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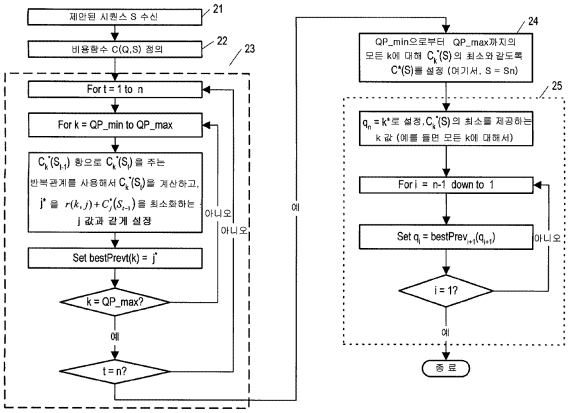
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1

n

, ,

n (subset)

,

.

2

1 , n n

.

3

1 , n

(Viterbi search algorithm) .

4

5

1 , (Quantizer Parameter; QP)

(frame-level control) , n

,

(candidate quantizer parameter sequence)

(Q)

(optimizing quantizer parameter sequence; Q^*) ,

(Q^*) (suggested quantizer parameter sequence; S) (Q) (C(Q,S))

, , ,

a) (S) ;

b) (C(Q,S)) , (C(Q,S)) (criterion)

(S) (Q)

(D(Q,S)), (Q)

(R(Q)) ;

c) (C(Q,S)) (Q^*)

, (bit-efficient way) (S)

(Q^*) .

6

5 , (S) (Region Of Interest)

.

7

5 , (C(Q,S)) (Q^*) (S) (k) , (optimum constrained cost function; $C^*_k(S_t)$) ,

(t) (partial suggested quantizer parameter sequence; S_t) , (k) t (partial candidate quantizer parameter sequence; $Q_{t,k}$) .

8

5 , (C(Q,S)) (Q^*) ,

a) (S) ;

b) (t) 1 ;

c) k ;

d) (optimum constrained cost function; $C^*_k(S_t)$) , (t) (partial suggested quantizer parameter sequence; S_t) ,

1 t $C^*_k(S_{t-1})$ $C^*_k(S_t)$, $(r(k,j)+C^*_j(S_{t-1}))$ (recursion relation) , r(k,j) (S) (j) Q (R(Q)) ;

e) t k $(r(k, j)+C^*_j(S_{t-1}))$ j ;

f) $(C^*_k(S_t))$, k 1 k t t 1 t , $(r(k,j)+C^*_j(S_{t-1}))$ j t k ;

g) (S) k $C^*_k(S_{t=n})$ $(C^*(S_{t=n}))$;

h) $C^*_k(S_{t=n})$ k , j (optimizing sequence; Q^*) .

9

5 , (D(Q,S)) ,

$$D(Q,S)=\sum_{i=1}^{n} d(q_i,s_i)$$

, $d(q_i, s_i)$ (arguments)
(q_i) (s_i)
(memoryless macroblock-level nonnegative cost component) .

10

9 , (R(Q)) ,

$$R(Q)=\sum_{i=1}^{n} r(q_i,q_{i-1})$$

, $r(q_i, q_{i-1})$ (i-1)
(i)
(memoryless macroblock-level nonnegative cost component) .

11

10 , (R(Q)) $(r(q_i, q_{i-1}))$,

$$r(q_i,q_{i-1})=\begin{cases}0, & |q_i-q_{i-1}|\le 2 \text{ 에 대해}\\ +\infty, & \text{그렇지 않으면,}\end{cases}$$

, (D(Q,S)) $(d(q_i, s_i))$,

$$d(q_i,s_i)=(q_i-s_i)^2$$

.

12

10 , (R(Q)) $(r(q_i, q_{i-1}))$,

$$r(q_i,q_{i-1})=\begin{cases}\lambda N_{q_i,q_{i-1}}, & \text{만약, qi가 표현 가능하다면,}\\ +\infty, & \text{그렇지 않으면}\end{cases}$$

, λ (rate distortion trade-off parameter) , $N_{qi,qi-1}$ q_{i-1} , q_i
, (D(Q,S)) $(d(q_i,s_i))$,

$$d(q_i, s_i)=||mse(q_i)-mse(s_i)||$$

, mse(...) $(q_i$ $s_i)$
(mean square error) .

13

n

, ,

n (subsets)

,

.

14

13 , n n

.

15

13 , n

(Viterbi search algorithm) .

16

17

13 , ,

(frame-level control) ,

,

n ,

(candidate quantizer parameter sequence) (Q)

(optimizing quantizer

parameter sequence; Q^*) ,

(Q^*) (suggested quantizer parameter

sequence; S) (Q) (C(Q,S))

, , ,

a) (S) ;

b) (C(Q,S)) , (C(Q,S)) (criterion)

(S) (Q)

(D(Q,S)), (Q)

(R(Q)) ;

c) (Q^*) ,

(bit-efficient way) (S)

(Q^*) .

