



Image Security using Model of Steganography and Asymmetric Cryptography Techniques

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Abstract:

Even so, we require strong and reliable security measures while transmitting data via communication channels or storing it in the cloud. We use either steganography algorithm, cryptography, or both to accomplish this. By combining the two, image security may be strengthened and made more secure. By utilising these strategies, we create a multi-level security system that makes it very difficult for unauthorized individuals to access sensitive information. The hybrid approach of image security employing asymmetric cryptography and steganography techniques is provided in this paper. The LSB approach is employed in this study for steganography, while the asymmetric RSA algorithm is used for cryptography to give digital images multi-level security.

Keywords: Asymmetric RSA Algorithm, LSB, Steganography, Cryptography, Encryption, and Decryption.

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INTRODUCTION

There are many benefits to the expansion of internet connectivity. However, privacy and security have become more challenging in recent years [1-3]. Data transfer via communication is therefore currently more open to misuse. Data hacking and channel breaches have grown to be a serious problem in our era of developing technology.

We apply picture cryptography and steganographic methods to maintain data confidentiality and privacy over the communication channel [4]. Data is encrypted in cryptography, and hidden images or texts are concealed under cover images in steganography. Many different symmetric and asymmetric encryption methods are available for encryption and decoding. The same key is used for both encryption and decryption in symmetric encryption techniques, while only one key is used in asymmetric encryption techniques.

In this research Steganography and asymmetric cryptography techniques are combined to provide a hybrid model of image security. The LSB approach is employed in this work for steganography, and the multi-level security for digital images is provided by the asymmetric RSA algorithm. LSB Steganography Technique

For data hiding In Steganography used LSB Technique in this hide image behind the image.

Algorithm for Asymmetric Cryptography, RSA

One of the most well-known asymmetric cryptographic methods is RSA, which generates the public key and private key using two prime numbers. These keys are used for encryption and decryption [11].

PROPOSED TECHNIQUE AND RESULTS

Algorithm

1. Select Cover Image, Secret Image 1 and Secret Image.
2. Hide Secret Image 2 into Secret Image 1.
3. Hide both Secret Images into Cover Image Using LSB Steganography Technique.
4. Get Stego Image.
5. Calculate MSE and PSNR Value.
6. Calculate Entropy Value before the Encryption.



