C.C.I.T.T.
STUDY GROUP XV WP XV/1
Specialist Group on Picture Coding
Ipswich 20-24 January 1986

DOC. # 63

English Version

Source: AT&T Bell Laboratories

Title: Coding Full Motion Color Video at 300-400 Kilobits/Second
Some Computer Simulation Results

This contribution consists of a videotape demonstration of full motion television image quality achievable after digital coding and compression down to the range of 300-400 kilobits/second, followed by decompression and conversion back to analog NTSC color TV. These results were obtained by computer simulation using the "Miss America" test image provided by the USA.

The first step for the simulation was to convert the test image into the "Common Intermediate Format (CIF)" agreed upon at the Torino, Italy meeting of the CCITT Specialists Group on Coding for Video Telephony. This format is basically, 288 line, 360 pel, 30 fields/sec noninterlaced. The CIF color difference signals are not yet specified. Thus, we made a reasonable choice of 4:1 horizontal and vertical subsampling of both the B-Y and R-Y color signals.

Next we reduced the field rate to 15 Hz incorporating some simple temporal low pass filtering, and each field was divided into 8x8 pel blocks. Alternate fields were then processed using block quantization of frame differences between the alternate fields. In future implementations, we may use motion compensated frame differences obtained by minimizing the average magnitude of the motion compensated differential signal[1].

The intermediate fields not processed above were then coded using conditional field subsampling[2]. With this technique a prediction of the intermediate field is made based on the two adjacent fields. If for a given block of pels, the prediction error is larger than some predetermined threshold, then the block is transmitted. Otherwise, it is not. In the future we may use motion compensated interpolation[3] for these intermediate fields.

In addition to these operations, a variable spatial/temporal resolution capability may be provided. When motion becomes excessive causing too high a bit rate for the channel, the intermediate fields are dropped from transmission, fewer block coder parameters are sent and they are quantized with fewer bits.

[1] "Predictive Video Encoding Using Measured Subject Velocity", B.G. Haskell and J.O. Limb, U.S. Patent 3,632,865, Jan. 4, 1972

[2] "Conditional Vertical Subsampling in a Video Redundancy Reduction System", R.F.W. Pease, U.S. Patent 3,736,373, May 29, 1973

[3] "Video Signal Interpolation Using Motion Estimation", A.N. Netravali and J.D. Robbins, U.S. Patent 4,383,272, May 10, 1983