18

17 , (S) (Region Of Interest)

.

19

17 , (C(Q,S)) (Q^*)

(S)

(k) , (optimum

constrained cost function; $C^*_k(S_t)$) ,

(t) (S_t) ,

(k) t

$(Q_{t,k})$.

20

17 , (C(Q,S)) (Q^*) ,

a) (S)

;

b) (t) 1 ;

c) (k) ;

d) (optimum constrained cost function; $C^*_k(S_t)$) ,

(t) (partial suggested

quantizer parameter sequence; S_t) , 1 t $C^*_k(S_{t-1})$ $C^*_k(S_t)$, $(r(k,j)+C^*_j(S_{t-1}))$ (recursion relation) ,

r(k,j) (S) (j) Q

R(Q) ;

e) t k $(r(k, j)+C^*_j(S_{t-1}))$ j ;

f) $(C^*_k(S_t))$, k 1

k t t 1

t , $(r(k,j)+C^*_j(S_{t-1}))$ j t k

;

g) (S) k $C^*_k(S_{t=n})$

$(C^*(S_{t=n}))$;

h) $C^*_k(S_{t=n})$ k ,

j (optimizing

sequence; Q^*)

.

21

17 , (D(Q,S)) ,

$$D(Q,S)=\sum_{i=1}^{n} d(q_i,s_i)$$

, $d(q_i, s_i)$ (arguments)

(q_i) (s_i)

(memoryless macroblock-level nonnegative cost component) .

22

21 , (R(Q)) ,

$$R(Q)=\sum_{i=1}^{n} r(q_i, q_{i-1})$$

, $r(q_i, q_{i-1})$ (i-1)
(i)
(memoryless macroblock-level nonnegative cost component) .

23

22 , (R(Q)) ($r(q_i, q_{i-1})$) ,

$$r(q_i, q_{i-1})=\begin{cases}0, & |q_i - q_{i-1}| \le 2 \text{ 에 대해} \\ +\infty, & \text{그렇지 않으면,}\end{cases}$$

, (D(Q,S)) ($d(q_i, s_i)$) ,

$$d(q_i, s_i)=(q_i - s_i)^2$$

.

24

22 , (R(Q)) ($r(q_i, q_{i-1})$) ,

$$r(q_i, q_{i-1})=\begin{cases}\lambda N_{q_i, q_{i-1}}, & \text{만약, qi가 표현 가능하다면,} \\ +\infty, & \text{그렇지 않으면}\end{cases}$$

, λ (rate distortion trade-off parameter) , $N_{qi,qi-1}$ q_{i-1} , q_i
, (D(Q,S)) ($d(q_i, s_i)$) ,

$$d(q_i, s_i)=||mse(q_i)-mse(s_i)||$$

, mse(...) (q_i s_i)
(mean square error) .

25

1 , n
(suggested sequence)
(candidate sequence) .

26

13 , n
(suggested sequence)
(candidate sequence) .

27

n

,

n (subset)

,

.

[0001] , -

2 , ITU-T H.263 MPEG-4 VLBV(Very Low Bit rate Video) .

[0002] - 2 1995 2

H.263, ITU-T SG 15 Experts Group for Very Low Bit rate Visual Telephony ITU-T H.263;

1996 11 MPEG , Doc. ISO/IEC/JTCI/SC29/WG11, N1469 Maceio MPEG-4 Video

Verification Model - 5.0 MPEG-4 VLBV(Very Low Bit rate Video) . 1

H.263 . H.263+ . , H.263

, 1 . MPEG-4 VLBV H.263

, H.263 .

[0003] H.263 (< 64 kbits/sec) ITU-T , ITU-T

, H.261 . H.261 1 . (

.) (encoder) (11),

(12) (T T), (13)(Q Q) . ,

(14) .

[0004] (14) , .

INTRA/INTER (decision data)

.

[0005]

. .

.

[0006] 1 ' ' , ' (video

in)' . " "

.

[0007] (temporal correlation) ,

(useful) , - , '

(useful)' (previous frames) (INTRA)

(INTER) .

, INTRA .

.

, (1 v) ( )

. , (spatial correlation) T DCT(Discrete Cosine

Transform) (,) .

, DCT Q , (entropy coded) .

(quantizer) (loss) .

( ) , 1 31 ,

(14) Q (QP) . (QP)

, QP ( ) . (1 qz).

[0008] H.263 . (MB: Macro Block) (,) H.263 . 16×16 (luminance block), 2 8×8 (chrominance blocks), ( ) - , - . (raster scan order) . - , - . (QP - . - , .)

[0009] H.263 QP - , QP QP 2 DQUANT . (H.263+(2/98) 5.3.6 .) H.263 5.3.6 - , QP ±2 . (rate control) QP , QP . , QP , (ROI: Region Of Interest) , ROI - .

