CCITT SGXV
Specialists Group on Coding for
Visual Telephony

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Title: A Hybrid Coder for n x 384 kbit/s with 64 kbit/s capability

Source: FRG

1. Introduction

In this paper a hybrid coder for n x 384 kbit/s is described which allows for a bitrate of 64 kbit/s. The coder supports common intermediate format, a minimum frame frequency of 10 Hz and a blocksize of 8 x 8 for the DCT. This blocksize requires reduction of side information for 64 kbit/s which is achievable by using macro blocks (document # 234). According to document # 234 only one motion vector is used for a Y-macroblock consisting of four 8 x 8 Y-blocks, while block attributes are available for macro blocks and 8 x 8 blocks. It has been shown that the coder performs well for 64 kbit/s as well as for n x 384 kbit/s (document # 266).
In this document, a refined scheme is described, allowing for motion vectors on an 8 x 8 and on a macro block basis.

2. Description of the coder

2.1 Definition of block data

To achieve a bitrate of 64 kbit/s with the hybrid coder for n x 384 kbit/s, macro blocks are used for coding of block attributes and motion vectors. A macro block consists of four 8 x 8 luminance blocks or four 8 x 8 crominance blocks. A complete definition of a macro block is given in the table below.

attribute for blocktype	additional data
FIXED 2)	---
INTRA	transform coefficients of 4 blocks
MCOFF	transform coefficients of 4 blocks
MC 1)	1 motion vector, transform coefficients of 4 blocks
FIXED-MC 1),2)	1 motion vector
NON	data of 4 blocks as defined in Tab. 2

Table 1 Data structure of a macro block

The first five attributes are the same as given in document # 141. They have been already used in the 64 kbit/s coder described in document # 234 and allow for an effective reduction of side information. A new attribute NON is introduced. If this attribute is used, block attributes and motion vectors are defined on an 8 x 8 block basis as given in Table 2. Therefore the attribute NON provides an escape to the 8 x 8 block basis, which is in particular useful for n x 384 kbit/s.

attribute for blocktype	additional data
FIXED 3)	---
INTRA	transform coefficients of 1 block
MCOFF	transform coefficients of 1 block
MC 1)	1 motion vector, transform coefficients of 1 block
FIXED-MC 1),3)	1 motion vector

Table 2 Data structure of a block

1) for Y only
2) not required if relative block addressing is used for macro blocks
3) not required if coefficient blocks containing an EOB without coefficients are allowed

2.2 Signalling of the quantizer

Signalling of the quantizer stepsize on an 8 x 8 block basis or on a macro block basis would result in too much side information at 64 kbit/s. On the other hand it would be advantageous to have a faster coding control than on a group of block basis. Relating the quantizer stepsize to so-called subpictures consisting of four Y-macro blocks and two C-macro blocks would solve the problem.

2.3 Filter in the loop

It has been shown earlier that a low-pass filter in the coding loop improves coding performance. Signalling of the status of the filter by block attributes on an 8 x 8 block basis or on a macro block basis results in too much side information at 64 kbit/s. Therefore a low-pass filter controlled by the motion vector is the preferable solution. If the motion vector is zero (no motion compensation) no filter is applied in the loop.

2.4 Group of block structure

Using 18 group of blocks within a picture results in too much side information for 64 kbit/s. Dividing a picture into 9 group of blocks would reduce the side information for the group of block sufficiently.

3. Conclusion

In the paper a refined version of a n x 384 kbit/s codec is described to allow for bitrates down to 64 kbit/s. The scheme meets the compatibility requirements of a future m x 64 and a n x 384 kbit/s visual telephone and videoconferencing service.