Design and Implementation of Stegnography Algorithm using Color Transformation

Anjali Dua , Sonia Sharma

Department of Computer Science and Engg., JMIT Radaur,
Yamunanagar, Haryana, India.

Abstract— In a computer, images are represented as arrays of values. These values represent the intensities of the three colors R(ed) G (reen) and B (lue), where a value for each of the three colors describes a pixel. Through varying the intensity of the RGB values, a finite set of colors spanning the full visible spectrum can be created. In an 8-bit gif image, therecan be 28 = 256 colors and in a 24-bit bitmap, there can be 224 = 16777216 colors. Large images are most desirable for steganography because they have the most space to hide data in. The best quality hidden image is normally produced using a 24-bit bitmap as a cover image. Each byte corresponding to one of the three colors and each three-byte value fully describes the color and luminance values of one pixel. The cons to large images are that they are cumbersome to both transfer and upload, while running a larger chance of drawing an "attacker's" attention due to their uncommon size. Our main focus to introduce the stegnography using color transformation.

***Index Terms* — Stegnography,Color Transformation, RGB,Data Hiding, Imperceptability.**

I. INTRODUCTION

Though the fields of steganography and cryptography are associated with one another, there is a distinction to be made. Cryptography is the art of jumbling a message so that a would-be eavesdropper cannot interpret the message. Steganography, on the other hand, is the art of hiding a message so that a would-be eavesdropper is unaware of the message's presence. While steganography has been around for centuries, the Digital Revolution has sparked a renewed interest in the field. For instance, the mass media industry has shown increasing interest in steganography to fight piracy.

STEGANOGRAPHIC PROCESS

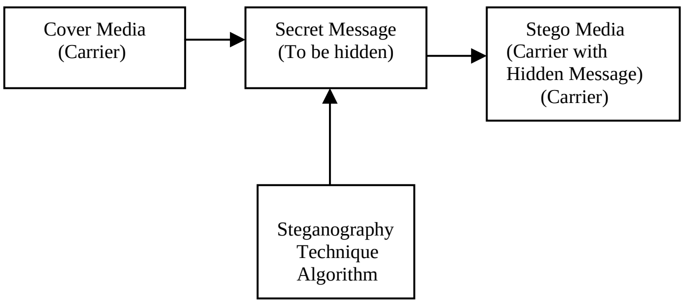


Fig. 1. Overview of steganographic system.

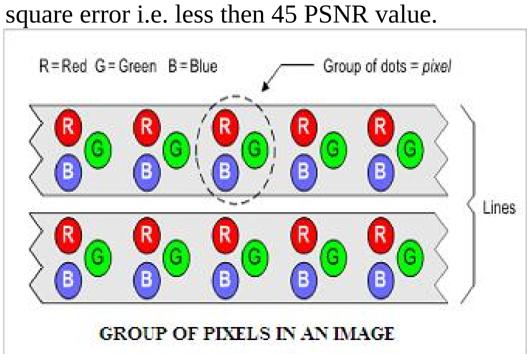
In the above figure cover media is the carrier medium - such as text ,image ,audio, video and even the network packet. The secret message is the private message that is to be hidden in the cover media.

II. WHY IMAGE AS CARRIER?

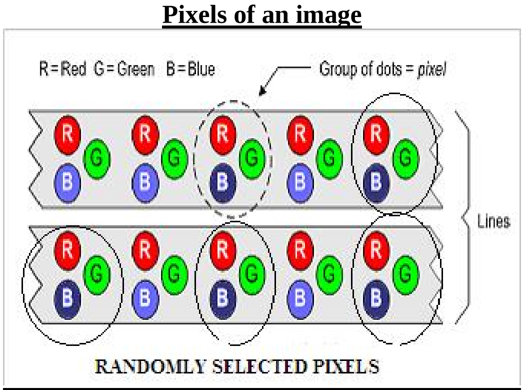
Images are a good medium for hiding the data. The more detailed an image ,the fewer constraints there are on how much data it can hide before it becomes suspect. Digital images are a preferred media for hiding information due to their high capacity and low impact on visibility.

