FIG. 1

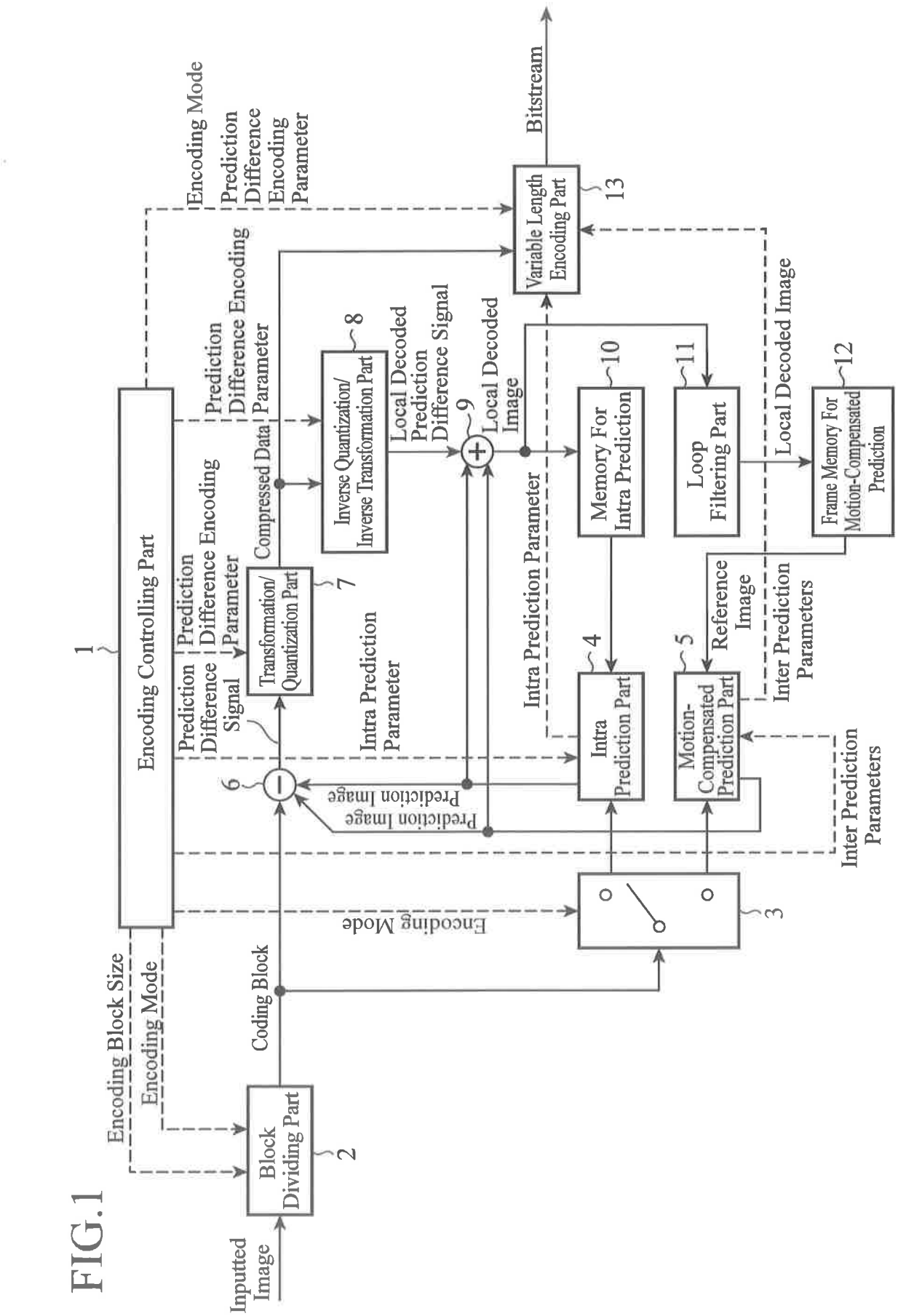

Inputted Image
Block Dividing Part
2
Encoding Block Size
Encoding Mode
Coding Block
Encoding Controlling Part
1
Encoding Mode
Prediction Difference Encoding Parameter
Prediction Difference Encoding Parameter
Compressed Data
Transformation/ Quantization Part
7
Inverse Quantization/ Inverse Transformation Part
8
Local Decoded Prediction Difference Signal
9
Local Decoded Image
Variable Length Encoding Part
13
Bitstream
Prediction Difference Signal
6
Intra Prediction Parameter
Intra Prediction Part
4
Memory For Intra Prediction
10
Loop Filtering Part
11
Local Decoded Image
Frame Memory For Motion-Compensated Prediction
12
Prediction Image
Prediction Image
Encoding Mode
3
Motion-Compensated Prediction Part
5
Reference Image
Inter Prediction Parameters
Inter Prediction Parameters

FIG.2

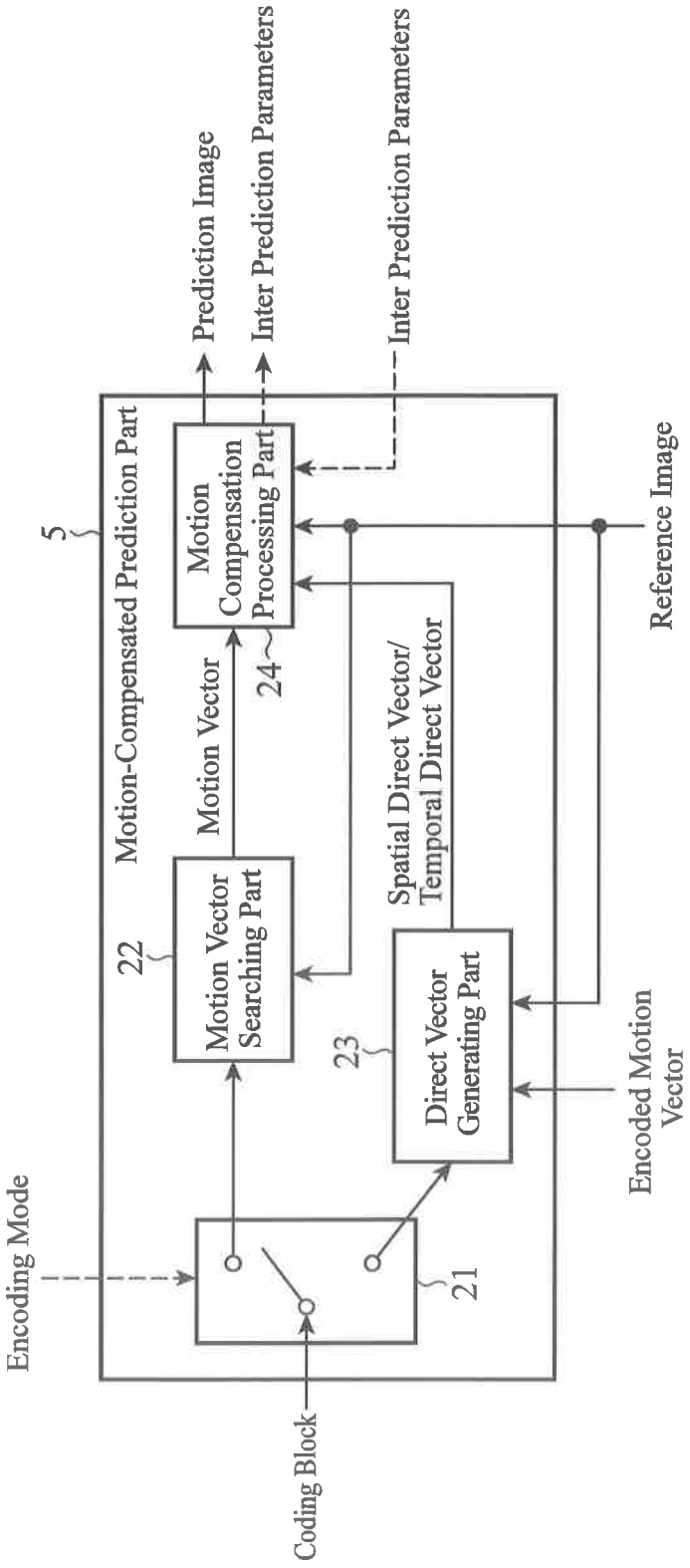

Prediction Image
Inter Prediction Parameters
Inter Prediction Parameters
5
Motion-Compensated Prediction Part
Motion Compensation Processing Part
24
Motion Vector
Spatial Direct Vector/ Temporal Direct Vector
Reference Image
22
Motion Vector Searching Part
23
Direct Vector Generating Part
Encoded Motion Vector
Encoding Mode
21
Coding Block

FIG.3

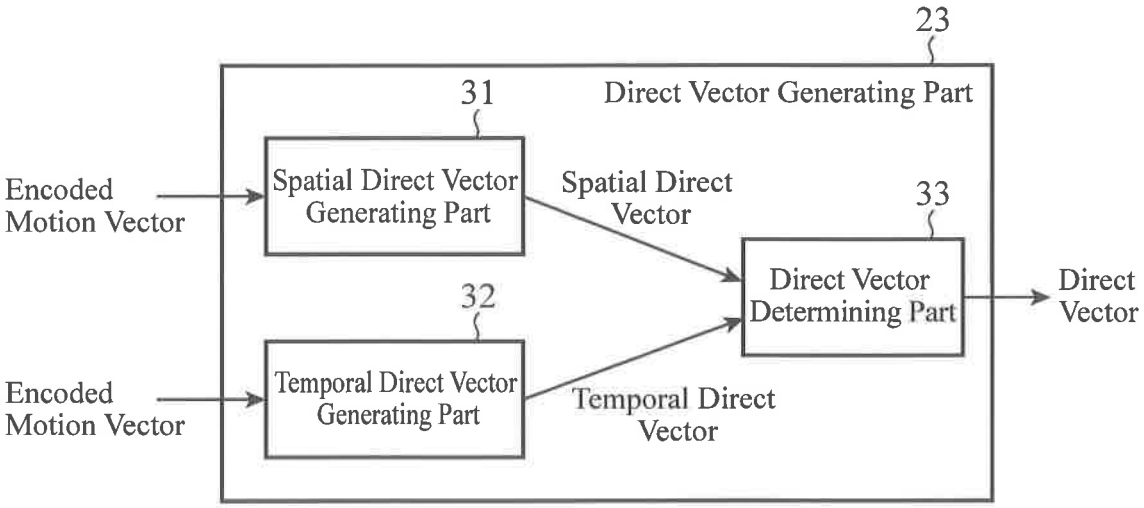

23
Direct Vector Generating Part
31
Spatial Direct Vector Generating Part
Encoded Motion Vector
Spatial Direct Vector
33
Direct Vector Determining Part
Direct Vector
32
Temporal Direct Vector Generating Part
Encoded Motion Vector
Temporal Direct Vector

FIG.4

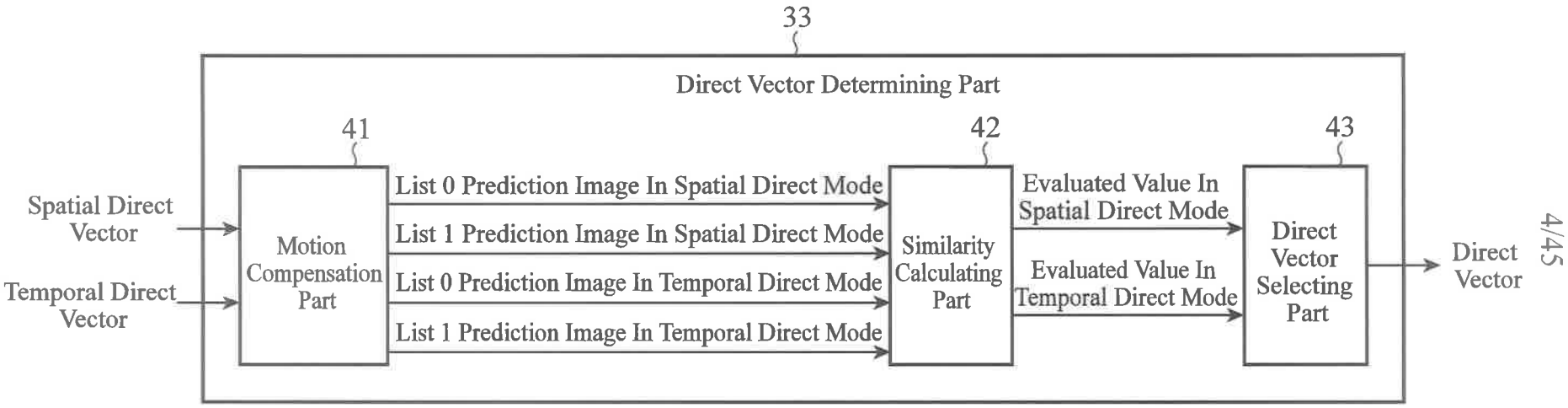

33
Direct Vector Determining Part
41
42
43
Spatial Direct Vector
Temporal Direct Vector
Motion Compensation Part
List 0 Prediction Image In Spatial Direct Mode
List 1 Prediction Image In Spatial Direct Mode
List 0 Prediction Image In Temporal Direct Mode
List 1 Prediction Image In Temporal Direct Mode
Similarity Calculating Part
Evaluated Value In Spatial Direct Mode
Evaluated Value In Temporal Direct Mode
Direct Vector Selecting Part
Direct Vector

FIG.5

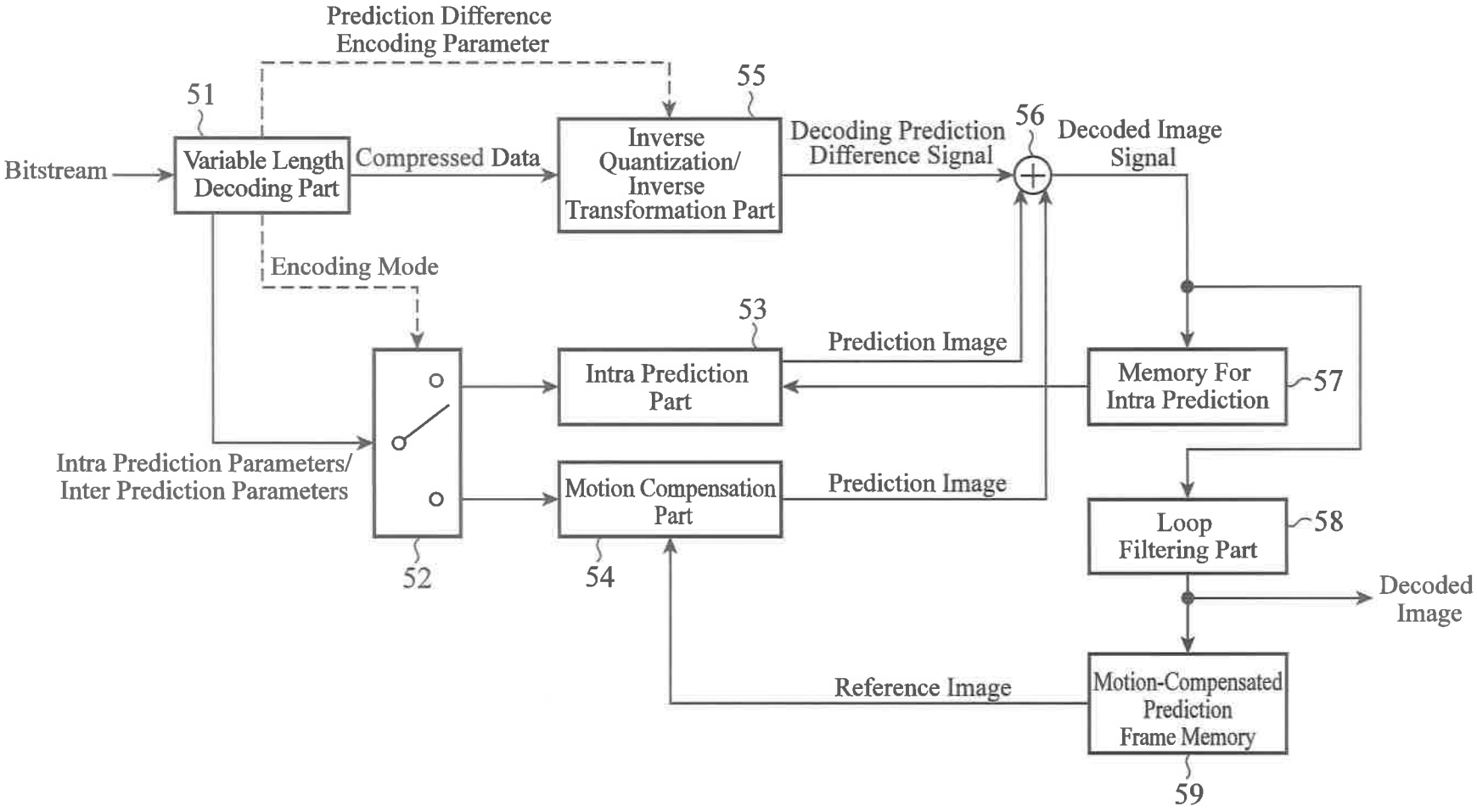

Prediction Difference
Encoding Parameter
51
55
Bitstream
Variable Length
Decoding Part
Compressed Data
Inverse
Quantization/
Inverse
Transformation Part
Decoding Prediction
Difference Signal
56
Decoded Image
Signal
Encoding Mode
53
Prediction Image
Intra Prediction
Part
Memory For
Intra Prediction
57
Intra Prediction Parameters/
Inter Prediction Parameters
Motion Compensation
Part
Prediction Image
Loop
Filtering Part
58
Decoded
Image
52
54
Reference Image
Motion-Compensated
Prediction
Frame Memory
59

