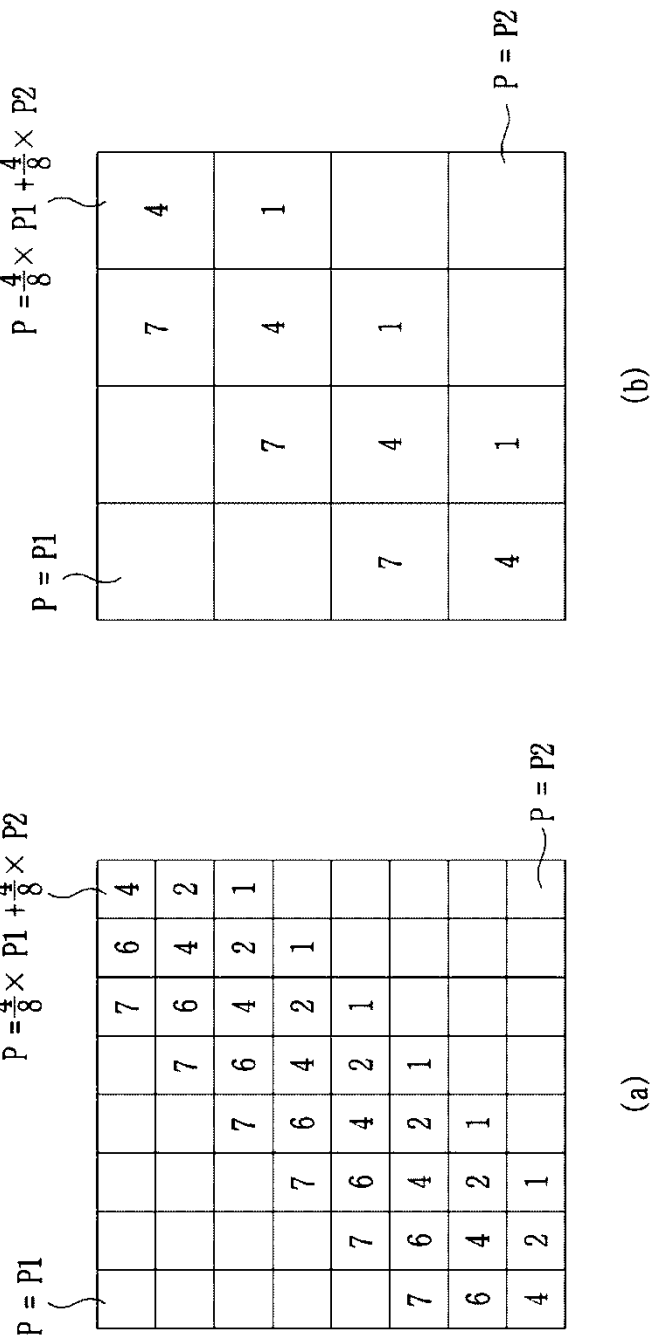


FIG. 39

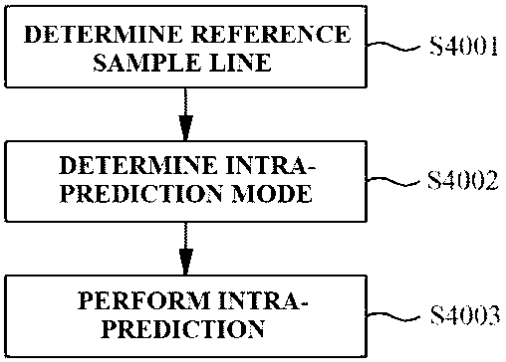