III. COLOR TRANSFORMATION OF RGB COMPONENT

Techniques used so far focuses only on the two or four bits of a pixel in a image ,(at most five bits at the edge of an image.) which results less peak to signal noise ratio and high root mean square error i.e. less then 45 PSNR value.



Pixels of an image



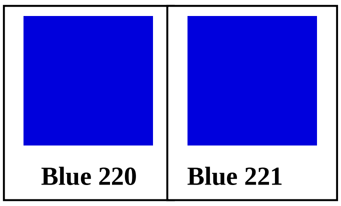
My proposed work concentrate on 8 bits of a pixel (8 bits of Red,blue Green component of a selected pixel in a 24 bit image), resulting better image quality. One can hide a message in three pixels of an image (24-bit colors). Suppose the original 3 pixels are:

(00100111 11101001 11001000) (00100111 11001000 11101001)

(11001000 00100111 11101001)

To hide the letter "A" which has a position 65 into ASCII character set and have a binary representation

01000001", by altering the first component (blue channel) bits of randomly selected pixels
(00100110 11101001 11001000) (**01000001** 11001000 11101000) (11001000 00100111 11101001)
For example; we can see the difference resulting by varying the value of first component (blue channel) of an pixel **:**



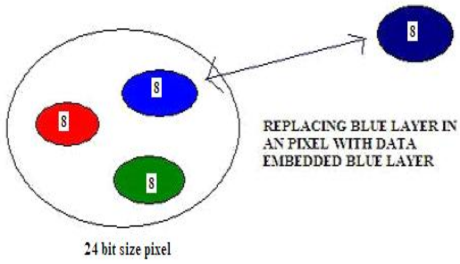
Only First component (Blue component) is selected because a research was conducted by Hecht, which reveals that the visual perception of intensely blue objects is less distinct that the perception of objects of red and green.

IV. DATA HIDING USING FIRST COMPONENT ALTERATION TECHNIQUE ALGORITHM

To insert the different matrices we have to take different perception as per the human visualization vision for the color Identification
1) Let R represents the Red Color matrix for the image :
|R1 R2 R3……..Rn| be cells for Red color matrix
2) Let B represents the Blue Color matrix for the image :
|B1 B2 B3……..Bn| be cells for Blue color matrix
3) Let G represents the Green matrix for the image
|G1 G2 G3……..Gn| be cells for Green color matrix
$R_1(0)$,$R_2(0)$,R3(0) …………………………. R_n (0) be total first channels in all pixels
$G_1(0)$,$G_2(0)$,G3(0) ………………………….G_n (0) be total Second channels in all pixels
$B_1(0)$,$B_2(0)$,B3(0) …………………………. B_n (0) be total third channels in all pixels

4) Input the characters that has to be hidden in the image .
Let ch_1,ch_2,ch_3……………………………….ch_m be total character that has to be inserted in the image :

5) Find the numeric value for the characters
Therefore total character that has to be inserted is given by:-
Dividing Characters into three format
Let V is the value
V = Chi -
for blue Chi = Chi-16; and Bi= Chi;
for Red Ri | Chi
for Green Gi | Chi Where i = 0,1,2…….n (total character to be hidden)



V. EXPERIMENTAL DESIGN

Five colour images are used as test images. These cover images are Cat (1), Dog (2), Tom (3), Girl (Fig. 1) Color can be described by its red (R), green (G) and blue (B) coordinates (the well-known RGB system), or by some its linear transformation as XYZ, CMY, YUV, IQ, among others. The CIE adopted systems CIELAB and CIELUV, in which, to a good approximation, equal changes in the coordinates result in equal changes in perception of the color. Nevertheless, sometimes it is useful to describe the colors in an image by some type of cylindrical-like coordinate system, it means by its hue, saturation and some value representing brightness. If the RGB coordinates are in the interval from 0 to 1, each color can be represented by the point in the cube in the RGB space.

