

June 1987

SOURCE : NTT, KDD, NEC and FUJITSU

TITLE : FILTER IN THE CODING LOOP

1. Introduction

The inclusion of a loop filter which is applied after the picture memory and uses pels within the predicted block was agreed at Nurnberg meeting. This document compares two criteria for switching the filter in terms of coding efficiency.

2. Criteria for switching the filter

The loop filter is adopted to minimize the prediction error in RM3 and RM4. We examined the following two criteria for switching the filter, as is described in Document #205.

Two criteria are , the filter is switched on if ,

- the resulting prediction error is less than that of the filter is off (RM4) ,
- the resulting prediction error is less than or equal to that of the filter is off (modified RM4) .

3. Simulation results

The simulation results are shown in Tables 1 - 3. In these tables , it is apparent that the number of filtered blocks increases and the number of fixed blocks decreases considerably in modified RM4. As a result, the coding efficiency of modified RM4 is worse than that of RM4 because the prediction error isn't reduced in spite of increase in number of bits for attributes.

4. Conclusion

We examined two criteria for switching filter based on RM4. As a conclusion, the criterion that includes 'equal' should not be used from the stand point of coding efficiency.

Table 1

Sequence : Miss America

Items			R M 4		RM 4 (MOD)	
			15th	Average	15th	Average
1) R. M. S for luminance			2.4	2.5	2.5	2.6
2) SNR for luminance			40.7	40.2	40.3	39.7
3) Mean value of the step size			9.8	11.1	11.1	13.1
4) Mean value of the number of non-zero coefficients			2.6	2.6	2.3	2.4
5) Mean value of the number of zeroes before the last non-zero coefficient			8.1	6.9	7.2	6.1
6) Block type of Y	Fixed		1014	989	192	191
	Intra		0	1	0	1
	Filtered Fixed		87	81	986	947
	Non-filt Fixed MC		30	56	46	69
	Filtered Fixed MC		16	58	17	80
	Non-filt Inter		246	152	155	74
	Filtered Inter		109	72	116	77
	Non-filt Inter MC		48	85	47	69
	Filtered Inter MC		34	88	25	76
	Filtered		246	300	1144	1180
7) Block type of C	Fixed		283	330	53	59
	Intra		0	1	0	1
	Filtered Fixed		96	81	393	431
	Non-filt Inter		191	164	113	82
	Filtered Inter		222	216	233	218
	Filtered		318	297	626	649
8) Number of bits	Attributes	Y	2886	2996	5796	5863
		Cr	741	712	1312	1330
		Cb	1097	1002	1269	1305
		Total	4724	4710	8377	8498
	Classification indexes		874	797	686	593
	EOB		1700	1559	1378	1195
	Motion Vectors		1024	2308	1080	2354
	Coefficients	Y	7065	6351	5003	4383
		Cr	1361	1470	1114	1122
		Cb	3355	2692	2454	1754
		Total	11781	10513	8571	7259
	Total		20103	19887	20092	19899

Table 2

Sequence : Checked Jacket

Items			R M 4		RM 4 (MOD)		
			15th	Average	15th	Average	
1) R. M. S for luminance			3.1	3.1	3.3	3.3	
2) SNR for luminance			38.2	38.3	37.7	37.7	
3) Mean value of the step size			11.8	11.6	13.9	13.7	
4) Mean value of the number of non-zero coefficients			3.3	3.2	3.7	3.1	
5) Mean value of the number of zeroes before the last non-zero coefficient			8.3	8.6	10.3	9.2	
6) Block type of Y	Fixed		941	937	501	497	
	Intra		1	2	0	2	
	Filtered Fixed		52	74	655	622	
	Non-filt Fixed MC		25	18	19	21	
	Filtered Fixed MC		18	15	15	20	
	Non-filt Inter		341	344	177	198	
	Filtered Inter		84	78	94	115	
	Non-filt Inter MC		64	65	67	57	
	Filtered Inter MC		58	51	56	52	
	Filtered		212	219	820	810	
7) Block type of C	Fixed		571	571	46	52	
	Intra		0	0	0	0	
	Filtered Fixed		43	36	662	622	
	Non-filt Inter		143	150	13	18	
	Filtered Inter		35	34	71	100	
	Filtered		78	70	733	722	
8) Number of bits	Attributes		Y	2934	3004	4838	4859
			Cr	461	466	1525	1484
			Cb	438	466	1460	1445
			Total	3833	3936	7823	7788
	Classification indexes		1096	1079	788	847	
	EOB		1452	1449	956	1083	
	Motion Vectors		1320	1192	1256	1196	
	Coefficients		Y	11456	10872	8623	8080
			Cr	497	567	297	332
			Cb	360	402	192	224
			Total	12313	11841	9112	8636
	Total			20014	19497	19935	19548

Table 3

Sequence : Split-Trevor

Items		R M 4		R M 4 (MOD)	
		15th	Average	15th	Average
1) R. M. S for luminance		4.0	3.3	4.3	3.6
2) SNR for luminance		36.1	37.6	35.4	37.1
3) Mean value of the step size		17.0	13.7	19.1	15.3
4) Mean value of the number of non-zero coefficients		3.8	4.2	3.5	3.9
5) Mean value of the number of zeroes before the last non-zero coefficient		6.7	6.8	5.8	6.4
6) Block type of Y	Fixed	650	772	218	435
	Intra	14	43	16	43
	Filtered Fixed	84	64	547	433
	Non-filt Fixed MC	37	27	41	31
	Filtered Fixed MC	146	61	163	78
	Non-filt Inter	179	141	150	101
	Filtered Inter	68	54	59	62
	Non-filt Inter MC	181	170	168	153
	Filtered Inter MC	225	251	222	248
	Filtered	523	430	991	821
7) Block type of C	Fixed	519	567	99	73
	Intra	19	10	20	11
	Filtered Fixed	61	58	509	571
	Non-filt Inter	77	77	27	22
	Filtered Inter	116	81	137	116
	Filtered	177	138	646	686
8) Number of bits	Attributes	Y	4107	3566	5640
		Cr	625	525	1364
		Cb	563	565	1363
		Total	5295	4656	8367
	Classification indexes		1334	1318	1230
	EOB		1758	1654	1598
	Motion Vectors		4712	4073	4752
	Coefficients	Y	14694	16298	11889
		Cr	1352	839	1124
		Cb	919	878	795
		Total	16965	18015	13808
	Total		30064	29714	29755