(19) (KR)
(12) (A)

(11) 10-2010-0041441
(43) 2010 04 22

(51) Int. Cl.
H04N 7/24 (2006.01)
(21) 10-2008-0100623
(22) 2008 10 14
2008 10 14

(71)

98

(72)

1

115 101

7 103

1102

5 519-510

(74)

: 15

(54) /

(57)

(polyphase decomposition)

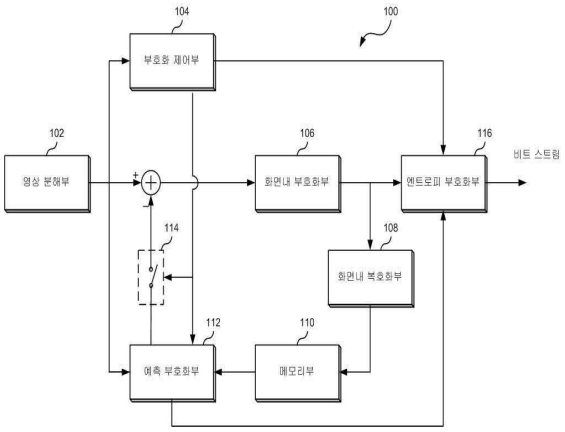
/ . 2

(subsampled image) ,

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- 1



1

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2 (subsampled image)

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2

1 ,

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3

2 ,

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6

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7

2 ,

(interpolation)

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8

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2

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9

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11

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12

8 ,

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13

8 ,

(interpolation)

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14

,

2 (subsampled image)

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15

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2

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[0001] / ,

(polyphase decomposition) /

.

[0002] MPEG(Moving Picture Experts Group) (motion compensation)

. MPEG I , P , B . I

(Intra) , P (Predictive) , B

(Bidirectionally Predictive) . I GOP(Group of Pictures)

, P B (Intra)

. I , I P

. B , I P

B .

[0003] I, P, B ( ) P B
.

[0004]
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[0005] ,
, . ,
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[0006] , 2
(subsampled image) ,
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[0007] ,
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[0008] , 2
(subsampled image) ,
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[0009] ,
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2 .

[0010]
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[0011] , ,
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[0012] 1 . ,
(100) (102), (104), (106), (108), (110),
(112), (114), (114) . 2 6

(100) .

[0013] 2 .

[0014] , (102) 2 (subsampled image) (202). 3 2 202 .

[0015] (102) 2 (302). 4 (sample) , 1 .

1

$$S^{C,M}_{(m,n)}[x,y] = S^{c}[Mx+m, My+n]$$
$$0 \le x < \frac{W}{M}, 0 \le y < \frac{H}{M}$$
$$0 \le m < M, 0 \le n < M$$

[0016]

[0017] C , (Y) (Cb, Cr) . $S^{C}[x, y]$ (0,0) C x, y . $S^{C,M}_{(m,n)}$ (0,0) m, n M C x, y . W H .

[0018] 302 (304). 2 4 , M 2 . 2 4 .

2

$$S^{Y,2}_{(0,0)}[x,y] = S^{Y}[2x,2y]$$
$$S^{Y,2}_{(1,0)}[x,y] = S^{Y}[2x+1,2y]$$
$$S^{Y,2}_{(0,1)}[x,y] = S^{Y}[2x,2y+1]$$
$$S^{Y,2}_{(1,1)}[x,y] = S^{Y}[2x+1,2y+1]$$

$$S^{Cb,2}_{(0,0)}[x,y] = S^{Cb}[2x,2y]$$
$$S^{Cb,2}_{(1,0)}[x,y] = S^{Cb}[2x+1,2y]$$
$$S^{Cb,2}_{(0,1)}[x,y] = S^{Cb}[2x,2y+1]$$
$$S^{Cb,2}_{(1,1)}[x,y] = S^{Cb}[2x+1,2y+1]$$

$$S^{Cr,2}_{(0,0)}[x,y] = S^{Cr}[2x,2y]$$
$$S^{Cr,2}_{(1,0)}[x,y] = S^{Cr}[2x+1,2y]$$
$$S^{Cr,2}_{(0,1)}[x,y] = S^{Cr}[2x,2y+1]$$
$$S^{Cr,2}_{(1,1)}[x,y] = S^{Cr}[2x+1,2y+1]$$

[0019]

[0020] 4 2 4 , W H 8 .

[0021] 202 . M=2 4 , 4 24 . 3 .

3

$$S_1^C[x,y] = S_{(0,0)}^{C,2}[x,y]$$
$$S_2^C[x,y] = S_{(1,0)}^{C,2}[x,y]$$
$$S_3^C[x,y] = S_{(0,1)}^{C,2}[x,y]$$
$$S_4^C[x,y] = S_{(1,1)}^{C,2}[x,y]$$

[0022]

[0023] S_n^C n C .

[0024] , (S_1^C) 3 (S_2^C, S_3^C, S_4^C) .

[0025] , (S_1^C) (106) . , JPEG MPEG (Intra Coding) .

(S_1^C) , (108) (110) (204).

[0026] 3 (S_2^C, S_3^C, S_4^C) (206).

[0027] . . POLYPHASE_PRED_MODE .

[0028] POLYPHASE_PRED_MODE , , 5 4 1 (4) . (interpolation filter) .

[0029] ,

2 (,) . 1/2 1/4 , 1/4 ±3 .

[0030] 6 .

[0031] MSE(Mean Square Error) , 1 2 .

[0032] ,

, 4 ,
.

4

$$R_{k,i}^{C}[x,y] = S_{k}^{C}[x,y] - \tilde{S}_{k-1}^{C}[x+\Delta x, y+\Delta y]$$
$$\hat{R}_{k,i}^{C} = Q(DCT(R_{k,i}^{C}))$$

[0033]

[0034] $\tilde{S}_{n}^{C}$ n C , $R^{C}_{n,i}$ n C i . DCT(·) Q(·) , $\hat{R}_{n,i}^{C}$ $R^{C}_{n,i}$. Δx Δy 2 .

