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CCITT SGXV
Working Party XV/1
Specialists Group on Coding for Visual Telephony

SOURCE: NTT, KDD, NEC AND FUJITSU

TITLE : EVALUATION METHOD FOR CODING ALGORITHMS

1. Introduction

Early selection of an efficient coding algorithm will be a key factor for the subrate codec standardization within the current CCITT period (1985-1988). For the first step, an evaluation method has to be agreed upon as soon as possible. Different coding algorithms should be evaluated and compared on the same basis using the same method. This contribution proposes an evaluation method for coding algorithms.

2. Algorithm selection principles

a. Computer simulations will be used for algorithm selection.

b. Evaluation for the candidate algorithms will be made in terms of entropy, S/N and picture quality.

c. The same scenes will be used.

d. Experiments using hardware will be made for final performance verification for the selected algorithm.

e. In case two or more candidates are selected through the computer simulation, a possibility of hardware experiments will be considered to finalize the algorithm.

3. Simulation method

(3.1) Picture materials

Several scenes are selected from the materials that have been agreed upon. The scenes can be, for example, "Split screen" and "Trevor" (Europe), "Three people" and "Standing up" (Japan), and two scenes (USA) (to be specified).

(3.2) Initial conditions

Frame No.0 is mid-gray (127). Where applicable, a buffer is assumed to be empty for Frame No.0. Simulation is started from Frame No.1. After simulation, the first six frames (Frames No.1 ~6) are discarded to avoid initial transient.

(3.3) Frame number

At least 25 frames are used for open loop performance comparison. Entropy and S/N data are compared at Frame No.25.

(3.4) Entropy

Entropy is obtained for the entropy coder output data after source coder. Entropy is calculated as

$$-\Sigma p \log_2 p \quad (p : \text{probability}) .$$

If there are more than two different kinds of data, total entropy is the weighted sum of the entropy values, the weighting factor being probability for each kind of data. Entropy is expressed by information bit rate in kbit/s.

(3.5) S/N

S and N values are defined as 255 x 0.7 and the difference between coder input signal and decoder output signal, respectively. If a pre-processor and/or a post-processor is employed, N is the difference between the pre-processor input signal and the post-processor output signal.

(3.6) Coding mode control

According to the agreement at the Holmdel meeting, the computer simulation is first carried out without coding mode control which keeps the output bit rate at a fixed value. Computer simulation result with coding mode control will be discussed at the next specialist meeting. The output bit rate is 300 kb/s, taking into account speech signal and overhead transmission.

(3.7) Processing for European scenes in the NTSC region

The first 256 lines for each field are used for the computer simulation. Since the recorded pel number is 624/line, 48 pels are added before and after the 624 pels for each line. The levels for these pels are assumed as Y = 63 , B - Y = 127, R - Y = 127. The resulting 720 pels are filtered and 2:1 subsampled to 360 pels, which are then encoded and decoded. The decoded pels are interpolated to 720 pels/line, from which 48 pels at each end are omitted.

(3.8) Reference simulation

To ensure that all the research organizations are carrying out computer simulations on the same basis, a reference

simulation is made for simple interframe encoding without quantization (See Fig.1). Entropy and S/N are calculated only for Y signal.

(3.9) Pre- and Post-processors

Considering that pre- and post-processors have significant impact on coding performance, they are treated as a part of the coding algorithm.

4. Conclusion

An evaluation method has been proposed for coding algorithms. Agreement on the evaluation method has to be reached as soon as possible to avoid unnecessary confusion in comparing different algorithms.

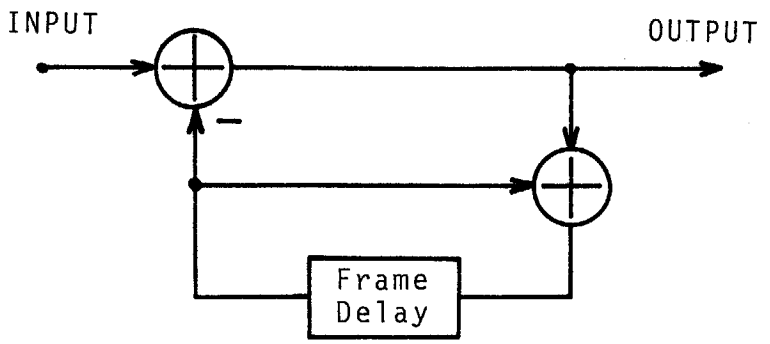

Fig.1 Reference Simulation