FIG.6

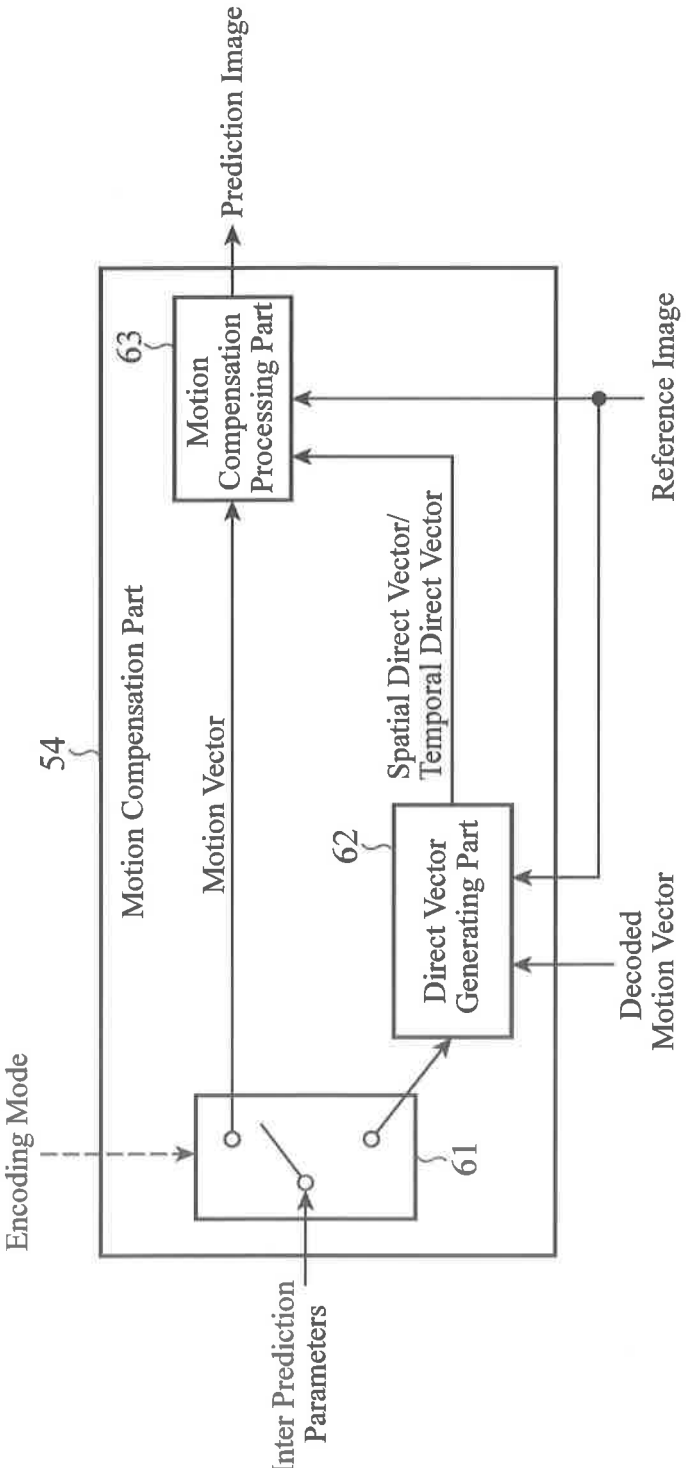

Prediction Image
63
Motion Compensation Processing Part
Reference Image
Motion Compensation Part
54
Motion Vector
Spatial Direct Vector/ Temporal Direct Vector
62
Direct Vector Generating Part
Decoded Motion Vector
Encoding Mode
61
Inter Prediction Parameters

FIG.7

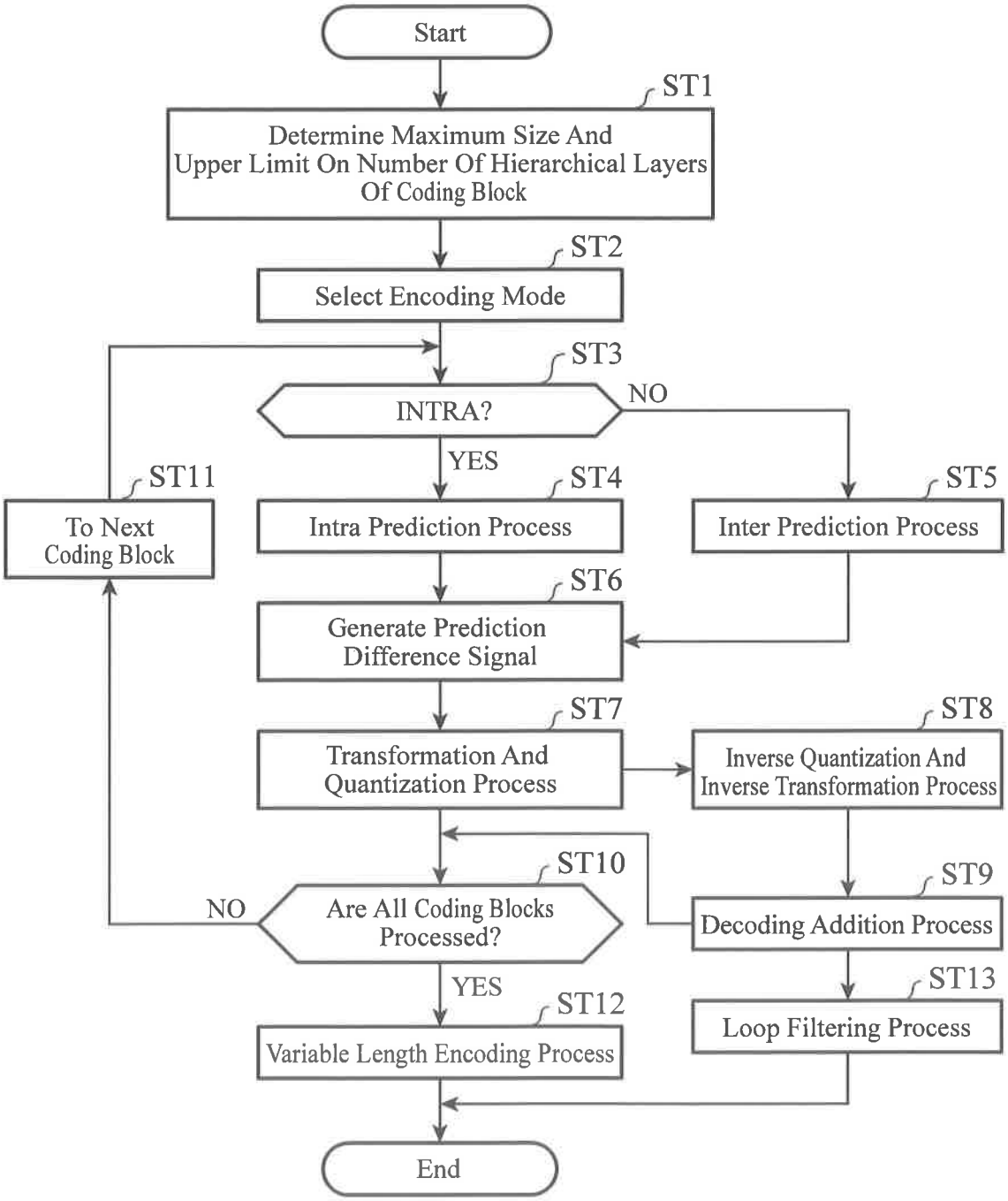

Start
ST1
Determine Maximum Size And Upper Limit On Number Of Hierarchical Layers Of Coding Block
ST2
Select Encoding Mode
ST3
INTRA?
NO
YES
ST4
Intra Prediction Process
ST5
Inter Prediction Process
ST11
To Next Coding Block
ST6
Generate Prediction Difference Signal
ST7
Transformation And Quantization Process
ST8
Inverse Quantization And Inverse Transformation Process
ST10
Are All Coding Blocks Processed?
NO
ST9
Decoding Addition Process
YES
ST12
Variable Length Encoding Process
ST13
Loop Filtering Process
End

FIG.8

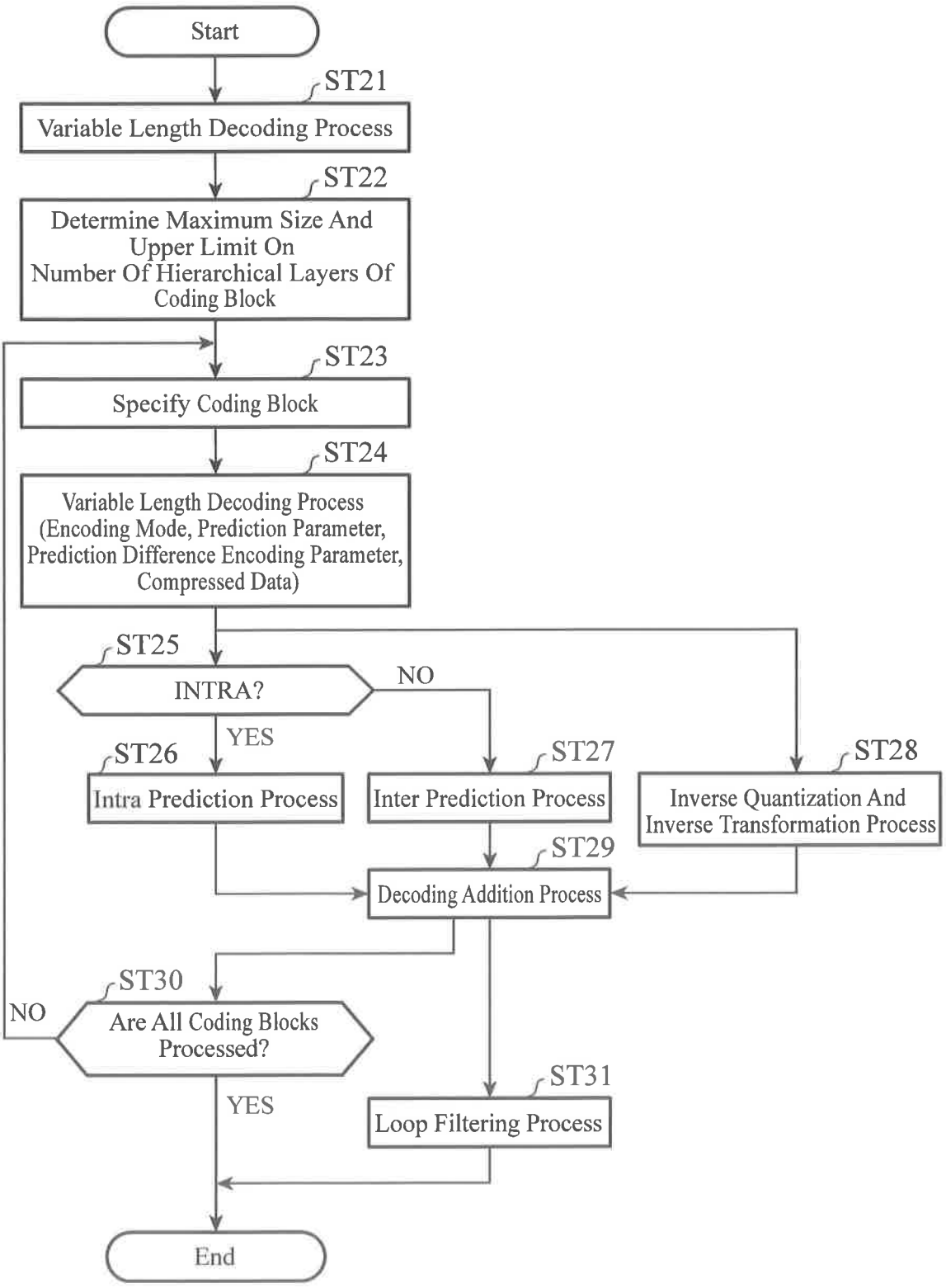

Start
ST21
Variable Length Decoding Process
ST22
Determine Maximum Size And Upper Limit On Number Of Hierarchical Layers Of Coding Block
ST23
Specify Coding Block
ST24
Variable Length Decoding Process (Encoding Mode, Prediction Parameter, Prediction Difference Encoding Parameter, Compressed Data)
ST25
INTRA?
NO
YES
ST26
Intra Prediction Process
ST27
Inter Prediction Process
ST28
Inverse Quantization And Inverse Transformation Process
ST29
Decoding Addition Process
ST30
Are All Coding Blocks Processed?
NO
YES
ST31
Loop Filtering Process
End

FIG.9

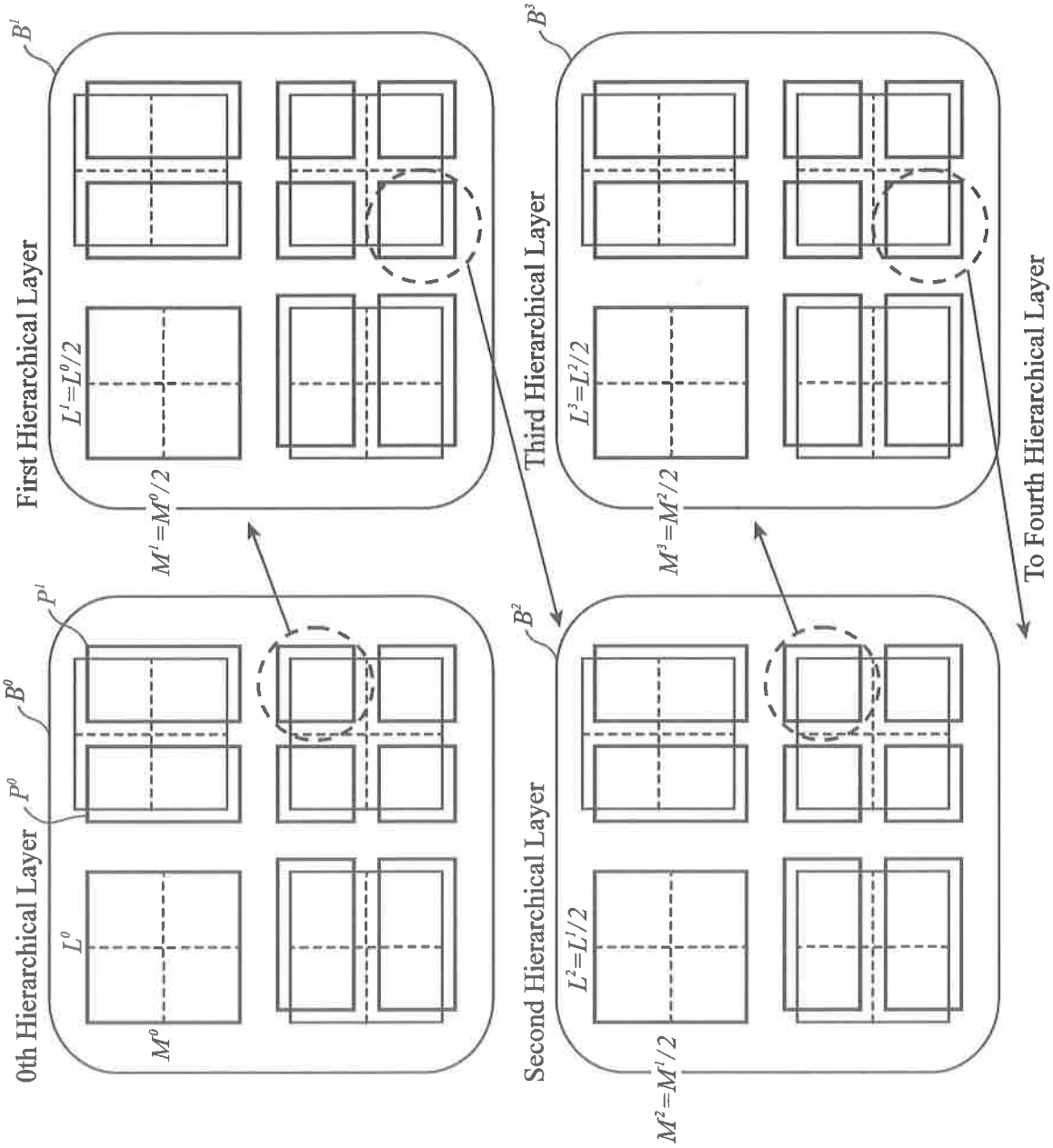

0th Hierarchical Layer
First Hierarchical Layer
Second Hierarchical Layer
Third Hierarchical Layer
To Fourth Hierarchical Layer
B^0
B^1
B^2
B^3
P^0
P^1
L^0
M^0
$L^1=L^0/2$
$M^1=M^0/2$
$L^2=L^1/2$
$M^2=M^1/2$
$L^3=L^2/2$
$M^3=M^2/2$