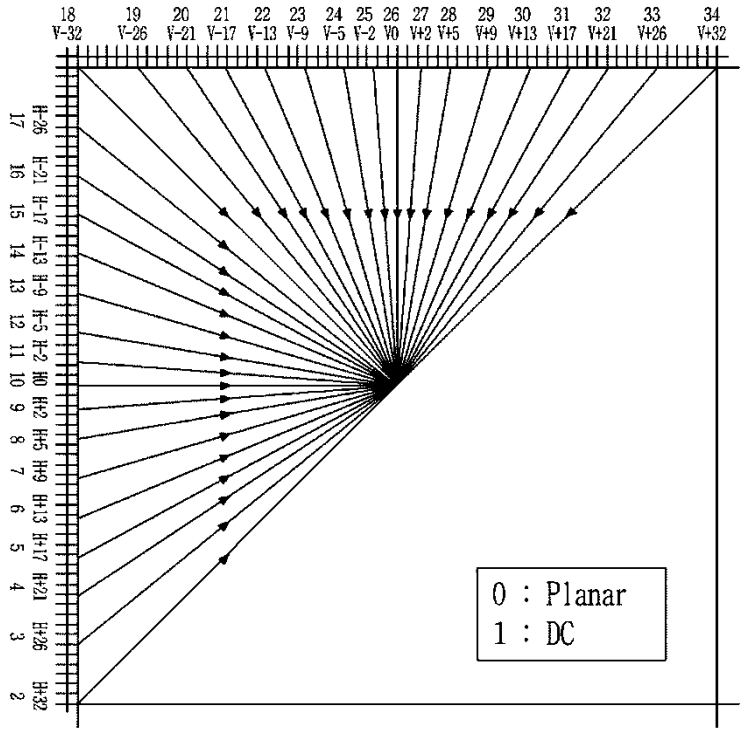
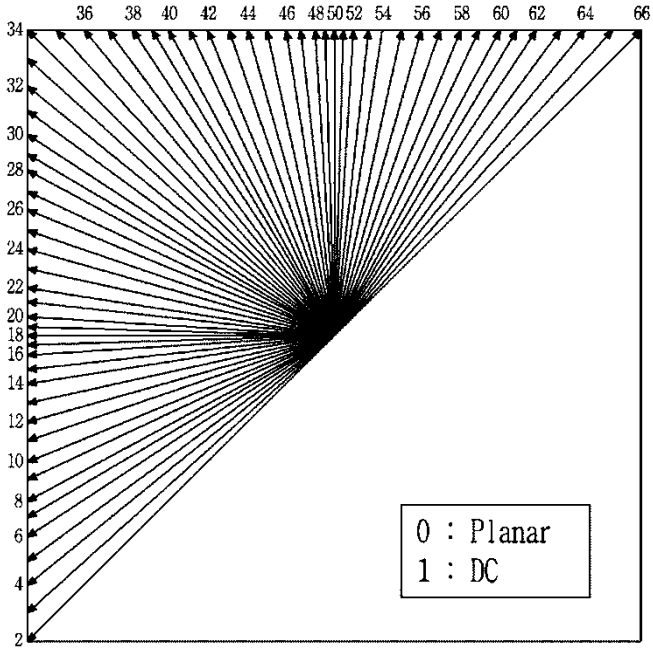

