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TITLE : CONSIDERATIONS ON COLOR DIFFERENCE SIGNAL PARAMETERS

1.Introduction

At the Holmdel meeting held in April, agreements were arrived at adopting simply related CCIR component coding as a coding system, and considering 360 pels/line as a basic parameter for the luminance signal.

Meanwhile, further studies have been carried out to determine the color difference signal parameters. This contribution reports on the results of a simulation experiment, using an actual video conferencing scene, on two types of parameters which are considered to be suitable for representing color difference signals.

2. Candidate Parameters

Band widths of the luminance signal and color difference signals are 4.5 MHz, and 1.2 and 0.6 MHz, respectively (in the NTSC TV system). However, considering that 384 kbit/s videocoding does not require the full band width, the sampling number for the luminance signal has been selected as 360 pels/line. Thus, the following two alternatives are fairly promising candidates for color difference signal parameters.

(1) 60 pels/line for both R-Y and B-Y;
transmit once every 2 lines.
(2) 90 pels/line for both R-Y and B-Y;
transmit once every 4 lines.

In this experiment, the orthogonal pel alignment was used in both cases. The R-Y and B-Y signals were taken from the same line. Sampling patterns are shown in Figure 1.

For evaluation purposes, (4:4:4) or (4:2:2) component signals were used. These signals were converted to TDM signals which employ the above parameters and are inverted again to (4:4:4) signals.

In this case, for candidate 1 the lowpass filter and inverse filter for the Y signal were composed of 9-taps in the horizontal direction, while for the color difference signals, 3-cascade 5-tap filters were used as the lowpass filter and 2-cascade 3-tap, 9-tap and 5-tap filters, a total of 4 stages in cascade, were used as the inverse filter. On the other hand, for candidate 2, the luminance signal was treated the same as for candidate 1. For the color difference signals, 2-cascade

5-tap filters and a 5-tap filter with different characteristics from the one used for candidate 1 were used as the lowpass filter. Also, 3-cascade 5-tap filters were used as the inverse filter.

For the color difference signals, for candidate 1 the same values were repeated as many times as necessary in the vertical direction, and for candidate 2, a vertical interpolative filter (using simple linear interpolation) was adopted.

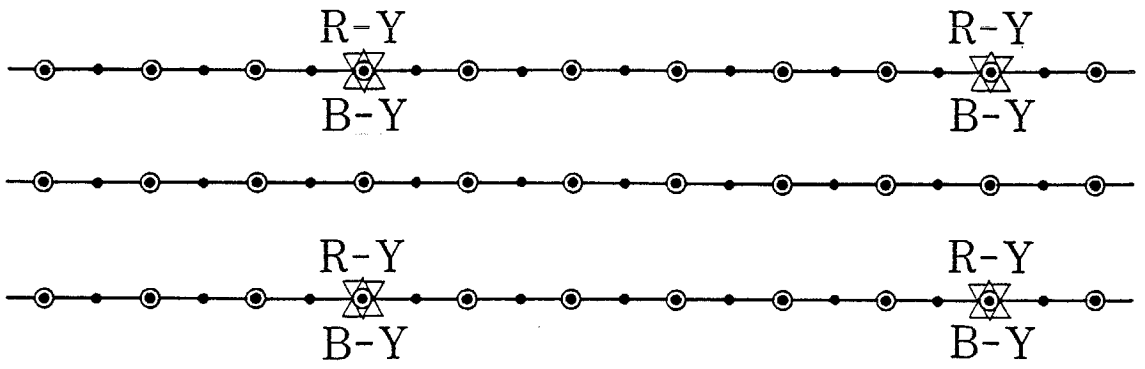
3. Results

The parameters for candidate 1 and candidate 2 were used. TDM converted and inverse converted pictures were prepared and evaluated. The results of the experiment are shown on a VTR.

The results of comparing the two candidates were summarized as follows.

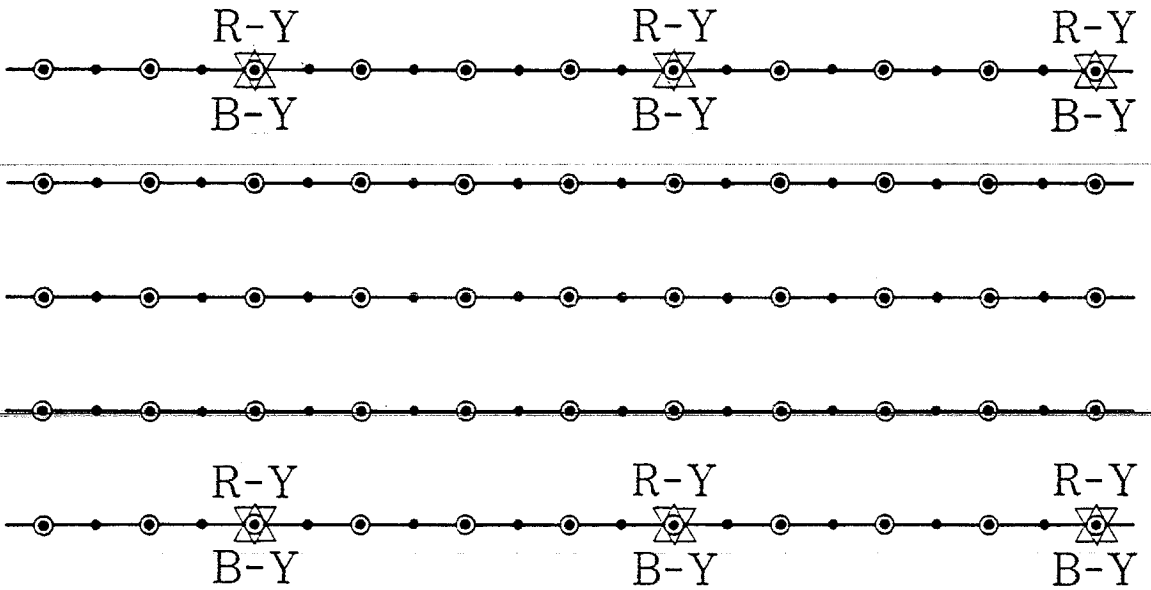
(1) Candidate 2 has better resolution for the color components in the horizontal direction.
(2) The loss of resolution in the vertical direction with candidate 2 is normally not so evident. However if the vertical interpolative filer is omitted, the distortion in slant sharp edges is quite apparent.
(3) Overall, candidate 1 gives slightly better picture quality.
(4) Considering cases in which a high efficiency coding is employed, the number of coded picture elements in candidate 2 is smaller than that in candidate 1, but the difference is only around 4 %.
(5) In the results obtained up to the present time, the number of bits required to code the color difference signals is less than that required to code the luminance signal. Thus, the difference in the number of coded picture elements is not so important.

An overall evaluation suggests that there is no really decisive difference between the above two candidates. However, candidate 1 seems to be preferable because of its simplicity in hardware configuration.



○ Y picture element
▽ R-Y picture element
△ B-Y picture element
• (4:4:4) Sample

a) Candidate 1, (2:1/3:1/3) and (2:0:0) system



b) Candidate 2, (2:1/2:1/2) and 3× (2:0:0) system

Fig. 1 Alignments of sampling patterns for colour difference signals