Let us imagine the attitude of the cube, where the body diagonal linking ”black” vertex and ”white” vertex is vertical. Then the height of each point in the cube corresponds to the brightness of the color, the angle or azimuth corresponds to the hue and the relative distance from the vertical diagonal corresponds to the saturation of the color.

Firstly, this experiment evaluates the performance of the color of the three images in terms of the stegnography. Secondly, it investigate the PSNR, and stego image size. However, the steganographic methods used in this experiment were coded in
MATLAB(2009) 7.0.1 M-files, a series of MATLAB 7.0.1 statements that implements specialized image processing algorithms. With the help of Image Processing Toolbox 5.0.1, it is very easy to read, write, display, modify or performing many other operations on images.
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Cat

Dog

Tom

Fig2. Test images used for encoding and decoding.

In this paper, the performance refers to the stego image quality, PSNR and the stego image size. Therefore, for every steganography encoding and decoding method is apply to the cover image, we have tested test image (e.g. encoding “Cat” and Decoding “Cat”).

Secondly, this paper investigates the capability and maintain the original size of the stego image.

VI. Results And Discussion

In objective measures of image quality metrics, some statistical indices are calculated to indicate the reconstructed image quality. The image quality metrics provide some measure of closeness between two digital images by exploiting the differences in the statistical distribution of pixel values. The most commonly used error metrics used for comparing compression are Mean Square Error (MSE) and Peak Signal to Noise Ratio (PSNR) .

The PSNR block computes the peak signal-to-noise ratio, in decibels, between two images. This ratio is often used as a quality measurement between the original and a compressed image. The higher the PSNR, the better the quality of the compressed or reconstructed image.

The *Mean Square Error (MSE)* and the *Peak Signal to Noise Ratio (PSNR)* are the two error metrics used to compare image compression quality. The MSE represents the cumulative squared error between the compressed and the original image, whereas PSNR represents a measure of the peak error. The lower the value of MSE, the lower the error.

To compute the PSNR, the block first calculates the mean-squared error using the following equation:

$$MSE = \frac{\sum_{M,N} [I_1(m,n) - I_2(m,n)]^2}{M * N} \quad (1)$$

In the previous equation, M and N are the number of rows and columns in the input images, respectively. Then the block computes the PSNR using the following equation:

$$PSNR = 10\log_{10}\left(\frac{R^2}{MSE}\right) \quad (2)$$

In the previous equation, R is the maximum fluctuation in the input image data type. For example, if the input image has a double-precision floating-point data type, then R is 1. If it has an 8-bit unsigned integer data type, R is 255, etc.

Table 5.1 RESULT OF IMAGE STEGNOGRAPHY USING TRANSFROMATION METHOD USING(RGB)

Image Name	*Original Size*	*Earlier Stego Size*	*Proposed stego sige*	*Earlier PSNR*	*Proposed PSNR*
Cat	222	5625.05	221.850	59.006	68.24719
Dog	5.17	34.959	5.1756	183.64	71.13376
Tom	33.6	40.556	33.6982	496.14	63.80164

In conclusion using the stegnography algorithum using color transformation (RGB) for data hiding maintain the original size of the stego image . Moreover, it increases the PSNR of the good stego image quality.

VI. Conclusion

In this paper, we proposed a new image steganography Algorithm using Color Transformation and three component alteration technique, and the proposed scheme is a type of spatial domain technique. In order to hide secret data in a cover-image . The method is an first component alteration of three channels of pixel, altering 8 bits of first component (RGB component) to hide the data in it. To make an algorithm robust enough that it can withstand different transmission parameters e.g. compression filters, Reformat Attack, File an Original copy.

To overcome these attacks we placed the key at asymmetric counts of the pixels and hence one can-not find which pixels are used to save the key as well as the hidden text. Thus making this algorithm technique best among other available techniques in terms of data capacity, robustness, fragile.The proposed technique is compatible and can be programmed with latest user friendly languages which are in connection with the latest online, E-Commerce and shopping applications as given in the example. More over the proposed method can be extended to all types of image formats e.g. jpeg, bmp etc.

In the future work, Also this technique can be push in video stegnography for the further research.

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