DETERMINE REFERENCE SAMPLE LINE
S4001
DETERMINE INTRA-PREDICTION MODE
S4002
PERFORM INTRA-PREDICTION
S4003

FIG. 40


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. 41

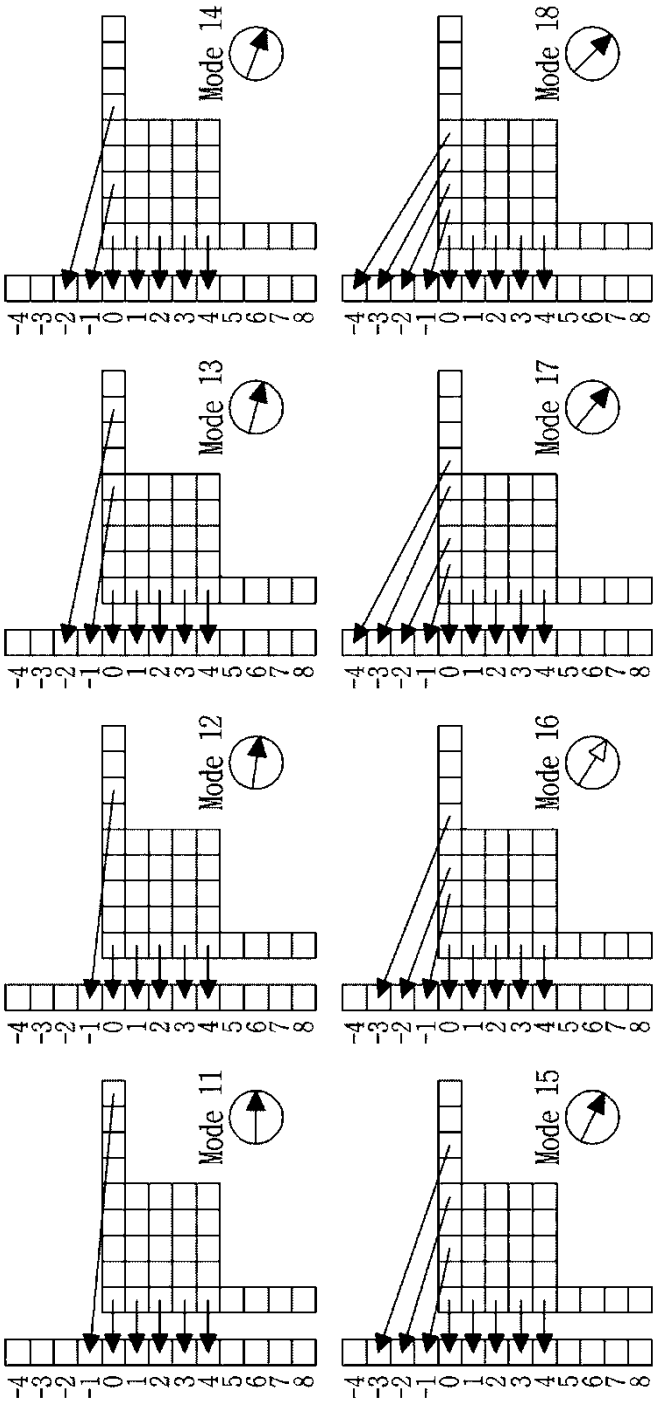

Mode 11
Mode 12
Mode 13
Mode 14
Mode 15
Mode 16
Mode 17
Mode 18
-4 -3 -2 -1 0 1 2 3 4 5 6 7 8