[0010] _____

[0011] (ROI: Region Of Interest) , QP . , QP . (ROI) QP (distribution) H.263 (MPEG-4 VLBV) . , . (optimality) ((a measure of cost)) , , (constrained realization) (total cost) , QP , .

[0012] , 1998 1 H.263 2, ITU-T SG 15 Experts Group for Very Low Bit rate Visual Telephony H.263+ , (arbitrary distribution) , . , . QP . QP QP . . (neighboring macroblocks) QP QP , QP .

[0013] (QP) (original suggestion) QP - (trade-off) . , , - .

[0014] _____

[0015] , ROI MPEG-4 , 2 (VOPs: Video-Object Planes), (foreground) VOP (background) VOP QP , 1998 12 , IEEE. Tran. on CAS for Video Technology, 928-934, vol. 8, no. 8, N.Doulamis, A. Doulamis, D. Kalogeras S. Kollias Low Bit-Rate Coding of Image Sequences Using Adaptive Regions of Interest , 1999 12 , IEEE. Tran. on CAS for Video Technology, 1190-1203, vol. 9, no. 8, T. Meier, N, Ngan Video Segmentation for Content-Based Coding . (separation) /

±2 .

[0016] 2 . , VOP (bit overhead) , (foreground) , . / , . , . , VOP QP (graded QP control) (, VOP). VOP QP / . QP , VOP QP .

[0017] H.263 , VOP . , . , ±2 H.263 . , H.263 ROI QP (QP) .

[0018] H.263+ QP (bit-costly mechanism) , 6 ( ) QP . (H.263 H.263+) , QP (bit budget) , . , H.263 , ROI QP - (QP) H.263+ .

[0019] QP , - .

[0020] , 1 , n , ,

[0021] n (subset) .

[0022] 1 , n n .

[0023] 1 , n (Viterbi search algorithm) .

[0024] 1 , n (suggested sequence) (candidate sequence) .

[0025] 1 , QP(Quantizer Parameter) (frame-level control) , n , (candidate quantizer parameter sequence) Q (optimizing quantizer parameter sequence) Q^* , Q^* (suggested quantizer parameter) S Q C(Q,S) , S ; C(Q,S) , C(Q,S) (criterion)

S Q D(Q,S), Q
R(Q) ; C(Q,S)
Q^* ,
(bit-efficient way) S
Q^* .

[0026] , S (ROI: Region Of Interest)
.

[0027] , C(Q,S) Q^*
S (spanned)
k , (optimum constrained cost function) $C^*_k(S_t)$
, t (partial
suggested quantizer parameter sequence) S_t , t k
(partial candidate quantizer parameter sequence) $Q_{t,k}$
.

[0028] , C(Q,S) Q^*
S
; t 1 ; k ;
(optimum constrained cost function) $C^*_k(S_t)$,
t (partial suggested quantizer parameter sequence)
S_t , 1 t $C^*_k(S_{t-1})$ $C^*_k(S_t)$,
$r(k,j)+C^*_j(S_{t-1})$ (recursion relation) , r(k,j)
S j Q
R(Q) ; t k $r(k, j)+C^*_j(S_{t-1})$
j ; $C^*_k(S_t)$, k
1 k t
t 1 t , $r(k,j)+C^*_j(S_{t-1})$ j
t k ; S k
$C^*_k(S_{t=n})$ $C^*(S_{t=n})$;
$C^*_k(S_{t=n})$ k ,
j
(optimizing sequence) Q^* ; .

[0029] , D(Q,S)

[0030] $D(Q,S)=\sum_{i=1}^{n} d(q_i,s_i)$

[0031] , $d(q_i, s_i)$ (arguments)
q_i s_i
(memoryless macroblock-level nonnegative cost component) ,
R(Q)

[0032] $$R(Q)=\sum_{i=1}^{n} r(q_i,s_i)$$

[0033] , $r(q_i, q_{i-1})$ i-1 ; R(Q) $r(q_i, q_{i-1})$

$$r(q_i,q_{i-1})=\begin{cases}0, & |q_i-q_{i-1}|\le 2 \text{ 에 대해}\\ +\infty, & \text{그렇지 않으면,}\end{cases}$$

[0034]

[0035] , D(Q,S) $d(q_i, s_i)$

[0036] $$d(q_i,s_i)=(q_i-s_i)^2$$

[0037] , R(Q) $r(q_i, q_{i-1})$

$$r(q_i,q_{i-1})=\begin{cases}\lambda N_{q_i,q_{i-1}}, & \text{만약, qi가 표현 가능하다면,}\\ +\infty, & \text{그렇지 않으면}\end{cases}$$

[0038]

[0039] , λ (rate distortion trade-off parameter) , $N_{qi,qi-1}$ q_{i-1} , q_i , D(Q,S) d(qi,si)

[0040] $$d(q_i, s_i)=||mse(q_i)-mse(s_i)||$$

[0041] , mse(...) q_i s_i (mean square error) .