[0035] , , 2 . , , .

[0036] POLYPHASE_SKIP_MODE POLYPHASE_PRED_MODE , POLYPHASE_PRED_MODE . , 2 , . H.264/AVC SKIP .

[0037] 4 .

[0038] (104) (114) (106) (Discrete Cosine Transform: DCT) , (112) (106) . (108) (110) . (100) (208).

[0039] , . . (100) , (208).

[0040] , . (100) , .

[0041] (116) (210) .

[0042] 7 . , (700) (702), (704), (706), (708),

(710), (712), (714) . 8 (700) .

[0043] 8 .

[0044] (100) (702) , (802).

[0045] 4 . (706) , (710) (804).

[0046] . , JPEG MPEG .

[0047] 3 . POLYPHASE_PRED_MODE , (100) 2 ( ) . , 2 . , . 5 .

5

$$\tilde{R}^C_{k,i} = IDCT(IQ(\tilde{R}^C_{k,i}))$$
$$\tilde{S}^C_k[x,y] = \tilde{R}^C_{k,i}[x,y] + \tilde{S}^C_{k-1}[x+\Delta x, y+\Delta y]$$

[0048]

[0049] IQ(·) IDCT(·) , $\tilde{R}^C_n$ n C i .

[0050] POLYPHASE_SKIP_MODE , 2 ( ) , 2 , .

[0051] . (100) (702) (704) (804), (704) (712) (706) , (708) (706) . (710) (808).

[0052] . (100) (702) (704) (804), (704) , . (710) (808).

[0053] . (100) (702) (704)

(804), (704)
,
.

[0054] (714) 4 ( ) 2
(810).

[0055] 4 ($\tilde{S}_1^C[x,y], \tilde{S}_2^C[x,y], \tilde{S}_3^C[x,y], \tilde{S}_4^C[x,y]$) 6
.

6

$$\tilde{S}^C[2x,2y] = \tilde{S}^{C,2}_{(0,0)}[x,y] = \tilde{S}_1^C[x,y]$$
$$\tilde{S}^C[2x+1,2y] = \tilde{S}^{C,2}_{(1,0)}[x,y] = \tilde{S}_2^C[x,y]$$
$$\tilde{S}^C[2x,2y+1] = \tilde{S}^{C,2}_{(0,1)}[x,y] = \tilde{S}_3^C[x,y]$$
$$\tilde{S}^C[2x+1,2y+1] = \tilde{S}^{C,2}_{(1,1)}[x,y] = \tilde{S}_4^C[x,y]$$

[0056]

[0057] $\tilde{S}^C$ C .

[0058] H.264/AVC
.

[0059] H.264/MPEG-4 AVC JM(Joint Model)11 .
H.264/MPEG-4 AVC ,
H.264/AVC (6-tap Wiener filter, bi-linear filter) .
7 .

7

$$QP_1 = QP_{AVC} - 6$$
$$QP_2 = QP_3 = QP_4 = QP_{AVC} - 2$$

[0060]

[0061] QP_{AVC} H.264/MPEG-4 AVC , QP_n n
. - (rate-distortion curve) QP_{AVC} 30, 34, 38, 42
.

[0062] H.264/MPEG-4 AVC CAVLC(Context-based Adaptive Variable Length Coding)
. MVC(Multi-view Video Coding) 6 VGA(640×480) 2
XVGA(1024×768) , 10 .
.

[0063] 9a 9h H.264/AVC
- . ▲
, ■ H.264/AVC .

[0064] ,
.

[0065] 1 . 1 , QP_{AVC} 34 .

1

Sequence	QP	Delta PSNR			Bit saving	Sequence	QP	Delta PSNR			Bit saving
		Y	U	V				Y	U	V	
Rena	30	0.59	0.16	-0.63	-7.70%	AkkoKayo	30	-0.31	0.03	-0.73	0.05%
	34	0.68	0.39	-0.23	-2.97%		34	0.32	-0.07	-0.98	8.82%
	38	0.59	0.21	0.04	3.83%		38	0.59	-0.04	-0.55	13.81%
	42	0.29	-0.1	-0.29	12.74%		42	0.63	-0.14	-0.56	14.74%
Ballroom	30	-0.23	0.52	0.56	2.12%	Exit	30	-0.4	0.59	0.63	-12.25%
	34	0.21	0.63	0.52	7.76%		34	-0.16	0.65	0.29	1.96%
	38	0.47	0.2	0.1	12.56%		38	0.27	0.45	0.4	8.98%
	42	0.49	-0.24	-0.18	14.83%		42	0.5	0.12	0.17	13.82%
Flamenco2	30	0.42	0.03	0.06	3.73%	Race1	30	0.43	0.25	0.18	2.78%
	34	0.65	-0.28	0.05	11.52%		34	0.51	-0.27	-0.22	10.80%
	38	0.84	-0.09	0.25	14.15%		38	0.48	-0.24	-0.04	15.38%
	42	0.79	-0.23	-0.13	15.26%		42	0.37	-0.05	0.08	16.00%
Uli	30	-0.58	-0.15	-0.31	-9.48%	Breakdancers	30	-0.18	0.6	0.7	-11.24%
	34	-0.14	-0.44	-0.41	4.09%		34	-0.05	0.69	1.03	5.96%
	38	0.34	-0.04	-0.05	10.55%		38	0.1	0.68	1.35	17.91%
	42	0.52	-0.02	0.02	16.09%		42	0.12	0.68	1.11	26.15%

[0066]

[0067] , . . , ( ) , . (CD, DVD) .

[0068] , , .

[0069] 1 .

[0070] 2 .

[0071] 3 2 202 .

[0072] 4 2 4 .

[0073] 5
.

