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SOURCE: Toshiba
TITLE: Comparison between Pyramid (Embedded) and Simulcast
PURPOSE: Information

1. Introduction

Some agreements were reached at the Kurihama meeting last year, indicating that consideration of backward compatibility for current standard (H.261 and MPEG1) is very important for core experiment. At the following Yokosuka meeting, it was agreed that the core experiment should allow backward compatibility method with MPEG1 or H.261 (as embedded bitstream at 1.15 Mbps) and comparison with simulcast modes. This document shows a comparison between the basic characteristics for the embedded coding and the simulcast, in condition of simple RM8 based coding at about 4 Mbps.

2. Simulation condition

Simulation was carried out to compare coding efficiencies for the coding embedded by pyramidal picture structure and simulcast. The simulation conditions are as follows;

1) Coding algorithm : RM8 based (with full search MV detection and without loop filter)
2) Rate control : None (fixed stepsize is applied and compared in generated amount of information)
3) Coded pictures : 704 x 576 (after field merging for R.601, 96 gray lines are added at the bottom of the picture)

Figure 1 shows a definite simulation method. In this simulation, full resolution picture is filtered and subsampled to CIF and QCIF. Those three pictures are coded by an RM8 based coding (A, B and C respectively). After that, the higher frequency part of the pyramid is made by subtracting the decoded and up-sampled picture of the CIF or QCIF picture from the full resolution picture. These pictures are also coded by RM8 based coding (D and E). Each layer is coded independently.

Fixed stepsize for each picture is determined as follows. For 704 x 576 size pictures, such a stepsize is searched for that can code the full resolution picture in 2.85 Mbps, and the determined stepsize is applied to each picture. For CIF and QCIF, such a stepsize is searched for that can code them in 1.15 Mbps. Then it is applied. Comparison between coding efficiencies is

carried out by comparing the amount of coded bits for B + D or C + E (embedded) and A + B or A + C (simulcast).

3. Simulation result

The simulation result is shown in Table 1. Simulation was carried out for three test sequences (flower garden, mobile and calender, and Susie). The result obtained for a full resolution picture at 4 Mbps is shown as a reference. In a column of bitrate, the bitrates for the first frame are shown in parentheses. For pyramid coding, SNRs for reconstructed pictures are also shown in parentheses.

Sequence: flower garden

Picture (Target rate)	Q scale	Bitrate (Mbps)	SNRy (dB)	SNRcb (dB)	SNRcr (dB)
Full (4M)	14	3.922 (10.638)	28.25	31.56	32.48
Full (2.85M)	18	2.835 (8.573)	26.85	30.65	31.97
CIF	13	1.128 (3.131)	28.16	30.60	32.70
QCIF	5	1.102 (1.974)	34.78	35.48	36.01
Full - CIF	18	3.028 (6.280)	26.95 (26.98)	30.56 (30.56)	31.95 (31.95)
Full - QCIF	18	2.867 (7.713)	26.89 (26.91)	30.50 (30.50)	31.80 (31.80)

Sequence: mobile and calender

Picture (Target rate)	Q scale	Bitrate (Mbps)	SNRy (dB)	SNRcb (dB)	SNRcr (dB)
Full (4M)	15	4.140 (12.691)	27.18	30.87	31.13
Full (2.85M)	19	2.883 (10.132)	25.73	30.09	30.23
CIF	16	1.178 (3.629)	25.53	29.45	29.19
QCIF	5	1.171 (2.822)	34.14	34.29	34.27
Full - CIF	19	3.732 (7.298)	25.73 (25.76)	30.14 (30.14)	30.27 (30.27)
Full - QCIF	19	3.051 (9.012)	25.66 (25.68)	29.86 (29.86)	30.08 (30.07)

Sequence: Susie

Picture (Target rate)	Q scale	Bitrate (Mbps)	SNRy (dB)	SNRcb (dB)	SNRcr (dB)
Full (4M)	3	3.930 (9.390)	40.16	45.73	46.17

Full (2.85M)	4	2.410 (7.497)	38.84	45.31	45.66
CIF	3	1.113 (3.364)	40.17	46.14	46.10
QCIF	1	1.039 (2.608)	47.03	48.51	48.46
Full - CIF	4	2.556 (4.776)	38.76 (38.76)	44.95 (44.95)	45.31 (45.31)
Full - QCIF	4	2.357 (6.416)	38.87 (38.87)	45.17 (45.17)	45.52 (45.52)

Table 1 Simulation result

4. Comments on simulation result

The following comments are on the simulation results.

