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Title : Comparision of CTV/HDTV compatible coding schemes
Purpose : Information

Introduction

The attempt of this contribution is to provide some information associated with the two compatibility approaches (pyramidal DCT coding[1] and spatio-temporal weighted compatible coding[2]) and the up/down conversion methods for compatible coding. In this document we compare the two compatibility approaches for compatible coding of CTV and HDTV and the up/down conversion schemes of CMTT and MPEG. The higher layer is HDTV resolution (Y:1920 x 1024, U/V: 960 x 1024) while the lower layer is CTV (Y: 960 x 512, U/V : 480 x 512).

Simulation Conditions

Compatible coding can be achieved through use of layered coding schemes. Figure 1 shows an encoder for pyramidal DCT coding [1]. The encoder for spatio-temporal compatible coding [2] is shown in figure 2. The up/down conversion filters such as those described in [2] and [3] are used and compared in this experiment.
The following settings were used.

- Picture format : 4 : 2 : 2
- Picture rate : 30Hz
- GOP & Prediction : N = 15, M = 1, Fr/Fi adaptive
- Motion vector search range : +/- 15/frame
- Rate Control : based on TM5

Compatible Coding Schemes

1) Pyramidal DCT Coding[1]

The CTV pictures were coded at 12 Mbits/s using Test Model 5 with adaptive field/frame prediction. The resulting coded pictures were up-

sampled back to HDTV resolution and used as a compatible prediction. The residual signal of HDTV sequences is encoded at 13.5 Mbits/s using TM 5 with adaptive field/frame prediction (total bit rate, 25.5Mbits/s for HDTV)

2) **Spatio - temporal coding[2]**

The CTV codec processes CTV picture at 12Mbits/s. The HDTV codec can utilize a compatible prediction from the locally decoded pictures of the CTV codec after proper up-conversion. The compatible prediction uses the spatio-temporal weighting technique. The higher layer is encoded at 13.5 Mbits/s.

Some simulation results of the compatible coding schemes using the CMTT up/down conversion techniques are shown in table 1.

Up/down Conversion

It is well known that the coding efficiency of the compatible coding schemes is greatly affected by the performance of the up/down conversion filters. In this document we compare the two up/down conversion approaches such as those described in [2] and [3] for scalable coding. Some simulation results of the up/down conversion schemes combined with the spatio-temporal compatible coding scheme are shown in table 2.

Conclusions

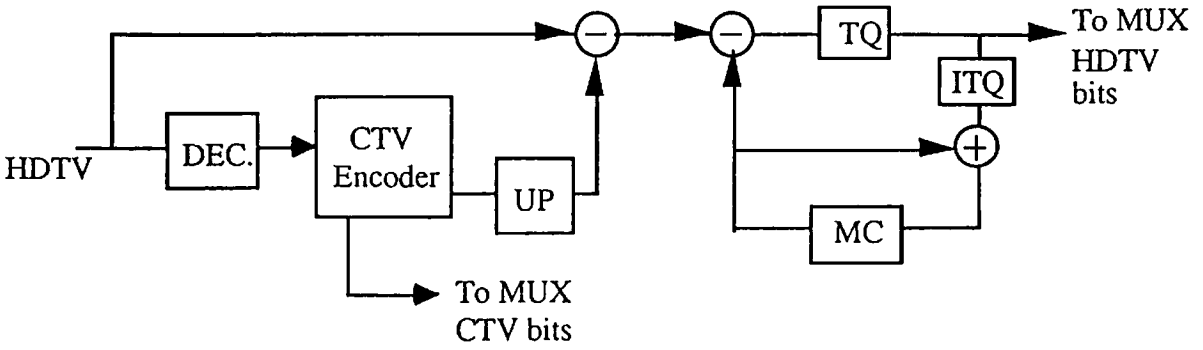
Some simulation results of compatible coding schemes and up/down conversion filters are presented for the purpose of information. It can be seen that the performance of spatio- temporal compatible coding method is a little superior to that of pyramidal DCT coding scheme. And the MPEG up/down conversion filters give better performance than the CMTT filters.

References

[1] CMTT/2-SRG-047,"Secondary distribution of TV and HDTV pyramidal DCT proposal".

[2] ISO/IEC JTC1/SC29/WG11 MPEG 93/400,"Test Model 5".

[3] CMTT/TG2-SRG1,"Production of an original decimated TV picture".



TQ : Transformation and Quantization
ITQ : Inverse transformation and inverse quantization

Figure 1. Pyramidal DCT coding scheme

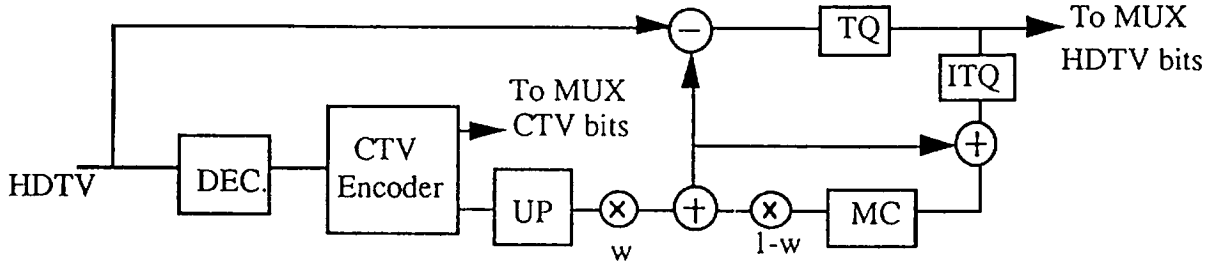


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Figure 2. Spatio-temporal weighted coding scheme

sequence		Pyramidal DCT				Spatial Compatible Coding			
		SNR(total)	SNR(Y)	SNR(Cb)	SNR(Cr)	SNR(total)	SNR(Y)	SNR(Cb)	SNR(Cr)
fashion show	CTV	38.22	36.66	40.30	41.13	38.22	36.66	40.30	41.13
	HDTV	36.86	35.01	39.51	40.88	37.42	35.39	39.92	41.45
fruits	CTV	39.29	38.32	40.25	40.90	39.29	38.32	40.25	40.90
	HDTV	37.07	35.63	38.78	39.76	38.18	36.84	39.56	40.82
swimming	CTV	34.73	33.42	36.37	36.91	34.73	33.42	36.37	36.91
	HDTV	32.84	31.58	34.10	35.21	33.00	31.74	34.28	35.38

Table 1. Simulation results of the compatible coding schemes
(Using the CMTT up/down conversion techniques)

sequence		TG CMTT/2-SRG Method				MPEG-2 Method			
		SNR(total)	SNR(Y)	SNR(Cb)	SNR(Cr)	SNR(total)	SNR(Y)	SNR(Cb)	SNR(Cr)
fashion show	CTV	38.22	36.66	40.30	41.13	39.36	37.76	41.48	42.39
	HDTV	37.42	35.39	39.92	41.45	37.66	35.84	40.14	41.70
fruits	CTV	39.29	38.32	40.25	40.90	40.23	39.14	41.36	42.06
	HDTV	38.18	36.84	39.56	40.82	38.38	37.03	39.72	41.09
swimming	CTV	34.73	33.42	36.37	36.91	35.77	34.44	37.39	37.91
	HDTV	33.00	31.74	34.28	35.38	33.03	31.78	34.30	35.35

Table 2. Simulation results of the up/down conversion schemes
(Combined with the spatio-temporal compatible coding scheme)