FIG. 42

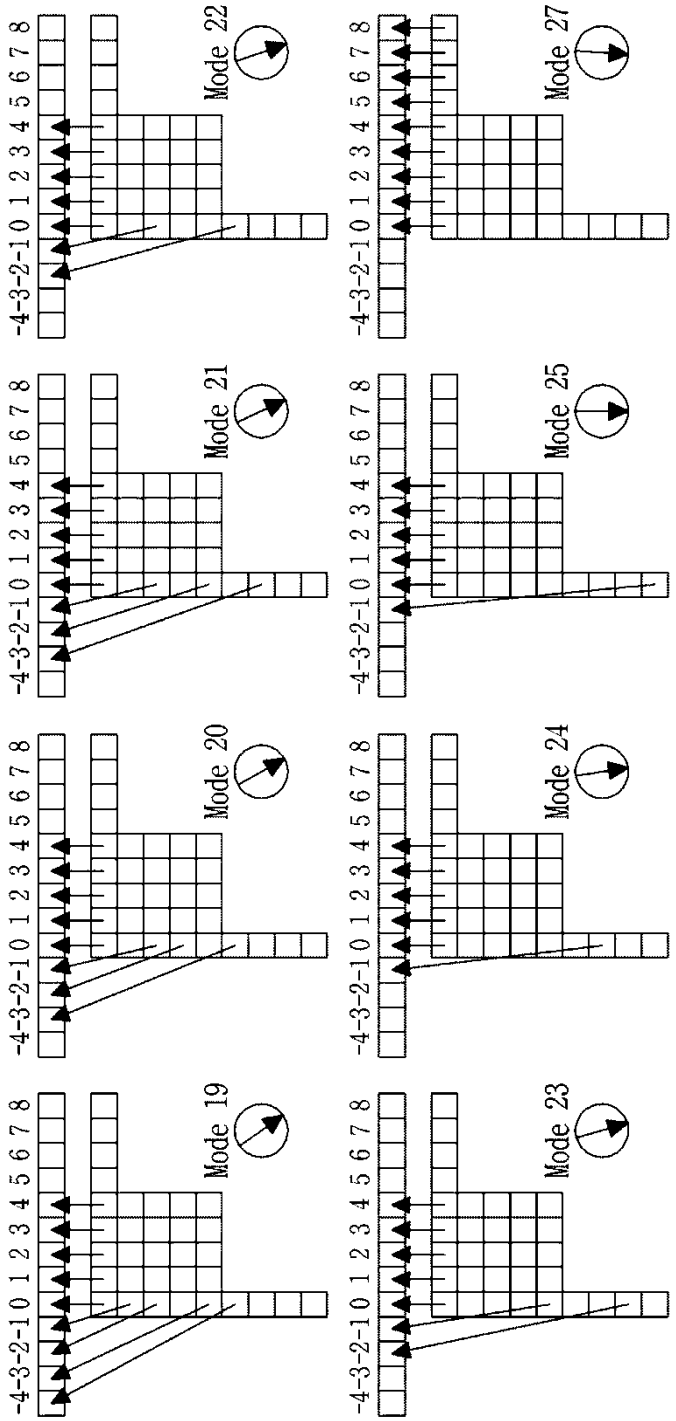

-4 -3 -2 -1 0 1 2 3 4 5 6 7 8
Mode 19
Mode 20
Mode 21
Mode 22
Mode 23
Mode 24
Mode 25
Mode 27