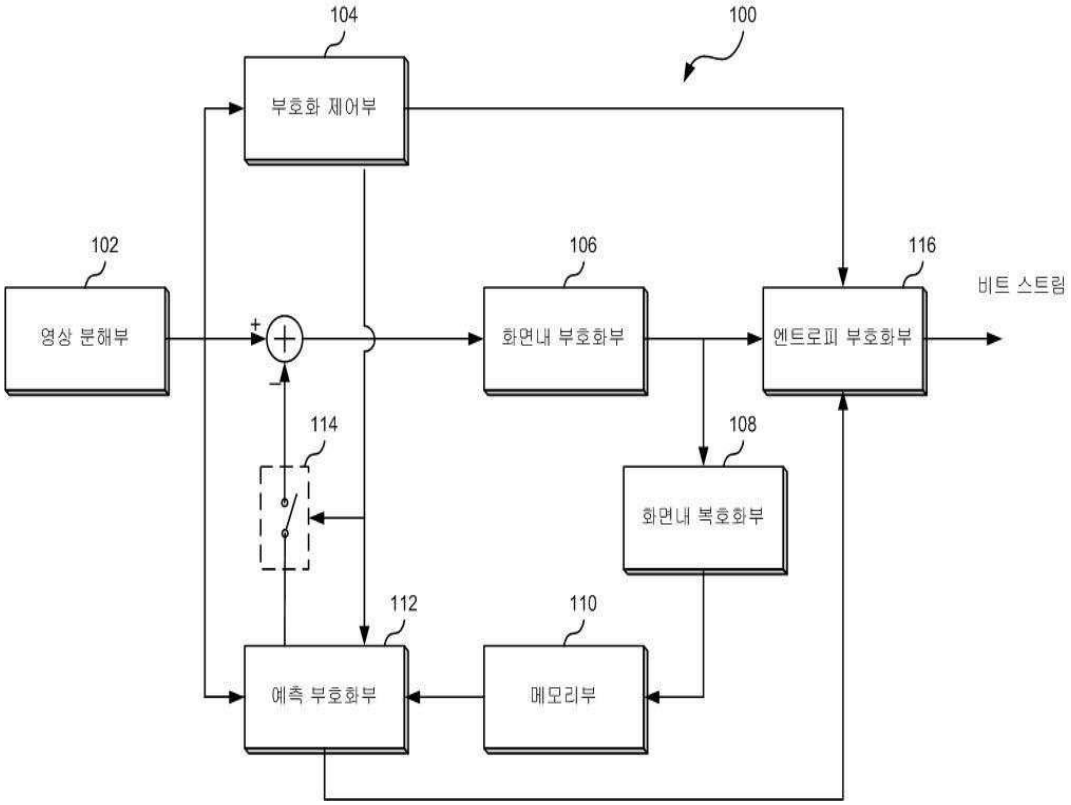
[0074] 6 .

[0075] 7 .

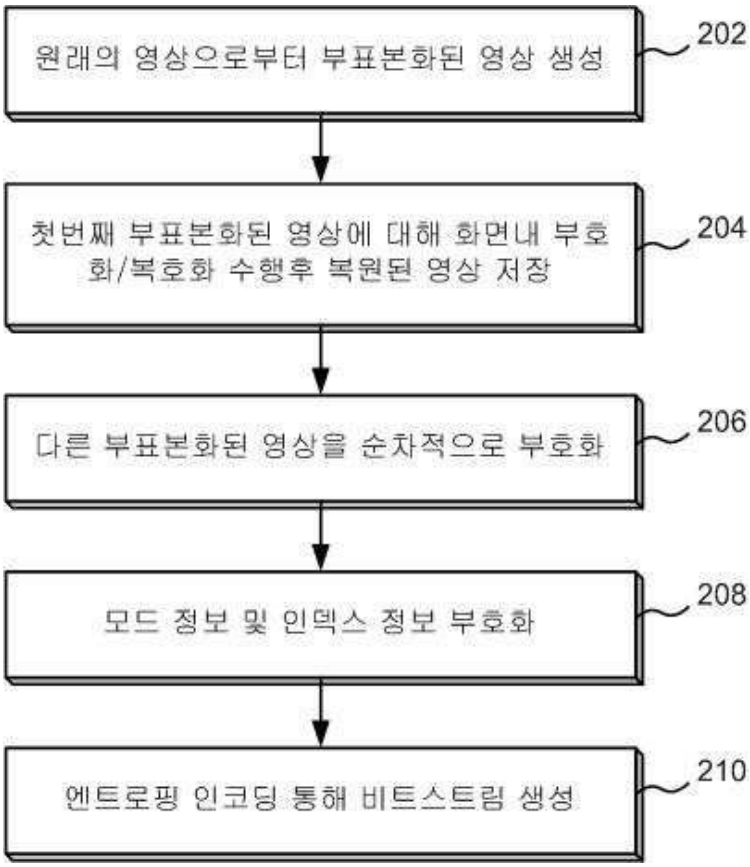
[0076] 8 .

[0077] 9a 9h H.264/AVC
.

