

Source : NL, UK, F, FRG

Title : Adaptive quantisation

1. Introduction

In this paper different kind of adaptations for the quantiser are described, i.e. two different stepsizes within one block for the low-frequency and high-frequency components (paragraph 2) and a non-linear threshold for low stepsize (paragraph 3). According to the simulations some results are given in paragraph 4, but they are not conclusive.

2. Different stepsizes for low- and high-frequency components

Each coefficient block is divided in two parts as depicted in figure 1.

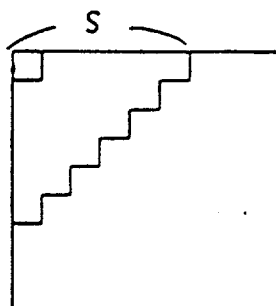


figure 1 : two parts in a coefficients block

S defines the size of the low-frequency components, while FACT defines the factor of the stepsize for high- and low-frequency components :

for low-frequency components :

$$q_{\text{dec}}(n) = T + (n-1) * g$$

$$q_{\text{rep}}(n) = (q_{\text{dec}}(n) + q_{\text{dec}}(n+1)) / 2$$

for high-frequency components :

$$q_{\text{dec}}(n) = T * \text{fact} + (n-1) * g * \text{fact}$$

$$q_{\text{rep}}(n) = (q_{\text{dec}}(n) + q_{\text{dec}}(n+1)) / 2$$

3. Non-linear quantiser-threshold

Because of the small threshold for low stepsizes, noise will be coded as well. Therefore a non-linear threshold is introduced (see figure 2).

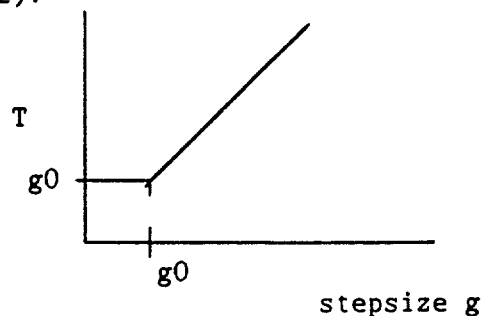


figure 2 : non-linear threshold for low stepsizes

$$\begin{cases} T = g0 & g \leq g0 \\ T = g & g > g0 \end{cases}$$

4. Results and conclusions

Subjective evaluation of the COST-sequence show that it makes no difference whether low- and high-frequency components are treated with different stepsizes (see also annex to this paper). The same conclusion holds for the non-linear threshold (for the COST-sequence).

For the MISS AMERICA-sequence there is a small, but no significant improvement for the adaptive quantisation (the SNR is 0.1 dB lower). Also for this sequence there is no improvement with the non-linear threshold.

This simulation results suggest that there is little to be gained from adaptive quantisation within a block.

It is proposed that this matter is investigated further during the optimization of the hardware experiments.

STATISTICS RM4

DATE : 1 - 6 - 1987

SEQUENCE : SPLIT / TREVOR ADAPTIVE QUANTISATION

COMPARISON :		-		S=3 ; fact=1.5		+ g0=6				
ITEM		15th pict		Mean seq		15th pict		Mean seq		
1. RMS for luminance		4.070		3.372		4.239		3.506		
2. SNR		35.939		37.572		35.586		37.235		
3. Mean value of step size		17.333		13.746		13.722		11.012		
4. Mean value of the no. of non-zero coefficients		4.000		4.207		3.549		3.763		
5. Mean value of the no. of zeroes before the last NZ-coef.		6.343		6.865		4.565		4.949		
6. Block type of Y	FIXED	673		786		638		757		
	INTRA	18		49		13		47		
	FILTERED FIXED	67		46		56		43		
	NON-FILT FIXED MC	65		35		57		28		
	FILTERED FIXED MC	141		58		108		45		
	NON-FILT INTER	196		152		228		177		
	FILTERED INTER	48		42		68		51		
	NON-FILT INTER MC	182		183		196		189		
	FILTERED INTER MC	194		229		220		242		
	Filtered	450		376		452		383		
7. Block type of UV	FIXED	535		586		522		558		
	INTRA	24		10		19		10		
	FILTERED FIXED	52		35		39		34		
	NON-FILT INTER	106		98		121		120		
	FILTERED INTER	75		60		91		68		
	Filtered	127		95		130		102		
8. Number of bits	Rel addr		1874		2036		1924		2027	
	Y		2615		2636		2233		2640	
	U		221		221		230		200	
	V		263		256		187		260	
	Total		5063		5149		4549		5157	
	Classification index		1276		1313		1450		1416	
	End of block		2529		1653		2868		1816	
	Motion vectors		4656		4055		4648		4048	
	Y		14515		16474		14181		15839	
	U		1044		906		1181		1069	
	V		1359		842		1549		985	
	Total		16918		18223		16911		17894	
Total		29166		28362		29576		28308		
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STATISTICS RM4

