

CCITT SG XV

Specialists Group on Coding for
Visual Telephony

May 87

Title: Motion vector control of loop filter

Source: FRG

1. Introduction

In the present specification of the Flexible Hardware and Reference Model No. 4, a 2D-filter is used in the coding loop. The filter is adaptive in the sense that it is switched on or off depending on the control strategy. To signal the status (on/off) of the filter to the decoder, extra side information is employed. This costs approx. 2300 bits/frame for typical scene encoded at about 300 kbit/s.

2. Investigation

We have investigated whether it is possible to signal the status of the filter implicitly rather than explicitly. We have taken the motion vector (MV) as a criterion. The following methods have been considered:

- A) Switching criterion and side information as defined in Ref. Model No. 4.
- B) Switching criterion:
 - Luminance block: $MV = 0$: Filter "off"
 - $MV \neq 0$: Filter "on"
 - Colour block: If at least one motion vector out of four luminance blocks covered by one colour block is unequal to zero, the filter for the colour block is "on".
- C) Switching criterion as in B), but no filtering of colour blocks.

3. Results and Conclusions

Detailed simulation results for methods A to C are given in the annex. Simulation was performed on the basis of Ref. Model No. 3. As a result methods B and C perform best. The performance difference between B and C is negligible. Method C is preferable for reasons of implementation.

Annex 1

Source : P K I
 Date : 21. 5. 1987
 COMMENT: SPLIT/TREVOR
 SOURCE FILE : CIFS
 CODE FILE : HS10
 BITRATE : (IN 1000 BIT) 300.00
 FRAME-FREQUENCY 10.00
 SCENE-CUT : 21
 BLOCK SIZE : 8
 Output Frames : 50
 Different Output Frames : 48

Item	A		B		C	
	Mean	15	Mean	15	Mean	15
R.M.S. for luminance	3.6	4.3	3.4	4.1	3.5	4.1
SNR for luminance	37.1	35.6	37.4	35.9	37.4	35.9
Mean value of the step size	10.2	12.8	9.9	12.3	9.9	12.3
Mean value of non-zero coeff.	3.7	3.5	4.0	3.9	3.9	3.8
Mean value of zero coeff.	5.8	5.8	6.1	6.2	6.1	6.1
Block type of Y						
Intra	69	0	69	0	69	0
Fixed (Inter/No MC/no coded)	756	709	745	715	746	688
Inter (Inter/No MC/coded)	160	226	170	214	170	234
Fixed MC (Inter/MC/no coded)	110	224	94	192	93	205
Inter MC (Inter/MC/coded)	391	389	407	427	408	421
filtered	430	576	502	619	501	626
Block type of C						
Intra	30	0	30	0	30	0
Fixed (Inter/No MC/no coded)	558	576	550	556	547	551
Inter (Inter/No MC/coded)	138	180	145	200	148	205
filtered	186	281	320	418	0	0
Number of bits						
Block attributes						
Y	1107	1513	1095	1431	1092	1504
total	1250	1693	1246	1631	1247	1709
Filter	2200	2304	0	0	0	0
Classification indexes	1643	1590	1712	1682	1720	1720
Address	1556	1765	1581	1808	1580	1815
EOB words	2464	2385	2568	2523	2580	2580
Motion Vectors	4177	4904	4181	4952	4174	5008
Coefficients						
Y	16536	13442	18391	15671	18222	15640
total	18157	15191	20146	17748	20140	17830
Total	30187	29832	30180	30344	30182	30662

Annex 2

Source : P K I
 Date : 19. 5.1987
 COMMENT: MISS A
 SOURCE FILE : CIFM
 CODE FILE : HS10
 BITRATE : (IN 1000 BIT) 300.00
 FRAME-FREQUENCY 15.00
 SCENE-CUT : 0
 BLOCK SIZE : 8
 Output Frames : 75
 Different Output Frames : 74