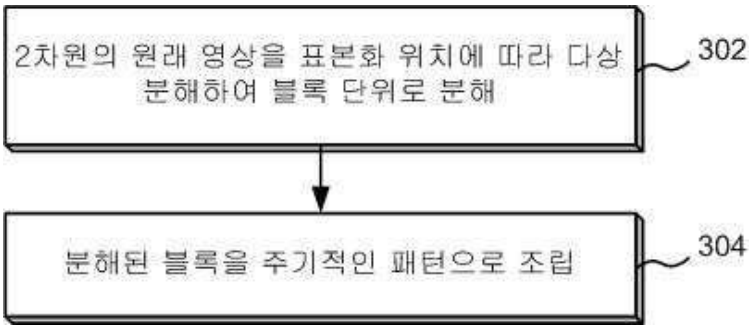
1



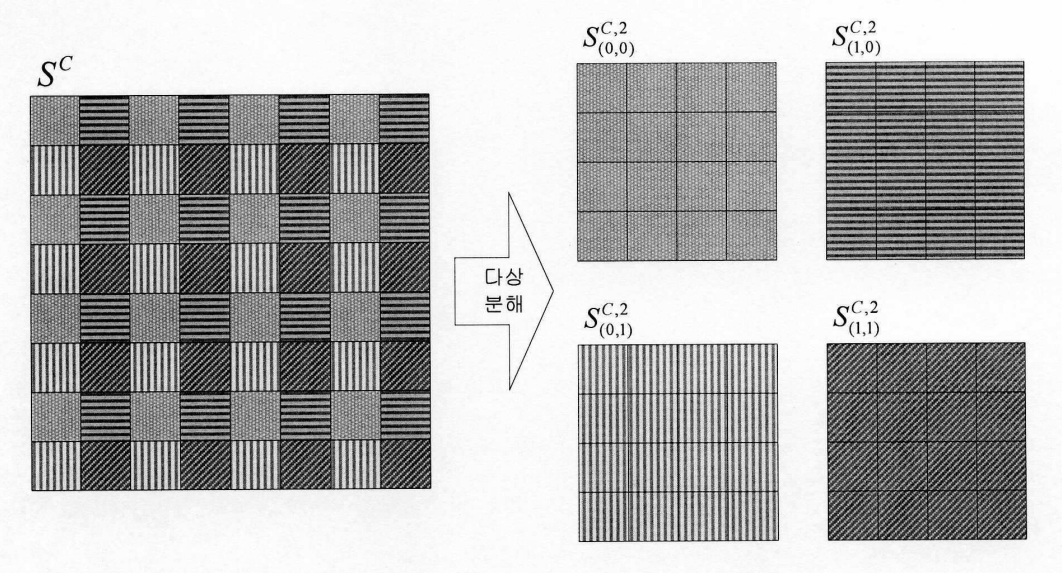
2


원래의 영상으로부터 부표본화된 영상 생성
202
첫번째 부표본화된 영상에 대해 화면내 부호화/복호화 수행후 복원된 영상 저장
204
다른 부표본화된 영상을 순차적으로 부호화
206
모드 정보 및 인덱스 정보 부호화
208
엔트로핑 인코딩 통해 비트스트림 생성
210

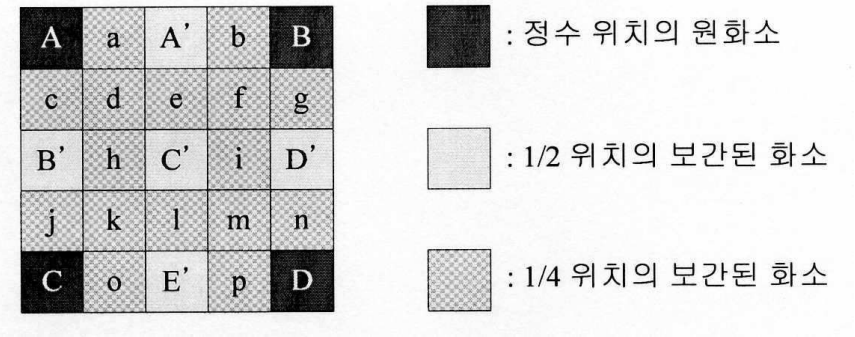
3


2차원의 원래 영상을 표본화 위치에 따라 다상 분해하여 블록 단위로 분해
302
분해된 블록을 주기적인 패턴으로 조립
304

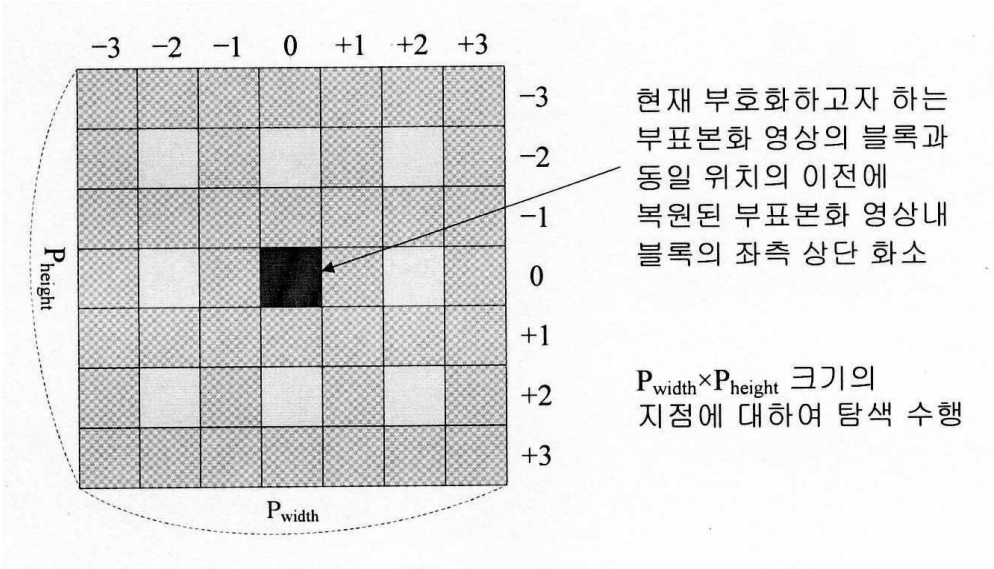
4


S^C
다상
분해
$S^{C,2}_{(0,0)}$
$S^{C,2}_{(1,0)}$
$S^{C,2}_{(0,1)}$
$S^{C,2}_{(1,1)}$

