

SECURE DATA HIDING IN TRANSFORMDOMAIN FOR DIGITAL VIDEO SEQUENCES

B. SubbaRaju¹, K. VijayaKumar², S.A.V.SatyaMurty³
^{1,2,3}Department of Civil Engineering, SVNIT Surat, Gujarat, India

Abstract: *Video data hiding presents a required to hide data in the transformed domain. Compared with still images, video watermarking presents a much higher capacity or bandwidth. At the same time the computational complexity in video watermarking is higher due to the amount of data that need to be processed. Since a video is formed from a sequence of frames, it presents the data hider with the possibility to embed and send a large amount of data[1].*

Data hiding in video sequences is performed in two ways, bit stream level and data level. In the bit stream level the redundancies in the current compression standards are exploited. .

Key words: - Data hiding, Secure zone, selective embedding, wavelet transform

I.INTRODUCTION

Data hiding refers to techniques for embedding data in host media. Most of the previous research has focused on still image watermarking; video watermarking has more potential for commercial applications, less research has been conducted on high capacity data hiding in video streams. Ancillary data embedded in a video stream can carry information about the content itself, low-level descriptors for video indexing, retrieval and segmentation. Other applications include annotation, subtitling, multi-lingual services, tele-text, etc. Due to the data intensive nature of that.

2. Proposed algorithm

Input low resolution satellite image is decomposed using DWT into LL, LH, HL, HHsubbands and these are interpolated using bicubic interpolation technique followed by combining all these images to generate a new high-resolution image by using inverse NDWT along with GMM. Proposed GMM interpolation is advisable in remote sensing applications to get a high-resolution image as the recorded satellite images have both low-frequency and high-frequency elements. 4 Experimental Results In order to show the improvement in the resolution of satellite images of the proposed method over the conventional and state-of-art image resolution enhancement techniques, two satellite images with different features are used for comparison. Figure.4 shows that high resolution images using the proposed techniques in (f) is much sharper than the original low-resolution images in (a), bilinear interpolation in (b), bicubic interpolation in (c) wavelet zero padding in (d), DWT based image decomposition and bicubic interpolated images in (e). The proposed technique is evaluated in terms of Peak Signal to Noise Ratio (PSNR), and Quality Index (QI) and compared with other techniques. It is clear that the proposed DWT-GMM technique is outperform than bilinear interpolation, bicubic interpolation, wavelet zero padding, DWT based image decomposition and bicubic interpolated techniques. The PSNR is calculated as follows:

2.1 Mean Square Error (MSE)

The MSE is the cumulative squared error between the compressed and the original image. A lower value of MSE means lesser error, and it has the inverse relation with PSNR. Mean square error is a criterion for an estimator: the choice is the one that minimizes the sum of squared errors due to bias and due to variance. In general, it is the average of the square of the difference between the desired response and the actual system

output. As a loss function MSE is also called squared error loss [3]. MSE measures the average of the square of the error. The MSE is the second moment of the error, and thus incorporates both the variance of the estimator and its bias. For an unbiased estimator, the MSE is the variance. In an analogy to standard deviation, taking the square root of MSE yields the root mean squared error or RMSE [8]. For an unbiased estimator, the RMSE is the square root of the variance, known as the standard error.

$$MSE = \frac{1}{m \times n} \sum_{y=1}^m \sum_{x=1}^n [I(x, y) - I'(x, y)]^2$$

Where, $I(x, y)$ is the original image and $I'(x, y)$ is the reconstructed image and m, n are the dimensions of the image. Lower the value of MSE, the lower the error and better picture quality [9].

3.2 Peak Signal to Noise Ratio (PSNR)

PSNR is a measure of the peak error. Many signals have very wide dynamic range, because of that reason PSNR is usually expressed in terms of the logarithmic decibel scale in (dB). Normally, a higher value of PSNR is good because it means that the ratio of signal to noise is higher [1]. Here, a signal represents original image and noise represents the error in reconstruction. It is the ratio between the maximum possible power of a signal and the power of the corrupting noise [4]. PSNR decreases as the compression ratio increases for an image. The PSNR is defined as:

$$PSNR = 10 * \log_{10} \left\{ \frac{MAX_I^2}{MSE} \right\} = 20 * \log_{10} \left\{ \frac{MAX_I}{\sqrt{MSE}} \right\}$$

PSNR is computed by measuring the pixel difference between the original image and compressed image [10]. Values for PSNR range between infinity for identical images, to 0 for images that have no commonality.

