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Highly Secured Method of Skin Tone Based Steganography for Real Images

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***Abstract*— "Steganography "is a Greek origin word which means "hidden writing". Steganography word is classified into two parts: stegaos which means secret and the graphic means "writing" (text). Steganography method used in this paper is based on biometric, and the biometric used to implement is skin tone region of image. The proposed method uses the embedding of secret data within skin region of image that will provide high secure location for data hiding. HSV (hue, saturation and value) color space is used for skin tone detection. First skin tone detection is performed on cover image then the secret data is embedded using frequency domain approach-DWT (Discrete wavelet transform). Secret data is hided in one of four sub-bands by tracing the skin pixels in that sub-band. Since this method uses the tracking of skin tone region in an image, therefore it provides high security. This biometric method of steganography increases the error capability than the existing method.**

***Index Terms*— Biometrics, DWT, LSB, skin tone detection, steganography**

I. INTRODUCTION

Steganography is a Greek origin word which means "hidden writing". Steganography is the art of hiding text into another media files such as image, text, sound, video[1]13].

In this proposed work biometric features used to implement steganography. In this method of steganography, the embedding of secret data is done within skin tone region of image that will provide highly secured location for data hiding. This method of Steganography is widely used when some confidential data must be protected from copying, modification or being destroyed by the legitimate users. Instead of embedding secret data anywhere in the image, it is embedded in the skin tone region of image. A skin tone region means the region which contains the skin color. Selection of decision boundary of skin color is used for detection of skin pixels in an image. Then the secret data is embedded using frequency domain approach-DWT. The steganography should be designed in such a way that the human eyes should not distinguish between the original image and the embedded image.

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II. RELATED KNOWLEDGE

In the earlier work of steganography different methods are used for hiding secret data such as LSB (least significant bit), Transform domain based steganography and Adaptive steganography.

A. LSB (least significant bit) based steganography

LSB hiding technique hides the secret message directly in the least two significant bits in the image pixel, hence it affects the image resolution which reduces the image quality, hence it can be easily detected by the fraudulent users [2]. The basic concept of LSB method is to embed the secret data at the rightmost bits (bits with less weight) so that the embedding procedure does not affect the original pixel value.

B. Transform domain steganography

Using transform domain technique we can hide secret image within cover image. The cover image is transformed into frequency domain coefficients before embedding the secret message. Different sub-bands are used for hiding secret data within skin tone regions of an image. Embedding is done in either high frequency components or low frequency component, but embedding done using high frequency component cannot be easily perceived by the human eyes hence provides more secure way of data hiding.

C. Adaptive steganography

Adaptive steganography is also known as "statistics aware embedding" and "masking". It is the special case of the above two methods.

III. PROPOSED WORK

The proposed method used is the embedding of secret data within skin regions of the cover image because it is not sensitive to HVS (human visual system). In order to provide high security, data is embedded in skin regions of the cover image.

Block diagram of proposed method uses the cropping method to perform embedding process which is shown in fig 1 :

