

Eindhoven - January 90

Title : Adaptive filter in the coding loop

Source : N. Texier - CNET - France Telecom

INTRODUCTION:

Due to the complexity of the test sequences and the very costly intra frame refreshment (1 intra frame every 12th), the images we can provide present a flicker effect at the intra frame refresh and a "mosquito noise" due to the coarse quantisation and the motion compensation. To reduce these artifacts, filtering is necessary. The MC predicted blocks are filtered (1/4 1/2 1/4 filter in both directions for H.261). This filter is not adaptive (relative to the step size) and does not operate on the intra coded parts.

Two kind of adaptive filters have been introduced before the frame memory.

FILTER ON THE BLOCK BOUNDARIES:

To avoid the blockiness and transitions on the block boundaries, due to the quantisation of the DC coefficients, a low pass filter has been introduced on the pixels around the 8*8 block boundaries.

x_1	x_2	x_3	block edge	$d_1 = (x_1+x_2+x_3)/3 - (y_1+y_2+y_3)/3$
y_1	y_2	y_3		$d_2 = (y_1+y_3+y_3)/3 - (z_1+z_2+z_3)/3$
z_1	z_2	z_3		

If $|d_1| < T$ and $|d_2| < T$ the pixels x_2 and y_2 are filtered.

A (1/4 1/2 1/4) low pass filter is used vertically for horizontal edges and horizontally for vertical edges.

The threshold T can be chosen adaptively relative to the contents of the picture and to the step size.

FILTER OVER THE WHOLE FRAME:

To reduce the mosquito effects around the objects and the transitions, it is necessary to process not only the block boundaries, but also the entire pictures.

For that, it is necessary to detect transitions in the frame. The idea is to compare the difference between neighbouring pixels and to decide if the difference is due to a transition or to noise. If the difference is less than a threshold, the pixels are filtered. The threshold has to be chosen relatively to the local step size. In a first approach, the value of $\text{step}/2$ has been chosen.

RESULTS:

Basic scheme:

source: 352*288 pixels

25Hz

Conversion filter: $(1\ 0\ -11\ 0\ 74\ 128\ 74\ 0\ -11\ 0\ 1)/256$

No other preprocessing

output: pixel interpolation (1/2 1/2)

field repetition

coding scheme: RM8 based

1 intra frame every 12th

MC 2 steps, window $[-11,+11]$, on real images

Zoom estimation

Prediction of DC coefficients

Modified buffer control

The two types of filters have been introduced before the frame memory in the coding scheme above.

S.N.R. plots and step size plots are annexed.

Recorded sequences will be presented.

CONCLUSION:

The filter on the block boundaries reduces a little bit the blocking effects but is not efficient on the mosquito noise (at the border of the table and around the head of the persons). With the second filter, the pictures are blurred, but the flicker due to the intra frame refreshment disappears and as well the mosquito noise. Subjective picture quality is better. It remains some work to do on the adaptivity of this filter and to compare the introduction of this filter inside the coding loop to the same one used as post processing filter.

We have to bear in mind the problem of that kind of "auto calculated" filter in relation with the DCT mismatch.

The decision filtered/not filtered is done by means of a thresholding after calculation at both coder and decoder side, and so is sensitive to the DCT mismatch. The accumulation of filtered/not filtered regions in both parts could cause trouble. As we have chosen 1 frame intra every 12th, it may not be important. For lower intra frame refreshment, it could be.













