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CODING OF MOVING PICTURES AND ASSOCIATED AUDIO INFORMATION

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1. Introduction

Simulations have been performed in order to assess the effectiveness of the compatible/spatial scalable layered coding scheme proposed in the TM. The efficiency of the spatio-temporal weighting feature has also been investigated.

These simulations are based on TM4.2 and in the context on conversational applications (M=1 , H.261 algorithm as compatible scheme).

A supporting D1-tape demonstration will be presented at the meeting.

2. Simulation conditions

Coding strategy :

Base layer :	H.261 - RM8
Upper layer :	H.26x - TM4.2
	Frame structure
	Adaptive Frame/Field prediction and DCT
	M=1 ; No intra pictures

Bit rates :

Base layer :	1.15 Mbit/s ;	384 kbit/s
Upper layer :	2.85 Mbit/s ;	1.616 Mbit/s
Total :	4.0 Mbit/s ;	2.0 Mbit/s

Picture rates :

Base layer :	25 Hz
Upper layer :	25 Hz

Prediction weights :

1/ Spatial only :

(1,0) Compatible Field 1
(0,1) Compatible Field 2
(1,1) Both Compatible Fields

2/ Switchable spatio-temporal weighting (weights set inTM5 App.G):

(1,0) Compatible Field 1

(0,1) Compatible Field 2
(1,1) Both Compatible Fields
(0.5 , 0.5) spatio-temporal

3/ Continuous spatio-temporal weighting (weights set in TM5 Ch. 9):
(1,0) Compatible Field 1
(0.75 , 0.25) spatio-temporal
(0.75 , 0.5) spatio-temporal
(0.5 , 0.5) spatio-temporal

Sequences : Susie - Flower Garden ; 625/50 standards

3. Experiment 1 : continuous spatio-temporal scheme vs switchable spatio-temporal scheme

The spatio-temporal weighting method performs a weighted combination of the temporal prediction from upper layer and the up-converted spatial prediction from base layer.

Two sets of weighting factors are proposed in TM5 : one with only one spatio-temporal prediction (refered to as switchable scheme) and one with three possible spatio-temporal predictions (refered to as continuous scheme). These two schemes are hereafter compared.

3.a. Simulation results :

	Flower 4.0 Mbps	Susie 4.0 Mbps	Susie 2.0 Mbps
switchable	26.81 dB	40.85 dB	38.03 dB
continuous	+ 0.09	- 0.08	+ 0.21

Table 1 : SNR for luminance (dB)

	Flower 4.0 Mbps	Susie 4.0 Mbps	Susie 2.0 Mbps
switchable	41.7 %	78.2 %	65.8 %
continuous	41.0%	71.0 %	62.7 %

Table 2 : % of Compatible Macroblocks

	Flower 4.0 Mbps	Susie 4.0 Mbps	Susie 2.0 Mbps
(1,0)	27.9 %	18.9 %	13.2 %
(0,1)	3.0 %	2.3 %	3.3 %
(1,1)	10.3 %	11.3 %	10.6 %
(0.5,0.5)	58.8 %	67.5 %	72.9 %

Table 3 : Distribution of weights - switchable mode

	Flower 4.0 Mbps	Susie 4.0 Mbps	Susie 2.0 Mbps
(1,0)	35.7 %	9.6 %	8.2 %
(0.75,0.25)	9.1 %	4.6 %	4.9 %
(0.75,0.5)	10.8 %	9.5 %	10.5 %
(0.5,0.5)	44.4 %	76.3 %	76.4 %

Table 4 : Distribution of weights - continuous mode

3.b. Analysis of simulation results :

The results above show that the continuous spatio-temporal weighting gives variations in SNR (from -0.08 to 0.21 dB) over the switchable spatio-temporal weighting.

Table 2 shows that the compatible prediction is chosen in a high proportion of cases in both schemes (41.0 % to 78.2 %).

The results in terms of picture quality are very similar.

3.c. Conclusion :

Since the continuous spatio-temporal weighting technique is considered costly in implementation , we do not think it should be incorporated in the syntax for H.261/H.26x scalability/compatibility.

4. Experiment 2 : Spatial compatible scheme vs switchable spatio-temporal scheme

This experiment aims to assess the efficiency of the spatio-temporal weighting method compared to spatial only prediction.

4.a. Simulation results :

	Flower 4.0 Mbps	Susie 4.0 Mbps	Susie 2.0 Mbps
Spatial	26.74 dB	40.68 dB	37.96 dB
Spatio-temporal	+ 0.07	+ 0.17	+ 0.07

Table 5 : SNR for luminance (dB)

	Flower 4.0 Mbps	Susie 4.0 Mbps	Susie 2.0 Mbps
Spatial	35.5 %	73.7 %	57.9 %
Spatio-temporal	41.7 %	78.2 %	65.8 %

Table 6 : % of Compatible Macroblocks

	Flower 4.0 Mbps	Susie 4.0 Mbps	Susie 2.0 Mbps
(1,0)	44.3 %	32.7 %	26.3 %
(0,1)	8.4 %	16.6 %	18.1 %
(1,1)	47.3 %	50.7 %	55.6 %

Table 7 : Distribution of weights - spatial prediction mode

	Flower 4.0 Mbps	Susie 4.0 Mbps	Susie 2.0 Mbps
(1,0)	27.9 %	18.9 %	13.2 %
(0,1)	3.0 %	2.3 %	3.3 %
(1,1)	10.3 %	11.3 %	10.6 %
(0.5,0.5)	58.8 %	67.5 %	72.9 %

Table 8 : Distribution of weights - spatio-temporal mode

4.b. Analysis of simulation results :

The results above show that the spatio-temporal weighting gives an improvement in SNR (0.07 to 0.17 dB) over the spatial compatible prediction.

Table 6 shows that the compatible prediction is chosen in a high proportion of cases in both schemes (35.5 % to 78.2 %).

The distribution of weights in spatio-temporal case shows that the spatio-temporal prediction is chosen in the majority of cases (58.8 % to 72.9 %).

However , the picture quality is not significantly better.

4.c. Conclusion :

Considering these results , the spatio-temporal weighting technique does not seem really needed for H.261/H.26x scalability/compatibility.

5. Experiment 3 : switchable spatio-temporal scheme vs simulcast

Four solutions seem possible to achieve H.261/H.26x compatibility : switchable mode , simulcast , embedded streams and transcoding .

In this experiment , we have compared the spatio-temporal compatible scheme and the simulcast scheme.

5.a. Simulation results :

	Flower 4.0 Mbps	Susie 4.0 Mbps	Susie 2.0 Mbps
Simulcast	26.52 dB	40.42 dB	37.82 dB
Spatio-temporal	+ 0.29	+ 0.43	+ 0.21

Table 9 : SNR for luminance (dB)

	Flower 4.0 Mbps	Susie 4.0 Mbps	Susie 2.0 Mbps
Spatio-temporal	41.7 %	78.2 %	65.8 %

Table 10 : % of Compatible Macroblocks

5.b. Analysis of simulation results :

The results above show that the spatio-temporal weighting gives an improvement in SNR (0.21 to 0.43 dB) over simulcast.

Table 10 shows that the compatible prediction is chosen in a high proportion of cases (41.7 % to 78.2 %).

5.c. Conclusion :

Simulation results show that the 2-layer coding scheme gives some improvement in terms of SNR. However , picture quality is very similar to the one obtained in the simulcast case.

In telecom environment , other solutions to achieve H.261/H.26x compatibility such as transcoding in the MCU (Multipoint Control Unit) for multipoint operations and switchable mode for point to point operations seem simpler and well adapted.