CCITT SGXV
Working party XV/1
Specialists Group on Coding for Visual Telephony

Doc. #206
March 1987

Source : NL,UK,F

Title : Quantisation with different thresholds

1. Introduction

This paper deals with some results of experiments with quantiser thresholds. The used quantiser characteristic is depicted in figure 1.

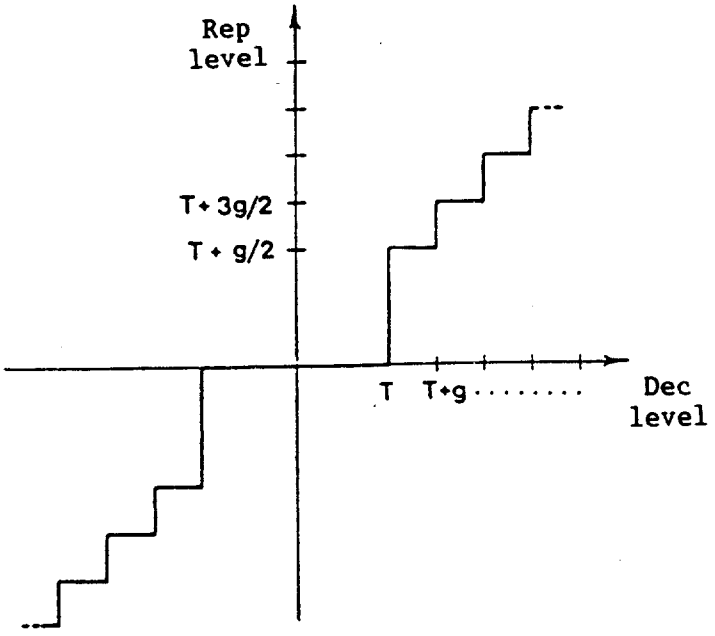

figure 1 : quantiser characteristic in Reference Model 3

The experiment includes a comparison between three different thresholds.

2. Description of the different thresholds

The three compared methods are (see figure 2) :

(1) $T = 1.5 * g$ (according to Ref. Model 3)

(2) $T = g$

(3)
$$\begin{cases} T = 1.5 * g & g < 10 \\ T = 15 & 10 \leq g \leq 15 \\ T = g & g > 15 \end{cases}$$

The philosophy for this strategy is that in the case the stepsize becomes greater than 16, the annihilation of coeffients due to the threshold 1.5 * g is reduced to 1 * g, which means that coefficient values between g and 1.5*g are not represented by 0.

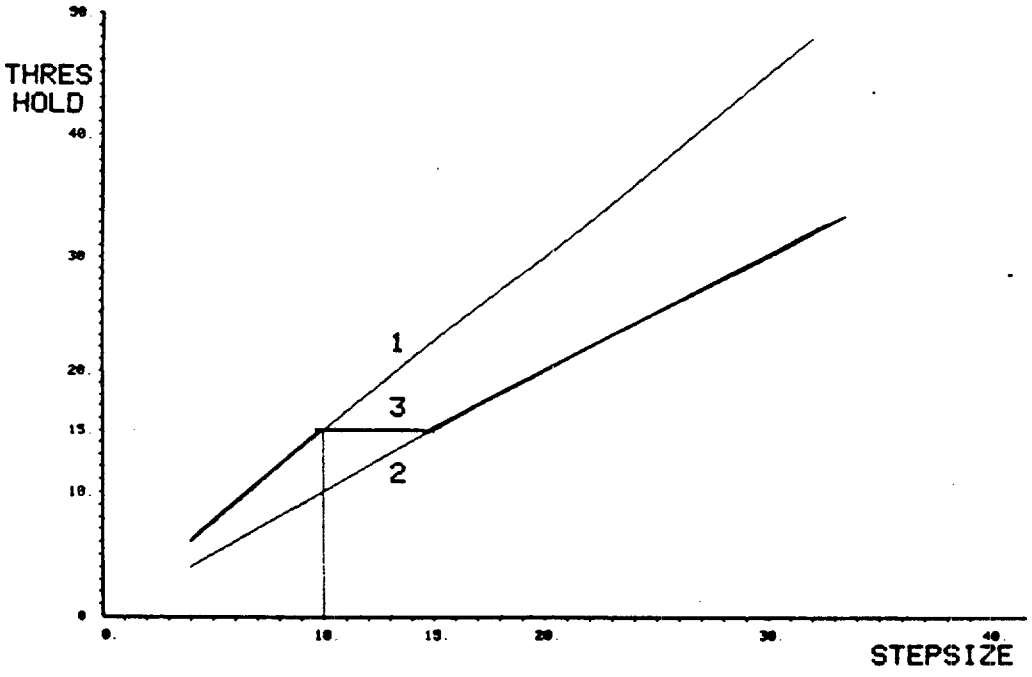

figure 2 : different thresholds for the quantiser

3. Experiments

Table 1,2 and 3 (see the annex to this paper) show the result of the comparison between the methods (1) and (2) for the Split/Trevor- , Miss America- and Checked Jacket-sequence respectively.

Examining the mean value of the stepsize, the mean value of the number of non-zero coefficients and the mean value of zeroes before the last non zero-coefficient, we can observe that:

the stepsize is approximately multiplied by 1.5: 1.38 for the Split/Trevor sequence, 1.44 for the Checked Jacket sequence and 1.45 for the Miss America sequence which seems to indicate that only the first step of the quantizer (i.e. the threshold) is important to determine the mean value of the stepsize in a closed loop simulation.

the non-zero coefficients are consequently more qoarsely quantized when T = g, which alllows to save bits to encode more coefficients. There is an increase of the mean value of the non zero coefficients of 5 % for Split/Trevor, 1.6 % for the Checked Jacket sequence and 4 % for the Miss America sequence. There is also an increase of the number of zeros before the last non zero coefficient of 4.5 % for Split/Trevor, 6.5 % for the Checked Jacket sequence and 4.2 % for the Miss America sequence.

