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Embed Watermarking in High of Image Coarseness

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Abstract:

Watermarking is a technique to hide data inside an image to show authenticity or proof of ownership. In this paper (research) the proposed system is an implementation of image watermarking techniques. The proposed watermarking scheme incorporates HVS models into watermark embedding and watermarking is performed in wavelet domain (the implementation of image watermarking scheme incorporates HVS models into watermark embedding and watermarking is performed in wavelet domain was proposed). in this algorithm (our main algorithm is divided into three algorithms). (First,) are (is a find coarseness), (second is to) chosen the high coarseness subband to hide watermarking in it by using coarseness algorithm a applied on many images, (third, is test a) similarity between original image and image watermarking. and the (This) method (was) robust against extracting watermarking on average(80-95%) (when it applied on many images), (the extracted method is implement)by using lowpass and highpass filters in data payload(256 bits).

Keyword: *watermark, coarseness, wavelet transform, HVS*

I. INTRODUCTION

The rapid growth of the Internet increased the access to multimedia data tremendously. The development of digital multimedia is demanding as an urgent need for protect multimedia data in internet. [1] Digital watermarking is nothing but the technology in which there is embedding of various information in digital content which have to protect from illegal copying. This embedded information to protect the data is embedded as watermark. Digital watermarks are of different types as robust, fragile, visible and invisible .Application is depending upon these watermarks classifications. There are some requirements of digital watermarks as integrity, robustness and complexity.[2] All watermarking methods share a watermark embedding system and a watermark extraction system. There are two main watermarking techniques available: spatial domain and frequency domain. [3] In spatial domain, the pixels of one or two randomly selected subsets of an image are modified based on perceptual analysis of the original image. However in the Frequency or transform domain, the values of certain frequencies are altered from their original image. [4], Various types of frequency transforms that have been used are Discrete Fourier Transform (DFT), Discrete Cosine Transform (DCT), and Discrete Wavelet Transform (DWT). Earlier watermarking schemes used DFT and DCT. [5]
The watermarking problem is to achieve a better trade-off between robustness and perceptivity. Robustness can be achieved by increasing the strength of the embedded watermark, but the visible distortion would be increased as well. However, DWT is much preferred because it provides both a simultaneous spatial localization and a frequency spread of the watermark within the host image. The basic idea of discrete wavelet transform in image process is to multi differentiated decompose the image into sub-image of different spatial domain and independent frequencies.[2]

II. HUMAN VISUAL SYSTEM (HVS) IN WATERMARKING

The Human Visual System is found to be less sensitive to the highly textured area of the image. Moreover, in all colors the blue is least sensitive to the HVS (Human Visual System). While working on colored images when using the mathematical and biological models of HVS, the preferred color model must be HSV (Hue, Saturation and Value) color model rather than RGB color model because it most closely defines how the image is interpreted by HVS. The high visual transparency in the technique is achieved.[7] Digital watermarking of images can be performed by employing similar visual models. Robustness, perceptual transparency and capacity are the requirements of digital watermarking techniques.[3][6] This means watermark is made highly robust against different types of attacks by performing the watermark insertion in transformed domain and making use of the transformation functions such as DWT.[7]

III. THE SYSTEM

In this research , the proposed system is an implementation of image watermark techniques. Our system will be used for embedding a watermark string into an image, which is BMP file format image by using wavelet transform technique to embedding text.

3.1 Embedding Algorithm

The wavelet method is depending on the selecting the best sub bands to embedding text watermarking in it depending on high texture in it. The coarseness is the feature of texture used in this method. In our wavelet method, we must compare among three sub band(HH,HL and LH) to choice one of them and embedding in high value coarseness sub band , the technique can be described in algorithm:-

Step1: input original image and watermark text
Step2: convert images RGB channel to grey level (256)
Step3: convert the watermark into steam of bits (0 and 1)
Step4: decomposition image by using wavelet transform, then find all bands of wavelet transform
Step 5: calculate the value coarseness of three subbands(HH,HL and LH) by using coarseness algorithm.
Step 6: compare between three coarseness values and choice the high coarseness value to hide watermark in this subband for it.
Step 7: store two bits key contains of two bits (00, 01, 10) represent LH, HL, HH of subband ; there is benefits to select band of high coareseness, theses bits store in left top corner first two byte of corners from subband LL
Step 8: store data in subband that is high coarseness, the subband is represented by a two dimensional array of values. The present paper divides the subband into non overlapped window of a predefined size. The size of any window is 3 x 3 coefficients. Check the center of window if odd value then store data in first diagonal or if even value store in the first and second diagonal by using LSB.

Example:

In this example see array of subbands 6x6 is proposed:-

Figure (1) shown window 3x3 the center for this window is even number (10) therefore we hidden watermarking in corner coefficients (2,9,22, and 2).