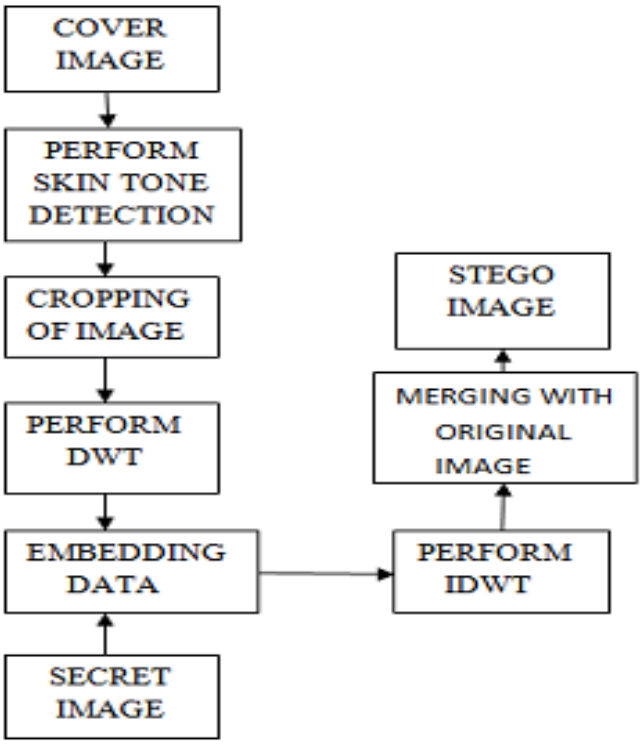

Fig 1: block diagram of proposed method

A. *Skin color tone detection*

Skin color tone detection is the process of detecting image pixels and region which contains skin tone color. We can use color transformation such as RGB (red, green, blue), YCbCr (yellow, chromatic blue, chromatic red) and HSV (hue, saturation, value) color space to detect the presence of human skin tone. The simplest way to detect whether a pixel is skin or not is to define a boundary. This will produce the mask image that contains skin and non-skin pixels [1]. The boundary values are :

Smin =0.23 Smax=0.68 Hmin=0° and Hmax= 50°

The skin detection algorithm produces a mask which is simply a black or white image. The black pixel values are 0(false) and the white pixel values are 1(true)[1]. The cover image and HSV image in fig 2:

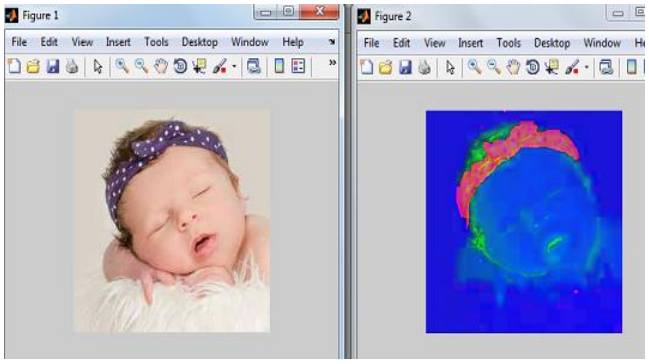

Fig 2: cover image and HSV image

B. *Cropping of image*

Cropping is performed on the mask image (Mc ×Nc) where Mc- cropped width and Nc- cropped height. The cropped area can be either must be square in shape as we have to perform DWT on the cropped part. The cropped area should contain skin region such as face, hand and body parts etc. In this cropped area, the hiding of secret data is performed in order to provide high security. Since we are applying DWT to specific skin regions therefore it is very much difficult for the unknown user to retrieve the secret data [4][6].

C. *Discrete wavelet transform*

Application of DWT on an image will divide the image into frequency components. The low frequency component holds the original image whereas the high frequency component holds the extra information about the image. After applying DWT on the cover image(fig 4) it produces 4 non-overlapping multi-resolution sub-bands namely LL (approximation coefficient), LH (vertical details), HL (horizontal details) and HH (diagonal details)[5].These sub bands can be seen in fig 3 :