FIG. 43

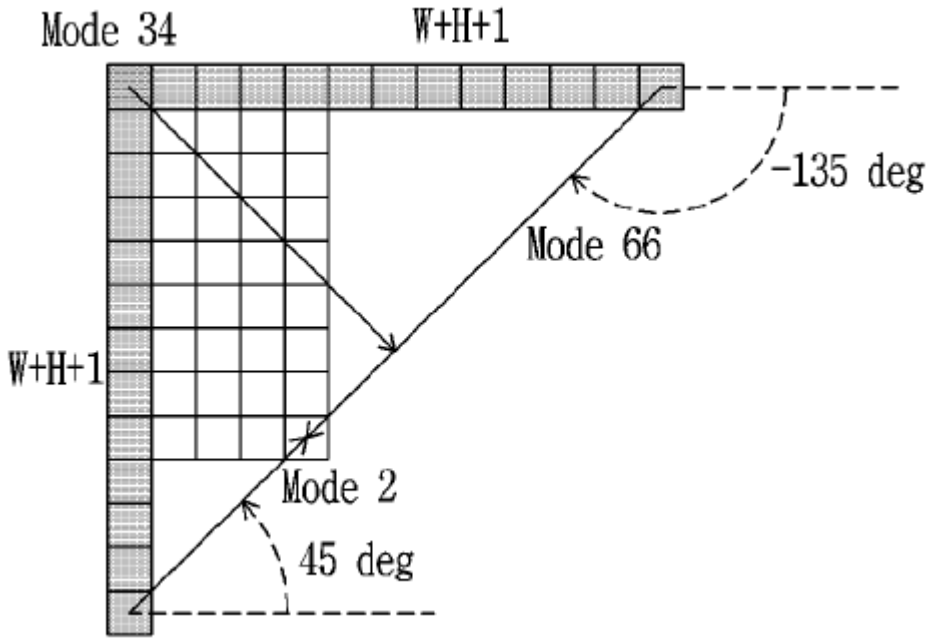


FIG. 44

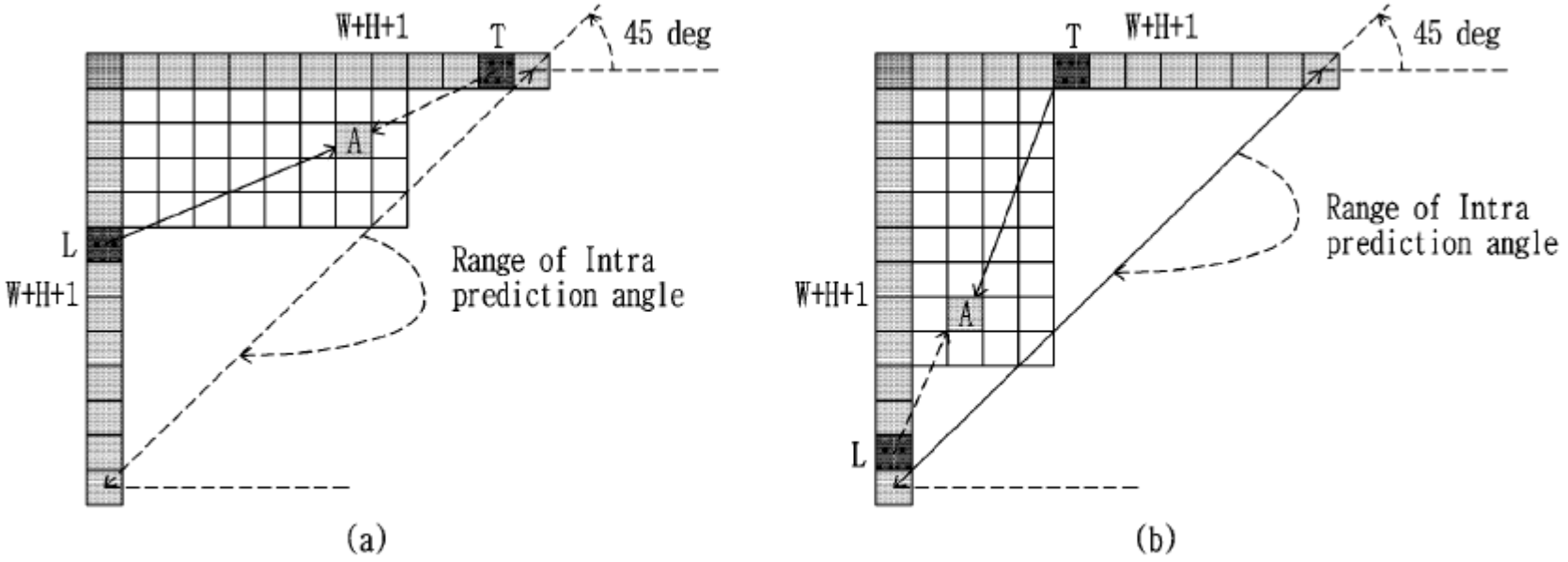

W+H+1
T
45 deg
A
L
W+H+1
Range of Intra
prediction angle
(a)
T
W+H+1
45 deg
Range of Intra
prediction angle
W+H+1
A
L
(b)