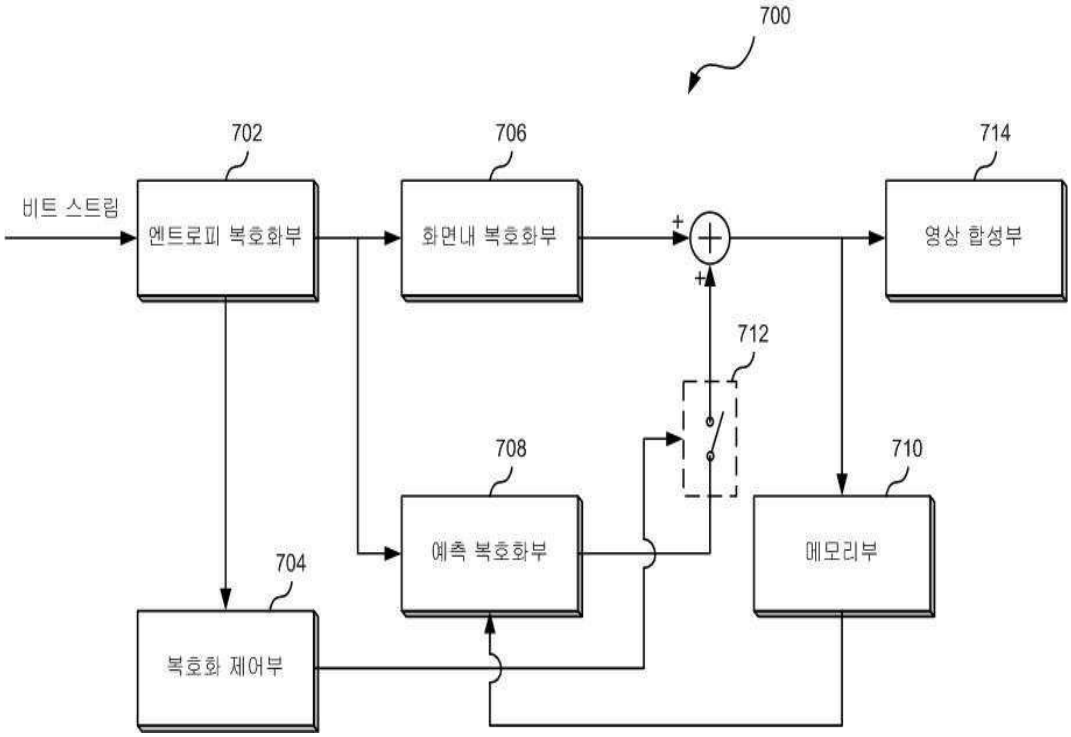
5


A a A' b B
c d e f g
B' h C' i D'
j k l m n
C o E' p D
: 정수 위치의 원화소
: 1/2 위치의 보간된 화소
: 1/4 위치의 보간된 화소

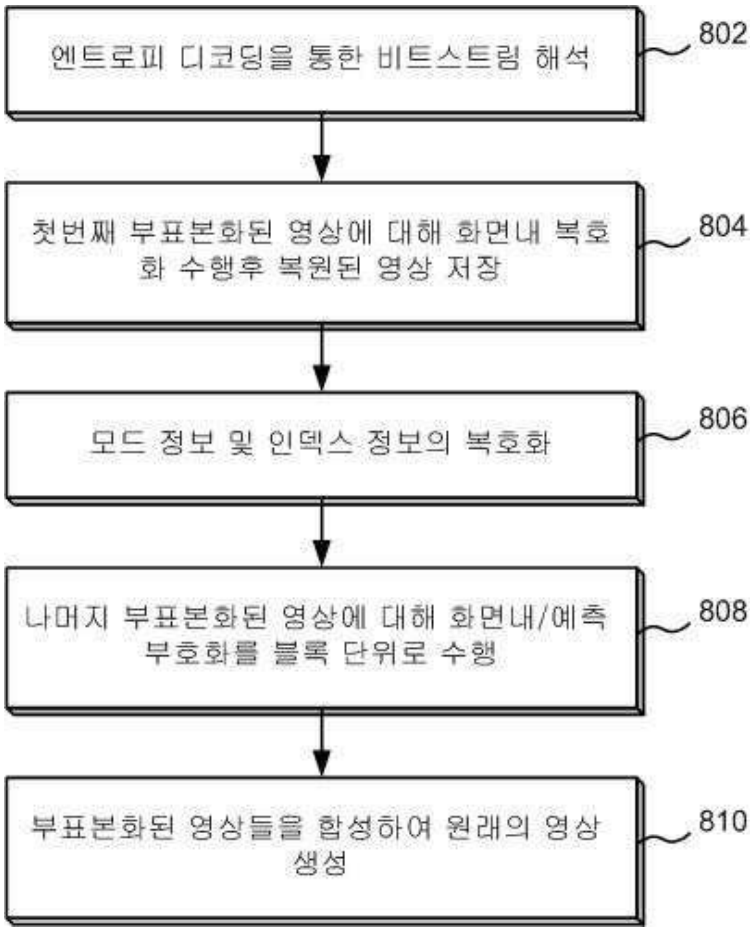
6


−3 −2 −1 0 +1 +2 +3
−3
−2
−1
0
+1
+2
+3
P_{height}
P_{width}
현재 부호화하고자 하는
부표본화 영상의 블록과
동일 위치의 이전에
복원된 부표본화 영상내
블록의 좌측 상단 화소
$P_{width} \times P_{height}$ 크기의
지점에 대하여 탐색 수행

