Hide Secret Message in Image Transform Conformal Mapping Based Image 2DHWT

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Abstract—The objective of this paper is steganography of data in images, after transform this image in any manner. Because in present to increases of social media, and internet and web networks. Therefore, it can need data security during transmit between sender and receiver. It will be proposed system for more security consisted of many phases. The first is compression image in two dimension Haar wavelet transform 2D-HWT to reduce size of image, in next is converts image to conformal mapping, and final hide secret message in image conformal mapping. The outcomes were obtained from a set of tests PSNR, MSE, Correlation Coefficient and entropy. The suggested system has excellent and efficiency, robustness, transparency, high security, and good capacity.

1. Introduction

Nowadays, connection in mystery methods with another has forever in one of the known glitches for the outdated periods. Though ciphering and information hiding is utilized for security communicated however there are various in naturals [1]. Information hiding is mostly used on computer devices with digital information existence, the loaded and nets creation the high-velocity access canals. Diverse loaded files forms (text, image, audio/vidimus, and protocol) can be uses to execution conceal data [2].

Facciolò et al. (2014) suggested integrating picture impersonation, which is a wonderful idea that allows one to evaluate the sum of picture values in rectangular areas of the picture for four processes, regardless of the volume of the areas. It was first suggested down the name of summed region table in the computer graphics society by Crow in 1984 to efficiently change textile maps. It was popularised in the computer community by Viola and Jones in2004 with its use in their real-time topic discovery framework. In this work, it was suggested to depict the integrated picture algorithm and study its implementation in the context of block matching. It was used to test trade-offs and the limit of the implementation success with respect to exhaustive block matching [3].

In 2014, Abbas F. Tukiwala, and Sheshang D. Degadwala, suggest technicality outline via combine the form of cryptography and steganography. The cryptography used check ASCII transformed and action involve convert the mystery letter at not-printałe format of selfsame size like majory letter of all case. Steganography is then utilized multilevel 2-D DWT to embeds this cryptography data into overlay media uses High Frequency Coefficients for all space into each levels of 2-D Haar DWT and hiding its presence. finally, Runing perhaps evaluation by using statistical parameter peak signal noise ratio (PSNR) and Mean Square error (MSE). The results of this technicality outfit all three parts of information hiding like capability, high safly and powerful [4].

Maisa’a Abid Ali Khodher (2015) suggested a picture as a covering to conceal the message using a secret random key. The secret key is a 9×9 array, and random items are selected for the reverse matrix. The reverse matrix is multiplied by a one-dimensional matrix, and the outcome is in hidden pictures. This algorithm keeps the pictures secure through a transformation via a network. Such an operation is defined as a random picture transformation and is regarded as a credible means of hiding. The outcomes obtained from the proposed algorithm rely on the covering picture. A secret key is created so that it can be retrieved from the original picture after receiving it without losing any concealed data by the recipient in the network [5].
2. 2D-Wavelet transform

2-D Wavelet transform feats both the spatial and frequency correlation of datum by expansions (or reduces), and the input datum is translations mother wavelet. It props the multiresolution analysis of datum i.e. it can be applying to various scales according to the details demanded, whereas allows gradual transmission and enlarging of image without the need of extra save [6]. Other hopeful feature of wavelet transform is its corresponding nature that is both the forward and the inverse transform has the same complication, constructing high speed compress and decompress routines, as shown in Figure (1), structure of wavelet decomposition in L2 and L3[7].

![Figure (1): Structure of wavelet decomposition in L2 and L3.](image)

3. image conformal transform

Conform transform, or charting, has numerous fundamental property and using. Once properties pertinent to picture transform has kept of locally form (excepted occasionally at insulated points) [8] [12]. This model utilized a 2-D Conform transform for distort of picture. The charting product to chip, g: R^2 -> R^2, has known to expression to a difficalt analyses work G: C -> C, when G(z) = (z + 1/z) / 2.