[0042] 2 , 1 .

[0043] , QP . (optimizing criterion) , . , .

[0044] H.263(+) MPEG-4 QP 1 . QP , (suboptimal) QP . , H.263+ QP , ( ) . , H.263 ROI QP . .

[0045] . , $r(q_i,q_{i-1})$ $d(q_i,s_i)$ (,), ( ) . (256). (overhead) .

[0046] ,

,

[0050] H.263 (, H.263), 2 , MPEG-4 VLBV .

[0051] (Viterbi algorithm) , QP . 1973 3 IEEE , 268-278 G.D. , , (THE VITERBI ALGORITHM) .

[0052] , QP , (raster scan order) QP . , .

[0053] **(Definition and Notation)**

[0054] s_i i ROI(Region Of Interest) QP , $S=\{s_i\}$ ROI QP . $Q=\{qi\}$ S QP QP (candidate QP sequence) . Q S . n .

[0055] QP (partial suggested QP sequence) $\{s_i\}_{i=1..t}$(, $\{s_1, s_2, ..., s_t\}$) s_t , $t \le n$. , $S_n=S$. , QP (partial candidate QP sequence) Q_t . Q_t (constrained form) , $Q_{t,k}$ (partial sequence) Q_t , Q_t $q_t=k$(k [1, 31]) . , , t=5 (n), k=8 , Q_t {3, 5, 2, 4, 8} , 8 5 .

[0056] S QP , C(Q,S) Q QP . (cost function) C(Q,S) (,), .

[0057] a) C(Q,S) .

[0058] b) Q (representable) , (C, Q) . (QP QP , QP . , QP {5, 12, ...} H.263 , H.263 QP +-2 , 12 5 7 . , {5, 12, ...} , (optimal approximation) .)

[0059] c) , Q S (discrepancy) . D(Q,S) , (optimizer) S QP . , D(Q,S) 1 - (memoryless macroblock-level non-negative cost components) .

1

$$D(Q,S)=\sum_{i=1}^{n} d(q_i,s_i)$$

[0060]

[0061] (memoryless) $i \neq k$, i q_k s_k . , D(Q,S) 1 .

[0062] D(Q,S) Q , R(Q) , , S . (R(Q) QP Q . S ROI (Analyzer) QP . R(Q) S , Q S .) Q , R(Q)≠+∞ . MPEG-4, H.263, H.263+ (differential encoding) R(Q) 2 - .

2

$$R(Q)=\sum_{i=1}^{n} r(q_i,q_{i-1})$$

[0063]

[0064] , $r(q_i, q_{i-1})$ i QP q_i , q_{i-1} . 1 (i=1) , QP 1 , PQUANT , QP . , q_0 PQUANT .

[0065] R(Q) D(Q,S) , (derived condition) .

3

$$C(Q,S)=D(Q,S)+R(Q)=\sum_{i=1}^{n}[d(q_i,s_i)+r(q_i,q_{i-1})]$$

[0066]

[0067] , C^* QP Q^* . C^* S , 4 .

4

$$C^*(S)=\min_{Q}[C(Q,S)]$$

[0068]

[0069] , Q^* QP Q . $C^*()$ (constrained version) , $C_k^*()$, q_{last} = k , 5 .

5

$$C_k^*(S_t)=\min_{Q_{t,k}}[C(Q_{t,k},S_t)]$$

[0070]

[0071] (constrained minimization) $C^*()$.

[0072] , $Q^*_{t,k}$ $Q_{t,k}$. ($Q_{t,k}$ q_t k Q_t)

[0073] ---

[0074] $C^*()$ $C_k^*()$ 6 .

6

$$C^*(S)=\min_{k}[C_k^*(S)]$$

[0075]

[0076] 6 $C^*(S)$ Q^* . , $C_k^*(S)$

QP k . $C_k^*(S)$, 5 $C_k^*(S)$, (recursive relation) .

7

[0077] $$C_k^*(S_1) = d(s_1, k) + r(k, q_0)$$

8

[0078] $$C_k^*(S_t) = d(s_t, k) + \min_j \left[r(k, j) + C_j^*(S_{t-1}) \right]$$

[0079] , q_0 QP QP ,
QP (, QP) .

[0080] (recursion step) (8) , j^* j , $r(k,j)+C^*_j(S_{t-1})$ j .
, $q_{t-1}=j^*$ $q_t=k$ (best preceding state) (r(k, j) k j
q_t q_{t-1}). , q_t= k ,
q_{t-1}= j^* . , .

[0081] $bestPrev_t(k)=j^*$

[0082] (.)

[0083] (QP Q) 7 8 $C_k^*(S)$
, 6 $C^*(S)$. (t, k)
(best preceding state) j^* QP
.