FIG.10

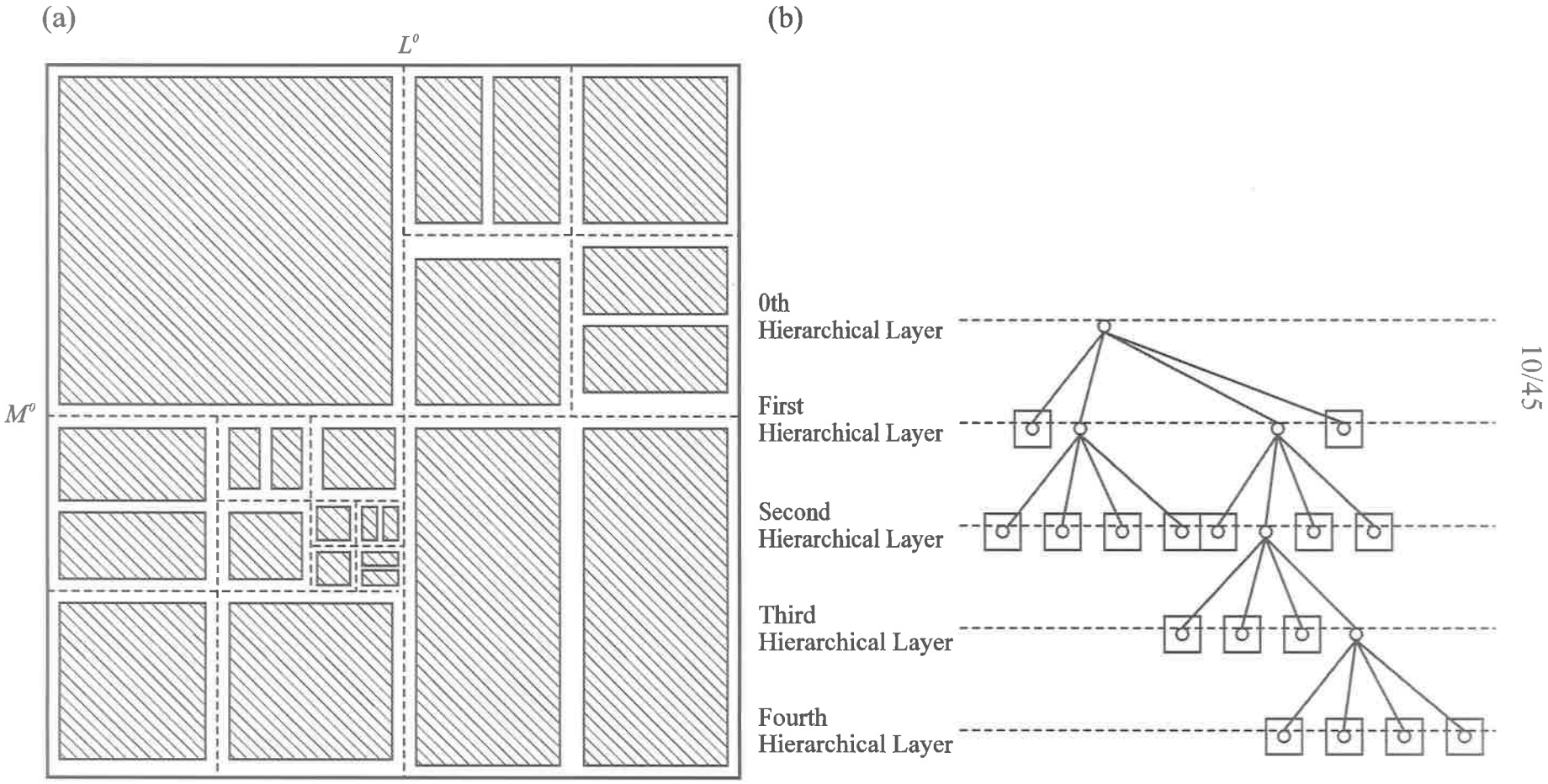

(a)
L^0
M^0
(b)
0th
Hierarchical Layer
First
Hierarchical Layer
Second
Hierarchical Layer
Third
Hierarchical Layer
Fourth
Hierarchical Layer

FIG.11

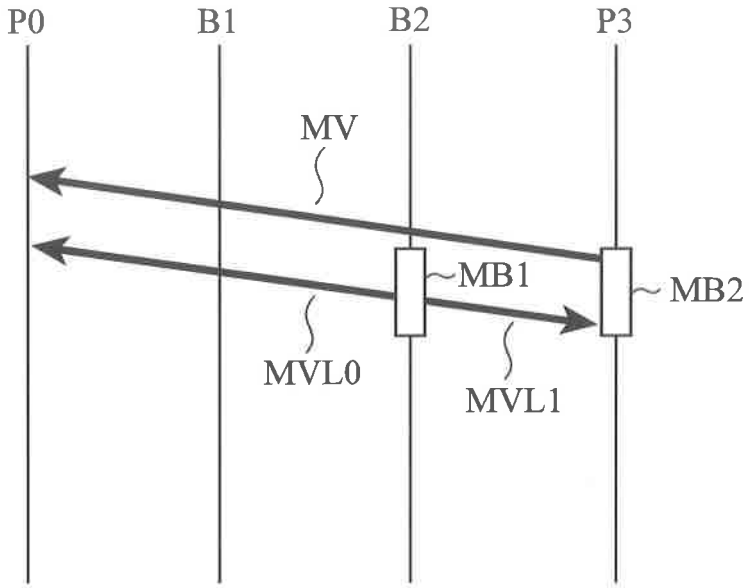


FIG.12

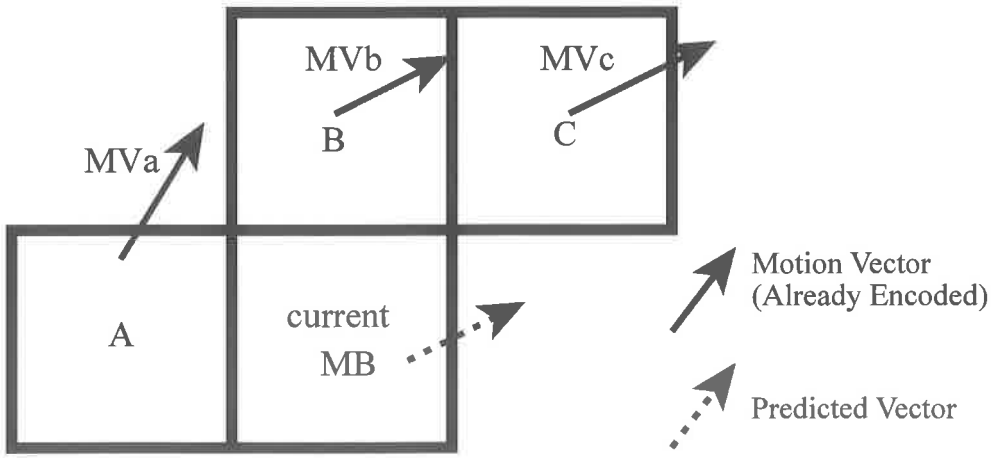


FIG.13

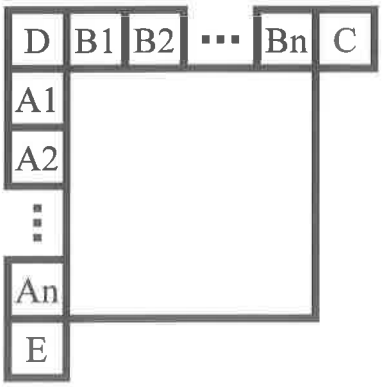


FIG.14

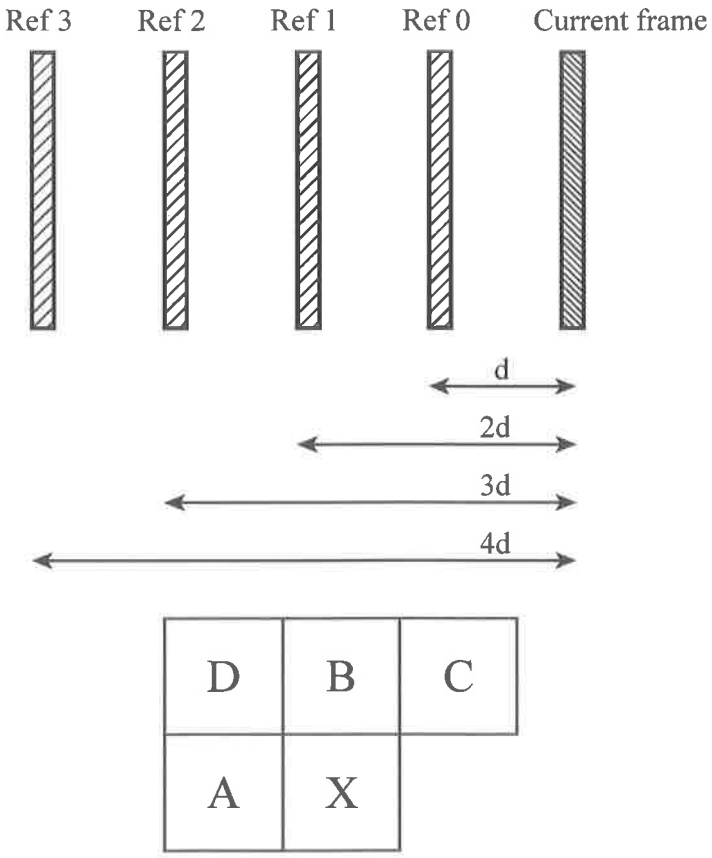
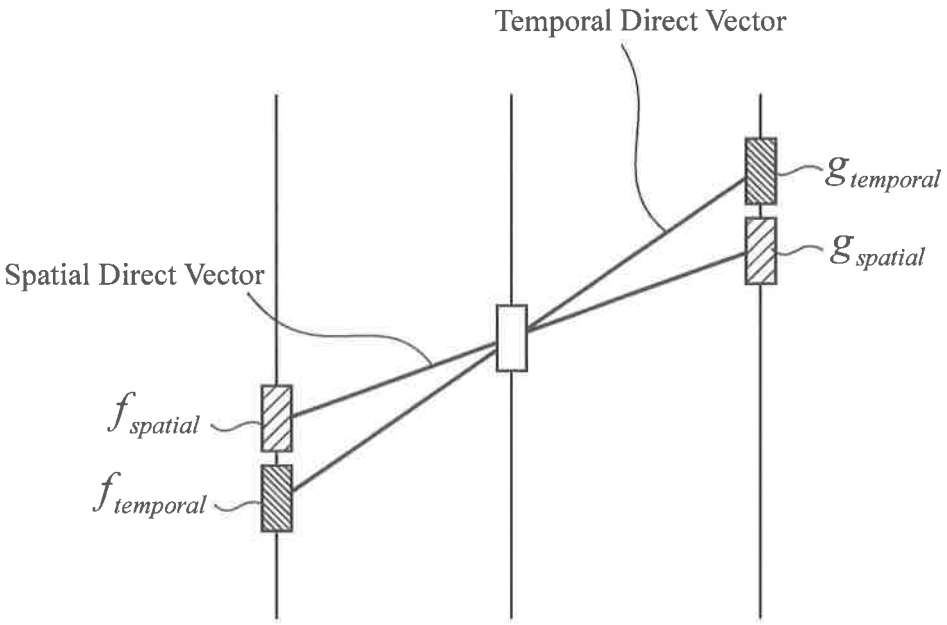


FIG.15

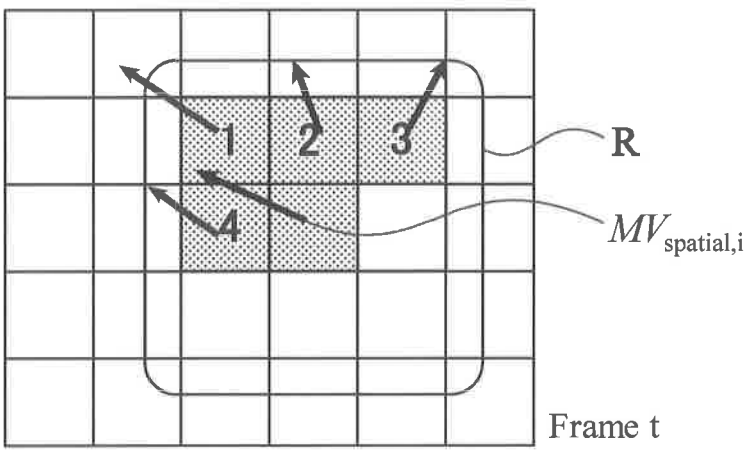


$$SAD_{spatial} = \left| f_{spatial} - g_{spatial} \right|$$

$$SAD_{temporal} = \left| f_{temporal} - g_{temporal} \right|$$

FIG.16

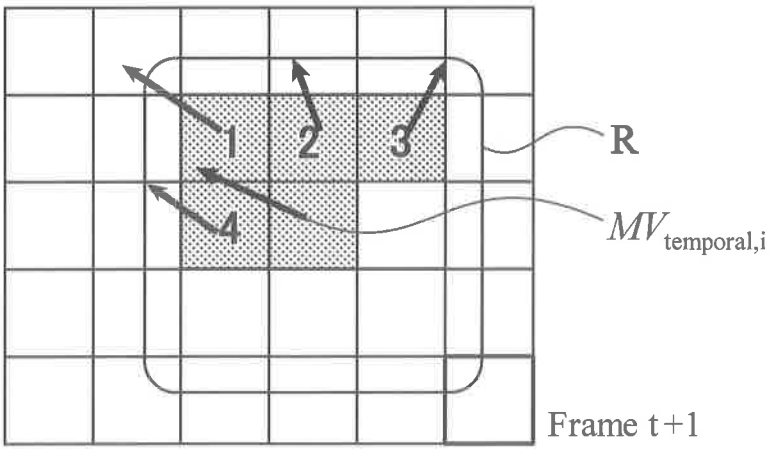
(a)



Evaluation Equation Using Variance

$$\sigma\,(spatial) = \frac{1}{N}\sum_{i \in R}(MV_{spatial,i} - \overline{MV}_{spatial})^2,\ N = 4$$

(b)



Evaluation Equation Using Variance

$$\sigma\,(temporal) = \frac{1}{N}\sum_{i \in R}(MV_{temporal,i} - \overline{MV}_{temporal})^2,\ N = 4$$

FIG.17

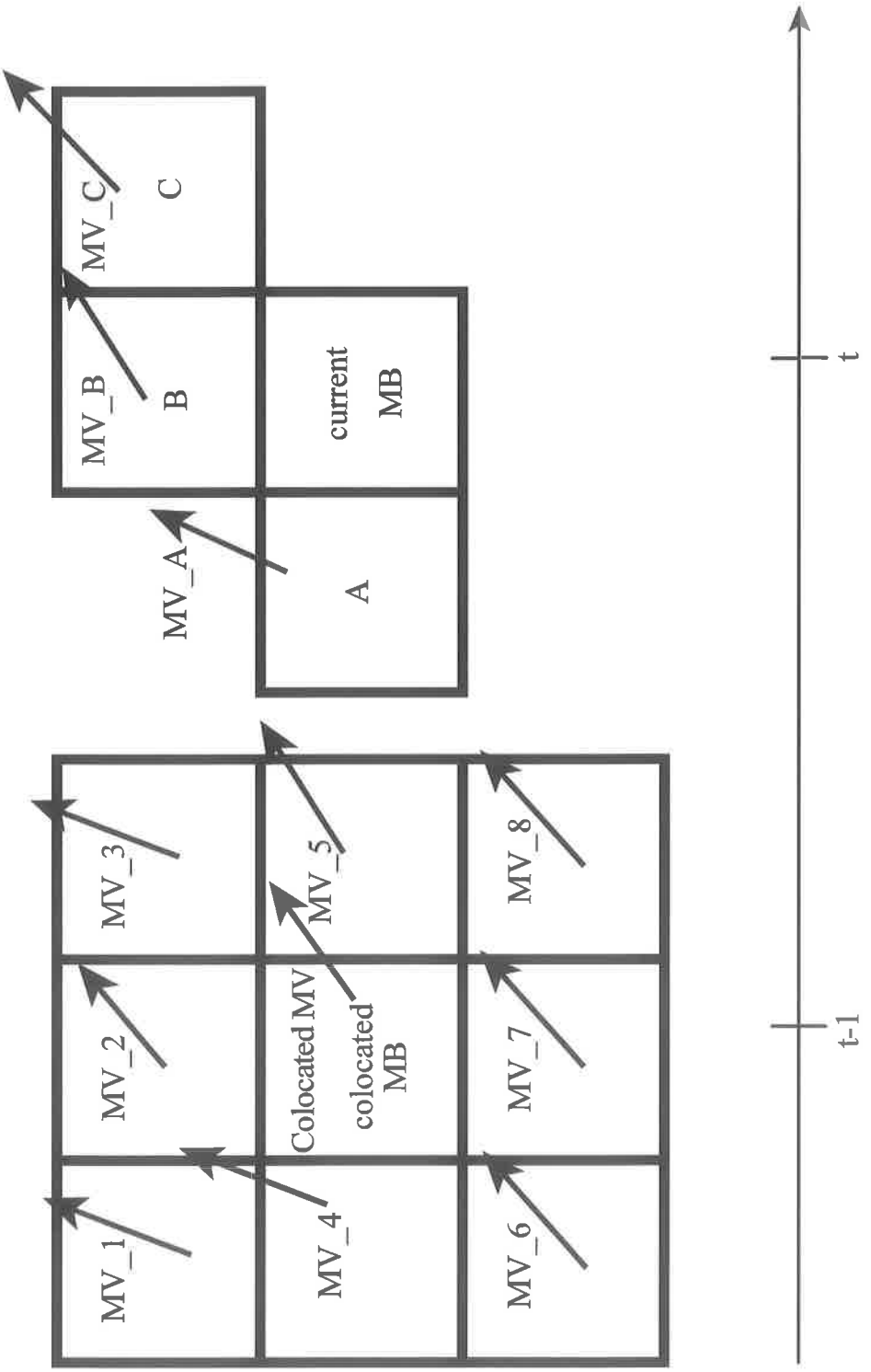
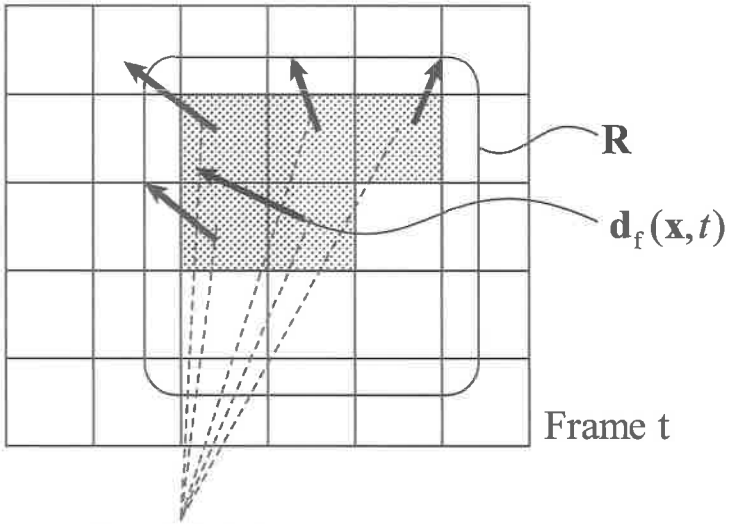