The know g across an immediate agreement among all point [8] (x, y) in R^2 (the Euclidean level) and the pixel z = x + iy in C (the complicated level), g (x, y) = (Re(w), Im (w)) = (u, v) when $w = u + iv = G (x + iy)$.

The notes in worth of complicated changes: though can be express the qualifier to g straight at expression to x and y, this will be mysterious the implied simple to transform [9] [15].

4. steganography

Information hiding was the way of concealment and transfer datum out of clearly unhurt transporter at a stress for hide to presence of datum, the term information hiding exactly intermediate conserved or conceal scripts. Information hiding has its site in safety [10]. It is no meant to exchange cryptography but complement it. Conceal secret letter with information hiding technique decreases the scope of a letter being reveal. If the letter is also cipher thereafter it supply other layer of security [11] [12]. The information hiding is using two main algorithms embedded and extracted, is see at Figure (2) [13], [14].

![Figure (2): The general steganography system](image)

5. proposed system

This system consists of many phases, to hide secret message in image using basic of embed and extract algorithm, the flowchart of proposed system, as shown in Figure (3).
5.1. The proposed system is compressed image, in 2-D Haar wavelet transform (HWT), to reduce size of image, and compression in two levels L2 is 16 Parts and L3 is 32 parts. The implementation of image in two levels using by level threshold to reduce size of image in each level, in this example the size of original image is 1.78MB, size of image in level two is 1.37MB, and size if image in level three is 1.35MB, as shown Figure (4).

5.2. The next phase is applied the transform conformal Mapping, for image in each level in L2 and L3, as shown in Figure (5)

![Flowchart for proposed system](image-url)

**Figure (3):** The flowchart for proposed system, (a) embedded algorithm, (b) extraction algorithm

![Compression image in two levels, L2 and L3](image-url)

**Figure (4):** compression image in two levels, L2 and L3

![Transform conformal Mapping](image-url)

**Figure (5):** transform conformal Mapping
Figure (5): Applying transform conformal mapping, a) Haar wavelet transform L2, b) Transform conformal mapping L2, c) Haar wavelet transform L3, and d) Transform conformal mapping L3

5.3. The final phase is hide secret message, is 50 character in cover transform conformal mapping in L2 and L3 in to object for conformal mapping image in L2 and L3. After convert each character to 8-bits by using ASCII, the secret message became 400 bits to hide in cover. It is using secret key is sequential in object, and obtained stego-conformal mapping image in L2 and L3, as show in Figure (6).

Function XOR
Cover Image
Stego Image
Secret key
Secret message

Figure (6): The stego-conformal mapping

a. Embedding Algorithm 1

Process:
Input: Originally photo, Secure letter, Secure key.
Output: Stego- Conformal mapping HWT.
A= Loading originally photo.
B= Haar Wavelet Transform.
C= Transform conformal mapping
D= Load secret message.
E= Load secret key.
F= stego-conformal mapping HWT.

Initial:
Step 1: Load original image in A.
Step 2: Applied original image to 2D HWT in level2 and level 3 in B.
Step 3: Convert image 2D HWT in level 2 and level 3 to transform conformal mapping in L2 and L3, in conformal mapping HWT in C.
Step 4: Convert secret message from character by using ASCII to binary bit, each character is represented 8-bits and continue to complete all secret message in D.
Step 5: Load secret key is sequential to selected each location to hide on bit. In each pixel in image in E.
Step 6: Load cover conformal mapping HWT in L2 and L3, binary secret message, and secret key, to embedded secret message by function is XOR in F.
Step 7: Put the Result of stego-conformal mapping in L2 and L3 in F.

End

b. Extraction Algorithm 2

Process
Input: Stego- conformal mapping, Secure key.
Output: Secure letter.
Initial:
A= Loading stego- conformal mapping in L2 and L3.
B= Loading secure key.
C= Loading transform conformal mapping.
D= Load binary letter.
E= Loading characters of secure letter.
F= Secure letter.