[0084] - **(The algorithm as pseudo-code)**

[0085] .

[0086] For t=1 to n(, n }

[0087] For k=QP_{min} to QP_{max} in incrementals of 1{ , QP_{min} and QP_{max} , 1 31 ,
QP }

[0088] 7 8,

[0089] $C_k^*(S_1) = d(s_1, k) + r(k, q_0)$ 및
$C_k^*(S_t) = d(s_t, k) + \min_j \left[r(k, j) + C_j^*(S_{t-1}) \right]$;

[0090] $C_k^*(S)$ (S Sn) ;

[0091] j^* r(k,j)+$C^*_j(S_{t-1})$ j ;

[0092] $bestPrev_t(k)$ = j ;

[0093] 6, $C^*(S) = \min_k \left[C_k^*(S) \right]$ $C^*(S)$, k^* , k $C^*_k(S)$;

[0094] set q_n=k;

[0095] For i = n-1 down to 1

[0096] set $q_i = bestPrev_{i+1}(q_{i+1})$;

[0097] End.

[0098] QP $\{q_1, q_2, \ldots, q_n\}$, QP (bit budget) (trade-off) , C(Q,S) QP .

[0099] 2 QP , S 21, S Q (discrepancy) D(Q,S) Q R(Q) C(Q,S) 22, Q^*, C(Q,S) Q^* Q^* 23, 24 25 . Q^* 23, 24, 25 .

[0100] **(Architecture of a coding control module according to the invention)**

[0101] 3 , QP QP ( ) (14a) 1 (14) , (optimizations) 2 D(Q,S) R(Q) C(Q,S) ((definition)). ((14)) ROI (31) S . Q (14b) , (14b) (operational parameters) p, t, qz, q ( ) .

[0102] ( ) (14) ROI (31) , (14) video in . , ROI (14) (source) (generator) . .

[0103] **(Various embodyments of the invention, including the best mode)**

[0104] 1 2 $r(q_i, q_{i-1})$ $d(q_i, s_i)$. (sensible) , (a) - (d) . , H.263, MPEG-4 VLEV, H.263+ , QP QP .

[0105] 2 , (simple mode), , (high performance mode) .

[0106] **(The simple mode)**

[0107] MPEG-4 H.263 . , $r(q_i, q_{i-1})$ $d(q_i, s_i)$.

9

$$r(q_i, q_{i-1}) = \begin{cases} 0, & |q_i - q_{i-1}| \le 2 \text{ 에 대해} \\ +\infty, & \text{그렇지 않으면,} \end{cases}$$

[0108]

10

[0109] $d(q_i, s_i) = (q_i - s_i)^2$

[0110] (optimizer) " (optimum representable approximation)" . (representable sequence) (representability part) . (H.263+ ,). QP . (ROI , QP [1, 31] . , [1, 31] QP H.263 , ROI . ROI (responsibility) ROI , (representability) (system dependent issue) . H.263+ , [1, 31]( ) QP , . , H.263+ .

[0111] **(An example of the Simple Mode)**

[0112] ROI QP 6, 7, 3, 2, 1, 3 , 1 QP 5 , 5 7 q_0 . (QP , QP q_0).

[0113] , 6 , t = [1, 6] , n=6 . q_0 , k=[1, 7] , QP 1 7 . (QP q_0 ,). 4 .

[0114] t=1 , (constrained partial sequence) $C^*_k(S_1)$, k 1 7 . QP 2 , 9 Q 0 , (∞) , . QP 5 , $C^*_1(S_1)$ $C^*_2(S_1)$, 9 .

[0115] 7 , $C^*_3(S_1)$ $C^*_3(S_1) = d(6,3)+r(3,5)$, 9 10 $C^*_3(S_1) = (3-6)^2 + 0 = 9$, , $C^*_k(S_t)$ (column) k=3 t=1 4 .

[0116] t=1 k , $C^*_4(S_1) = 4$, $C^*_5(S_1) = 1$, $C^*_6(S_1) = 0$, $C^*_7(S_1) = 1$ . . (, 4)

[0117] t=2 2 QP

. 8 k=1 t=2 ,

[0118] $$C_1^*(S_2) = d(7,1) + \min_j \left[r(1,j) + C_j^*(S_1) \right]$$

[0119] .

[0120] $C^*_1(S_2)$, j , $r(1, j) + C^*_j(S_1)$ j . QP 2 (, 9), 1 k , j 1, 2, 3 . j , j (t = t-1) , 8 (9 10) j , j . , . , j 1 2 , ($C^*_j(S_1)$ j = 1 2), k = 1 j = 3 . j 3 , .

[0121] $C^*_1(S_2)=(1-7)^2 + [r(1,3) + C^*_3(S_1)] = 6^2 + [0+9] = 45$

[0122] , $j^*(k,t) = j^*(1,2) = BestPrev_t(k) = BestPrev_2(1) = 3$. (45 3) 4 .

