Document #110

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

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SOURCE : NTT, KDD, NEC and FUJITSU

TITLE : FILTER INSIDE THE CODING LOOP

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1. Introduction

Based on the reference model, this document clarifies the effect of the shaping filter which was shown at the local decoder loop in the document # 78. We propose that the adaptively controlled shaping filter should be incorporated in the prototype hardware implementation because of the experimental results showing the high coding efficiencies.

2. Experiment

Two shaping filters and three control methods described below are examined using the new reference model.

Shaping filter

SHF 1 : median filter (fig. 1)

SHF 2 : 2-dimensional low pass filter (coefficients are shown in fig. 1)

Control method

Adaptive control

Motion vector control(MC) : When the motion vector is not zero the shaping filter is operated, otherwise is not operated.

Differential magnitude control(DC) : When the absolute difference between the filter input and the output is greater than 6, the shaping filter is not operated, otherwise is operated.

Non-adaptive control

Steady control(SD) : The filter is operated at all area.

The combinations of the filter and the control method shown in the table 1 are experimented and the results for four scenes are shown there.

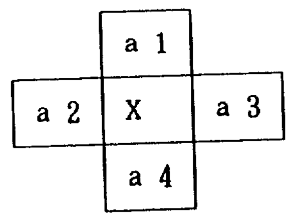
As is clearly shown in the table 1, the adaptively controlled shaping filters can give better S/N ratio compared to that of the reference model. The improvement is about 1 dB for SP and TR and about 0.5 dB for MA and CJ. Non-adaptive one can not attain such high coding efficiency. Another simulation combining SHF 1 and DC also showed same results.

One of these good performances will be shown by VTR at the meeting.

3. Conclusion

Based on the reference model we clarified the effect of the adaptively controlled shaping filter in the local decoder loop. The improvement of S/N ratio and picture quality concludes that the shaping filter should be incorporated in the prototype hardware implementation.

What shaping filter is favourable and how to control it is for further study at this moment.



$$\overline{X} = MED(X, a1, a2, a3, a4)$$

(a) Median Filter

$$\overline{X}' = \left(6 \times X + \sum_{i=1}^{4} ai\right) / 10$$

(b) 2-dimensional LPF

Fig. 1 Shaping Filter

Table 1 Simulation Results

	Filter / Control	no (Ref)	SHF 1 (MED) MC	SHF 1 (MED) SD	SHF 2 (LPF) MC	SHF 2 (LPF) SD
S/N (dB)	MA	39.36	39.77	39.36	39.85	39.59
(bit/frm)	(59th)	19668	19809	19314	20158	20214
S/N (dB)	CJ	37.88	38.27	37.72	38.27	37.44
(bit/frm)	(39th)	19960	19798	20022	19662	20095
S/N (dB)	SP	33.97	34.84	34.98	34.91	34.68
(bit/frm)	(31th)	30307	29123	30139	29856	29670
S/N (dB)	TR	38.13	39.17	39.18	39.25	39.12
(bit/frm)	(100th)	29002	28867	29186	29316	29319

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Filter inside the Coding Loop

--- VTR Demonstration of Simulation Results ---

Simulation results obtained by the coding process described in Section 2 will be demonstrated on VTR at the meeting.

Contents of VTR is as follows :

- Split sequence
  - (1) LPF + MC (Table 1)
  - (2) LPF + SD (Table 1)

The decoded images are displayed under the condition of 2:1 frame droping rate.