DATE : 1 - 6 - 1987

SEQUENCE : MISS AMERICA ADAPTIVE QUANTISATION

COMPARISON :		-		S=3 ; fact=1.5		+ g0=6	
ITEM	15th pict	Mean seq	15th pict	Mean seq	15th pict	Mean seq	
1. RMS for luminance	2.321	2.443	2.359	2.483	2.353	2.482	
2. SNR	40.817	40.374	40.676	40.231	40.700	40.235	
3. Mean value of step size	9.333	10.767	7.444	8.902	7.389	8.907	
4. Mean value of the no. of non-zero coefficients	2.665	2.626	2.434	2.326	2.395	2.326	
5. Mean value of the no. of zeroes before the last NZ-coef.	7.521	6.467	4.228	3.641	4.146	3.644	
6. Block type of Y	FIXED	1044	1006	999	968	970	
	INTRA	0	1	0	1	1	
	FILTERED FIXED	68	66	51	55	54	
	NON-FILT FIXED MC	15	57	15	51	53	
	FILTERED FIXED MC	8	48	6	43	40	
	NON-FILT INTER	275	171	336	215	214	
	FILTERED INTER	97	60	94	69	69	
	NON-FILT INTER MC	39	89	42	97	98	
	FILTERED INTER MC	38	82	41	81	82	
	Filtered	211	258	192	249	247	
7. Block type of UV	FIXED	306	336	224	278	281	
	INTRA	0	1	0	1	1	
	FILTERED FIXED	61	62	53	48	46	
	NON-FILT INTER	221	200	311	262	262	
	FILTERED INTER	204	191	204	200	199	
	Filtered	265	253	257	249	245	
8. Number of bits	Rel addr		2059	2206	2140	2136	
	Y		1427	1493	1717	1709	
	U		583	585	524	521	
	V		229	293	289	283	
	Total		4307	4577	4672	4650	
	Classification index		898	1026	929	931	
	End of block		2622	3084	1858	1860	
	Motion vectors		800	832	2193	2194	
	Coefficients		7472	6717	5858	5890	
	Y		3664	3769	2901	2902	
	U		1193	1514	1493	1478	
	V		1239	1200	10253	10271	
	Total		20058	20493	18978	18977	

DATE : 1 - 6 - 1987

STATISTICS RM4

SEQUENCE : CHECKED JACKET ADAPTIVE QUANTISATION

COMPARISON : - S=3 ; fact=1.5 + g0=6

ITEM	15th pict	Mean seq	15th pict	Mean seq	15th pict	Mean seq
1. RMS for luminance	3.063	3.065	3.317	3.270	3.284	3.255
2. SNR	38.408	38.402	37.716	37.839	37.802	37.880
3. Mean value of step size	11.556	11.349	9.500	8.960	9.278	8.861
4. Mean value of the no. of non-zero coefficients	3.949	3.337	2.554	2.524	2.641	2.600
5. Mean value of the no. of zeroes before the last NZ-coef.	9.268	8.939	4.750	5.312	4.911	5.637
6. Block type of Y	FIXED INTRA FILTERED FIXED NON-FILT FIXED MC FILTERED FIXED MC NON-FILT INTER FILTERED INTER NON-FILT INTER MC FILTERED INTER MC Filtered	1017 7 31 32 18 275 81 71 52 182	977 3 37 17 12 362 60 65 47 157	858 3 35 15 9 478 68 66 48 161	852 5 28 20 13 463 79 77 47 167	883 2 33 14 9 459 65 66 48 156
7. Block type of UV	FIXED INTRA FILTERED FIXED NON-FILT INTER FILTERED INTER Filtered	622 0 26 116 28 54	590 0 18 158 23 42	512 0 17 237 24 41	530 0 26 203 33 59	520 0 17 229 24 42
8. Number of bits	Rel addr Y U V Total	1680 1512 123 127 3442	1747 1504 123 139 3515	1992 1745 161 177 4076	2022 1803 180 167 4172	2009 1686 158 173 4028
	Classification index	972	1079	1330	1342	1287
	End of block	1890	1444	1853	2721	1795
	Motion vectors	1384	1147	1115	1256	1114
	Coefficients Y U V Total	11920 346 443 12709	11331 418 563 12313	9943 571 691 11207	10177 538 598 11313	10119 551 684 11355
	Total	19425	18420	18882	19462	18294