CCITT SG XV
Specialists Group on Coding for Visual Telephony

Document #220
June 1987

Source: NTT, KDD, NEC and FUJITSU

Title: Effect of adaptive scanning in RM4

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1. Introduction

This document describes the effect of the scanning class method in the RM4 simulation. The purpose of this document is to find out whether the adaptive scanning method is effective or not when the two dimensional variable length coding is introduced.

2. Comparison of coding efficiency

The following two methods are compared;

(1) RM4: Four scanning classes with 2 dimensional VWL coding
(2) Mod: Only zig-zag scanning with 2 dimensional VWL coding.

Table 1 summarizes the simulation results. It has been shown that the two methods display almost the same effectiveness. Since the cost to represent zero-level coefficients was 1 bit in RM3, the adaptive scanning method directly saved bits to represent those coefficients. Meanwhile, in two dimensional coding method, we need less than 1 bit to represent them. Therefore, effect of adaptive scanning is canceled out by increase of overhead information indicating scanning classes. Table 2 shows the precise data.

3. Conclusion

Adaptive scanning method is not effective if two dimensional coding is employed.

Table 1 Simulation results. SNR of each method.

Method	CJ	MA	ST
RM4 (4 scanning)	38.31	40.24	37.60
MOD (1 scanning)	38.23	40.24	37.60

Table 2 Comparison between four scanning and one scanning

Item			CJ RM4	CJ MOD	MA RM4	MA MOD	ST RM4	ST MOD
1)R.M.S. for luminance			3.10	3.13	2.48	2.48	3.36	3.36
2)SNR for luminance			38.31	38.23	40.24	40.24	37.60	37.60
3)Mean value of the step size			11.63	11.83	11.15	11.13	13.83	13.87
4)Mean value of the number of non-zero coefficients			3.34	3.34	2.59	2.60	4.18	4.17
5)Mean value of the number of zeroes before the last non-zero coefficient			9.08 (4.21)	13.29	6.93 (2.06)	8.99	6.83 (3.39)	10.22
6) Block type of Y	Fixed		953	964	995	997	772	772
	Intra		1	1	1	1	43	43
	Filtered Fixed		73	73	81	81	65	67
	Non-filt Fixed MC		17	17	55	56	27	27
	Filtered Fixed MC		14	14	58	56	62	63
	Non-filt Inter		331	321	148	144	137	136
	Filtered Inter		77	75	70	72	52	53
	Non-filt Inter MC		63	61	85	85	170	167
	Filtered Inter MC		51	53	87	88	251	251
	Filtered Block of Luminance		217	216	297	298	433	435
7) Block type of C	Fixed		582	586	330	330	567	568
	Intra		0	0	0	0	10	10
	Filtered Fixed		38	38	81	81	58	58
	Non-filt Inter		136	134	164	165	75	75
	Filtered Inter		33	32	214	214	80	79
	Filtered Block of Chrominance		72	71	295	295	138	138
8) Number of bits	Attributes	Y	3020	2984	3029	3029	3627	3636
		Cr	475	467	731	731	541	540
		Cb	484	473	1016	1017	586	588
		Total	3980	3925	4777	4778	4756	4765
	Classification indexes		1050	0	784	0	1311	0
	EOB		1391	1359	1544	1544	1644	1636
	Motion Vectors		1171	1177	2293	2299	4096	4080
	Coefficients	Y	10973	12128	6337	7121	16200	17541
		Cr	545	535	1466	1462	830	820
		Cb	385	366	2685	2691	873	868
		Total	11905	13029	10489	11276	17903	19230
	Total		19499	19491	19888	19898	29711	29712
9)Number of coded blocks			696	680	772	772	822	818
10)Number of coded coefficients			8524	11138	7384	8988	8961	11661

Presented data are average values of whole sequence.
RM4: Refference Model 4.
MOD: Removed the adaptive scanning. (Zigzag Scan only)