CCITT SG XV
Specialists Group on Coding for
Visual Telephony

Doc.No. 234

May 1987

Source: FRG,F,GEC,UK,SEPA

Title: Hybrid Coding at 64 kbit/s and its compatibility with 384 kbit/s

~~Draft Version~~

1. Introduction

In this paper a hybrid coder for a bitrate of 64 kbit/s is presented, supporting common intermediate format, a max. frame frequency of 10 Hz and a blocksize of 8x8 for the DCT. This blocksize is the same as for the nx384kbit/s-Codec, to ensure compatibility.
The blocksize of 8x8 for the DCT is achievable by reducing the side information. The complete hybrid coder is described in the next section.

2. Description of the hybrid coder

The presented hybrid coder for 64 kbit/s is based on document # 141 (reference model 2). Modifications which need standardisation are :

- Macro attributes

  Block attributes are extended to groups of 4 8x8 blocks which are called macro blocks.
  A Y-macro block is a group of 4 Y blocks forming a 16x16 block. A C-macro block is a group of 2 U-blocks and 2 V-blocks of a C-row. The block attributes for macro blocks and their code words can be the same as for 8x8 blocks given in # 141.
  Using macro blocks reduces the side information for block attributes efficiently.

- Motion estimation

  As for DCT-blocksize 16x16 a single motion vector is generated for a group of 4 Y-blocks forming a 16x16 block. This reduces the side information for motion vectors efficiently.

- DPCM for DC-coefficients

  Parts of the DC-coefficients of an intraframe coded macro block are transmitted in form of their differences to preceeding DC-coefficients. These differences can be quantized and binary coded like AC-coefficients.
  This method reduces the number of bits in intraframe mode and avoids a buffer overflow after a scene cut.

A p p e n d i x

Source : P K I
Date : 1. 5.1987
Comment:
Source file : CIFM
Code file : VM05
Bitrate : (in 1000 bit) 64.00
Frame-frequency 10.00
Scene cut : 0
Block size : 8
Output frames : 50
Different output frames : 49

Item		Mean	1	2	3	4	5	15
R.M.S. for luminance		3.2	4.0	4.0	3.7	3.4	3.2	3.0
SNR for luminance		37.9	36.1	36.1	36.8	37.5	38.0	38.5
Mean value of the step size		15.4	20.8	30.2	21.6	16.1	14.1	12.2
Mean value of non-zero coeff.		2.0	1.2	1.7	1.8	1.9	2.0	2.1
Mean value of zero coeff.		3.0	0.9	2.0	2.4	3.1	2.8	2.9
Block type of Y								
Intra		0	1584	0	0	0	0	0
Fixed (Inter/No MC/no coded)		1127	0	991	1325	1279	1202	1180
Inter (Inter/No MC/coded)		62	0	13	127	117	114	68
Fixed MC (Inter/MC/no coded)		280	0	515	99	108	141	190
Inter MC (Inter/MC/coded)		114	0	65	33	80	127	146
filtered		395	0	580	132	188	268	336
Block type of C								
Intra		0	792	0	0	0	0	0
Fixed (Inter/No MC/no coded)		656	0	740	710	702	689	662
Inter (Inter/No MC/coded)		136	0	52	82	90	103	130
filtered		0	0	0	0	0	0	0
Number of bits								
Block attributes	Y	1061	1188	953	957	1041	1177	1054
	total	1649	1782	1331	1440	1564	1715	1632
Classification indexes		0	0	0	0	0	0	0
EOB words		938	3996	390	726	861	1032	1032
Motion Vectors		789	0	1160	264	376	536	672
Coefficients	Y	1989	11104	582	1325	2109	2395	2425
	total	2877	16181	931	1801	2602	2938	3241
Total		6252	21959	3812	4231	5403	6221	6577

3. Simulation results

Simulations yield a mean signal to noise ratio of 37.9 dB for the Miss America sequence (appendix). The input source format is CIF and the frame frequency is 10 Hz.
The quantizer stepsize is evaluated after each Y-row and C-row. The transmission buffer size is 8 kbit. The eob-trick is used for the VLC. A 2-dimensional 1-2-1 filter is used after the frame memory if the motion vector is unequal to zero.
The attributes CODED and NOT CODED are available for 8x8 blocks as well as for macro blocks.
For an intraframe coded Y-macro block, 2 U-blocks and 2 V-blocks respectively the first DC-coefficient is transmitted directly while the other DC-coefficients are transmitted in DPCM-mode.

4. Conclusion

Our simulations at 64 kbit/s show reasonable results for block-size 8x8 for the DCT. Concerning compatibility to nx384 kbit/s this blocksize together with CIF seems to be considerable, as the complete coding loops of the source encoder and decoder are identical with the nx384 kbit/s codec. If modifications of paragraph 2 are incorporated, a codec results with an improved picture quality at nx384 kbit/s, allowing compatibility to a 64 kbit/s codec with the same coding technique and the same hardware.
Disregarding parts of the compatibility, simulations have also been done with the reduced format (Y: 256x192, R-Y,B-Y: 128x96). These simulations indicate the advantages of the presented coding method too.

This work was carried out by the moving picture group within the European Strategic Program of Research in Information Technology ESPRIT 925.