Residue coding technique for video compression

Mohit Vaishnav, Binny Tewani, Anil Kumar Tiwari[‡]

This work introduces a step prior to the entropy coding scheme which is the contemporary path followed for any compression technique. In this work, after getting error frame we mapped that into another range. Proposed algorithm is described as follows:

- *Step 1:* Error frame E can be obtained using difference between two consecutive frames. Range of error value can be [-255, 255].
- *Step 2:* We remap the error sample values by adding 255 to each of the samples i.e. $E(n) = E(n)+255$. Now the range gets changed to [0,510].
- *Step 3:* This data E is remapped to a new value and stored in matrix B. The new value will be in the range [0,255]. The mapping is carried out by associating every 2 values of E to a single value in B; Range of B is [0,511]. If E matrix element has the intensity value is of the form of either as $2x$ or $2x + 1$ then it is mapped to x where x is any integer in the range of [0,255].
- *Step 4:* As the new range is equivalent to the domain of gray scale image. Hence this is saved in PGM format encoded using CALIC framework.
- *Step 5:* Another matrix of information (I) is required for lossless recovery of the video sequence i.e. 1 bit data conveying about from the two mapped to a single value which one is to be chosen back at the decoder side. If $2x$ is mapped to x at the encoder side then the I matrix at that location has the value 1 else 0 at the same location.

This completes the encoder part of the proposed work. Matrix B is encoded using CALIC method and Matrix I is saved as it is. At the decoder end,

- *Step 1:* CALIC decodes the pixels to the range [0,255].
- *Step 2:* Using information stored in matrix I, this range is then extended to [0,510]. If the I matrix has value 1 where B has the value x, then this represents the value as $2x$, else $2x + 1$.
- *Step 3:* Now from the above obtained matrix, 255 is subtracted; hence we get back the original matrix E containing errors data from where we started.

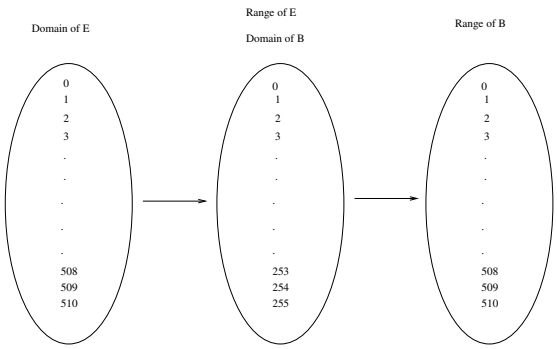

Figure 1: Proposed mapping process

Complexity associated with the proposed method is the remapping carried out to convert it into a gray scale image and overload bits associated with them for lossless recovery. I can also be compressed to a great extent when compression of this binary information is done.

We have simulated our proposed scheme over various HD, CIF, QCIF and some other test video sequences. Motivation behind introducing another step before entropy coding is to somehow create correlation amongst each error frame. Results obtained are compared to various other schemes like carrying out the traditional method of prediction using motion compensation and entropy coding is done using arithmetic encoding. Other methods to which comparison is performed are CALIC and JPEG-LS where each of the video frames are encoded using the above mentioned schemes. It shows that there is a gain of $0.21bpp$, $0.48bpp$, $0.77bpp$ w.r.t. to standard motion compensation, CALIC and JPEG-LS respectively.

*Mohit Vaishnav and Binny Tewani are with The LNMIIT, Jaipur, Rajasthan, India e-mail:(mohit.vaishnav@gmail.com)
†Anil Kumar Tiwari is with the Department of Electrical Engineering, IIT Jodhpur, Rajasthan (India) e-mail: (akt@iitj.ac.in)

1068-0314/14 $31.00 © 2014 IEEE
DOI 10.1109/DCC.2014.92