# Wavelet Family Based Invisible Embedding Methodology

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***Abstract*— In this work the targeted invisible watermarking is approached using Haar Wavelet functions, the watermark or message embedded into cover image, prior to it , image segmentation approach is utilized here to extract the object of interest in message and covert an 8bit or 16 bit message information to one bit binary message. The embedding is performed in odd and even blocks of LH and HL bands, by modulation the corresponding band value on the basis of proposed embedding rule set.**

***Keywords*— image processing, watermarking, segmentation, wavelet domain.**

## I. Introduction

Digital watermarking defines a technique that can serve purposes. A large number of watermarking scheme proposed to hide copyright marks and other information in digital images, video, audio and many other multimedia objects. A watermark is a form of image or text that is the paper provides evidence of its authenticity, but impressed. Digital watermarking is an extension of concept of cryptography in the digital World. Unprecedented growth in recent years of the Internet has highlighted the need for mechanisms to protect ownership of digital Media. Absolutely identical copies of digital information, be it images, audio or text, can be produced and distributed easily. While the aforementioned advantages offer immense opportunities for creators, the ability to make perfect copies and ease by which those copies are distributed also facilitate misuse, illegal copying and distribution ("piracy"), plagiarism, and misappropriation. Content creators and owners are concern about the consequences of illegal copying and distribution on a massive scale.

## II. LITERATURE SURVEY

Continuous efforts are made to device an efficient watermarking algorithm but techniques proposed upto do not proves to be robust to all possible attacks and multimedia processing operations. Watermarking sudden increase in interest is most likely due to the increase in concern over IPR. Generally, watermarking of static image, video, and audio demonstrated certain common basic concepts. Reported several watermarking applications in literature depends on services we want to support. Thus watermarking techniques seems to be relevant in various application areas including Copyright protection, Copy protection, Temper detection, Fingerprinting etc [1-3]. Based on their embedding domain , watermarking schemes are classified either as Spatial Domain (watermarking system directly changes main data like pixels in an image, to hide watermark information) or Transformed Domain (here system alters the frequency transforms of data elements to hide the watermark information). Latter had proved to be robust than the spatial domain watermarking process[1], [4].

To transpose an image to frequency representation, scholars used several conversion like Discrete Cosine Transform (DCT), Discrete Wavelet Transform (DWT), or Discrete Fourier Transform (DFT)[1]. Though spatial domain based methodologies cannot sustain most of general attacks like compression, filtering high pass or low pass etc., researchers will present the spatial domain techniques too [1], [4].

## III. HAAR BASED INVISIBLE EMBEDDING

Discrete wavelet transform posses a huge number of uses in science, engineering, and mathematics and computer science. Mostly, it is used for signal coding, represent a discrete signal in a more often as a prerequisite for data compression is unnecessary. Applications of practical use can also be found in signal processing of accelerations for gait analysis, [26] in digital communications and so on[27] [28][29].

There exist a wide range of applications for wavelet transform. They are applied in various fields ranging from signal processing biometrics, and the list is still growing. One prominent applications is in the FBI fingerprint compression standard. Wavelet transform is used to compress the fingerprint pictures for storage in their data bank. Chosen first discrete cosine transforms (DCT) did not perform well at high compression ratio. This blocking effect which produced severe made it impossible to follow the ridge lines in the fingerprints after reconstruction. It did not happen with Wavelet Transform due to its property of retaining the details present in the data. In DWT, prominent information of signal appears in high amplitudes and the less prominent information appears in very low amplitudes. Data compression can achieved by discarding these low amplitudes.

The wavelet transforms enables high compression ratios with good quality of reconstruction. Presently, the application of wavelets for image compression is one the hottest areas of research. For most compression applications, data processing involves entropy coding and quantization to yield compressed image. In while of this process, all the wavelet coefficients that are below a chosen threshold are discarded. These rejected coefficients are replaced with zeros during reconstruction at other end. To reconstruct the signal, the entropy coding, and then finally back then decodes the quantized Wavelet Transformed.

## IV. METHODOLOGY

### *A. ALGORITHM FOR WATERMARKING USING DWT*

*a) Embedding Procedure*

Step 1. Decompose 1-Level DWT on an M*N host image.

Step2. Divide the HL and LH sub band into non-touching blocks of 2*2 size and blocks are slected in odd columns of LH and blocks in even columns of HL for watermark embedding.

Step 3. Retreive each selected block B(m, n) and a bit w from watermark. Calculate mean value M(m, n) of four coefficients in B(m, n)

$$M(m,n) = \frac{\sum_{i=0}^{1}\sum_{j=0}^{1}(x_{m+i,n+j})}{4}$$

Embed bit w of watermark

R := M(m, n) mod 6;

for i := 0 to 1

for j := 0 to 1

**if** $0 \le R < 3$ **then**

**if** $w = 1$ **then** $xm+i,n+j := xm+i,n+j + (3-R)$;

**if** $w = 0$ **then** $xm+i,n+j := xm+i,n+j - R$;

**if** $3 \le R < 6$ **then**

**if** $w = 1$ **then** $xm+i,n+j := xm+i,n+j + (3-R)$;

**if** $w = 0$ **then** $xm+i,n+j := xm+i,n+j + (6-R)$;

**Step 4**. Apply IDWT on embedded image to obtain an invisible hided image.

*b) Extraction Procedure*

**Step 1.** Apply one-Level DWT to M*N stego image.

**Step 2**. Segregate HL and LH subband into non-touching blocks of 2*2 size and select blocks in odd columns of LH and blocks in even columns of HL for extracting watermark.

