

Source : JAPAN
Title : Loop Filter Control

1.Introduction

The loop filter control was reported for bit rate around 1 Mbit/s by doc#528 at Stuttgart, June 1989.

In this Document, Simulation results of Reference Model 8 with loop filter control for lower bit rate are reported and compared with original Reference Model 8.

2.Simulation Results

The simulation is performed as follows.

2-1: Loop Filter Control

(1)The method of loop filter control : same as #doc528.

$d(i)$ = MC inter frame prediction error
 $df(i)$ = MC inter filtered frame prediction error

if $\sum M.B[d(i)]^2 \geq \sum M.B[df(i)]^2$ then loop filter is ON
else then loop filter is OFF condition

(2) VLC for Additional Macro Block Types :

MC Coded Not Filtered ----- '0000 0001'
MC Not Coded Not Filtered --- '0000 0000 1'
MC Coded Q Not Filtered ----- '0000 0000 01'

(3) Sequence : Miss America , Claire (q=1,6)

The simulation results are shown in Table 1 to 6. The results show that there is no difference in SNR and the step size improved approximately 0.3.

2-2: VLC for Macro Block Types (TYPE3)

(1)One of VLC of Type3 is shorten as follows.

'0000 0001' (MC Coded Not Filtered) -----> 2bits
'0000 0000 1' (MC Not Coded Not Filtered) -----> not changed
'0000 0000 01' (MC Coded Q Not Filtered) -----> not changed

(2) Sequence : Miss America , Beach and Flower (q=6,18)

The simulation results are shown in Table 7 to 8. The results show that there is no difference in SNR and other parameters.

3.Conclusion

For lower bit rate, loop filter control has no effective advantage of Original Reference Model 8 in SNR and step size, but has no bad influence. Change of TYPE3 VLC makes no improvement for SNR and step size. Therefore, we are affirmative for the Stuttgart decision for loop filter control and VLC of TYPE3.

Statistics	RM8 Filter vs. Conditional filter(RM8+)
Bit rate	q=1
Source	SONY/JAPAN
Date	Oct. 1989
CIF/QCIF	CIF

Sequence Frame rate	Claire 10Hz RM8	Claire 10Hz RM8+
S.N.R.Y	38.40	38.45
S.N.R.C	40.34	40.48
Step Size	18.0	17.27
Nbr of non zero coef.	Y: 3.09 C: 1.58	3.04 1.66
Nbr of zero coef.	Y: 5.69 C: 2.63	5.36 2.68
MACRO BLOCK TYPE		
Fixed	277	272
Fixed MC No Filt	0	3
Fixed MC Filter	6	5
Inter	66	70
Inter MC No Filt	0	17
Inter MC Filter	47	30
Intra	0	0
NUMBER OF BITS		
Macro Attributes	1237	1374
End of Block	537	542
Motion vectors	334	336
Coefficients :Y C	3581 237	3514 257
Total	5932	6031

(150 frames are taken into account for the statistic chart.)

Table-1

Statistics	RM8 Filter vs. Conditional filter
Bit rate	q=1
Source	SONY/JAPAN
Date	Oct. 1989
CIF/QCIF	QCIF

Sequence Frame rate	claire 10Hz RM8	claire 10Hz RM8+
S.N.R.Y	39.18	39.09
S.N.R.C	41.30	41.41
Step Size	9.99	9.62
Nbr of non zero coef.	Y: 6.87 C: 2.97	6.68 2.89
Nbr of zero coef.	Y: 13.41 C: 8.80	13.45 8.27
MACRO BLOCK TYPE		
Fixed	48	46
Fixed MC No Filt	0	0
Fixed MC Filter	0	0
Inter	42	44
Inter MC No Filt	0	5
Inter MC Filter	9	4
Intra	0	0
NUMBER OF BITS		
Macro Attributes	469	511
End of Block	269	275
Motion vectors	45	44
Coefficients :Y	4314	4287
C	425	421
Total	5523	5539

Table-2

Statistics	RM8 Filter vs. Conditional filter
Bit rate	q=1
Source	SONY/JAPAN
Date	Oct. 1989
CIF/QCIF	CIF

Sequence Frame rate	Miss America 10Hz RM8	Miss America 10Hz RM8+
S.N.R.Y	38.05	38.09
S.N.R.C	38.25	38.25
Step Size	18.21	17.93
Nbr of non zero coef.	Y: 2.33 C: 1.37	2.30 1.39
Nbr of zero coef.	Y: 3.78 C: 2.45	3.59 2.46
MACRO BLOCK TYPE		
Fixed	209	207
Fixed MC No Filt	0	4
Fixed MC Filter	22	19
Inter	90	91
Inter MC No Filt	0	23
Inter MC Filter	75	52
Intra	0	0
NUMBER OF BITS		
Macro Attributes	1763	1929
End of Block	646	645
Motion vectors	601	604
Coefficients :Y	2247	2143
C	646	681
Total	5905	6005

Table-3

Statistics	RM8 Filter vs. Conditional filter
Bit rate	q=1
Source	SONY/JAPAN
Date	Oct. 1989
CIF/QCIF	QCIF