[0123] , k=2 (t=2), .

[0124] $$C_2^*(S_2) = d(7,2) + \min_j \left[r(2,j) + C_j^*(S_1) \right]$$

[0125] , j . (j k) ±2 , j 4 , 1, 2, 3, 4 . (t=1) , $C^*_4(S_1)= 4$, j=4 , .

[0126] $C^*_2(S_2) = (2-7)^2 + [r(2,4) + C^*_4(s_1)] = 5^2 + [0+4\} = 29$

[0127] , $C^*_2(S_2)$ (, k=2 t=2), (t=1) QP 4 , $BestPrev_2(2) = 4$. 4 , t=2 $C^*_3(S_2)=17$, $C^*_4(S_2)=9$. $C^*_5(S_2)=4$, $C^*_6(S_2)=1$, $C^*_7(S_2)=0$. , $j^*(k,2)$. $C^*_7(S_6)$ t .

[0128] , $C^*_k(S_6)$, 6 $C^*(S)$.

[0129] $$C^*(S) = \min_k \left[C_k^*(S) \right] = C_3^*(S) = 2$$

[0130] . , $j^*(k,t)=BestPrev_t(k)$ " (route)" . , (3), $q_n = k^*$, k^* t=n k . $q_6 = k^* = 3$. , Q^* 3 . (, k=3 , 2 , t=6 .) i=n-1 , Q^* q_{n-1} 1 .

[0131] $q_i = q_5 = BestPrev_{i+1}(q_{i+1}) = Bestprev_6(3) = j^*(3,6) = 1$

[0132] i=n-2 , $j^*(k,t)$ 2 , QP 2 , . 6, 6, 4, 2, 1, 3 , 4 , (QP=3) t=6 k , 2 , k 3 .

[0133] **(The High-performance Mode)**

[0134] MPEG-4, H.263, H.263+ . , $r(q_i, q_{i-1})$ $d(q_i, s_i)$ 11 12 .

11

$$r(q_i, q_{i-1}) = \begin{cases} \lambda N_{q_i, q_{i-1}}, & \text{만약, qi가 표현 가능하다면,} \\ +\infty, & \text{그렇지 않으면} \end{cases}$$

[0135]

12

[0136] $d(q_i, s_i) = ||mse(q_i) - mse(s_i)||$

[0137] , λ - (rate-distortion trade-off parameter) , $N_{qi, qi-1}$ q_{i-1} q_i , $mse(q_i)$ q_i QP , (original) (reconstructed) (mean square error) . (2 , (arrays), , (rank) 2 (multi-element quantities) (discrepancy) (measure) . (- (multi-element) (element-wise) .) (mse . QP . , ( ) , . , , (reference quantity) . , QP q , mse(q) , QP q , mse(q) .)

[0138] (bit budget) , QP QP (variation) - . 12 $d(q_i, s_i)$, . - , (computation-intensive part) .

[0139] **(Discussion)**

[0140] QP QP (distribution) . , QP - (non-causal) QP (QP transition) . , QP ( ) . , (before) . , , . 6 , , , , ROI 6 QP (abrupt drop) . (ROI) QP

S {15, 15, 15, 15, 15, 10, 15, 15, ...} . " (before)" " - (non-causal)" 1-D . QP 6 (, 6) . H.263 - QP {15, 15, 15, 15, 13, 11, 13, 15, 15...} . 1 5 , 5 1 , 1 . (approximator) 6 QP .

[0141] (distortion measurements) . , QP QP (QP) ( ) . (formulation) , QP , , (,) , ( ) ( ) .