MV_1
MV_2
MV_3
MV_4
Colocated MV
colocated MB
MV_5
MV_6
MV_7
MV_8
t-1
t
MV_A
A
current MB
MV_B
B
MV_C
C

FIG.18



Encoded Vector

$\mathbf{d}(\mathbf{x}+\mathbf{v}_i,t+1),0\le i\le 4,(\mathbf{v}_4=\mathbf{0})$

Encoding Residual

$\boldsymbol{e}(\mathbf{x}+\mathbf{v}_i,t+1),0\le i\le 4,(\mathbf{v}_4=\mathbf{0})$

Estimate Equation $\mathbf{d}_f(\mathbf{x},t)=\dfrac{\sum_R \varphi_i \mathbf{d}(\mathbf{x}+\mathbf{v}_i,t+1)}{\sum_R \varphi_i}$

Where $\varphi_i=\dfrac{1}{\sum_{\mathbf{x}\in B}\left|e(\mathbf{x}+\mathbf{v}_i,t+1)\right|}$

FIG.19

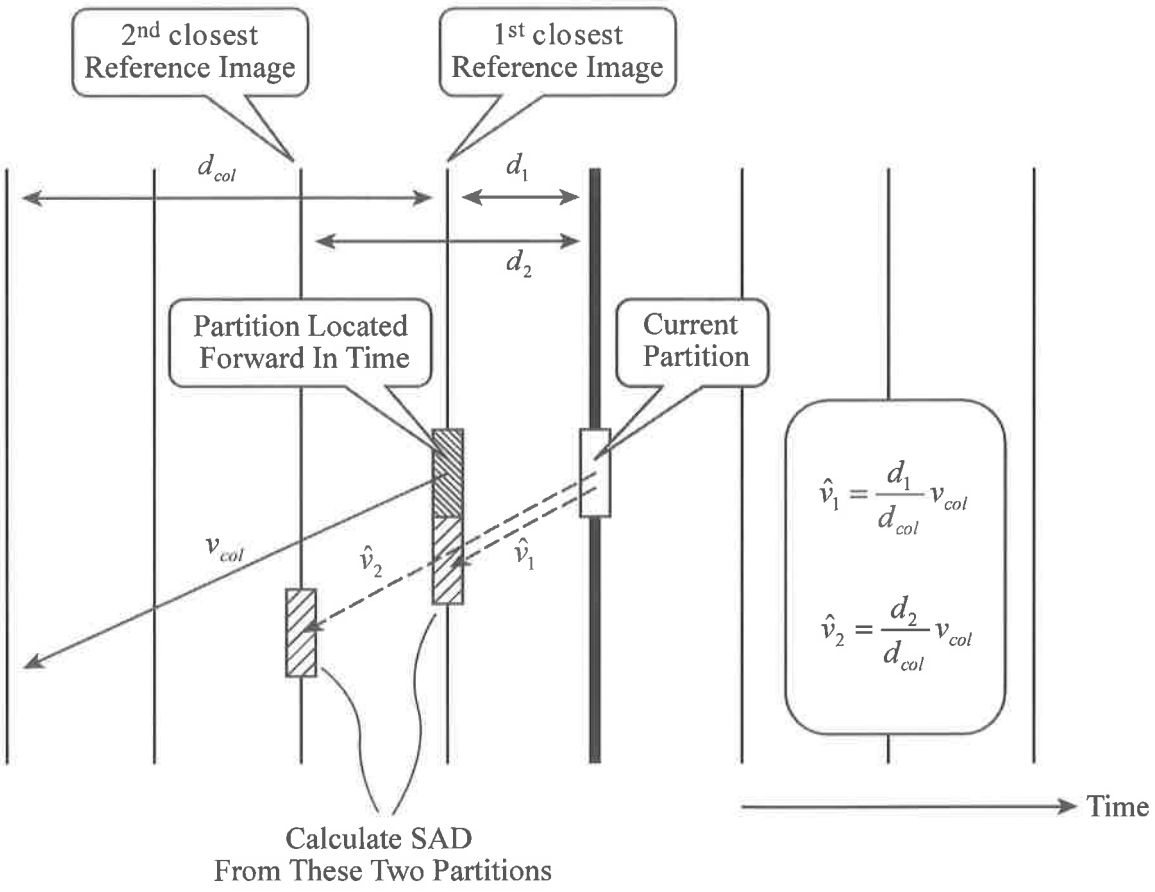
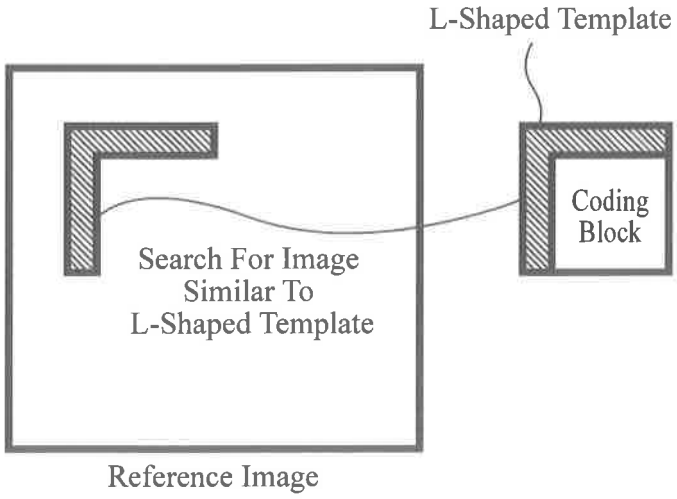

2nd closest Reference Image
1st closest Reference Image
d_{col}
d_1
d_2
Partition Located Forward In Time
Current Partition
v_{col}
$\hat{v}_2$
$\hat{v}_1$
$\hat{v}_1 = \frac{d_1}{d_{col}} v_{col}$
$\hat{v}_2 = \frac{d_2}{d_{col}} v_{col}$
Time
Calculate SAD From These Two Partitions

FIG.20


L-Shaped Template
Coding Block
Search For Image Similar To L-Shaped Template
Reference Image

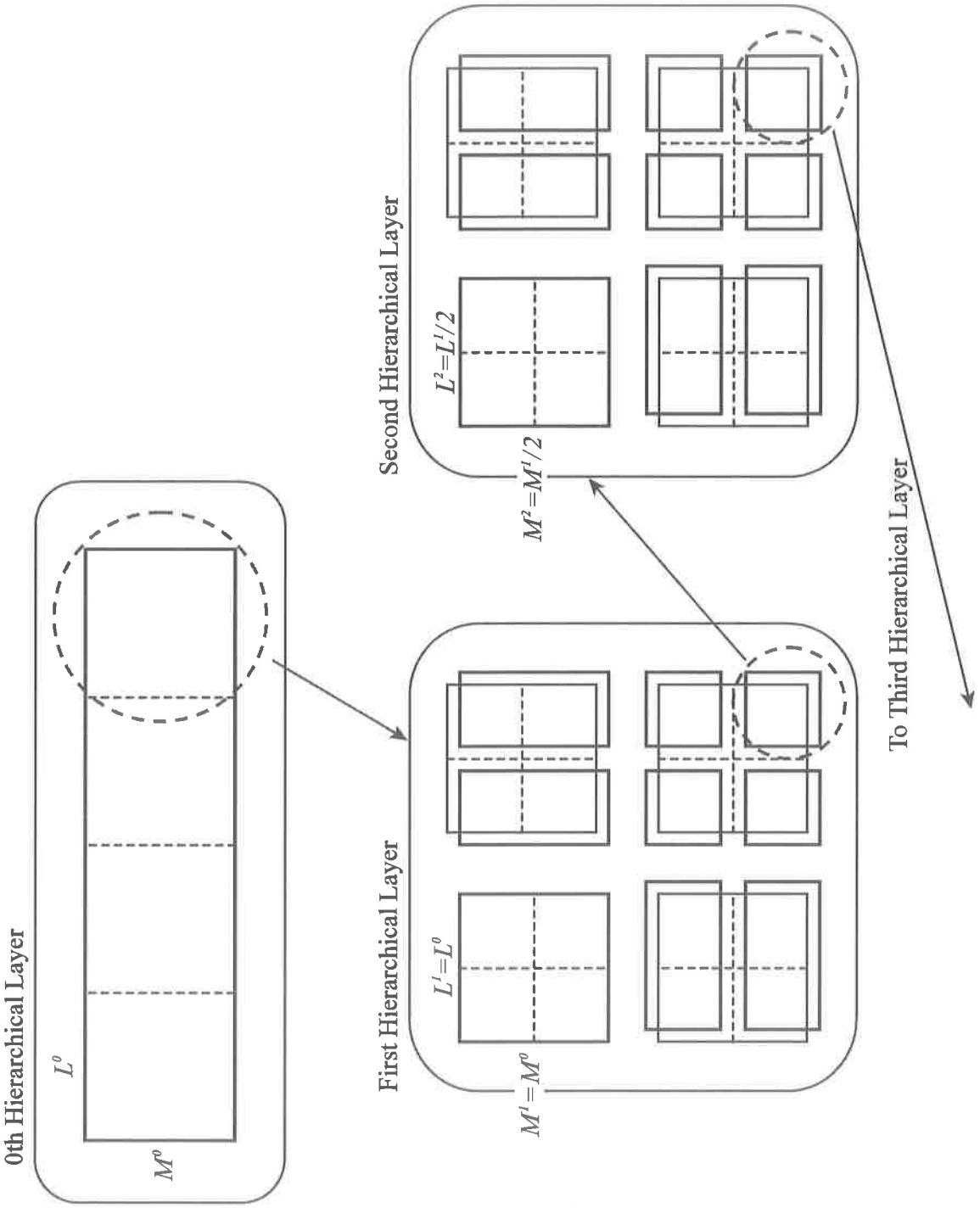

0th Hierarchical Layer
L^0
M^0
First Hierarchical Layer
$L^1=L^0$
$M^1=M^0$
Second Hierarchical Layer
$L^2=L^1/2$
$M^2=M^1/2$
To Third Hierarchical Layer

FIG.21

FIG.22

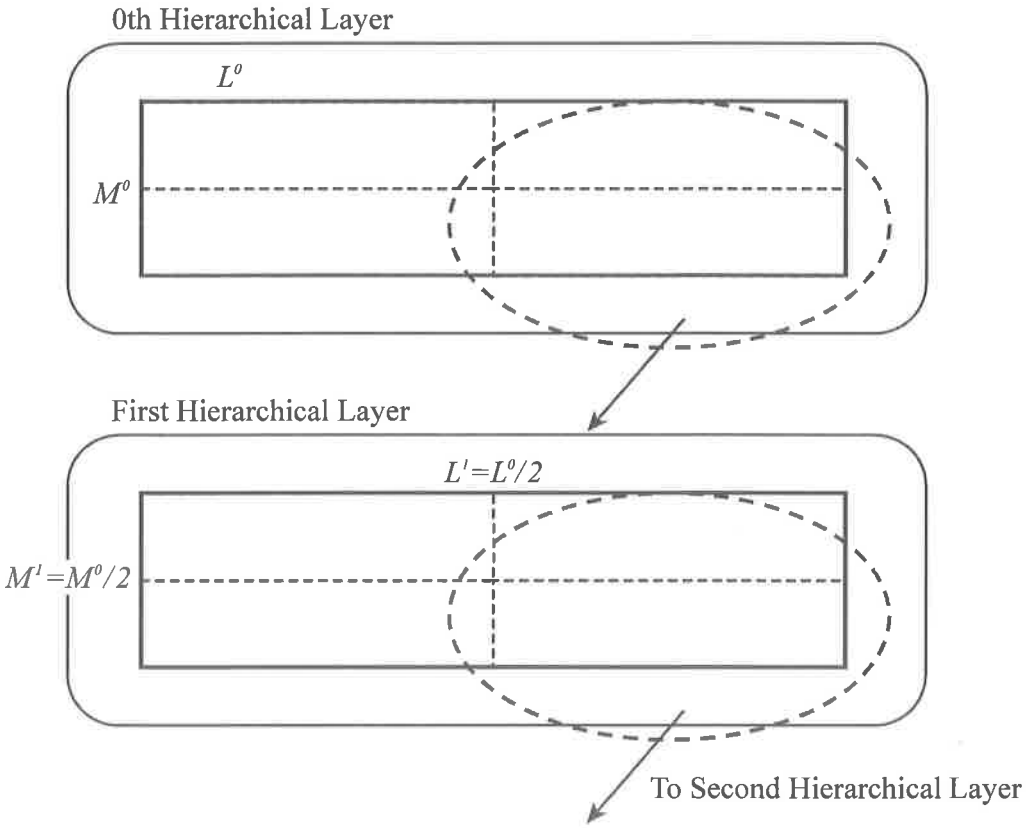

0th Hierarchical Layer
L^0
M^0
First Hierarchical Layer
$L^1=L^0/2$
$M^1=M^0/2$
To Second Hierarchical Layer

FIG.23

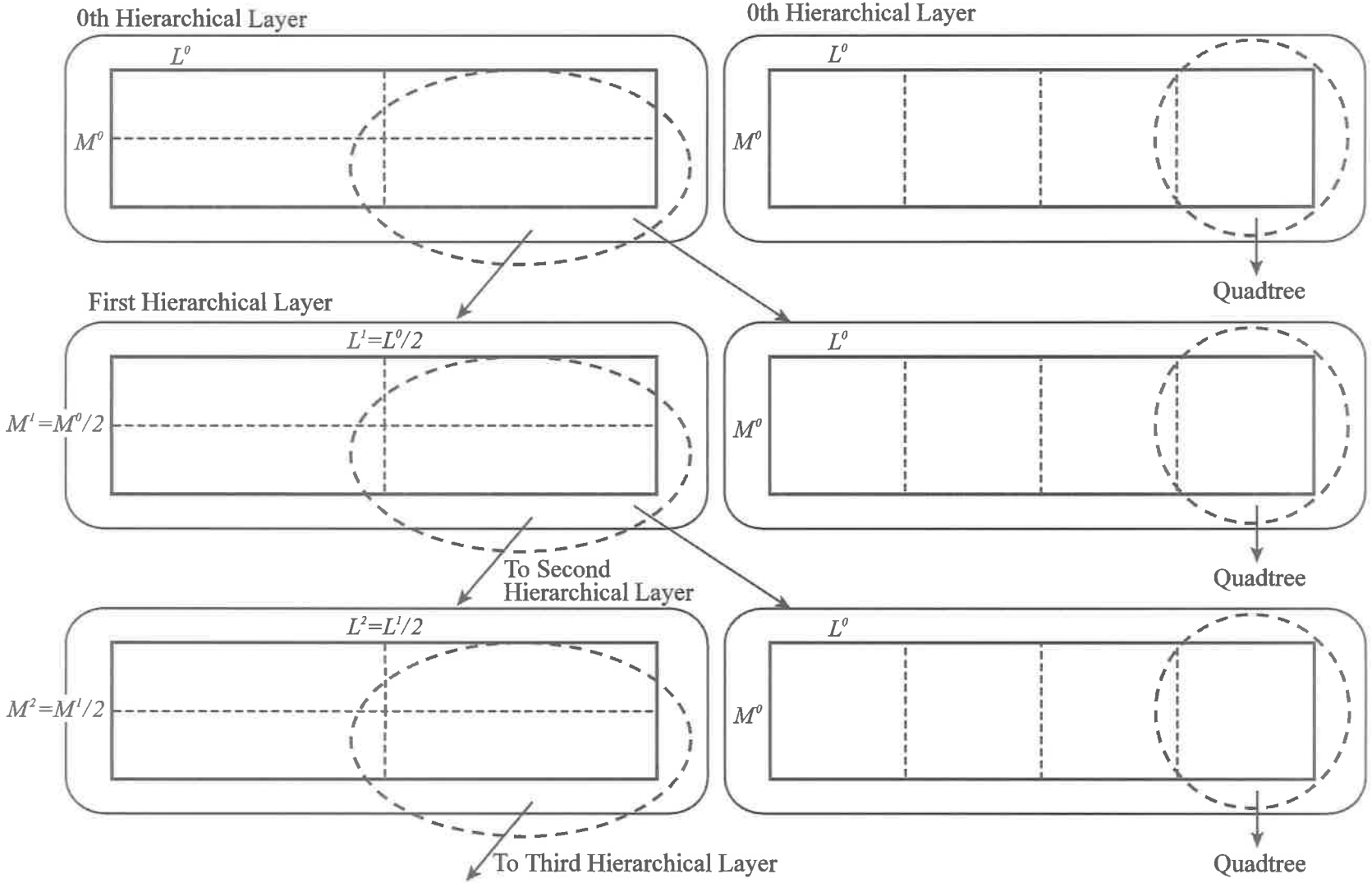

0th Hierarchical Layer
L^0
M^0
0th Hierarchical Layer
L^0
M^0
Quadtree
First Hierarchical Layer
$L^1=L^0/2$
$M^1=M^0/2$
L^0
M^0
Quadtree
To Second Hierarchical Layer
$L^2=L^1/2$
$M^2=M^1/2$
L^0
M^0
Quadtree
To Third Hierarchical Layer