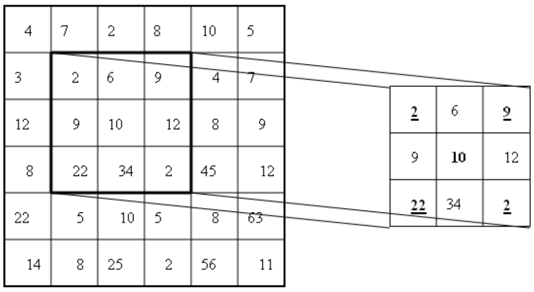

Figure (1) windows the center even and the corner coefficients selected

While in figure (2) see the center is odd number (3) therefore we hidden watermarking in middle coefficients (4,12,9, and 45)

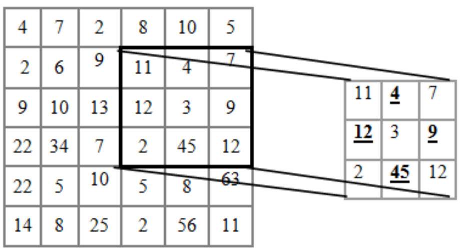

Figure (2) shown windows the center odd and the middle coefficients selected

Step9: saves watermarked color image as BMP (24-bit) file, then displays it.

3.2 Coarseness algorithm

Step1: Coarseness for subband or block can be defined as:-

$$C = 1 - \frac{1}{1 + SD} \quad \ldots\ldots(3)$$

Step 2: SD is dispersion of the subband, is defined as: - $SD = \sum_{i=0}^{L-1} (i - Sm)^2 h[i]$ ……. (4)

h[i] means the histogram of the subband or block

Sm means the Mean of the histogram can be calculated by using equation:-

Step 3: $Sm = \frac{1}{N} \sum_{i=0}^{N} val[i]$ ..…. (5)

Val[i] is pixel value

N is the dimension of subband (width X depth) [9]

3.3 Extraction algorithm

In Extracted method, we need to input the image watermarking and the output watermarking text then find two bits from LL corner band to limit the band that using storage on it.

Step1: input image watermarking

Step2: convert images RGB channel to grey level (256)

Step3: decomposition image by using wavelet transform, then find all bands of wavelet transform

Step4: check from key two bits in left top corner first two byte from LL subband to determine the subband that selected to store data watermark in it.

Step5: divide subband that selected into windows 3X3 and check the center of window to determined coefficients extraction text watermarking by using same method in the example.

IV. EXPERIMENTAL RESULTS

In this algorithms, many true color was implemented, Balloons image is a test true color for our *system or method* , Figure(3) was show : (a) origin image, (b) balloon image before hiding a text watermark, (c) balloon image after hiding a text watermark, (d) image watermark after high pass filter, and (e) image watermark after low pass filter.

