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ISO-IEC/JTC1/SC29/WG11
CODING OF MOVING PICTURES AND ASSOCIATED AUDIO

ISO-IEC/JTC1/SC29/WG11
MPEG 92/ 594

Source: FRANCE TELECOM - CNET
Title: Experiment on spatio-temporal weighted H261/MPEG2 compatibility
Purpose: information

Introduction:

Among various possibilities to achieve H261/MPEG2 compatibility, it has been concluded that two layered "prediction of input" coding scheme gives better results.
Experiment suggests that we investigate this way out, by combining MC based temporal prediction from top layer with compatible spatial prediction from lower layer.
The resulting filtered prediction effect should allow to reduce noise and flicker.
Different sets of weights for averaging spatial and temporal predictions have been tested.

Experiment conditions:

Guidelines: number of layers: 2
bit-rate layer 1: 1.15 Mbit/s
bit-rate layer 2: 2.85 Mbit/s

Coding parameters and standards:

M,N: for 25 Hz M=1,N=∝
No Intra pictures (except the first of the sequence)
No Interpolated pictures

MC prediction modes: Frame pictures only
Frame/Field MC

Standard for based layer: CCITT H261

Experiment details:

Upper layer's CCIR 601 frames are MPEG2 coded with frame pictures , using optional compatible prediction from lower layer.
Lower layer's SIF odd fields are H261 coded, then decoded and upsampled in both horizontal and vertical dimensions with the {1/2,1,1/2} taps filters.

Case 1: Spatio-temporal weighted compatible field coding.

Concerning the upper layer's odd fields, MPEG2 prediction is made:
- either from the lower layer compatible corresponding 16*8 submacroblock,
- or from the local reconstructed 16*8 submacroblock using motion compensation.

For the upper layer's even fields, prediction is made from the addition of the two 16*8 submacroblocks mentioned above. The former is ω weighted, the latter $(1-\omega)$ weighted, ω being chosen in a proposed four weight set:
[1, 1/2, 1/4, 0].
The spatio-temporal combination is based on the least MSE, and the selected weight is indicated by a two bit codeword at the macroblock level.
More explanations for this method and the attached new syntax are provided in MPEG2/506 and in experiment 1(a) 1(b) details.

Case 2: Spatio-temporal weighted compatible frame coding.

The same method as for Case1- even fields is applied on both odd and even upper layer's fields. This involves the choice, based on a least MSE criterion, of a pair of spatial weights ($\omega1$,$\omega2$) among the proposed set: $\omega1$ $\omega2$ or another set which might give better results.

1	0
3/4	1/4
3/4	1/2
1/2	1/2

The selected weight is indicated by a two bit codeword at the macroblock level.
More explanations for this method and the attached new syntax are provided in MPEG2/506 and in experiment 1(a) 1(b) details.

Results:

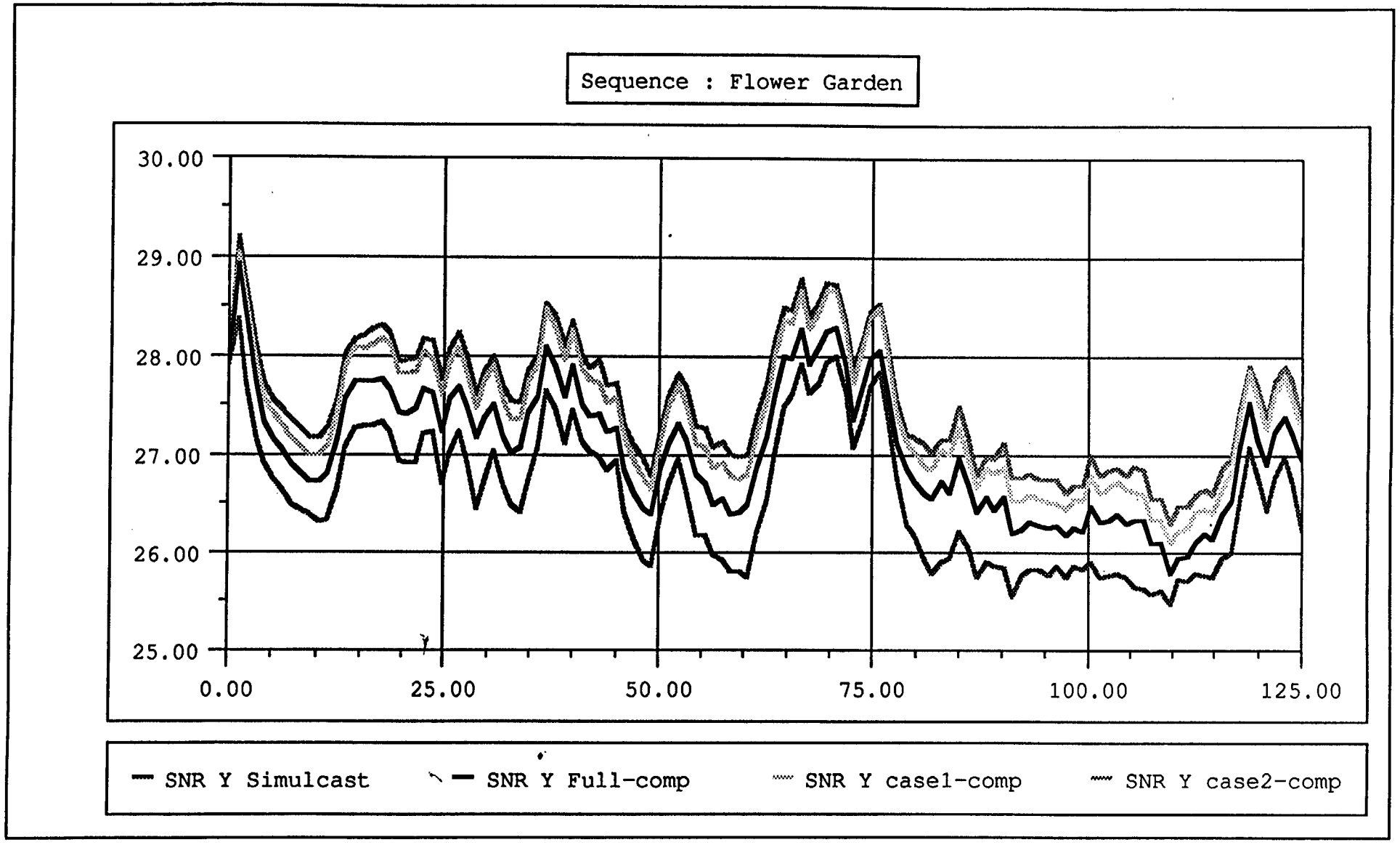
Spatio-temporal weighted compatible prediction has been performed on FLOWER GARDEN and SUSIE for case1 and case2 with the proposed weight sets.