FIG.24

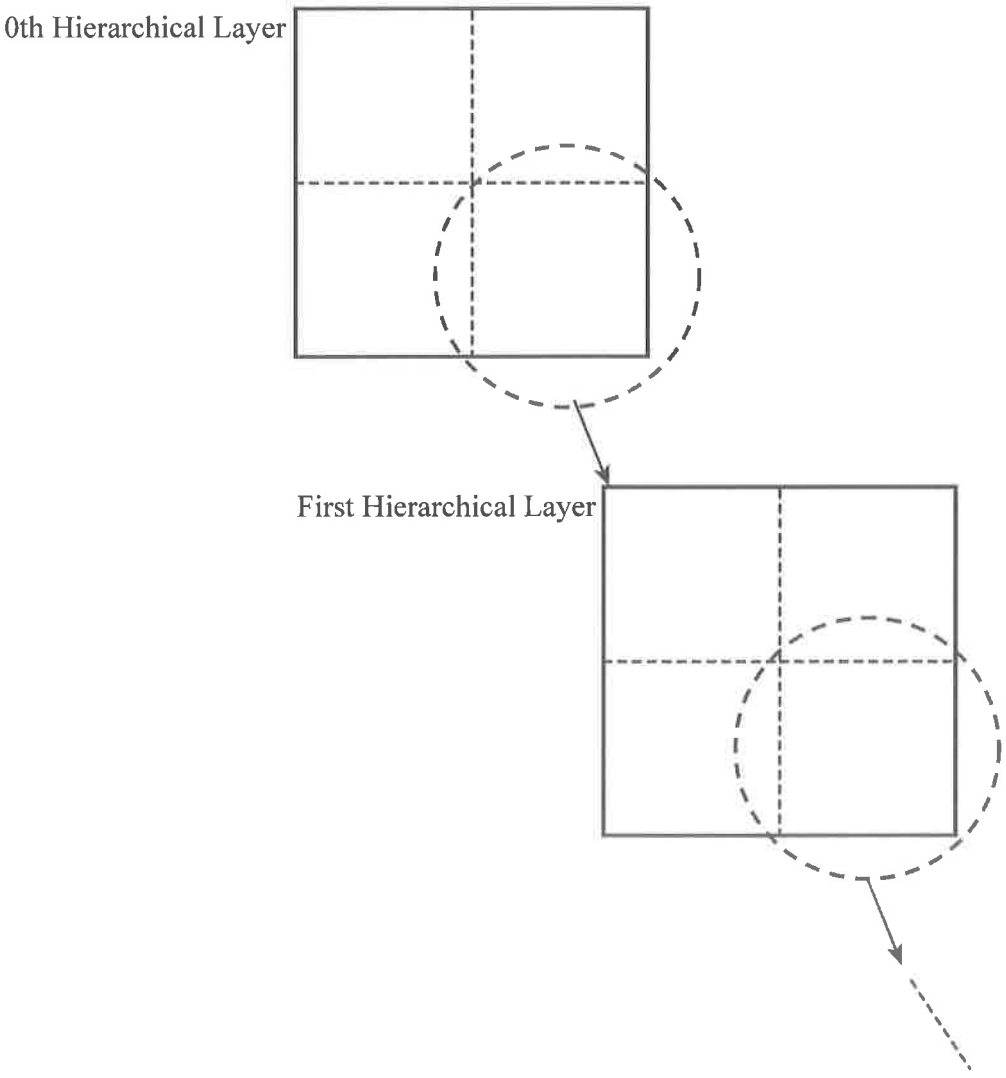


FIG.25

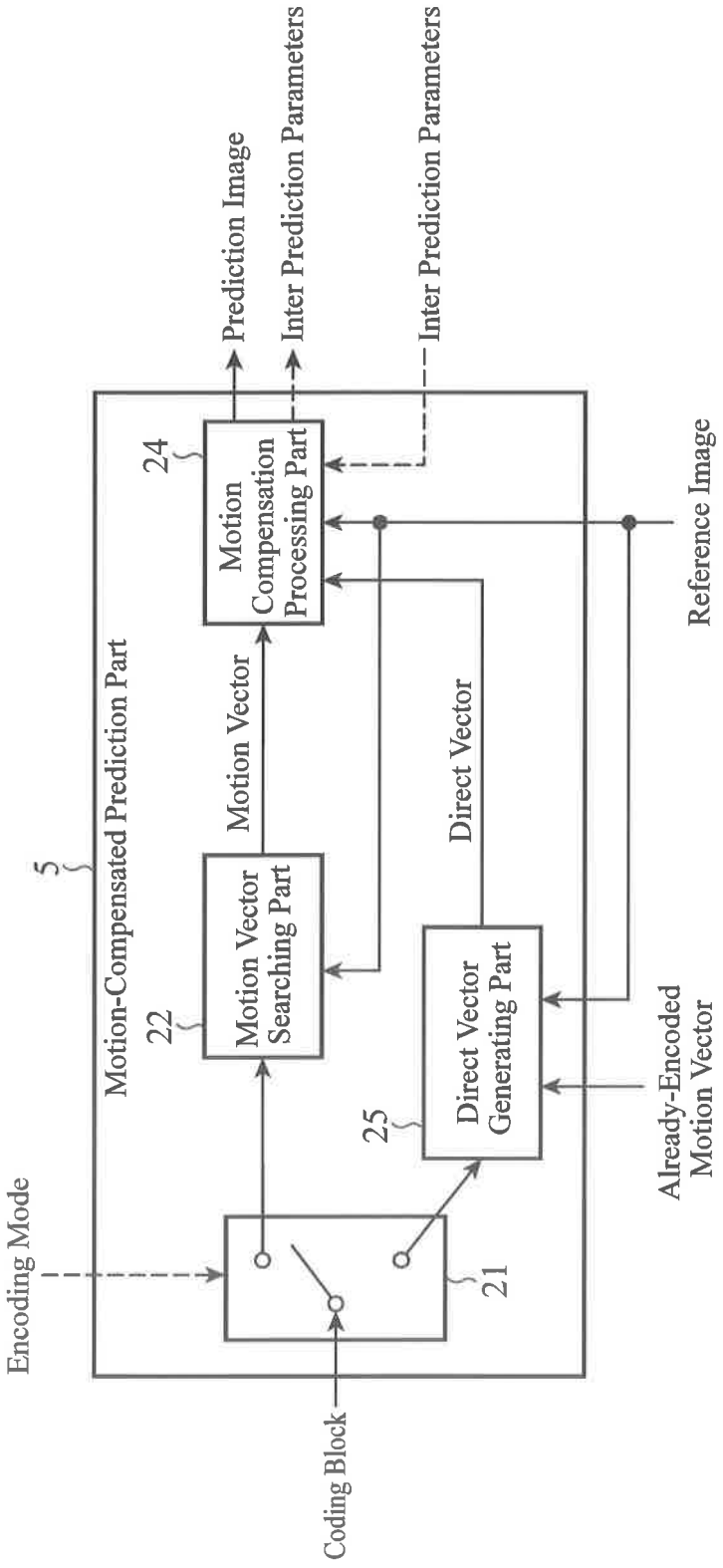

Prediction Image
Inter Prediction Parameters
Inter Prediction Parameters
24
Motion Compensation Processing Part
Reference Image
Motion-Compensated Prediction Part
5
Motion Vector
Direct Vector
22
Motion Vector Searching Part
25
Direct Vector Generating Part
Already-Encoded Motion Vector
Encoding Mode
21
Coding Block

FIG.26

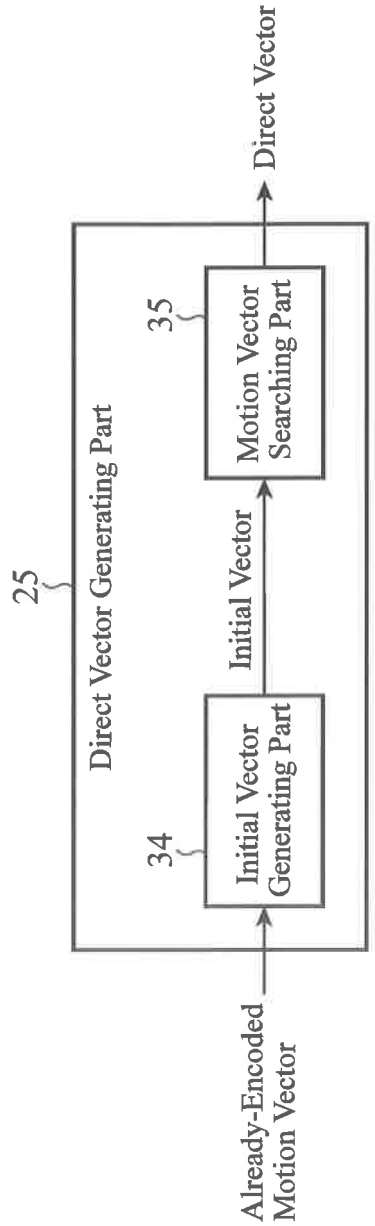

Already-Encoded Motion Vector
25
Direct Vector Generating Part
34
Initial Vector Generating Part
Initial Vector
35
Motion Vector Searching Part
Direct Vector

FIG.27

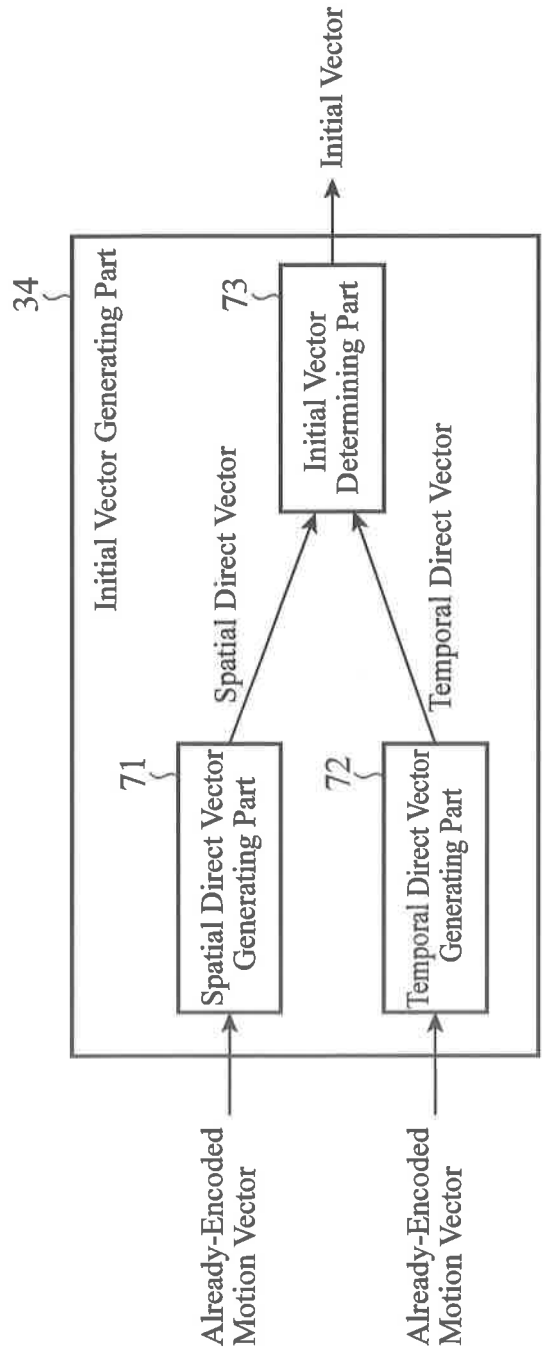

Initial Vector
34
Initial Vector Generating Part
73
Initial Vector Determining Part
Spatial Direct Vector
Temporal Direct Vector
71
Spatial Direct Vector Generating Part
72
Temporal Direct Vector Generating Part
Already-Encoded Motion Vector
Already-Encoded Motion Vector

FIG.28

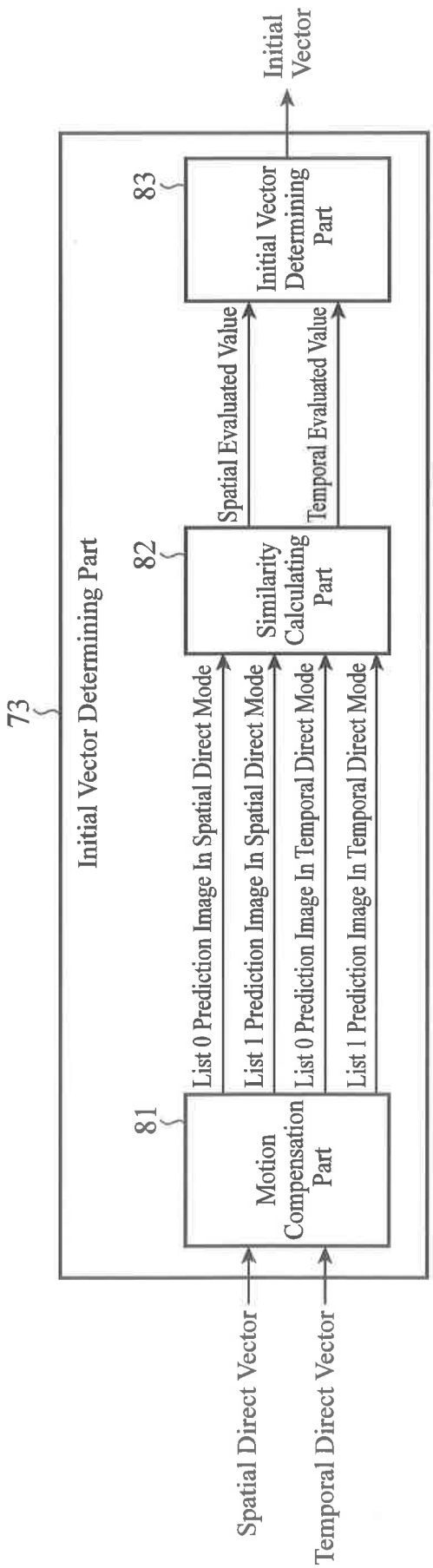

Spatial Direct Vector
Temporal Direct Vector
73
Initial Vector Determining Part
81
Motion Compensation Part
List 0 Prediction Image In Spatial Direct Mode
List 1 Prediction Image In Spatial Direct Mode
List 0 Prediction Image In Temporal Direct Mode
List 1 Prediction Image In Temporal Direct Mode
82
Similarity Calculating Part
Spatial Evaluated Value
Temporal Evaluated Value
83
Initial Vector Determining Part
Initial Vector