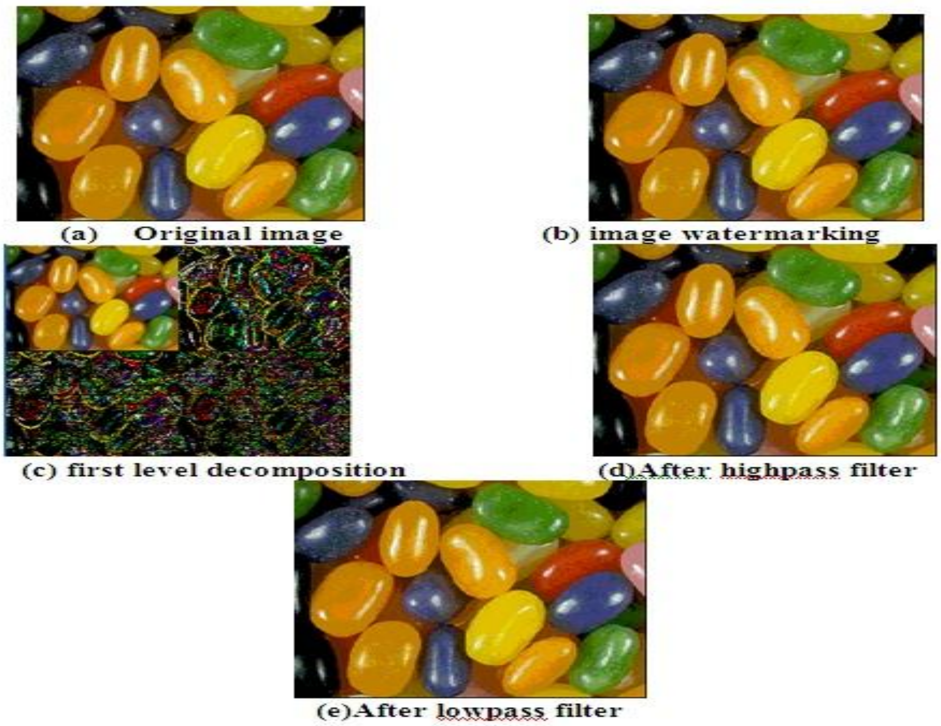

Figure (3) implementation of wavelet method for balloons image

For original image and image after embedded Watermark, an imperceptibility of watermarking is measured by the watermark image quality in term of Peak-Signal-to-Noise Ratio (PSNR) (in dB). Most common difference measure between tow images is the mean square error. The mean square error measure is popular because it correlates reasonably with subjective visual tests and it is mathematically tractable. The quality measure of PSNR is defined with,

$$PSNR = 10 \log_{10}\left(\frac{I_{max}^{2}}{MSE}\right) dB \quad \ldots\ldots\ldots(1)$$

Where max I is equal to 255 for 8 bit gray scale images.
The MSE is calculated by using the Eq. (2) given below:

$$MSE = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}\left(Y_{i,j} - S_{i,j}\right)^{2} \quad \ldots\ldots\ldots\ldots(2)$$

Were, M and N denote the total number of the pixels in the horizontal and the vertical dimensions of the image, Si,j, represent the pixels in the original image, and Yi,j, represent the pixels of the steg-image, the results shows in table(1) and its shown Simulations on the images.
The simulations table, is contains some images was tested through our *system or method*, the coarseness value in each of subbands(LH,HL and HH), PSNR measure for image after: watermark hiding, lowpass and highpass filters, and MSE measure for image after watermark hiding.

Table (1) : Simulations of Test Images

images	subband	Coarseness values	PSNR			MSE After hiding watermarking
			After hiding watermarking	After lowpass filter	After highpass filter	
Balloons	**LH**	**0.156030**	**61.010457**	**28.892155**	**28.795898**	**0.051527**
	HL	**0.167565**				
	HH	**0114692**				
Car	**LH**	**0.460789**	**38.574837**	**27.536013**	**25.826790**	**9.028105**
	HL	**0.139319**				
	HH	**0.381036**				
Lion	**LH**	**0.312850**	**35.772292**	**29.233935**	**25.532085**	**17.212785**
	HL	**0.329154**				
	HH	**0.239908**				
Sky	**LH**	**0.139608**	**61.332747**	**23.095036**	**23.091272**	**0.047842**
	HL	**0.13**				
	HH	**0.188458**				

In **Simulations of Test Images**, the bits embedding in one of three subbands (LH, HL and HH) depending on high value of coarseness and the three values different in each image, the data payload used (256 bit), therefore see in each image choice subband different.
Figure (4), shown the relation between PSNR after hiding watermark in image and after low and high pass filters in four test images(Sky, Lion, Car, and Balloons).

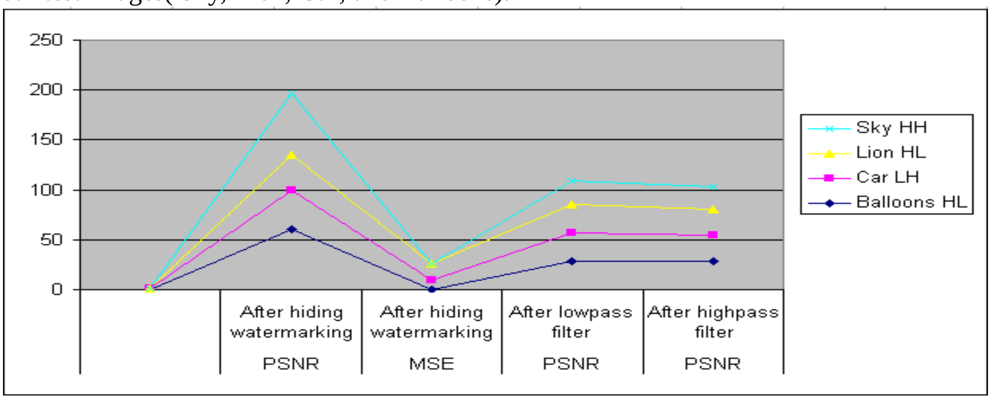

Figure (4) relation between PSNR measure in tested images

V. CONCLUSION

There are number of conclusions were noticed from:-

1. The proposed system gives us the random location of watermark text in different test images.
2. The criteria of accuracy of watermark image acceptable because the PSNR values are high and MSE is low values, it means low distortion and Resistant to low and high pass filter is acceptable.
3. In our method bits of watermarking hiding in different subband(LH,HL and HH) depending on high value of coarseness this increase secure and choice the best subband from HVS system to hide watermarking.

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