**Step 3.** For each block B(m, n) . Calculate average value M(m, n) of retreived four coefficients in B(m, n)

$$M(m,n) = \frac{\sum_{i=0}^{1}\sum_{j=0}^{1}(x_{m+i,n+j})}{4}$$

Extract bit w of watermark

*R* := *M*(*m, n*) mod 6 ;

**if** $0 \le R < 1.5$ **then** $w := 0$;

**if** $1.5 \le R < 4.5$ **then** $w := 1$;

**if** $4.5 \le R < 6$ **then** $w := 0$;

## V. RESULTS

The watermarked images resulted from embedding algorithm applied individually on six messages is represented by below figure, where binary message bits are embedded into LH and HL band of cover images.

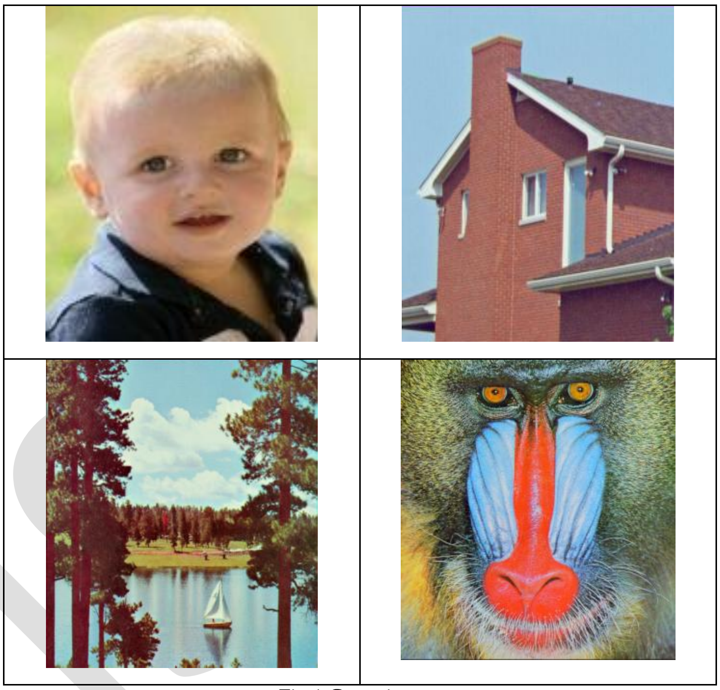

Fig.1 Cover image set

| Hided Message Image | Watermarked Cover Image |
|---|---|
|  |  |
|  |  |

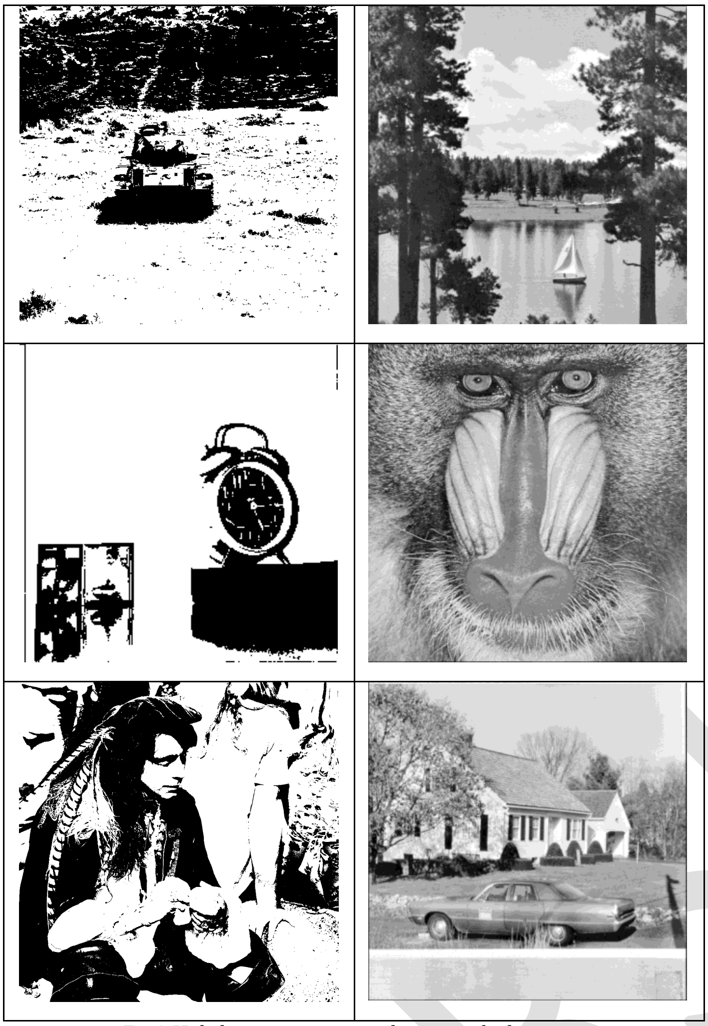

Fig.2 Hided message image and watermarked cover image

## VI. Conclusion

As future scope concept of Digital Watermarking and Cryptography can be combined to develope more secured watermarking system. We can apply the watermarking technique in the frequency domain for various applications. We can also implement in other spatial domain techniques and cryptography algorithms for most advanced encryption technique to encrypt the messages. From this article can be concluded that promisable watermarking can be achieved using suggested methodology.

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