4. Conclusion

An improvement has been obtained by modifying the threshold. The gain for method (2), in term of SNR, is 0.2 dB for Split/Trevor, 0.01 dB for Miss America and 0.23 dB for Checked Jacket.
Simulations of these comparisons shows that subjectively method (2) yields also the best performance.
Therefore it should be proposed to adopt a threshold in the quantiser characteristic of 1*g instead of 1.5*g.

Note:

The first representation level for method (2) according to the quantiser depicted in figure 1 is 1.5*g.

STATISTICS RM3 DATE : 5 - 3 - 1987

SEQUENCE : SPLIT / TREVOR

COMPARISON :				-		T = g	
ITEM				15th pict	Mean seq	15th pict	Mean seq
1. RMS for luminance				4.20	3.55	4.18	3.47
2. SNR				35.66	37.12	35.72	37.32
3. Mean value of step size				12.89	10.49	18.39	14.54
4. Mean value of the no. of non-zero coefficients				2.33	3.91	3.72	4.09
5. Mean value of the no. of zeroes before the last NZ-coef.				6.03	6.15	6.06	6.42
6. Block type of Y		coded	MC				
	INTRA	-	-	16	43	13	44
	FIXED	F	F	765	867	762	868
	INTER	T	F	210	161	212	161
	FIXED MC	F	T	222	121	203	107
	INTER MC	T	T	371	392	394	404
	Filtered			487	385	478	407
7. Block type of UV	INTRA	-	-	20	10	22	10
	FIXED	F	-	606	649	608	641
	INTER	T	T	166	133	162	141
	Filtered			142	107	157	120
8. Number of bits	Attributes	Y		4373	3955	4361	3932
		U		684	681	683	689
		V		738	674	744	682
		Total		5795	5310	5788	5303
	Classification index			1194	1192	1238	1218
	End of block			2349	2216	2409	2281
	Motion vectors			4744	4106	4776	4096
	Coefficients	Y		13999	15382	13555	15271
		U		870	793	833	792
		V		1197	739	1272	760
		Total		16066	16914	15660	16823
	Total			30148	29738	29871	29721

table 1 : Comparison between method (1) and (2) for the Split/Trevor - sequence

STATISTICS RM3 DATE : 5 - 3 - 1987

SEQUENCE : MISS AMERICA

COMPARISON :				-		T = g	
ITEM				15th pict	Mean seq	15th pict	Mean seq
1. RMS for luminance				2.43	2.62	2.44	2.61
2. SNR				40.42	39.77	40.38	39.78
3. Mean value of step size				6.72	7.94	9.94	11.46
4. Mean value of the no. of non-zero coefficients				2.83	2.57	2.62	2.68
5. Mean value of the no. of zeroes before the last NZ-coef.				7.68	6.11	7.40	6.37
6. Block type of Y		coded	MC				
	INTRA	-	-	0	1	0	1
	FIXED	F	F	1198	1146	1189	1142
	INTER	T	F	246	156	277	160
	FIXED MC	F	T	71	125	49	120
	INTER MC	T	T	69	155	69	162
	Filtered			179	251	199	264
7. Block type of UV	INTRA	-	-	0	1	0	1
	FIXED	F	-	459	483	444	472
	INTER	T	T	333	307	348	319
	Filtered			254	252	257	266
8. Number of bits	Attributes	Y		3385	3449	3371	3455
		U		1015	952	1051	968
		V		765	774	790	780
		Total		5165	5175	5212	5203
	Classification index			630	624	692	646
	End of block			1944	1863	2082	1927
	Motion vectors			1120	2246	944	2248
	Coefficients	Y		7386	6423	7060	6301
		U		3230	2292	3057	2320
		V		905	1273	964	1249
		Total		11521	9988	11081	9870
	Total			20380	19896	20011	19894

table 2 : Comparison between method (1) and (2) for the Miss America - sequence

STATISTICS RM3 DATE : 5 - 3 - 1987

SEQUENCE : CHECKED JACKET

COMPARISON :				-		T = g	
ITEM				15th pict	Mean seq	15th pict	Mean seq
1. RMS for luminance				3.38	3.36	3.28	3.28
2. SNR				37.54	37.59	37.82	37.82
3. Mean value of step size				8.94	9.06	13.22	13.04
4. Mean value of the no. of non-zero coefficients				3.91	3.13	3.73	3.18
5. Mean value of the no. of zeroes before the last NZ-coef.				9.17	8.29	9.27	8.83
6. Block type of Y		coded	MC				
	INTRA	-	-	1	2	0	2
	FIXED	F	F	1123	1098	1101	1103
	INTER	T	F	297	331	313	326
	FIXED MC	F	T	54	45	56	41
	INTER MC	T	T	109	107	114	112
	Filtered			162	163	195	185
7. Block type of UV	INTRA	-	-	0	0	0	0
	FIXED	F	-	698	663	690	661
	INTER	T	T	94	129	102	130
	Filtered			68	46	65	53
8. Number of bits	Attributes	Y		3441	3526	3501	3503
		U		579	618	577	626
		V		619	656	663	668
		Total		4639	4800	4741	4797
	Classification index			814	880	854	878
	End of block			1503	1706	1587	1709
	Motion vectors			1304	1221	1360	1225
	Coefficients	Y		10596	10149	10622	10174
		U		292	313	155	276
		V		556	480	463	440
		Total		11444	10942	11240	10890
	Total			19704	19549	19782	19499

table 3 : Comparison between method (1) and (2) for the Checked Jacket - sequence