FIG.29

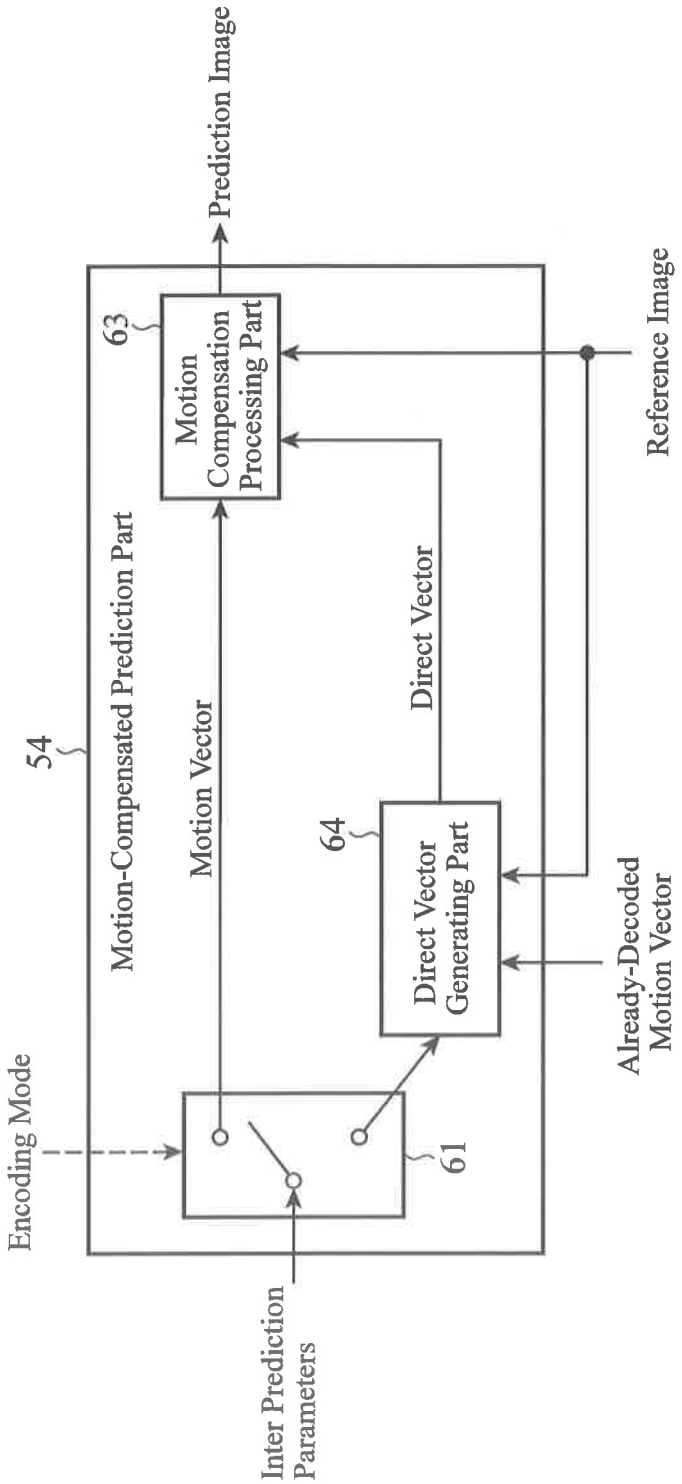

Prediction Image
63
Motion Compensation Processing Part
Reference Image
54
Motion-Compensated Prediction Part
Motion Vector
Direct Vector
64
Direct Vector Generating Part
Already-Decoded Motion Vector
Encoding Mode
61
Inter Prediction Parameters

FIG.30

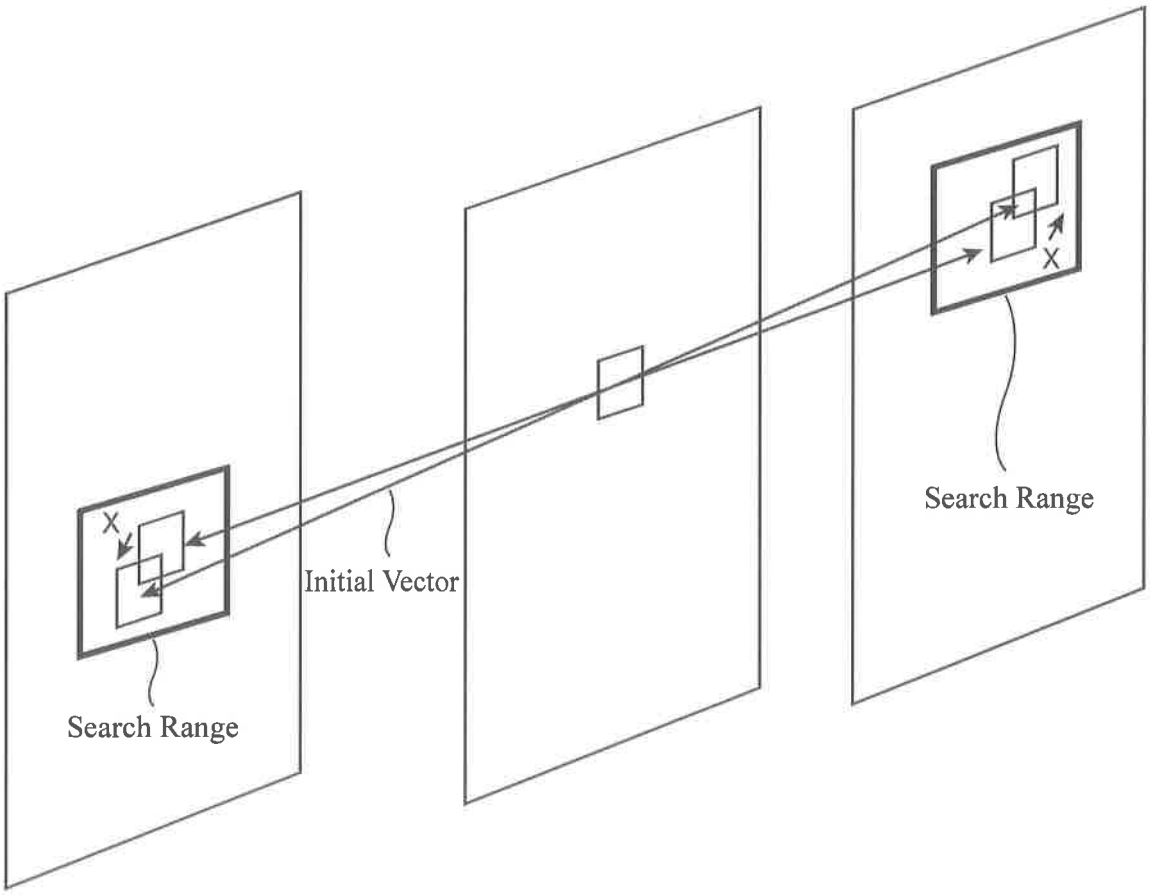


FIG.31

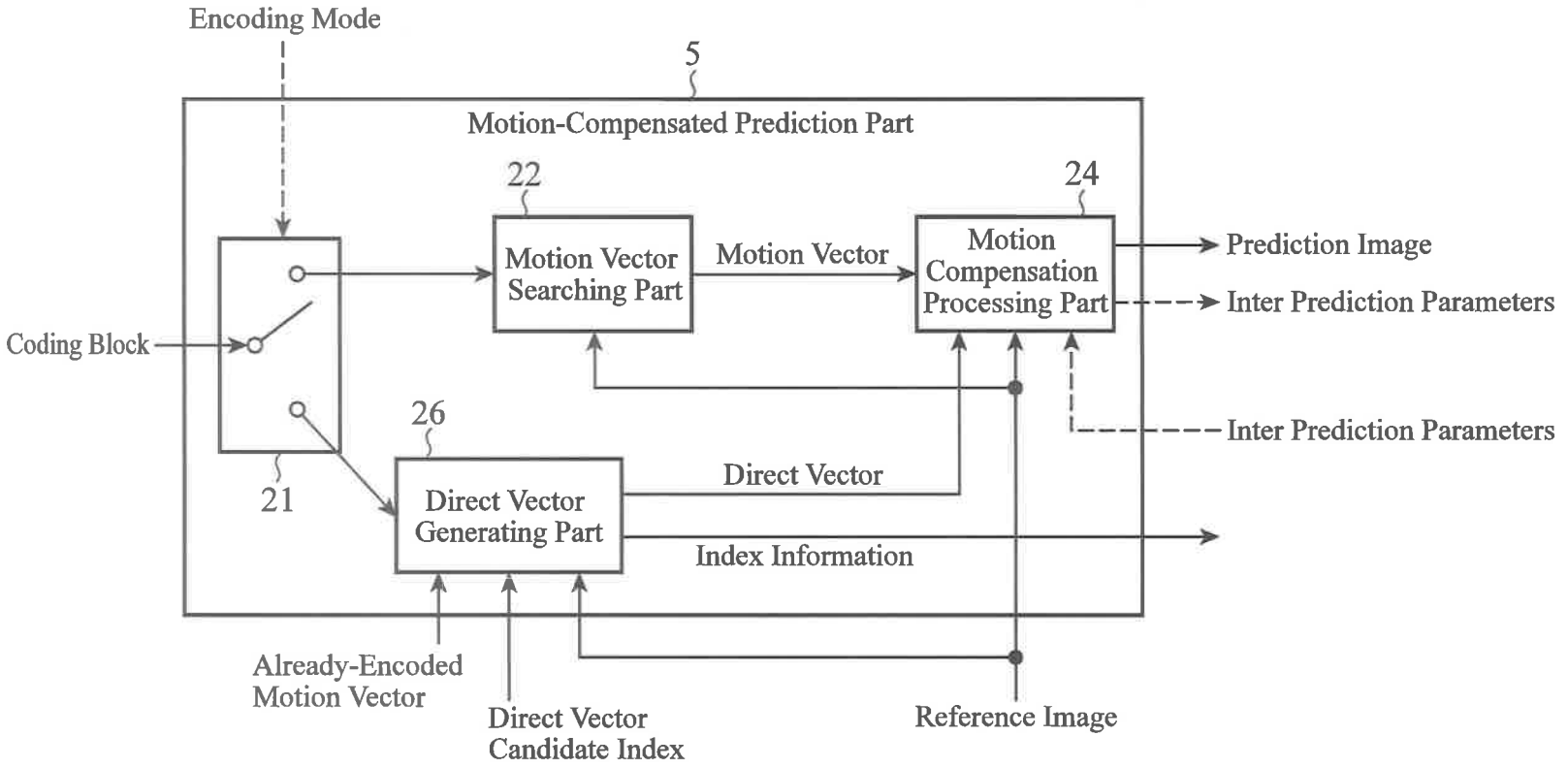

Encoding Mode
5
Motion-Compensated Prediction Part
22
24
Motion Vector Searching Part
Motion Vector
Motion Compensation Processing Part
Prediction Image
Inter Prediction Parameters
Coding Block
26
Inter Prediction Parameters
21
Direct Vector Generating Part
Direct Vector
Index Information
Already-Encoded Motion Vector
Direct Vector Candidate Index
Reference Image

FIG.32

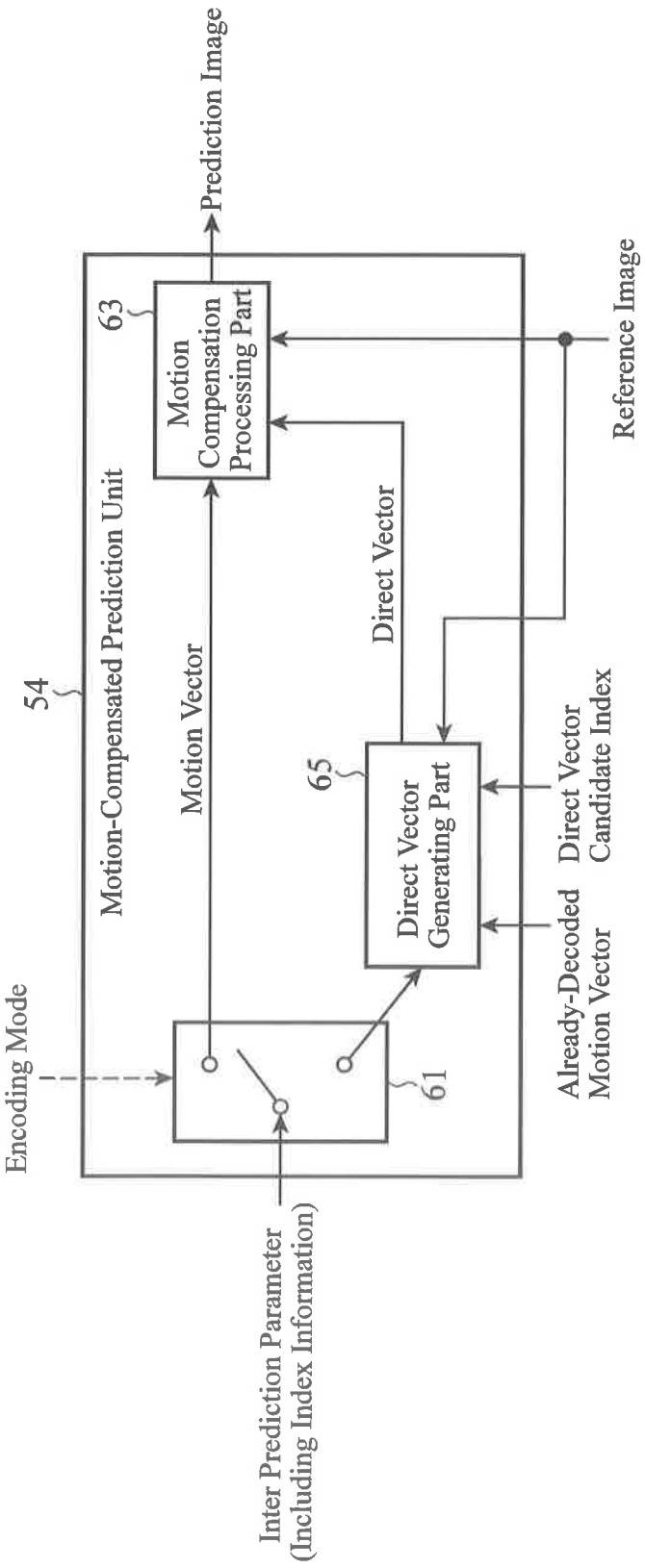
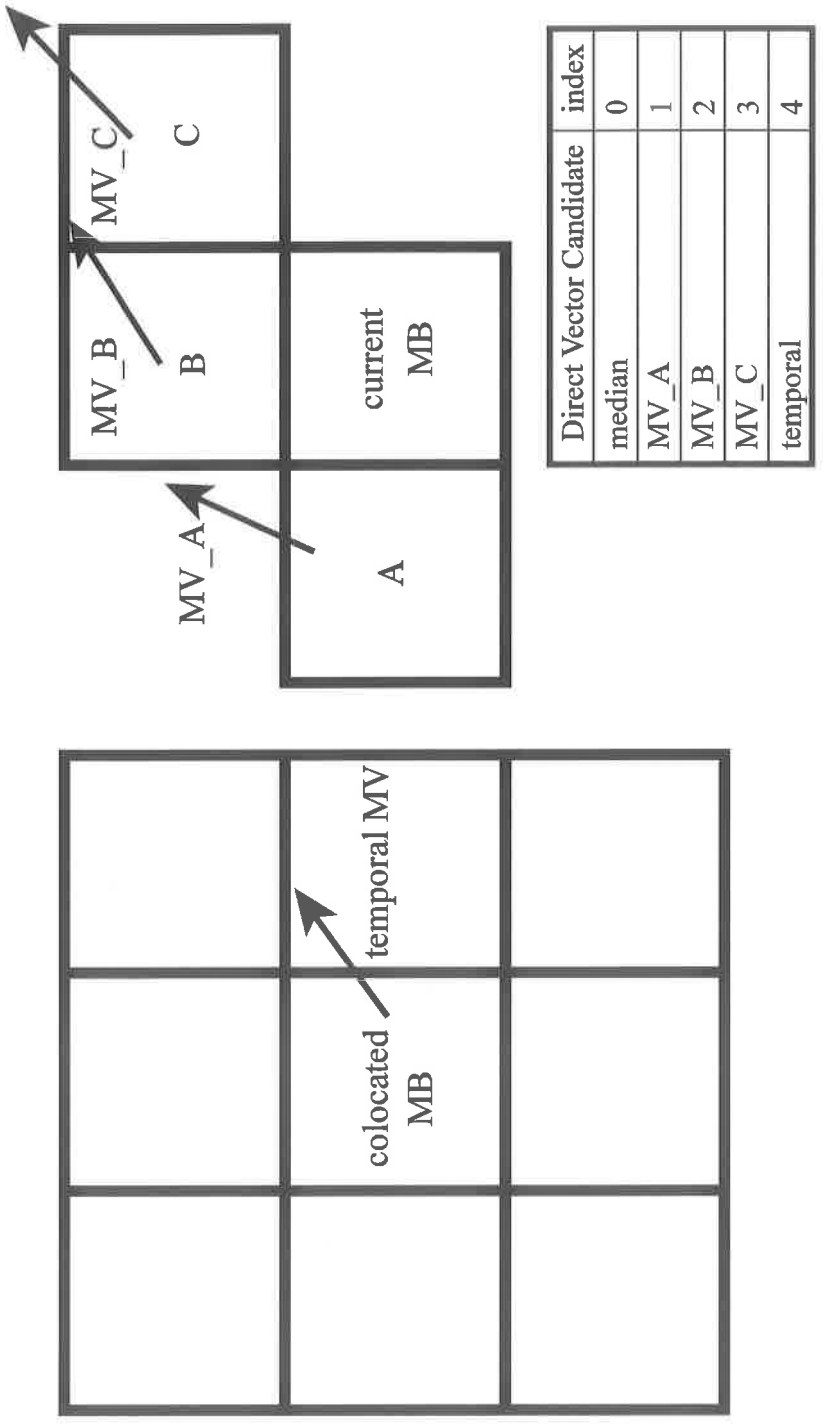

Prediction Image
Motion Compensation Processing Part
63
Reference Image
Motion-Compensated Prediction Unit
54
Motion Vector
Direct Vector
65
Direct Vector Generating Part
Direct Vector Candidate Index
Encoding Mode
61
Already-Decoded Motion Vector
Inter Prediction Parameter (Including Index Information)