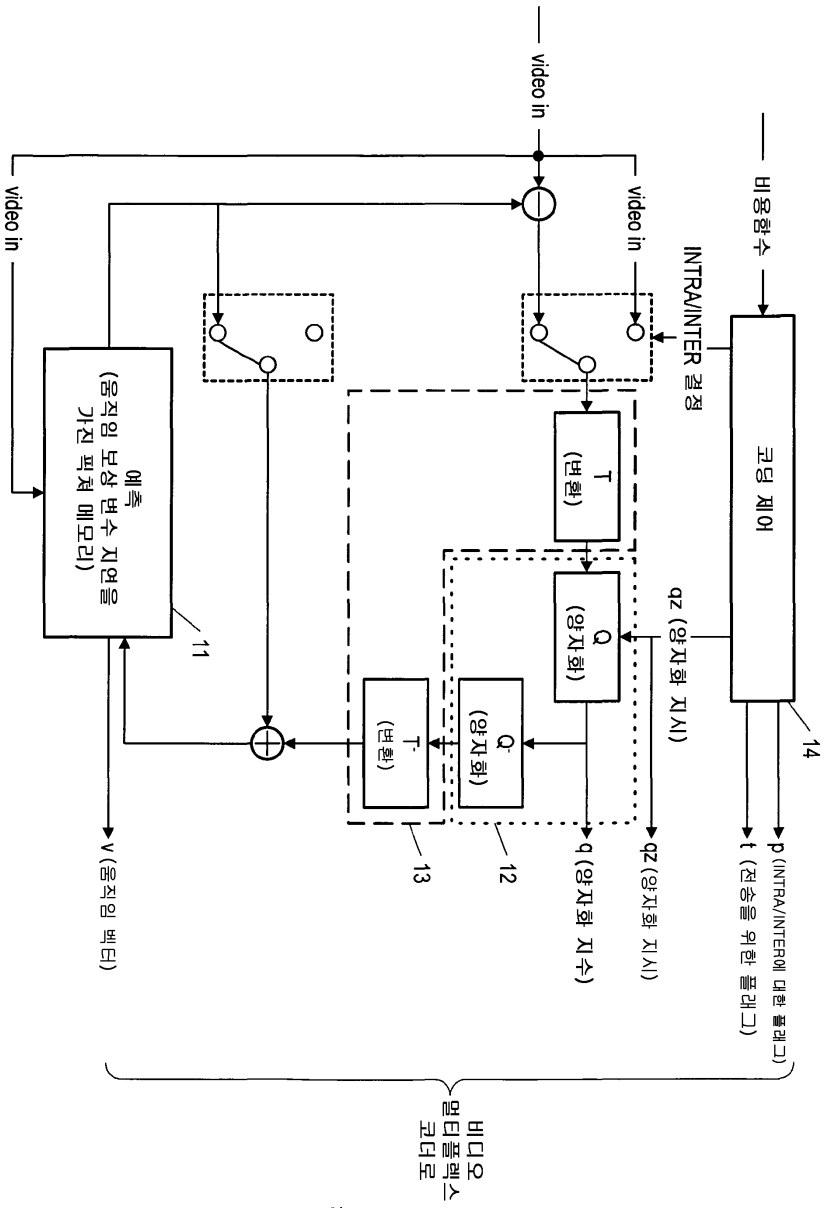
[0142] . , .

[0047] 1 H.263 , , , , .

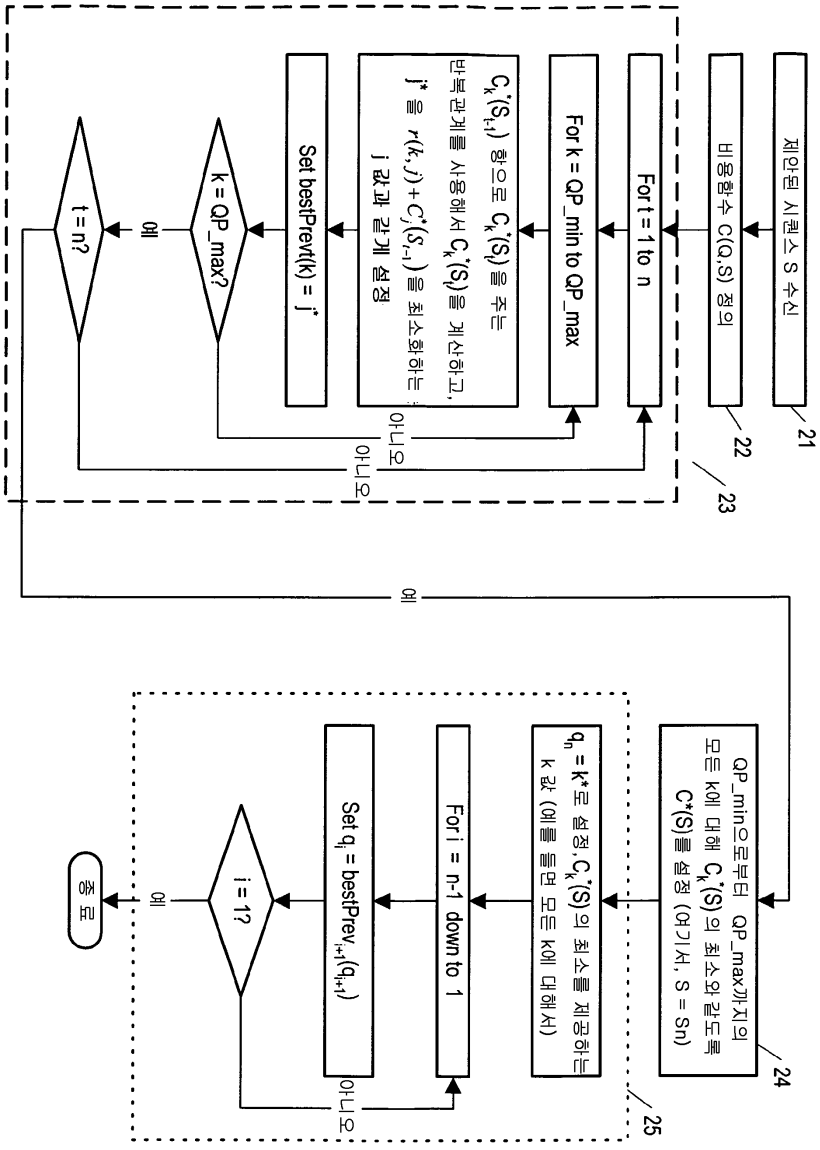
[0048] 2 .