Step 1: Load stego- conformal mapping in L2 and L3 in A.
Step 2: Load secure key is sequential in B
Step 3: Secret Key selected every location from stego-conformal mapping in L2 and L3 to extraction binary secret message by function OR to retrieve one bit from each location in C.
Step 4: Load all binary secret message from stego-conformal mapping in L2 and L3 in D.
Step 5: Convert binary secret message to character by using ASCII to each 8-bits binary is one character and continue to complete all binary bit in E.

Step 6: Put the outcome of extraction secure letter.

6. Test of the result

In this section, discussion the test of hide secret message in cover conformal mapping, in level two L2 and level three L3. And how difference between them. In Table 1 indicates of implementation proposed system in L2, and Table 2 indicates of implementation proposed system in L3. Table 3, and Table 4 indicates of measurements proposed system in level 2 and Level 3 respectively, through PSNR, MSE, Correlation Coefficient and entropy.

The analysis of suggested system, the measurements is difference between wavelet transform, conformal mapping, and stego-conformal mapping. The range of PSNR in HWTL2 is from 17.4926 to 17.5433, and L3 is from 17.4778 to 17.4838. The range of MSE in HWTL2 is from 50.3801 to 51.7639, and L3 is from 48.9321 to 40.5180. The range of PSNR in conformal mapping L2 is from 21.0518 to 21.0339, and L3 is from 21.0288 to 21.0213. The range of MSE in conformal mapping L2 is from 94.3336 to 97.3307, and L3 is from 93.9932 to 97.0345. The range of PSNR in conformal mapping L2 is from 21.0518 to 21.0339, and L3 is from 21.0288 to 21.0213. The range of MSE in conformal mapping L2 is from 94.3336 to 97.3307, and L3 is from 93.9932 to 97.0345. The range of stego-conformal mapping in L2 is from 21.1562 to 21.0343, and L3 is from 21.0286 to 21.0215. The range of MSE in stego-conformal mapping in L2 is from 94.3347 to 97.3417, and L3 is from 93.9936 to 97.0347. When you see this PSNR in HWTL2 and HWTL3 is increased, and MSE in HWTL2 is increased while in HWTL3 is decreased, this indicates the HWTL3 best than HWTL2. The conformal mapping PSNR the is decreased in L2 and L3, and MSE in L2 is increased while in L3 also increased. The PSNR in stego-conformal mapping in L2 and L3 is increased, and the MSE in stego-conformal mapping in L2 and L3 is decreased. This indicates system is good in hide data in image.

Table 1: Implementation system in L2.

| No. of image | Original image | HWT L2 | conformal mapping HWTL2 | Stego-conformal mapping HWTL2 |
|--------------|----------------|--------|--------------------------|-----------------------------|
| 1            | ![Image 1]      | ![Image 2] | ![Image 3]              | ![Image 4]                |
| 2            | ![Image 5]      | ![Image 6] | ![Image 7]              | ![Image 8]                |
| 3            | ![Image 9]      | ![Image 10] | ![Image 11]            | ![Image 12]               |
| 4            | ![Image 13]     | ![Image 14] | ![Image 15]            | ![Image 16]               |

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Table 2: Implementation system in L3.

| No. of image | Original image | HWT L3 | conformal mapping HWTL3 | Stego-conformal mapping HWTL3 |
|--------------|----------------|--------|-------------------------|-------------------------------|
| 1            | ![Original image 1](image1) | ![HWT L3 1](image2) | ![conformal mapping HWTL3 1](image3) | ![Stego-conformal mapping HWTL3 1](image4) |
| 2            | ![Original image 2](image5) | ![HWT L3 2](image6) | ![conformal mapping HWTL3 2](image7) | ![Stego-conformal mapping HWTL3 2](image8) |
| 3            | ![Original image 3](image9) | ![HWT L3 3](image10) | ![conformal mapping HWTL3 3](image11) | ![Stego-conformal mapping HWTL3 3](image12) |
| 4            | ![Original image 4](image13) | ![HWT L3 4](image14) | ![conformal mapping HWTL3 4](image15) | ![Stego-conformal mapping HWTL3 4](image16) |