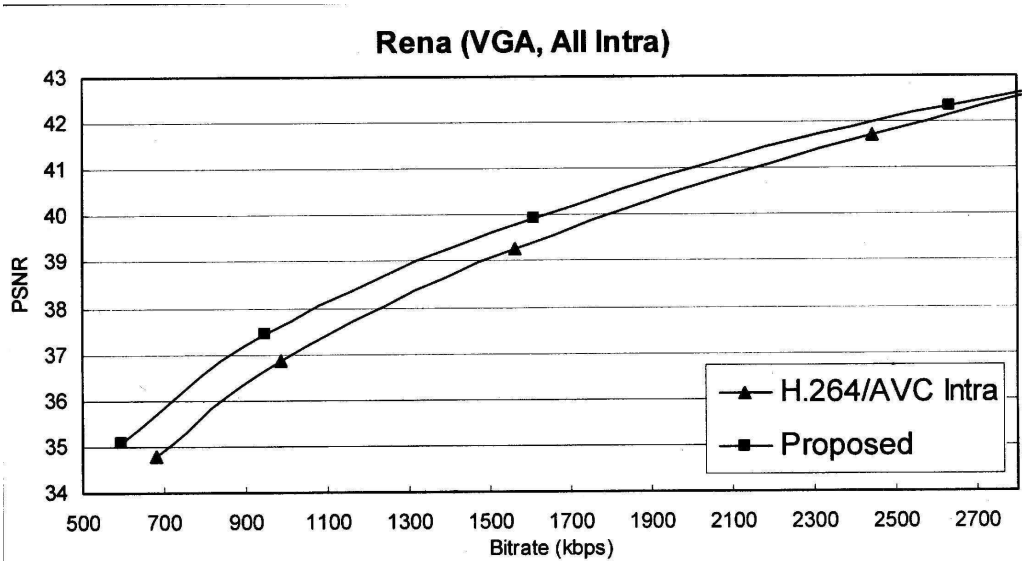
7


700
702
706
714
비트 스트림
엔트로피 복호화부
화면내 복호화부
+
+
영상 합성부
712
708
710
예측 복호화부
메모리부
704
복호화 제어부

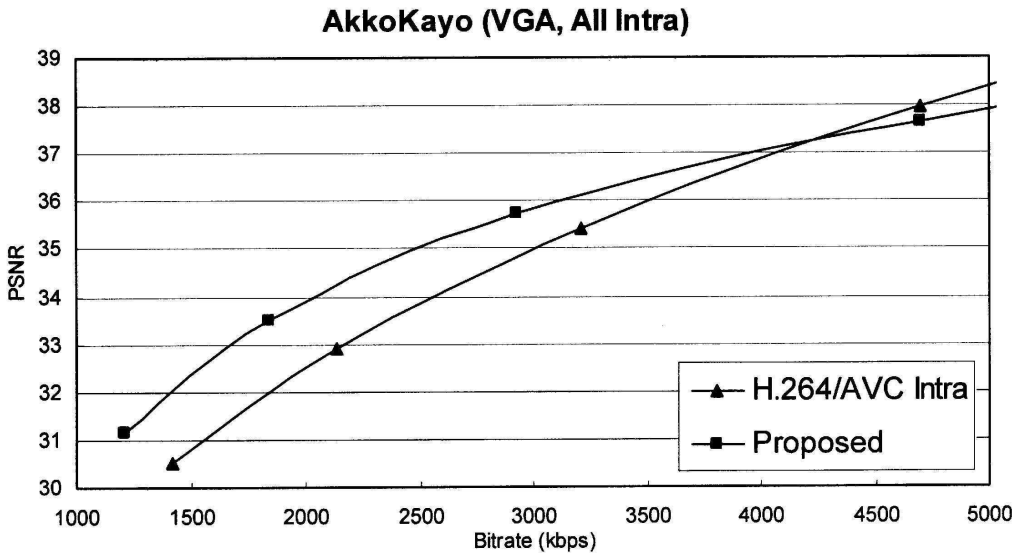
8


엔트로피 디코딩을 통한 비트스트림 해석
802
첫번째 부표본화된 영상에 대해 화면내 복호화 수행후 복원된 영상 저장
804
모드 정보 및 인덱스 정보의 복호화
806
나머지 부표본화된 영상에 대해 화면내/예측 부호화를 블록 단위로 수행
808
부표본화된 영상들을 합성하여 원래의 영상 생성
810

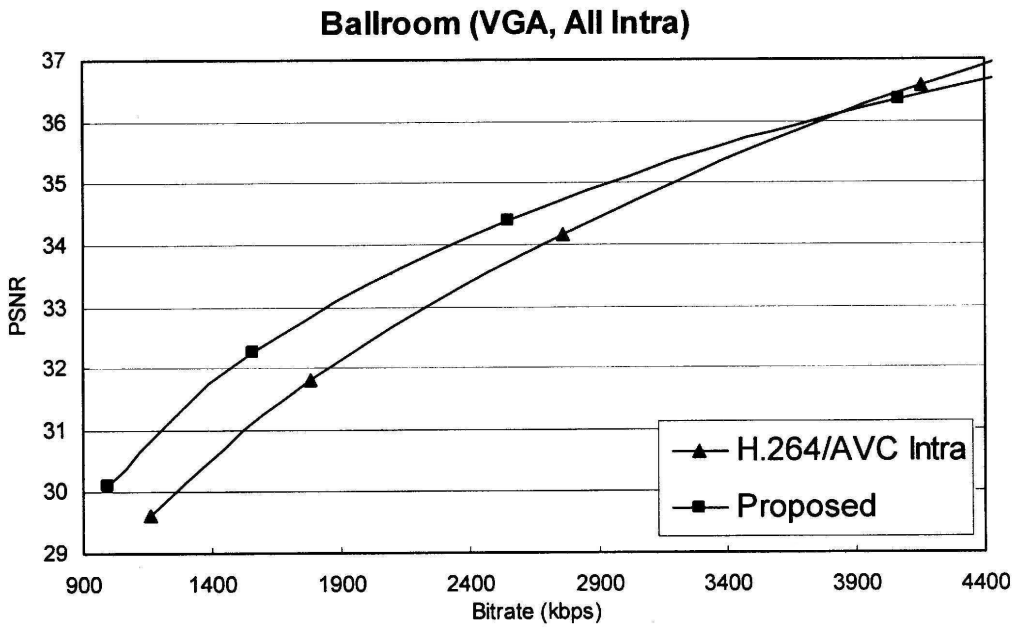
9a


Rena (VGA, All Intra)
PSNR
43
42
41
40
39
38
37
36
35
34
500
700
900
1100
1300
1500
1700
1900
2100
2300
2500
2700
Bitrate (kbps)
H.264/AVC Intra
Proposed