FIG. 45

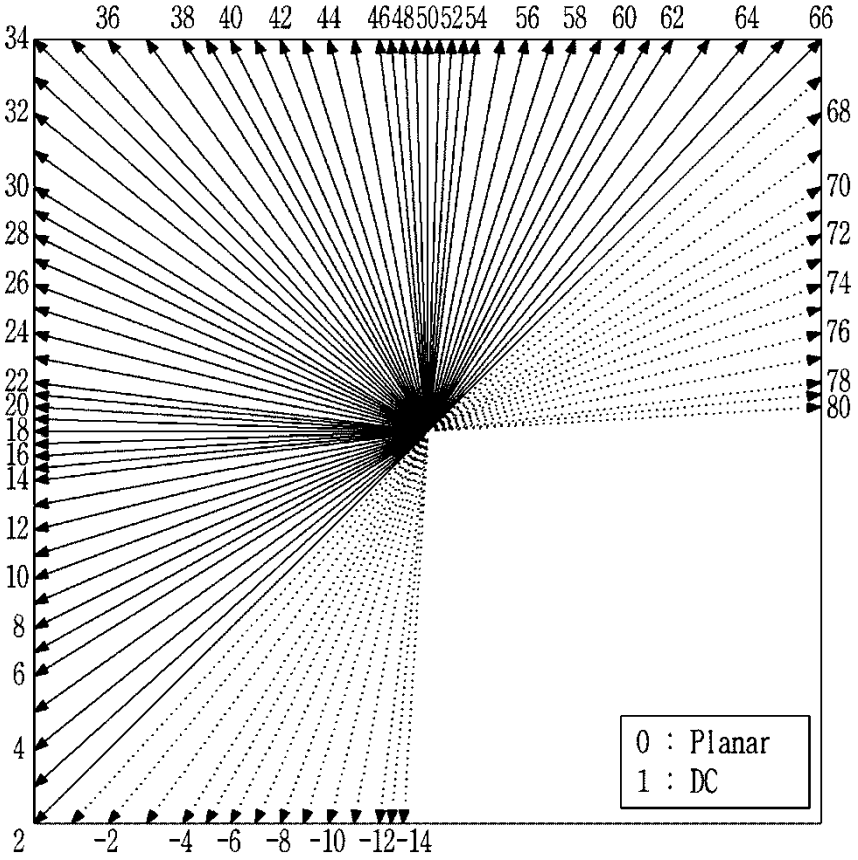

36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66
34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2
68 70 72 74 76 78 80
-2 -4 -6 -8 -10 -12 -14
0 : Planar
1 : DC