1) A comparison between the embedded coding and the simulcast indicates that the simulcast gives a higher coding efficiency at the condition of RM8 without any contrivance. Some efforts seem to be necessary to obtain better coding efficiency in embedded pyramid coding (for example, adaptive prediction switching between low resolution current picture and high resolution previous picture).

2) Comparing the coding embedded with CIF and the coding embedded with QCIF, the coding embedded with QCIF gives better coding efficiency. There seem to be two reasons. One is because lower frequency coefficients are quantized twice for the coding embedded with CIF. The other reason is that MC becomes more difficult to match for the coding embedded with CIF. But, considering the coding efficiency of the first frame, the latter reason seems to be more reasonable.

END

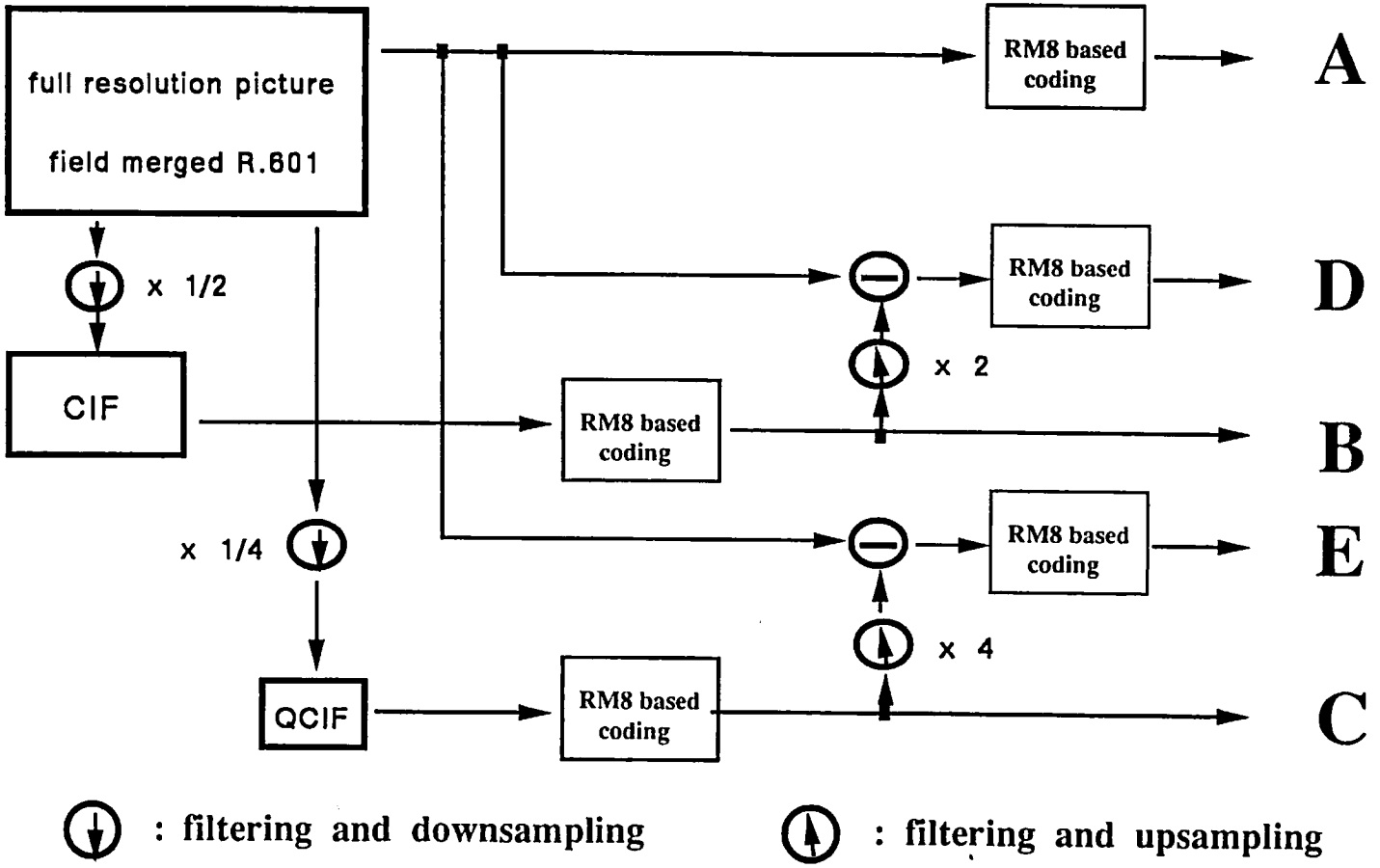

Fig. 1 Simulation method