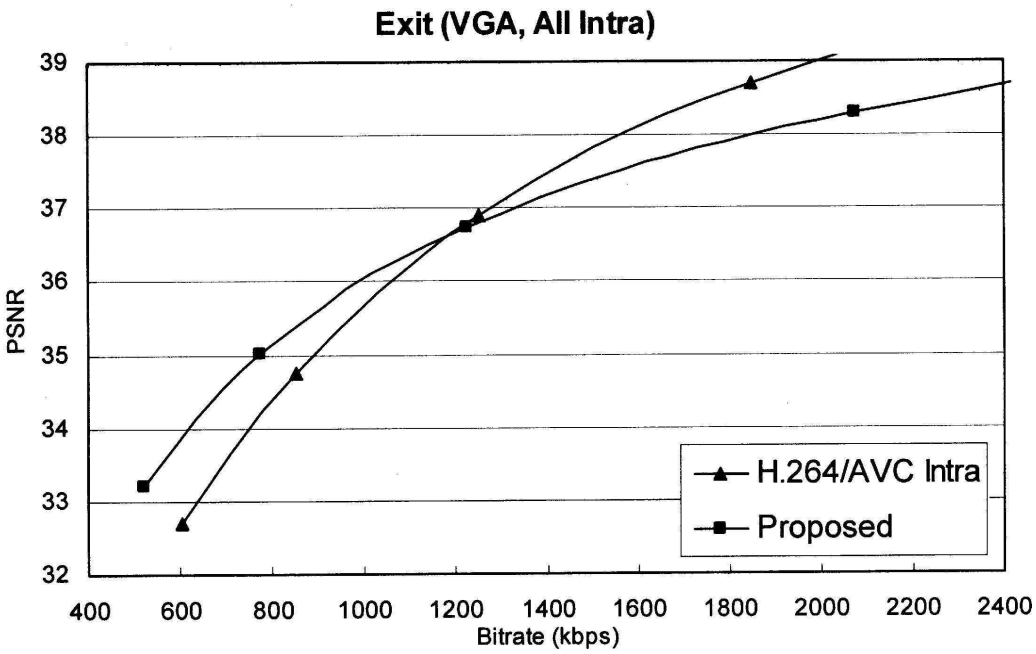
9b


AkkoKayo (VGA, All Intra)
PSNR
39
38
37
36
35
34
33
32
31
30
1000
1500
2000
2500
3000
3500
4000
4500
5000
Bitrate (kbps)
H.264/AVC Intra
Proposed

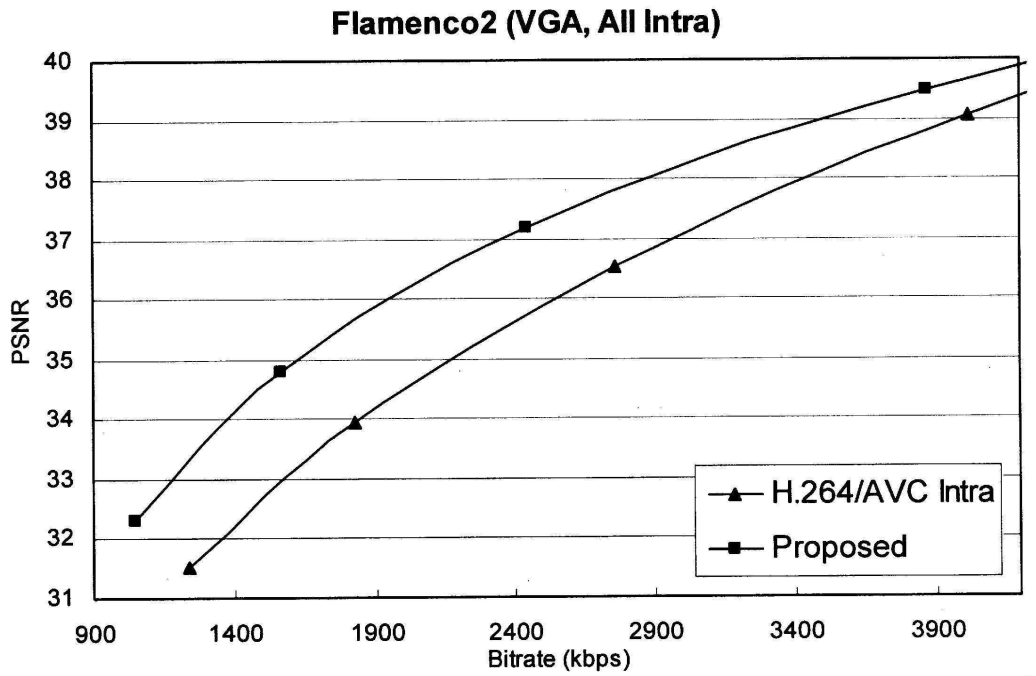
9c


Ballroom (VGA, All Intra)
PSNR
37
36
35
34
33
32
31
30
29
900
1400
1900
2400
2900
3400
3900
4400
Bitrate (kbps)
H.264/AVC Intra
Proposed