FIG. 46

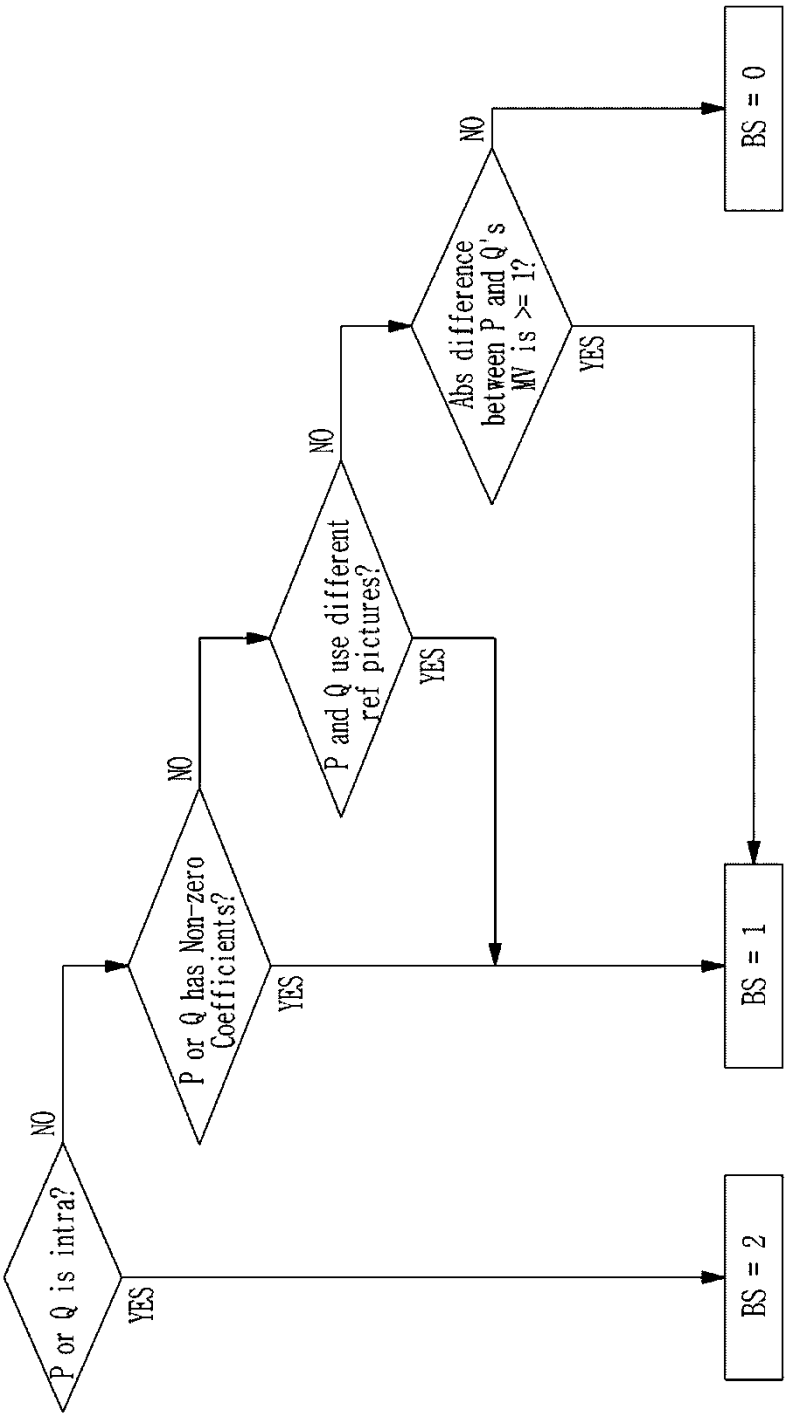

P or Q is intra?
NO
YES
BS = 2
P or Q has Non-zero Coefficients?
NO
YES
BS = 1
P and Q use different ref pictures?
NO
YES
BS = 1
Abs difference between P and Q's MV is >= 1?
NO
YES
BS = 1
BS = 0

FIG. 47

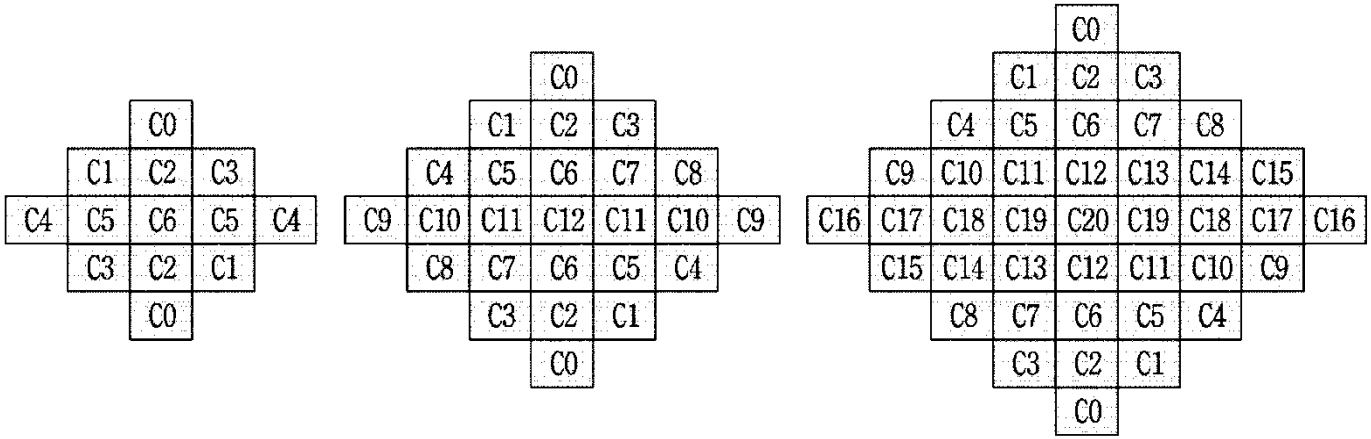

C0
C1 C2 C3
C4 C5 C6 C5 C4
C3 C2 C1
C0
C0
C1 C2 C3
C4 C5 C6 C7 C8
C9 C10 C11 C12 C11 C10 C9
C8 C7 C6 C5 C4
C3 C2 C1
C0
C0
C1 C2 C3
C4 C5 C6 C7 C8
C9 C10 C11 C12 C13 C14 C15
C16 C17 C18 C19 C20 C19 C18 C17 C16
C15 C14 C13 C12 C11 C10 C9
C8 C7 C6 C5 C4
C3 C2 C1
C0

FIG. 48