# A NOVEL COMPUTATIONALLY EFFICIENT MOTION COMPENSATION METHOD BASED ON PIXEL BY PIXEL PREDICTION

Mohit Vaishnav      Ashwani Sharma
The LNM Institute of Information Technology, Jaipur

Anil Kumar Tiwari
Indian Institute of Technology Rajasthan

We proposed an efficient method for finding motion compensated frames by matching pixels rather than conventional method based on block matching. This matching is done in a feedback manner using only causal neighborhood pixels of the pixel to be matched. Suppose we wish to find the best match of pixel $x$ shown in Fig. 1. The procedure to be followed is given below:

1. Take west, north, and north-west neighborhood pixels with respect to $x$. Let these neighborhood pixels be denoted by $x^w$, $x^n$, and $x^{nw}$ respectively, as shown in Fig. 1.

2. Select nine pixels ($x_1$, $x_2$, ... $x_9$) in the previous frame. It is expected that $x$ will be matched to one of these nine pixels.

3. Select three neighborhood pixels around these nine pixels. $x_i^w$, $x_i^n$, $x_i^{nw}$ are west, north and north-west pixel with respect to the pixel $x_i$ where $1 \le i \le 9$.

4. Find an array $SAD_i = \text{abs}(x^w - x_i^w) + \text{abs}(x^n - x_i^n) + \text{abs}(x^{nw} - x_i^{nw})$

5. If $SAD_k$ is the minimum in the array $SAD_i$, then $x_k$ is the best matched value for $x$.

To be computationally efficient we experimentally found that we need not test all the nine cases but can stop comparison test if the absolute difference is less than 17.

We have compared the proposed method of motion compensation with the standard one by simulating it over various QCIF format video sequences like car, news, miss, hall and many others. Proposed motion compensation scheme gives similar performance to that of standard motion compensation. Further, we used LS based (pixel by pixel) and LOPT-3D (threshold=3) methods on compensated frames obtained by the proposed method and the standard methods. Performance of the methods are similar. To be specific, LS based with standard motion resulted on an average entropy of 2.67$bpp$ while same with our method of motion compensation resulted in 2.72$bpp$.

This paper has introduced a new algorithm to deal with the problems of displacement estimation for motion compensation. The simulation results show that the quality of the motion compensated prediction is similar to the one. However, the complexity associated with the calculation of motion estimation is reduced by 97%.
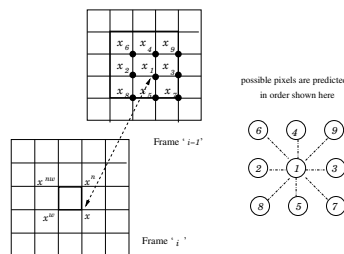


Figure 1: Pixels used in proposed scheme of motion estimation

IEEE
computer
society