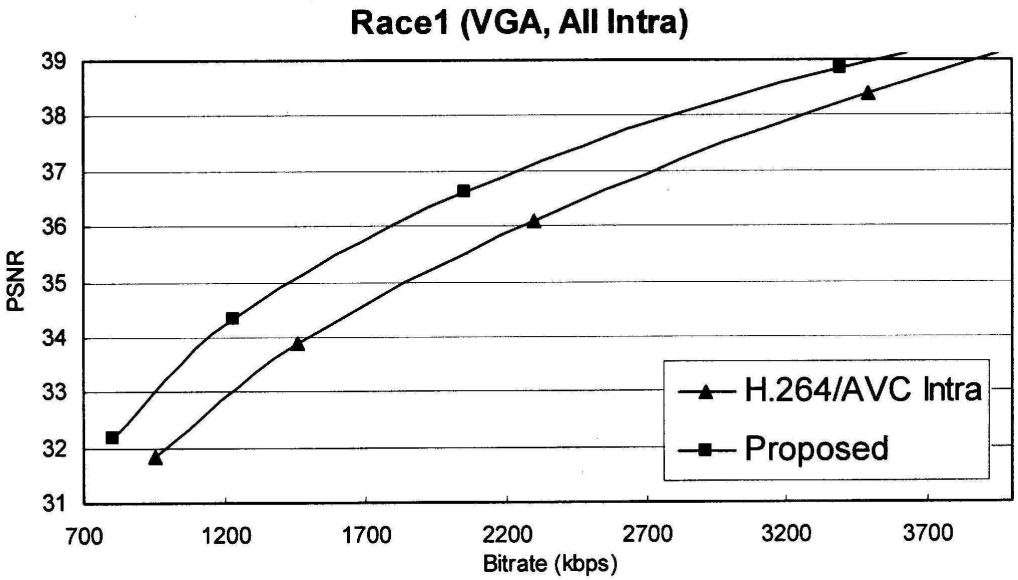
9d


Exit (VGA, All Intra)
PSNR
39
38
37
36
35
34
33
32
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
Bitrate (kbps)
H.264/AVC Intra
Proposed

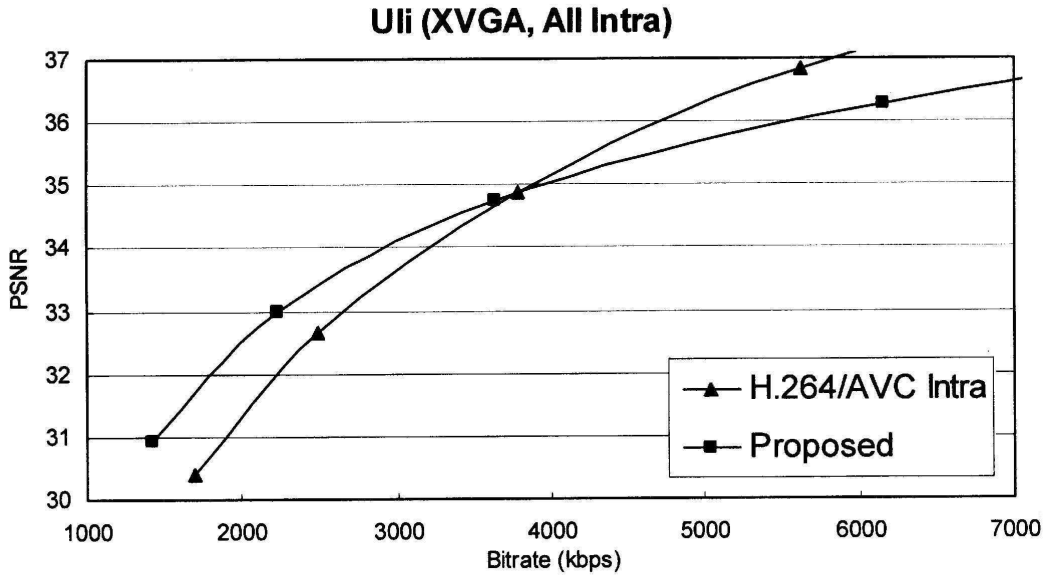
9e


Flamenco2 (VGA, All Intra)
PSNR
40
39
38
37
36
35
34
33
32
31
900
1400
1900
2400
2900
3400
3900
Bitrate (kbps)
H.264/AVC Intra
Proposed

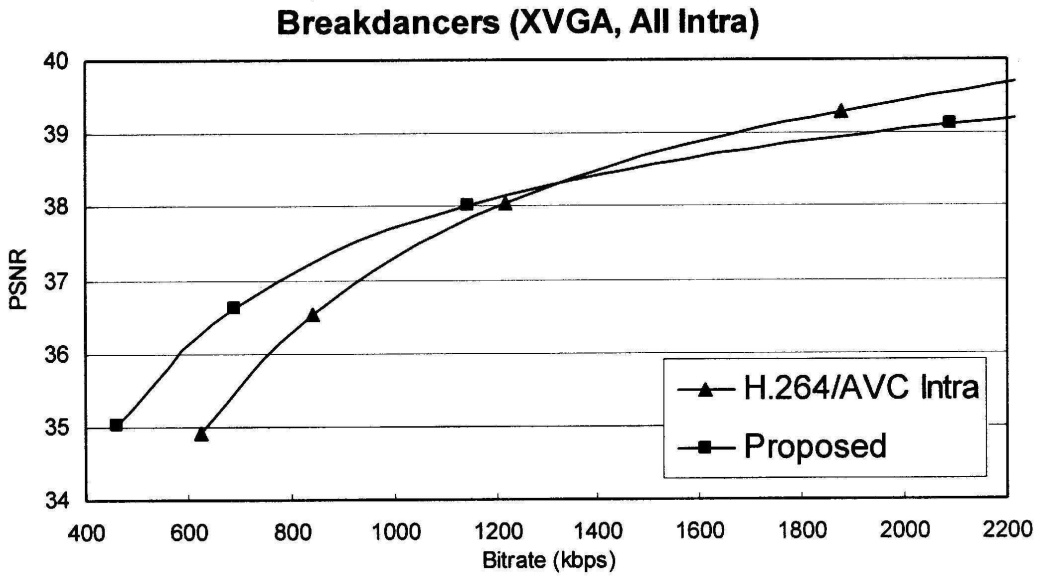
9f


Race1 (VGA, All Intra)
PSNR
39
38
37
36
35
34
33
32
31
700
1200
1700
2200
2700
3200
3700
Bitrate (kbps)
H.264/AVC Intra
Proposed

9g


Uli (XVGA, All Intra)
PSNR
37
36
35
34
33
32
31
30
1000
2000
3000
4000
5000
6000
7000
Bitrate (kbps)
H.264/AVC Intra
Proposed

9h


Breakdancers (XVGA, All Intra)
PSNR
40
39
38
37
36
35
34
400
600
800
1000
1200
1400
1600
1800
2000
2200
Bitrate (kbps)
H.264/AVC Intra
Proposed