II. SECURE ZONE BASED SELECTIVE DATA HIDING

This method depends on the secure zone concept which means that no alteration is been allowed in this region for data hiding process. Let s be the host signal in R and $m \in \{0,1\}$ be the data to be hidden [3]. Then the marked signal is obtained as

$$\hat{s} = \begin{cases} s, & s \in FZ \\ Mm(s), & s \in AZ \end{cases} \quad (1)$$

Where FZ is the forbidden zone and AZ is the allowed zone and $Mm(s)$ is the mapping function which can be expressed as

$$M_m(s) = \{s + e_m (1 - \frac{r}{||e_m||})\} \quad (2)$$

$$\begin{aligned} &\text{The FZ can be knows from} \\ &FZ_m = \{s | ||e_m|| \leq r\} \\ &AZ_m = \{s | ||e_m|| > r\} \end{aligned} \quad (3)$$

During the extraction process minimum distance approach has been considered

$$\hat{m} = \operatorname{argmin}_m d(y, y_m) \quad (4)$$

Where y is the received signal and y_m is equal to the FZ obtained.

III. NON SUBSAMPLED CONTOURLET TRANSFORM

The NSCT is completely shift invariant, multi-scale and multi direction expansion that has better directional frequency localization and fast implementation where it helps to achieve the similar sub band decomposition as that of contourlet but without the down samplers and up samplers in it [8]. The NSCT construction can be divided into two parts where one part demonstrates the non sub-sampled pyramid structure, which splits the input into a low pass sub band and a high pass sub band .The other is non sub-sampled directional filter bank structure, which decomposes the high pass sub band into several directional sub bands as shown in Fig.1. This process is iterated repeatedly on the low pass sub band outputs of non sub-sampled pyramids. Here, non sub-sampled pyramids provide multiscale decomposition and non sub-sampled directional filter banks provide directional decomposition

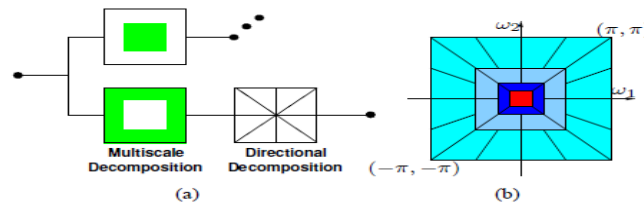
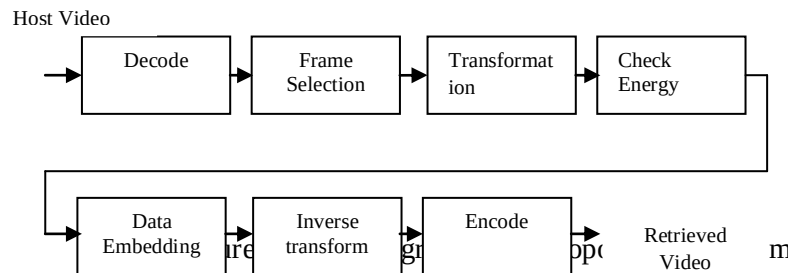


Figure 1: Illustration of Non-sub-sampled Contourlet Transform (a) Block diagram (b) Resulting frequency division

IV. PROPOSED METHODOLOGY

The below figure shows the generalized block diagram for the proposed mechanism



a)Embedding Procedure

1. For the embedding Y-channel is been utilized
2. Apply the transformation (NSCT/DWT) and partition the low frequency components into 8x8 non overlapping blocks
3. In the selective embedding procedure the data will be hidden only in certain block of the certain frames. So firstly we are supposed to select the blocks and the frames.

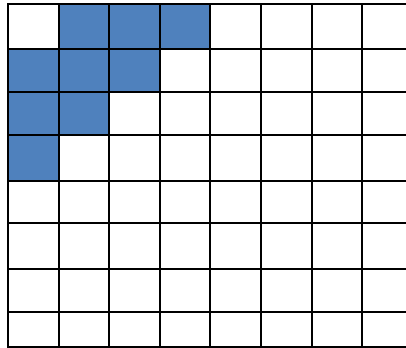


Figure 3: Mask for considering frequency band

4. Block selection: Energy of the mask region is calculated for a given block if this energy is above certain threshold (T_1) then the block is processed or else left unchanged.
5. Frame selection: Selected number of blocks in the whole frame is counted .If the ration of the selected blocks to the all bocks is above certain threshold (T_0) the frame is processed or else it is left unchanged
6. Coefficient selection: Energy of each coefficient in the selected block region is compared against a certain threshold T_2 .If the energy is above the threshold then it is used for data hiding or else left unchanged

b) Extraction Procedure

The given marked video sequence will be undergoing the first three steps in the embedding procedure

1. At each frame, frame synchronization markers are decoded first. Message decoding is performed once the end of the group of frames is detected.
2. Two frame indexes are stored current f_{cur} and previous f_{pre} to decode the message u
3. If $f_{cur} > t$ then skip this frame
4. If $f_{cur} = f_{pre}$ then skip this frame
5. If both the cases are not met then process the current frame. Put om values in the corresponding place of data structure .Non selected blocks re left as erasures

V.CONCLUSION

Secure zone based selective data embedding scheme is proposed in wavelet domain .The method out performs than the existing DCT based approach with and increment of about 0.2dB of PSNR on average with a probability of error 0.05 decrement. It is here by concluded that the current scheme may be utilized for better selective approach. This work can be further extended with spreading codes and higher multi resolution analysis transformations.

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