CCITT SGXV
Working Party XV/1
Specialists Group on Coding for Visual Telephony
Source: NTT, KDD, NEC and FUJITSU

Document #149
November 1986

Title: ADAPTIVE QUANTIZATION(For information)

1.Introduction

When coarse quantizers are applied to transform coefficients, picture quality degradation is sometimes visible as blocky picture. In order to avoid or reduce this degradation, it is important to use appropriate quantizer characteristics to coefficients. In this contribution, discussed is a quantization method using plural characteristics for transform coefficients in a block.

2.Plural Quantization Characteristics

Figure 1 shows transform coefficients in a block, low frequency components at the upper left part and high frequency components at the lower right part. A variable S represents the width of the low frequency components. Transform coefficients in the low frequency part are quantized with relatively fine characteristics, while transform coefficients in the high frequency part outside S are quantized with relatively coarse characteristics. If S is zero, coefficients are quantized with a single characteristic. If S is equal to one, only DC coefficient is quantized with a fine characteristic and the other with coarse characteristics.

It is agreed that up to 32 quantizers are used in Flexible Hardware to be built. The quantization method here makes use of up to 32 combinations of quantizers.

The parameter S can be used to control quantity of information to be generated. If S is chosen to be large, spatial resolution in reproduced sequences become high at the cost of information quantity increase. This control method will produce more gradual picture quality change than a method which changes nothing but quantizing step size.

3.Experiment

With this method, an experimental result is shown in VTR for a frame out of "Miss America" sequence.

In Fig.2 information quantity is shown for various combination of S and quantizers using RM2. "Split Screen" sequence was used. Vertical axis represents information quantity/coded-frame, horizontal axis S values. It is readily seen from Fig.2 that more than one combination of S and quantizers will result in the same information quantity. However, reproduced picture quality will not be the same.

VTR demonstration shows two reproduced sequences corresponding to A and B in Fig.2. Generated information quantities for the two sequences are almost the same. Comparing reproduced sequences A and B, it seems that distortion becomes a little bit less visible when larger S is used. From these reproduced sequences, it is seen that suitable S will be one or more. However, it is not clear which S is optimum at the moment. It is left for further study.

4.Conclusion

It is expected that better picture quality can be reproduced by using plural quantizing characteristics in a block. It is suggested that DC and low frequency coefficients be quantized with fine characteristics, while high frequency coefficients be quantized with relatively coarse quantizers. This suggestion implies that a combination of quantizers assigned to each sequency requires change in quantizer structure in Flexible Hardware.

The effectiveness of plural quantizers for coefficients in a block will be better shown when they are used for variety of pictures in real-time in Flexible Hardware.

Fig.1 Transform Coefficients

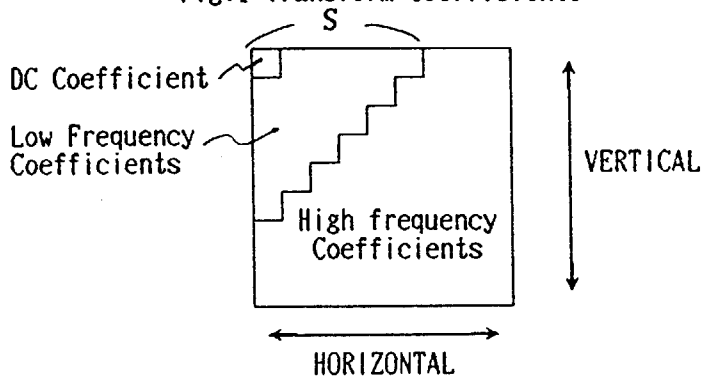

Fig.2 Quantity Information
"Split Screen" coded frame #9(Original Start from #1)