Table 3: Indicates of measurements PSNR, MSE, Correlation Coefficient and entropy in Level 2.

| No. of image | PSNR   | MSE    | Correlation coefficient | Entropy |
|--------------|--------|--------|-------------------------|---------|
| Original image 1 |        |        |                         |         |
| HWTL2        | 17.4908 | 51.0101 | 0.8725                  | 7.6278  |
| Conformal mapping HWTL2 | 21.0518 | 94.3336 | 0.9741                  | 4.0966  |
| Stego-Conformal mapping HWTL2 | 21.1562 | 94.3347 | 0.9741                  | 4.0961  |
| Original image 2 |        |        |                         |         |
| HWTL2        | 17.8865 | 75.4681 | 0.9055                  | 7.6781  |
| Conformal mapping HWTL2 | 21.4273 | 89.7169 | 0.9636                  | 4.1679  |
| Stego-Conformal mapping HWTL2 | 21.4379 | 89.7171 | 0.9636                  | 4.1681  |
| Original image 3 |        |        |                         |         |
| HWTL2        | 17.4802 | 42.5808 | 0.8265                  | 7.2850  |
| Conformal mapping HWTL2 | 20.9846 | 87.9734 | 0.9745                  | 3.9826  |
| Stego-Conformal mapping HWTL2 | 20.9853 | 87.9740 | 0.9745                  | 3.9830  |
Table 4: Indicates of measurements PSNR, MSE, Correlation Coefficient and entropy in Level 3.

| No. of image | PSNR  | MSE   | Correlation coefficient | Entropy |
|-------------|-------|-------|-------------------------|---------|
| Original image 1 | 17.4908 | 51.0101 | 0.8725 | 7.6278 |
| HWTL3 | 17.4778 | 48.9321 | 0.8824 | 7.5849 |
| Conformal mapping | 21.0288 | 93.9932 | 0.9778 | 4.0867 |
| Stego- conformal mapping | 21.0286 | 93.9936 | 0.9778 | 4.0872 |
| Original image 2 | 17.8865 | 75.4681 | 0.9055 | 7.6781 |
| HWTL3 | 17.7991 | 72.7504 | 0.9065 | 7.7919 |
| Conformal mapping | 21.3495 | 89.0065 | 0.9646 | 4.1969 |
| Stego- conformal mapping | 21.3492 | 89.0070 | 0.9646 | 4.1974 |
| Original image 3 | 17.4802 | 42.5808 | 0.8265 | 7.2850 |
| HWTL3 | 17.4838 | 40.5180 | 0.7926 | 7.2843 |
| Conformal mapping | 20.9961 | 87.7308 | 0.9791 | 3.9630 |
| Stego- conformal mapping | 20.9964 | 87.7310 | 0.9791 | 3.9634 |
| Original image 4 | 17.5320 | 52.2577 | 0.8896 | 7.4284 |
| HWTL3 | 17.5182 | 50.1390 | 0.8831 | 7.4058 |
| Conformal mapping | 21.0213 | 97.0345 | 0.9846 | 3.9575 |
| Stego- conformal mapping | 21.0215 | 97.0347 | 0.9846 | 3.9577 |

7. Conclusion
In this paper uses two methods to transform image, first transform image to 2D Haar wavelet transform, and second transform conformal mapping. To hide secret message with secret key is sequence, for conceal in object of conformal mapping, to increase security.

It has used many measurement, and purpose to known the quality of the image and not saw by human eye, whereas secret message not a known and clear by attackers. It uses a set of measurement to test powerful of system is PSNR, MSE, Correlation coefficient and Entropy. The PSNR and MSE is decreases in wavelet L2 and L3, while increases in conformal mapping and stego image. The entropy is varying between original image and wavelet transform, whereas begin decreased in conformal mapping and stego image. The outcomes of proposed system are efficiency, robustness, high security, and transparency.

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