FIG.33



Direct Vector Candidate	index
median	0
MV_A	1
MV_B	2
MV_C	3
temporal	4

FIG.34

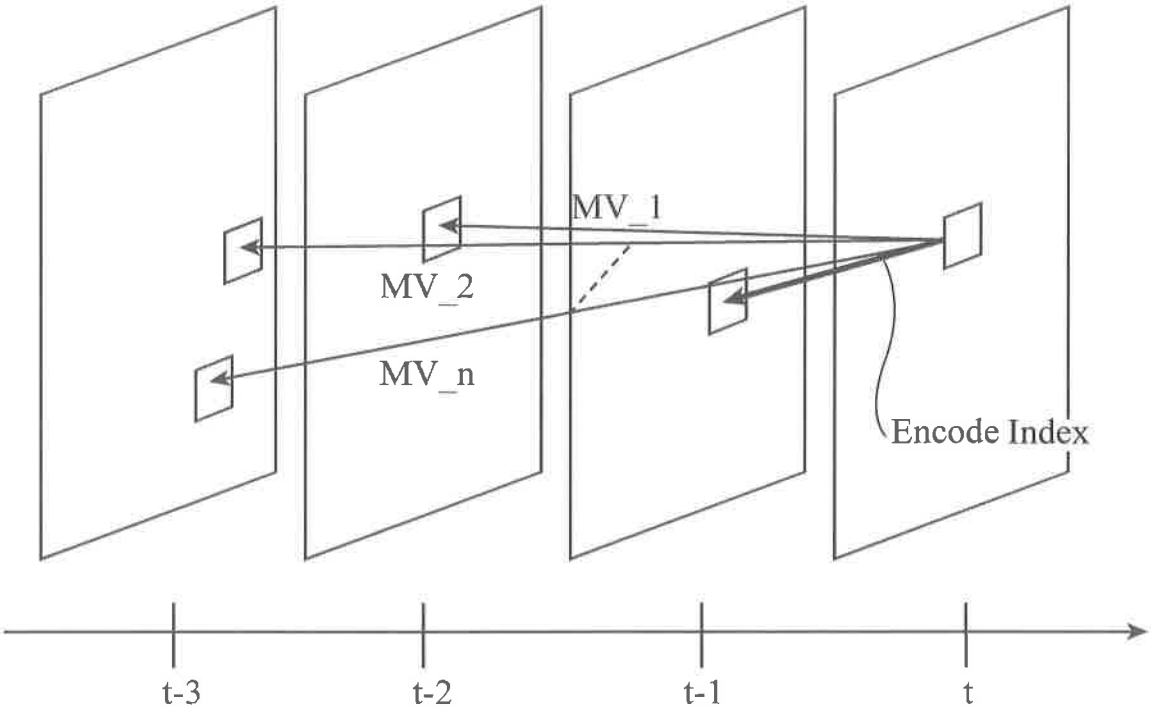

MV_1
MV_2
MV_n
Encode Index
t-3
t-2
t-1
t

FIG.35

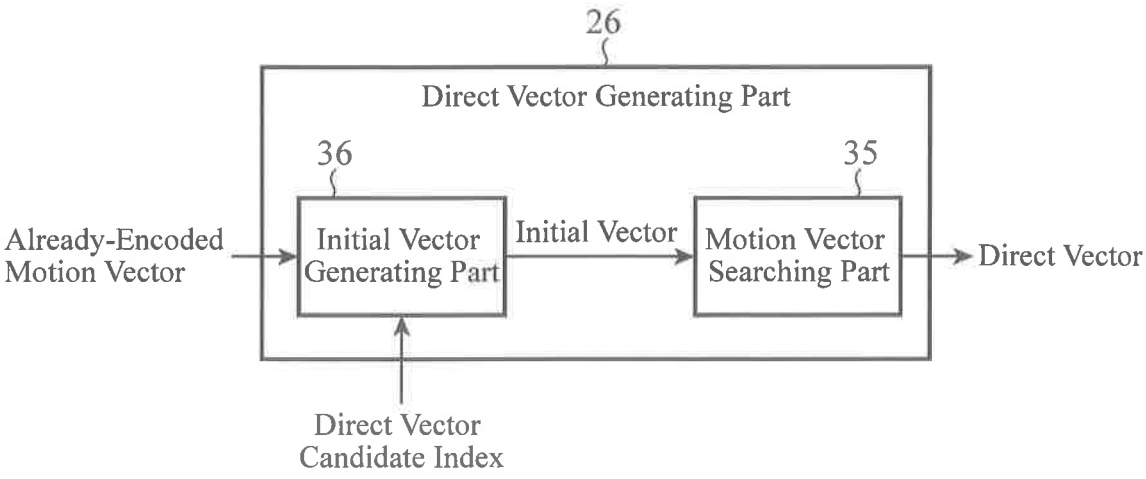

26
Direct Vector Generating Part
36
35
Already-Encoded Motion Vector
Initial Vector Generating Part
Initial Vector
Motion Vector Searching Part
Direct Vector
Direct Vector Candidate Index

FIG.36

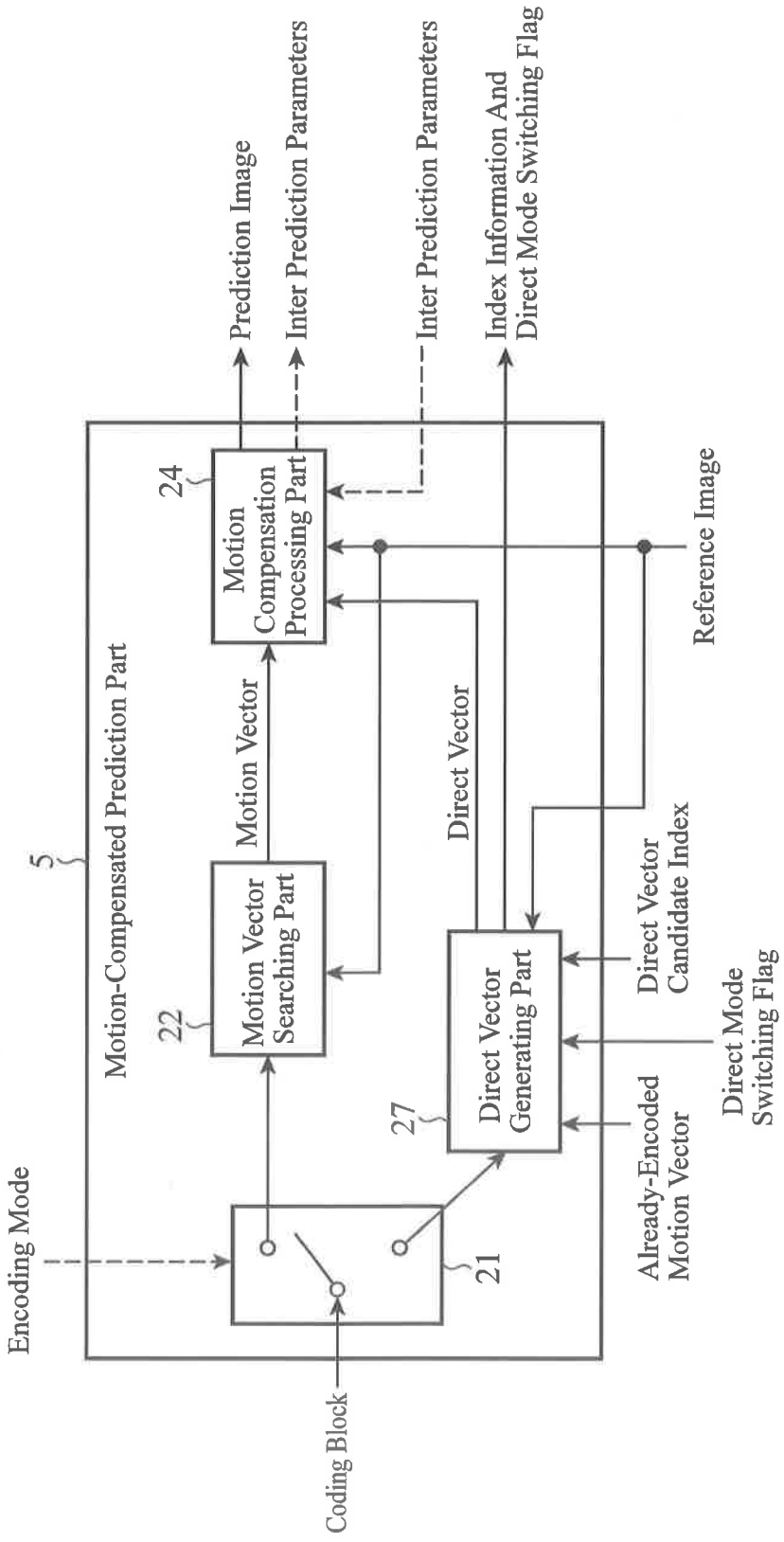

Prediction Image
Inter Prediction Parameters
Inter Prediction Parameters
Index Information And Direct Mode Switching Flag
Motion Compensation Processing Part
24
Motion-Compensated Prediction Part
5
Motion Vector
Direct Vector
Reference Image
Motion Vector Searching Part
22
Direct Vector Generating Part
27
Direct Vector Candidate Index
Direct Mode Switching Flag
Encoding Mode
21
Already-Encoded Motion Vector
Coding Block

FIG.37

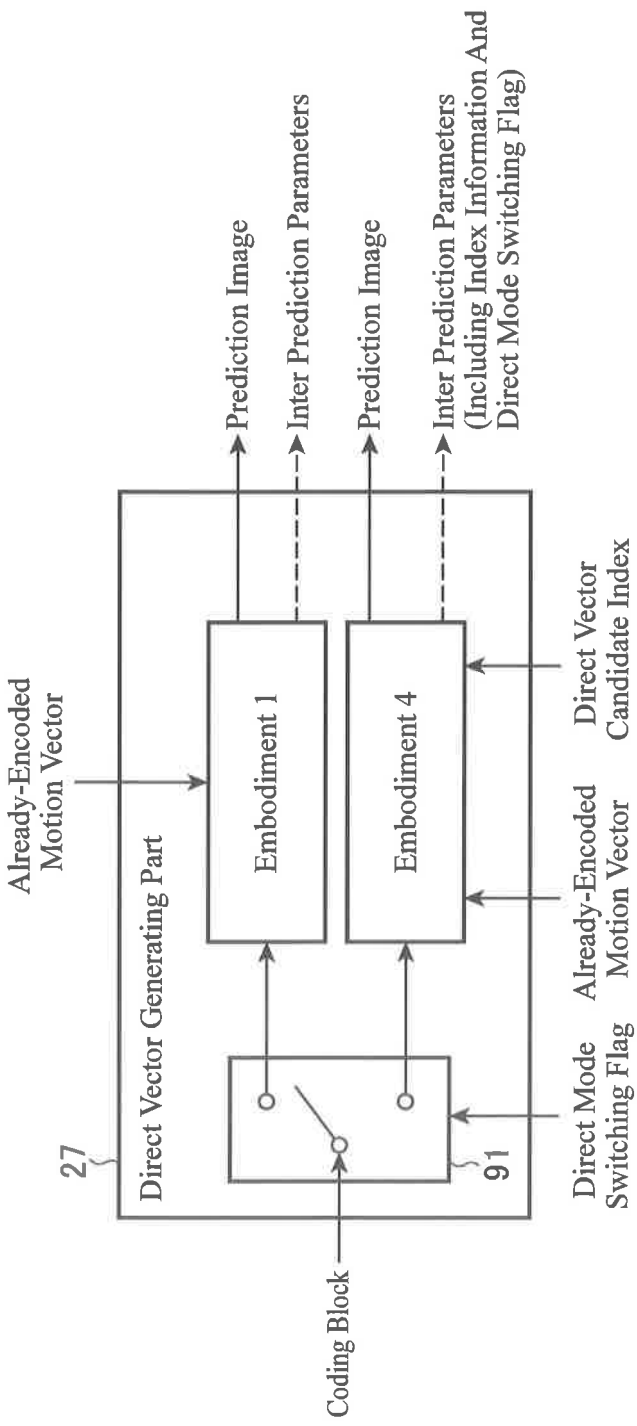

Already-Encoded Motion Vector
27
Direct Vector Generating Part
Embodiment 1
Embodiment 4
91
Coding Block
Direct Mode Switching Flag
Already-Encoded Motion Vector
Direct Vector Candidate Index
Prediction Image
Inter Prediction Parameters
Prediction Image
Inter Prediction Parameters (Including Index Information And Direct Mode Switching Flag)

FIG.38

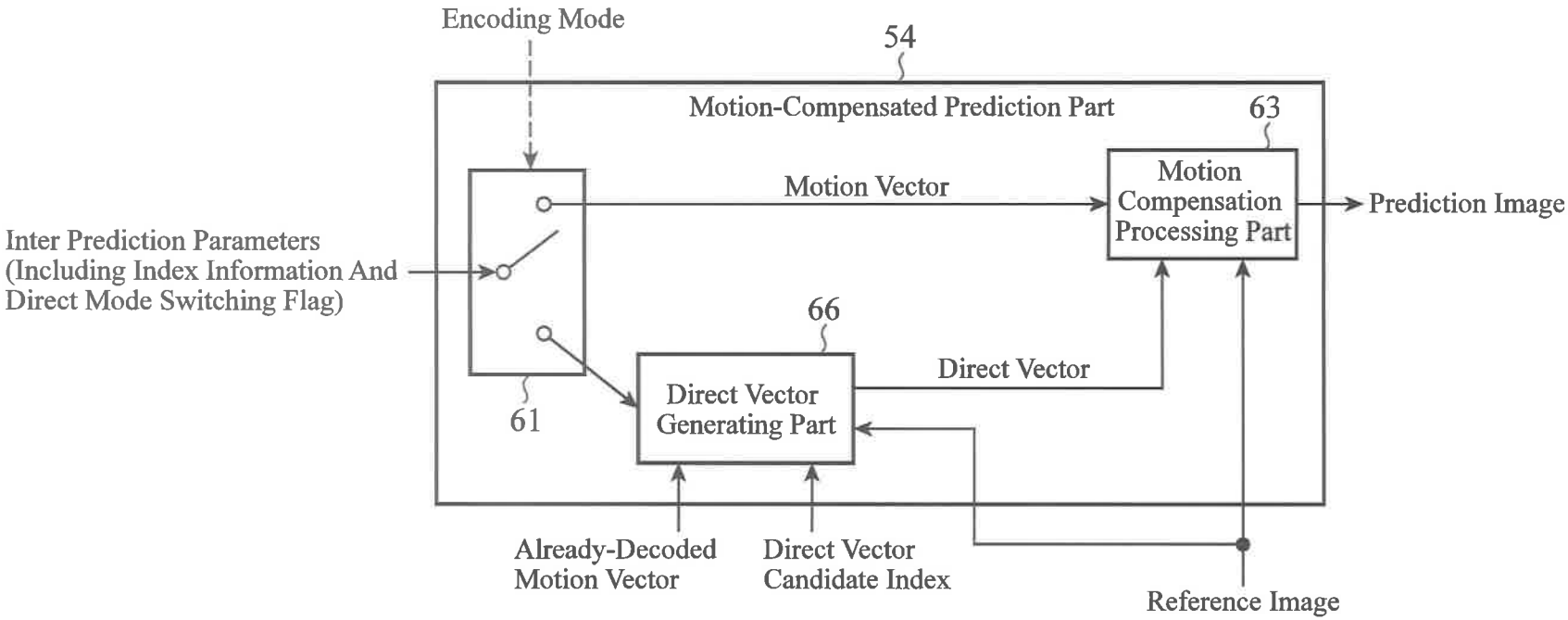

Encoding Mode
54
Motion-Compensated Prediction Part
63
Motion Vector
Motion Compensation Processing Part
Prediction Image
Inter Prediction Parameters (Including Index Information And Direct Mode Switching Flag)
66
Direct Vector
Direct Vector Generating Part
61
Already-Decoded Motion Vector
Direct Vector Candidate Index
Reference Image

FIG.39

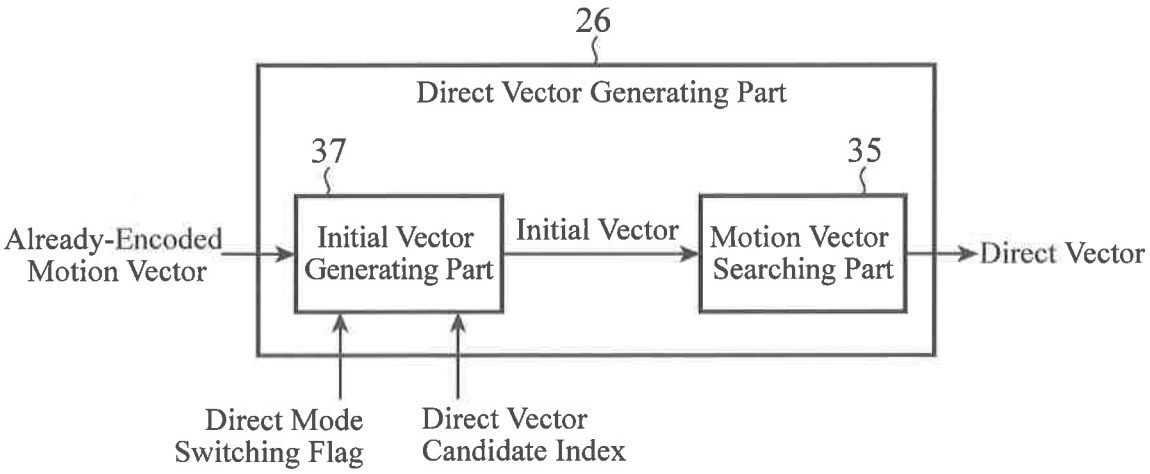

26
Direct Vector Generating Part
37
35
Already-Encoded
Motion Vector
Initial Vector
Generating Part
Initial Vector
Motion Vector
Searching Part
Direct Vector
Direct Mode
Switching Flag
Direct Vector
Candidate Index