Item	A		B		C	
	Mean	15	Mean	15	Mean	15
R.M.S. for luminance	2.5	2.4	2.5	2.4	2.5	2.4
SNR for luminance	40.2	40.6	40.2	40.6	40.2	40.6
Mean value of the step size	7.8	6.7	7.7	6.6	7.9	6.6
Mean value of non-zero coeff.	2.5	2.5	2.6	2.6	2.7	2.5
Mean value of zero coeff.	5.0	5.8	5.6	6.1	5.9	6.1
Block type of Y						
Intra	21	0	21	0	21	0
Fixed (Inter/No MC/no coded)	1053	1121	1023	1072	1032	1076
Inter (Inter/No MC/coded)	180	312	207	353	196	341
Fixed MC (Inter/MC/no coded)	119	48	105	38	110	33
Inter MC (Inter/MC/coded)	155	67	171	85	169	98
filtered	394	307	277	123	279	131
Block type of C						
Intra	10	0	10	0	10	0
Fixed (Inter/No MC/no coded)	413	391	383	342	382	345
Inter (Inter/No MC/coded)	323	365	353	414	354	411
filtered	374	330	210	112	0	0
Number of bits						
Block attributes	Y					
total	896	835	926	905	915	879
Filter	1228	1200	1288	1319	1279	1290
Classification indexes	2304	2304	0	0	0	0
Address	1414	1488	1564	1704	1539	1700
EOB words	1725	1750	1797	1825	1774	1857
Motion Vectors	2120	2232	2346	2556	2310	2550
Coefficients	2250	920	2274	984	2291	1048
Y	6678	6964	7899	8257	7586	7915
total	9574	10104	11341	12190	11422	12043
Total	20065	19998	20060	20578	20064	20488

Annex 3

Source : P K I
 Date : 16. 5.1987
 COMMENT: SPLIT/TREVOR with full search
 SOURCE FILE : CIFS
 CODE FILE : HS10
 BITRATE : (IN 1000 BIT) 300.00
 FRAME-FREQUENCY 10.00
 SCENE-CUT : 21
 BLOCK SIZE : 8
 Output Frames : 50
 Different Output Frames : 48

Item	A		B		C	
	Mean	15	Mean	15	Mean	15
R.M.S. for luminance	3.4	4.1	3.3	4.0	3.4	4.0
SNR for luminance	37.5	35.8	37.6	36.2	37.6	36.1
Mean value of the step size	9.7	12.3	9.5	11.9	9.5	12.0
Mean value of non-zero coeff.	3.6	3.6	3.9	3.8	3.9	3.8
Mean value of zero coeff.	6.1	6.0	6.3	6.1	6.4	6.4
Block type of Y						
Intra	68	0	68	0	69	0
Fixed (Inter/No MC/no coded)	743	733	735	699	736	706
Inter (Inter/No MC/coded)	161	187	169	221	167	214
Fixed MC (Inter/MC/no coded)	120	234	99	212	100	217
Inter MC (Inter/MC/coded)	394	394	416	416	416	411
filtered	399	510	514	628	515	628
Block type of C						
Intra	30	0	30	0	30	0
Fixed (Inter/No MC/no coded)	548	565	543	547	540	544
Inter (Inter/No MC/coded)	148	191	153	209	155	212
filtered	189	297	322	420	0	0
Number of bits						
Block attributes Y	1142	1470	1113	1494	1113	1490
total	1296	1661	1272	1703	1275	1702
Filter	2201	2304	0	0	0	0
Classification indexes	1670	1544	1741	1692	1743	1674
Address	1573	1747	1606	1823	1599	1825
EOB words	2504	2316	2612	2538	2613	2511
Motion Vectors	4285	5024	4287	5024	4295	5024
Coefficients Y	16124	12805	18023	15230	17856	15070
total	17907	14673	19912	17361	19918	17305
Total	30178	29269	30172	30141	30183	30041