[0049] 3 1 / .

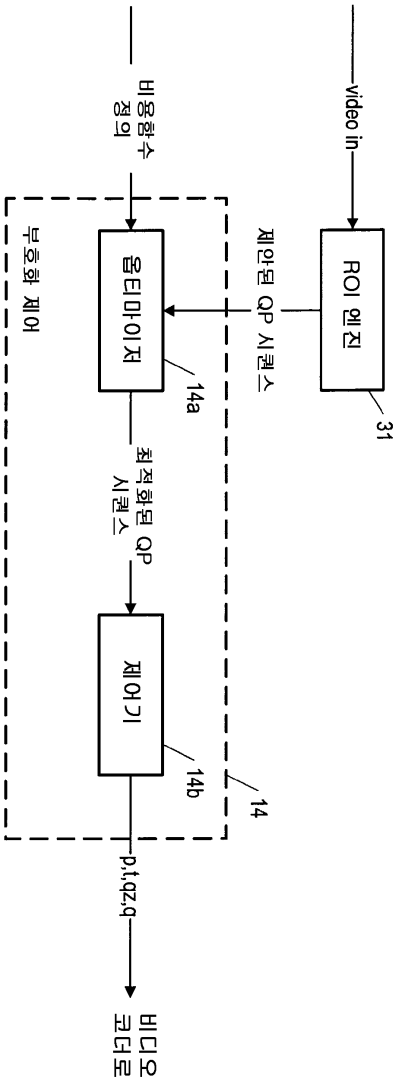
1


video in
video in
video in
비용함수
INTRA/INTER 결정
코딩 제어
T (변환)
Q (양자화)
qz (양자화 지시)
예측 (움직임 보상 변수 지연을 가진 픽쳐 메모리)
11
Q⁻ (양자화)
T⁻ (변환)
13
12
q (양자화 지수)
qz (양자화 지시)
14
v (움직임 벡터)
t (전송을 위한 플래그)
p (INTRA/INTER에 대한 플래그)
비디오 멀티플렉스 코더로

2


제안된 시퀀스 S 수신
21
비용함수 C(Q,S) 정의
22
For t = 1 to n
For k = QP_min to QP_max
$C_k'(S_{t-1})$ 항으로 $C_k'(S_t)$을 주는
반복관계를 사용해서 $C_k'(S_t)$을 계산하고,
j^*을 $r(k,j)+C_j'(S_{t-1})$을 최소화하는
j 값과 같게 설정
Set bestPrevt(k) = j^*
23
k = QP_max?
아니오
t = n?
아니오
예
예
QP_min으로부터 QP_max까지의
모든 k에 대해 $C_k'(S)$의 최소와 같도록
$C^*(S)$를 설정 (여기서, S = Sn)
24
q_n = k*로 설정. $C_k'(S)$의 최소를 제공하는
k 값 (예를 들면 모든 k에 대해서)
For i = n-1 down to 1
Set q_i = bestPrev$_{i+1}(q_{i+1})$
i = 1?
아니오
예
종료
25

3


video in
비용함수 정의
ROI 엔진
31
제안된 QP 시퀀스
부호화 제어
옵티마이저
14a
최적화된 QP 시퀀스
제어기
14b
14
비디오 코더로

4

	$(q_t - s_j)^2$	j^*	$C_k^*(S_j)$	$(q_t - s_j)^2$	j^*	$C_k^*(S_j)$	$(q_t - s_j)^2$	j^*	$C_k^*(S_j)$	$(q_t - s_j)^2$	j^*	$C_k^*(S_j)$	$(q_t - s_j)^2$	j^*	$C_k^*(S_j)$		j^*	$C_k^*(S_j)$
k \ t	1			2			3			4			5			6		
1	25	N/A	∞	36	3	45	4	3	21	1	3	5	0	2	2	4	1	6
2	16	N/A	∞	25	4	29	1	4	10	0	4	2	1	2	3	1	1	3
3	9	N/A	9	16	5	17	0	5	4	1	4	3	4	2	6	0	1	2
4	4	N/A	4	9	6	9	1	7	2	4	4	6	9	2	11	1	2	4
5	1	N/A	1	4	6	4	4	7	4	9	4	11	16	3	19	4	3	10
6	0	N/A	0	1	3	1	9	7	9	16	4	18	25	4	31	9	4	20
7	1	N/A	1	0	6	0	16	7	16	25	5	29	36	5	47	16	5	34
S	6			7			3			2			1			3		