FIG.40

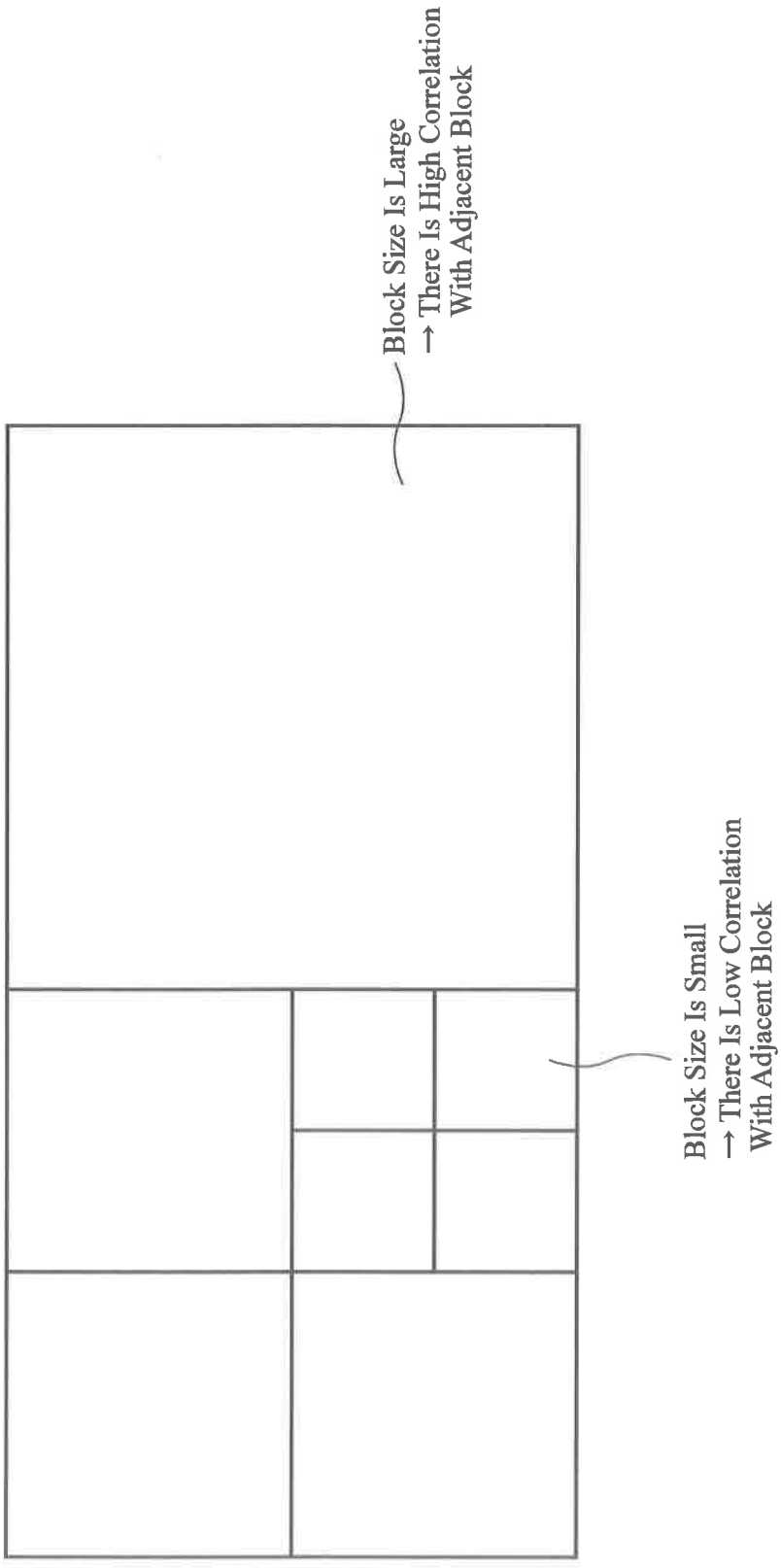

Block Size Is Large
→ There Is High Correlation
With Adjacent Block
Block Size Is Small
→ There Is Low Correlation
With Adjacent Block

FIG.41

Block Size	MV_A	MV_B	MV_C	median	temporal
64	1	1	1	0	1
32	1	1	1	0	1
16	1	1	0	0	1
8	0	0	0	1	1

FIG.42

Block Size	MV_A	MV_B	MV_C	median	temporal
128	1	1	1	0	1
64	1	1	1	0	1
32	1	1	1	0	1
16	1	1	0	1	1
8	0	0	0	1	1

Maximum Block Size=128

Block Size	MV_A	MV_B	MV_C	median	temporal
64	1	1	1	0	1
32	1	1	1	0	1
16	1	1	0	1	1
8	0	0	0	1	1

Maximum Block Size=32
→Use List Items Whose Block Sizes Are Equal To Or Smaller Than 32

Block Size	MV_A	MV_B	MV_C	median	temporal
maxsize	1	1	1	0	1
maxsize/2	1	1	1	0	1
maxsize/4	1	1	1	0	1
maxsize/8	1	1	0	1	1
maxsize/16	0	0	0	1	1

Maximum Block Size=maxsize
Switch According To maxsize

FIG.43

partition	MV_A	MV_B	MV_C	median	temporal
1part	1	1	1	1	1
2partH1	1	1	1	0	1
2partH2	0	1	1	0	1
2partV1	1	1	0	0	1
2partV2	1	0	0	0	1
4part	1	1	1	1	1

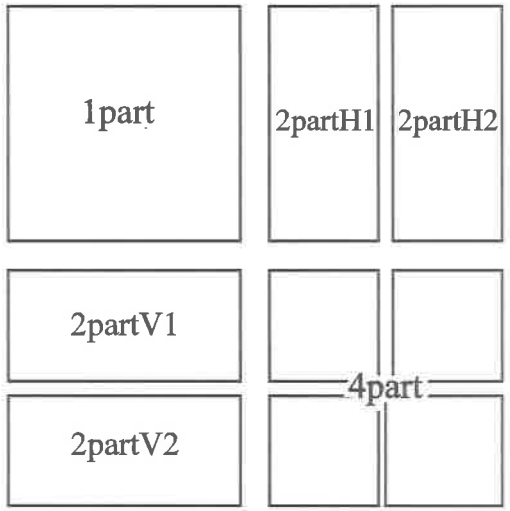


FIG.44

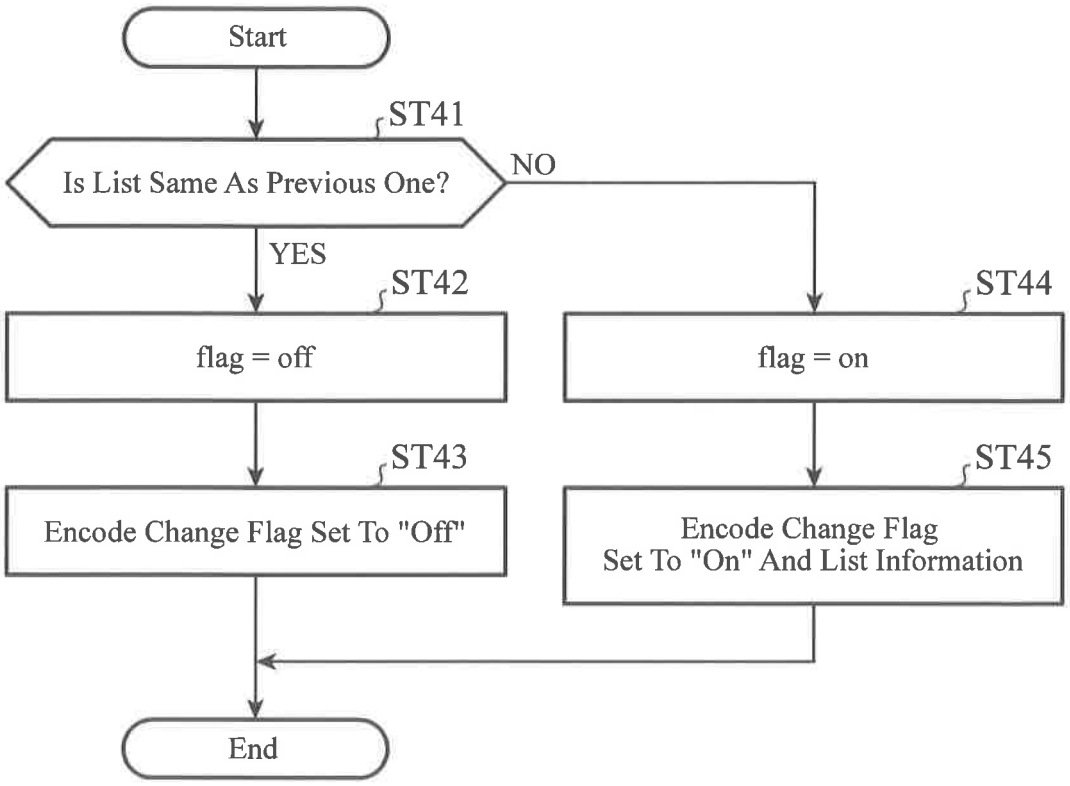

Start
ST41
Is List Same As Previous One?
NO
YES
ST42
flag = off
ST44
flag = on
ST43
Encode Change Flag Set To "Off"
ST45
Encode Change Flag
Set To "On" And List Information
End

FIG.45

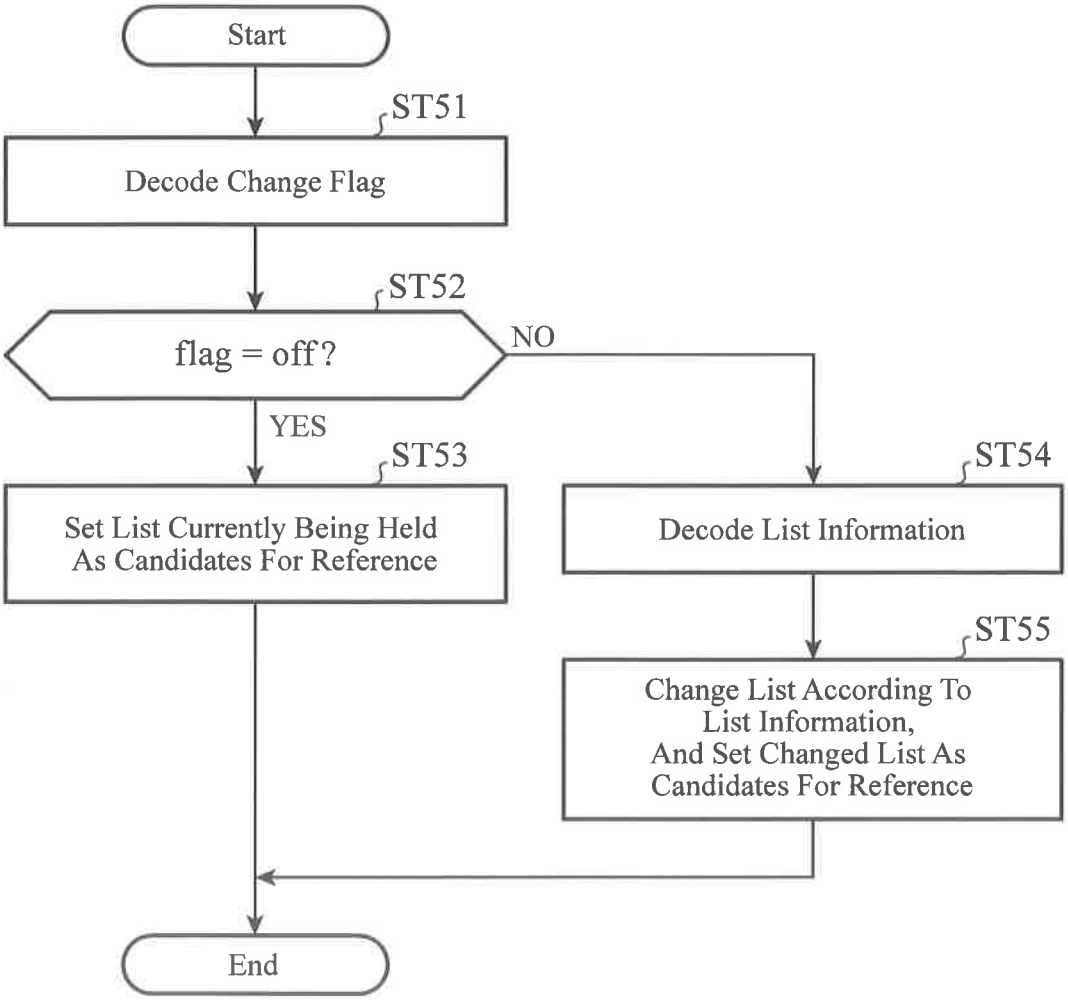

Start
ST51
Decode Change Flag
ST52
flag = off?
NO
YES
ST53
Set List Currently Being Held As Candidates For Reference
ST54
Decode List Information
ST55
Change List According To List Information, And Set Changed List As Candidates For Reference
End

FIG.46

Vector Candidate	MV_A	MV_B	MV_C	median	temporal
on/off	1	1	1	1	1

Previous List

Vector Candidate	MV_A	MV_B	MV_C	median	temporal
on/off	1	1	1	1	0

Changed List

Set Change Flag

Vector Candidate	MV_A	MV_B	MV_C	median	temporal
on/off	1	1	1	1	0

Encode List Information

FIG.47

Vector Candidate	MV_A	MV_B	MV_C	median	temporal
on/off	1	1	1	1	1

List Currently Being Held

Set Change Flag

Vector Candidate	MV_A	MV_B	MV_C	median	temporal
on/off	1	1	1	1	0

Changed List

FIG.48

Block Size	MV_A	MV_B	MV_C	median	temporal
64	1	1	1	1	1
32	1	1	1	0	1
16	1	1	0	0	1
8	0	0	0	0	1

Previous List

Block Size	flag
64	0
32	1
16	1
8	0

Change Flag

Block Size	MV_A	MV_B	MV_C	median	temporal
32	1	1	1	1	1
16	0	0	0	1	1

Encode Only Changed Part

Block Size	MV_A	MV_B	MV_C	median	temporal
64	1	1	1	1	1
32	1	1	1	1	1
16	0	0	0	1	1
8	0	0	0	0	1

Changed List

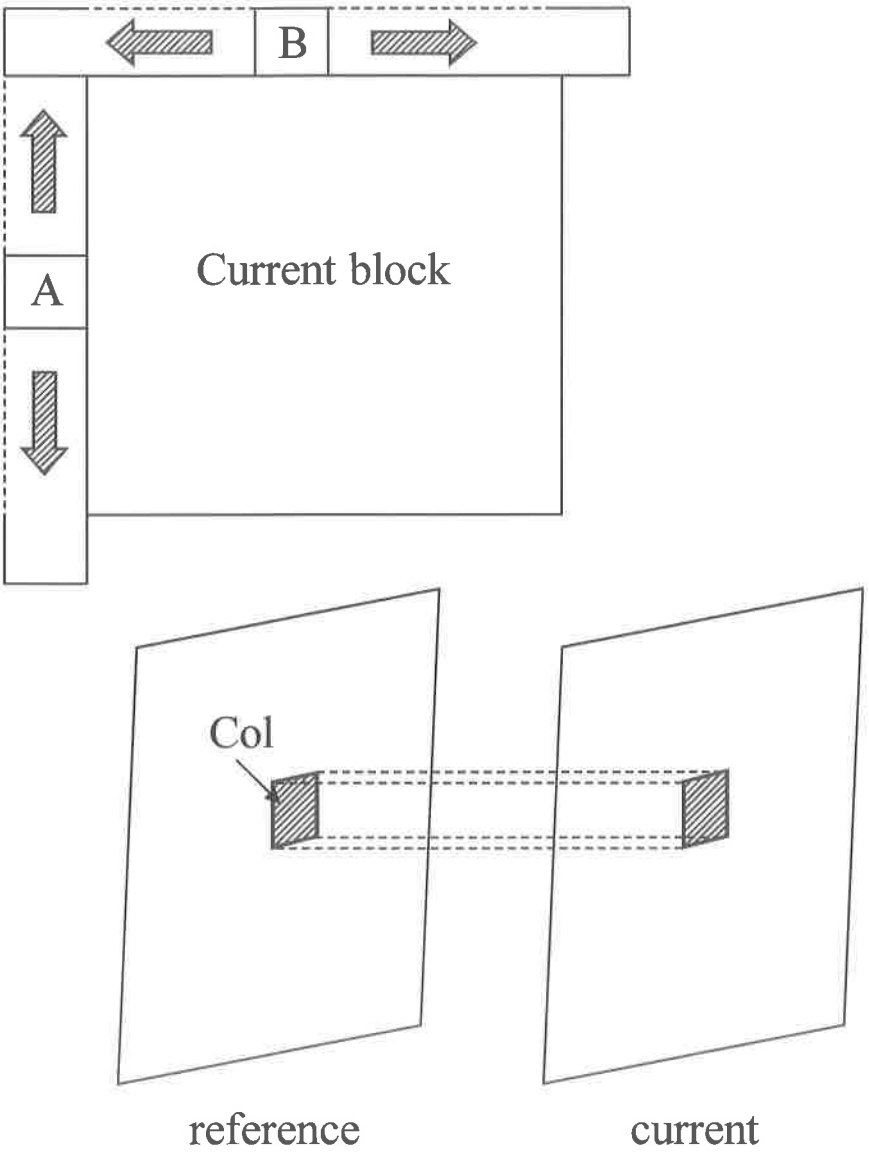


FIG.49