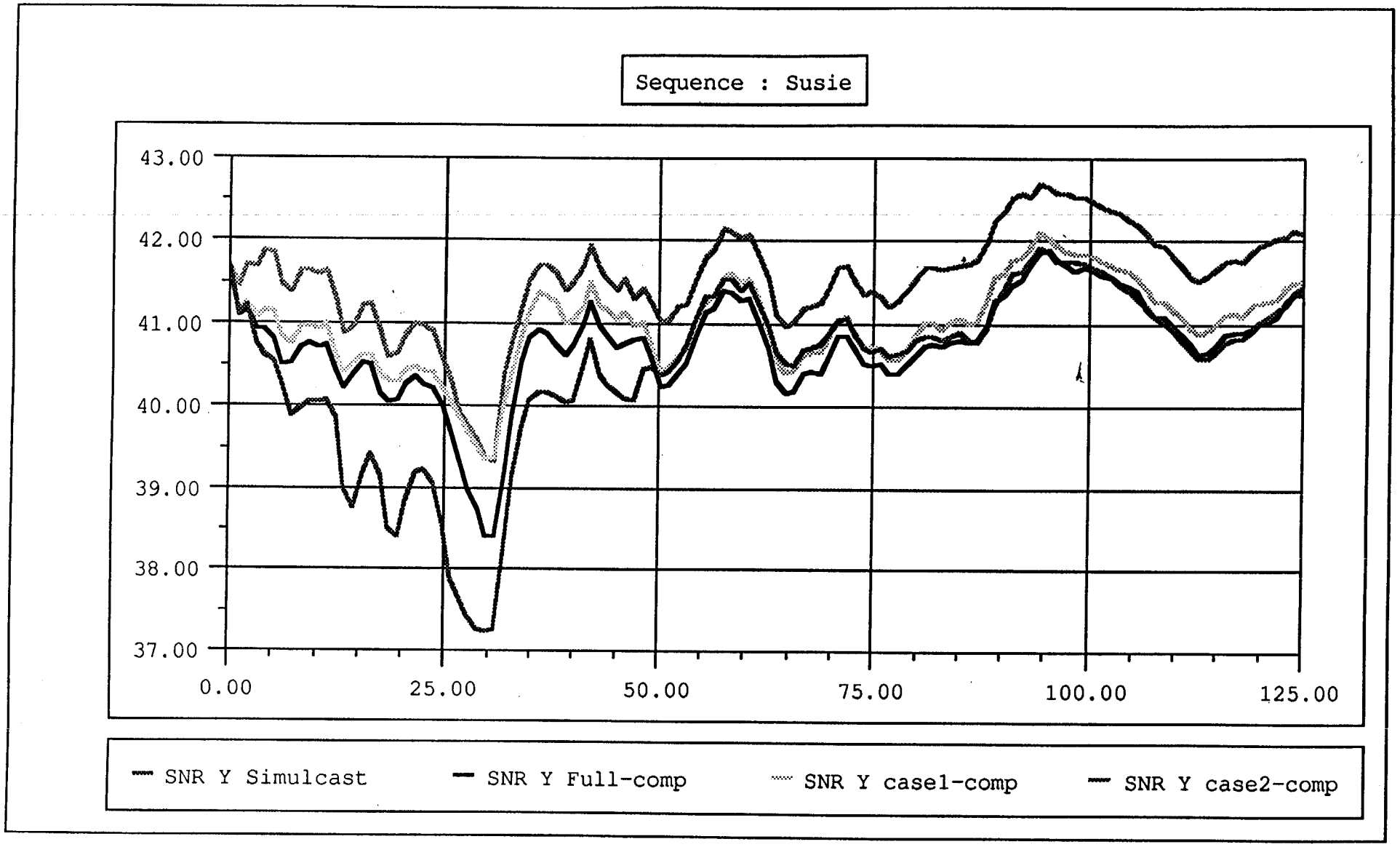
The attached graphs plot the SNR of the luminance signal for the simulcast mode, the full spatial compatible mode and the two weighted compatible modes.
The average luminance gain versus simulcast is respectively:

	simul	full-comp	case1-comp	case2-comp
FLOWER GARDEN :	26.51 dB /	+0.49 dB /	+0.82dB /	+0.97dB
SUSIE :	40.34 dB /	+0.50 dB /	+0.63dB /	+1.16dB

The following tables give the distribution of the compatible MB types and weight flags.
There is a supporting D1 tape presentation comparing simulcast mode and case2 compatible mode for FLOWER GARDEN and SUSIE.
Simulations results show that case2 compatible mode outperforms the other compatible approaches.

Results for Predicted pictures					
124 frames		flower garden		susie	
	case1	case2	case1	case2	
mc_cbp_comp "1"	55	78	398	579	
mc_comp "00010"	95	165	58	92	
nmc_cbp_comp "00011"	8	9	107	143	
mc_cbp_quant_comp "01"	350	434	375	442	
mc_quant_comp "000001"	0	0	0	0	
nmc_cbp_quant_comp "001"	33	34	139	148	
fix_comp "00001"	26	45	17	28	
flags WT0	56	113	102	105	
flags WT1	38	337	71	374	
flags WT2	177	67	504	158	
flags WT3	296	248	418	796	
% compatible MBs	36	48	69	90	


Sequence : Flower Garden
30.00
29.00
28.00
27.00
26.00
25.00
0.00
25.00
50.00
75.00
100.00
125.00
SNR Y Simulcast
SNR Y Full-comp
SNR Y case1-comp
SNR Y case2-comp


Sequence : Susie
43.00
42.00
41.00
40.00
39.00
38.00
37.00
0.00
25.00
50.00
75.00
100.00
125.00
SNR Y Simulcast
SNR Y Full-comp
SNR Y case1-comp
SNR Y case2-comp