LL	HL	APPROXIMATION	HORIZONTAL DETAILS
LH	HH	VERTICAL DETAILS	DIAGONAL DETAILS

Fig 3: different sub-bands after applying DWT on cover image

LL: Horizontally low pass vertically low pass

LH: Horizontally low pass vertically high pass

HL: Horizontally high pass vertically low pass

HH: Horizontally high pass vertically high pass

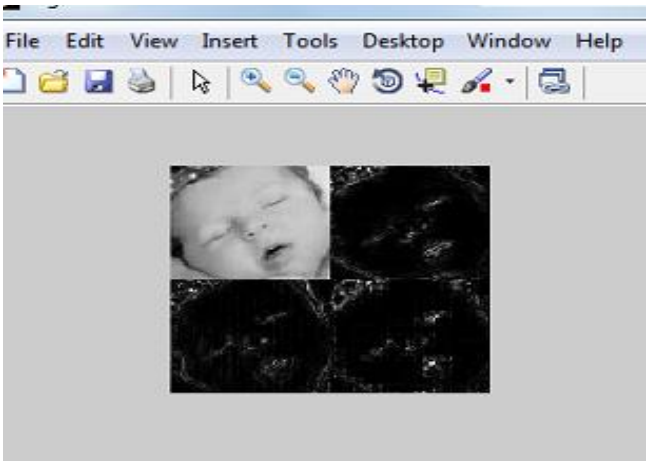

Fig 4: image after 1 step decomposition by 2D-DWT

D. *Embedding of secret data*

Here embedding of secret data is performed in skin tone regions of the cover image. Since human eyes are much more sensitive to low frequency part (LL sub-band) therefore

hiding of secret data is performed in high frequency sub-band without altering the LL sub-band[8] . While embedding secret data will not be embedded in all pixels of DWT sub-bands but only to those pixels that are skin pixels. Hence embedding is performed by taking secret data coefficients by coefficients in the selected sub-band [7]. While embedding bits of one of the sub-band are replaced with bits of secret data.

Embedding procedure:

1. Load the cover image(M×N)
2. Perform skin tone detection
3. Cropping of the image(Mc×Nc : where Mc ≤ M and Nc ≤ N and Mc=Nc hence we select square shape region)
4. Perform DWT on the cropped part
5. Loading the secret image and embedding with the cropped image.
6. Perform IDWT to combine the 4 sub-bands.
7. Merging with original image
8. Finally we have stego image(M×N)

IV. Results and Discussion

The proposed method uses the real image as the cover image and the secret image which is to be hided inside the cover image is presented with the propose scheme. This is being implemented with MATLAB 8.2.

A 8 bit color image of size 234×234 have been used as the cover image and the secret image of size 141×179 , which is used to hide inside the cover image using cropping method is shown in fig 5

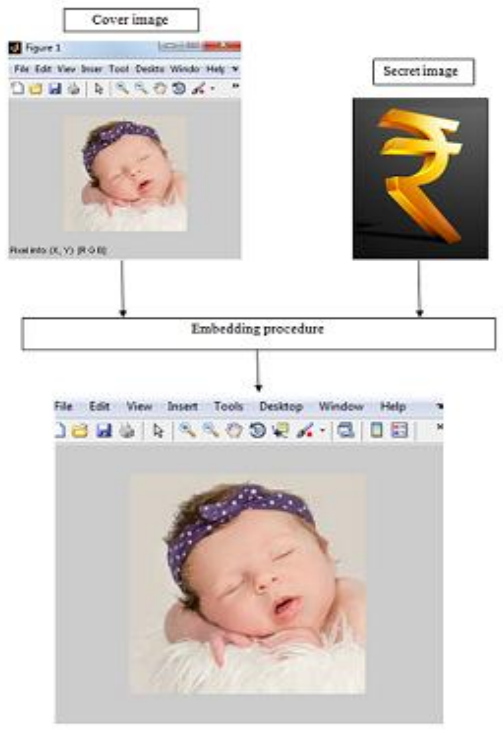

Fig 5: Experimental results of image steganography

Since in this proposed work cropping on the cover image is done by taking square area in order to perform DWT. The cropped area should contain skin region such as face, hand etc therefore data can be hided in skin tone region of cover image. The cropping is done in order to provide high security because if some legitimate user applies DWT on whole image then it is not possible to collect secret data, as we are applying DWT on specific cropped region only.

V. Conclusion

The proposed work is related with steganography technique by using skin tone regions of image. The embedding is done using discrete wavelet transform domain. This is widely used and efficient transform domain technique than Fourier transform. The DWT method is used in order to maintain secrecy. Therefore it is difficult to extract the secret data without having the knowledge of cropped region. Hence this proposed method can be termed as successful new technique of image steganography.

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