Sequence Frame rate	Miss America 10Hz RM8	Miss America 10Hz RM8+
S.N.R.Y	39.45	39.56
S.N.R.C	39.26	39.30
Step Size	10.87	10.50
Nbr of non zero coef.	Y: 5.37 C: 2.83	5.16 2.90
Nbr of zero coef.	Y: 9.68 C: 7.47	9.83 7.88
MACRO BLOCK TYPE		
Fixed	35	35
Fixed MC No Filt	0	0
Fixed MC Filter	1	1
Inter	44	45
Inter MC No Filt	0	10
Inter MC Filter	19	9
Intra	0	0
NUMBER OF BITS		
Macro Attributes	617	684
End of Block	384	393
Motion vectors	89	87
Coefficients :Y	3777	3707
C	1018	1106
Total	5886	5980

Table-4

Statistics	RM8 Filter vs. Conditional filter
Bit rate	q=6
Source	YAMAHA/JAPAN
Date	Oct. 1989
CIF/QCIF	CIF

Sequence Frame rate	Claire 15Hz RM8	Claire 15Hz RM8+
S.N.R.Y	44.21	44.15
S.N.R.C	45.08	45.16
Step Size	5.20	5.07
Nbr of non zero coef.	Y: 5.45 C: 2.48	5.26 2.43
Nbr of zero coef.	Y: 10.88 C: 7.47	10.99 7.52
MACRO BLOCK TYPE		
Fixed	142	138
Fixed MC No Filt	0	0
Fixed MC Filter	0	0
Inter	217	220
Inter MC No Filt	0	21
Inter MC Filter	35	15
Intra	2	1
NUMBER OF BITS		
Macro Attributes	2164	2321
End of Block	1408	1429
Motion vectors	172	174
Coefficients :Y	17344	16954
C	2495	
Total	23582	23401

Table-5

Statistics	RM8 Filter vs. Conditional filter
Bit rate	q=6
Source	YAMAHA/JAPAN
Date	Oct. 1989
CIF/QCIF	CIF

Sequence Frame rate	Miss America 15Hz RM8	Miss America 15Hz RM8+
S.N.R.Y	40.75	40.69
S.N.R.C	40.82	40.73
Step Size	7.06	7.01
Nbr of non zero coef.	Y: 3.47 C: 2.53	3.40 2.58
Nbr of zero coef.	Y: 12.68 C: 6.29	12.11 6.41
MACRO BLOCK TYPE		
Fixed	43	41
Fixed MC No Filt	0	0
Fixed MC Filter	1	0
Inter	282	284
Inter MC No Filt	0	29
Inter MC Filter	70	42
Intra	0	0
NUMBER OF BITS		
Macro Attributes	3267	3458
End of Block	2128	2128
Motion vectors	358	360
Coefficients :Y	12859	12511
C	6778	6936
Total	25391	25392

Table-6

Statistics	Conditional filter + New VLC (RM8++) vs. RM8 Conditional Filter (RM8+)
Bit rate	q=6
Source	YAMAHA/JAPAN
Date	Oct. 1989
CIF/QCIF	CIF

Sequence Frame rate	Miss America 15Hz RM8 ++	Miss America 15Hz RM8+
S.N.R.Y	40.69	40.69
S.N.R.C		
Step Size	7.00	7.01
Nbr of non zero coef.	Y: 3.41 C: 2.59	3.40 2.58
Nbr of zero coef.	Y: 12.10 C: 6.46	12.11 6.41
MACRO BLOCK TYPE		
Fixed	42	41
Fixed MC No Filt	0	0
Fixed MC Filter	0	0
Inter	275	284
Inter MC No Filt	28	29
Inter MC Filter	40	42
Intra	0	0
NUMBER OF BITS		
Macro Attributes	3349	3458
End of Block	2131	2128
Motion vectors	361	360
Coefficients :Y	12557	12511
C	6988	6936
Total	25386	25392

Table-7

Statistics	Conditional filter + New VLC (RM8++) vs. RM8 Conditional Filter (RM8+)
Bit rate	q=18
Source	YAMAHA/JAPAN
Date	Oct. 1989
CIF/QCIF	CIF

Sequence Frame rate	Miss America 15Hz RM8 ++	Miss America 15Hz RM8+
S.N.R.Y	42.38	42.38
S.N.R.C		
Step Size	4.14	4.14
Nbr of non zero coef.	Y: 4.66 C: 5.36	3.42 4.65
Nbr of zero coef.	Y: 23.76 C: 13.22	17.39 11.53
MACRO BLOCK TYPE		
Fixed	3	3
Fixed MC No Filt	0	0
Fixed MC Filter	0	0
Inter	324	324
Inter MC No Filt	26	26
Inter MC Filter	41	41
Intra	0	0
NUMBER OF BITS		
Macro Attributes	3788	3875
End of Block	3698	3700
Motion vectors	334	336
Coefficients :Y	40419	40404
C	23053	23003
Total	71291	71317

Table-8