7. Now Apply the Asymmetric RSA Algorithm on Stego.Images.

8. Calculate Entropy Value after the Encryption.

9. Calculate Time Duration in Seconds.

10. Get Encrypted Image

RESULTS & DISCUSSIONS

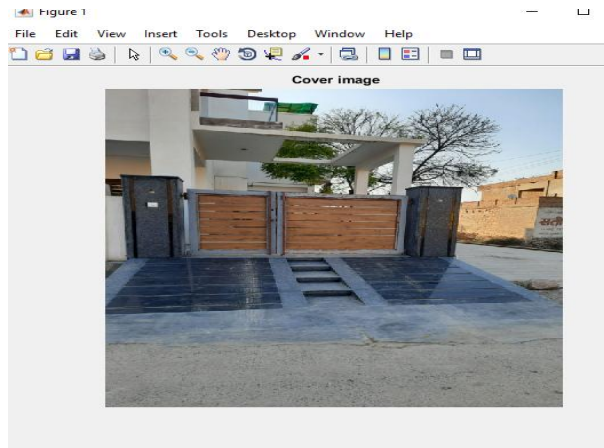


Fig. 1. Taken Cover Image

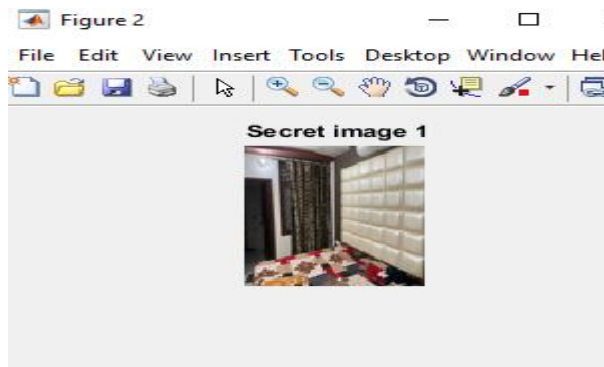


Fig. 2. Selected Secret Image 1

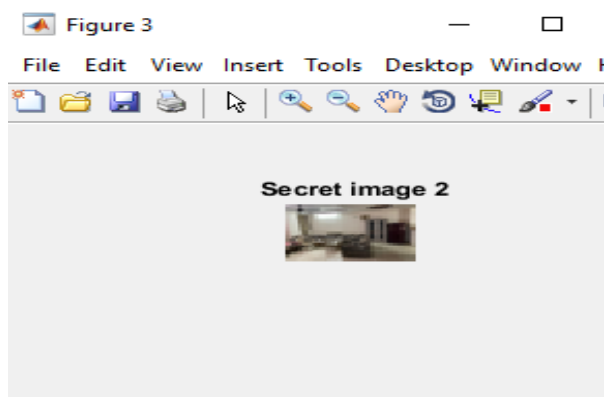


Fig.3 Selected Secret Image 2

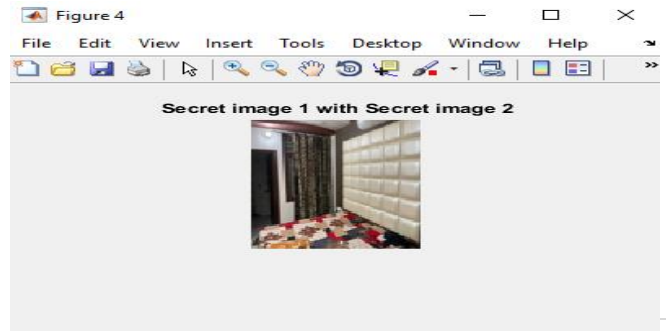


Fig.4 Secret Image 1 with Secret Image 2

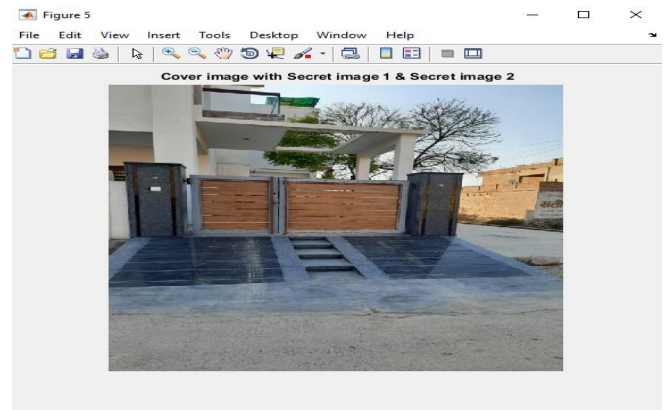


Fig.5 Cover Image with Secret Image 1 & Secret Image 2

Now apply the LSB steganography method to hide the secret image 1 into secret image 2 and the resultant image is displayed in Fig 6. Now hide this digital picture into selected cover image and got the stegopicture that is display in Fig 7. Fig 7 consist cover image with selected secret images.

After getting the stego picture calculate MSE and PSNR values that are shown obtained 0.088756 and 58.6488 respectively and display in fig 8. The Value of MSE and PSNR is observed using below given eq. 1 and 2.

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

Where, in the input image the number of row and columns are represented by the M and N respectively.

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

In the input image R is the maximum fluctuation.



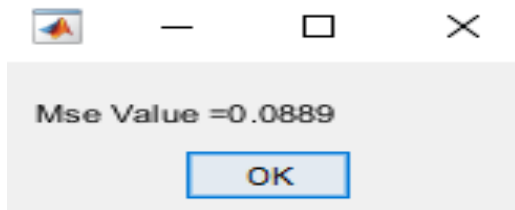


Fig.6 Calculated MSE Value

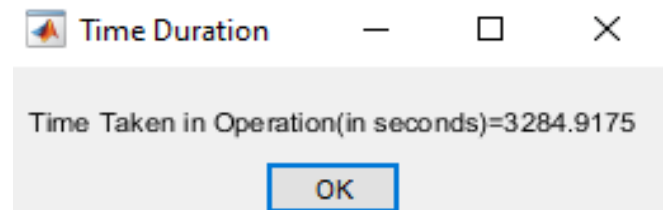


Fig.11 Total Taken Time in Operation

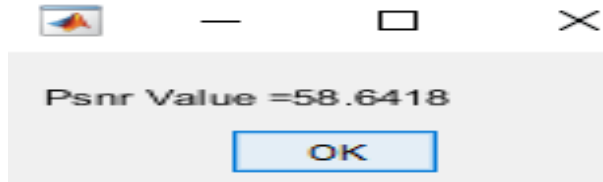


Fig.7 Calculated PSNR Value

Now to get the encrypted image apply the RSA asymmetric algorithm on stego image and the obtained encrypted image is totally differed then than all the taken digital images and shown in fig 10. The value of entropy is also calculated the before and after the encryption. Before the encryption the value of entropy is got the 7.579 and after encryption the value of entropy is got the 6.4849 shown in fig 9 and 11 respectively. The total run time of the complete process is shown in fig 12 that is obtained 3683.0579 sec.

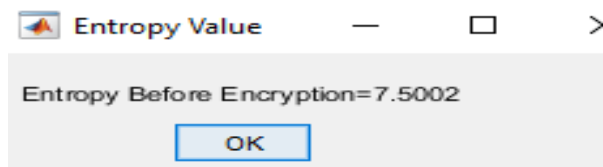


Fig.8 Value of Entropy Before the Encryption

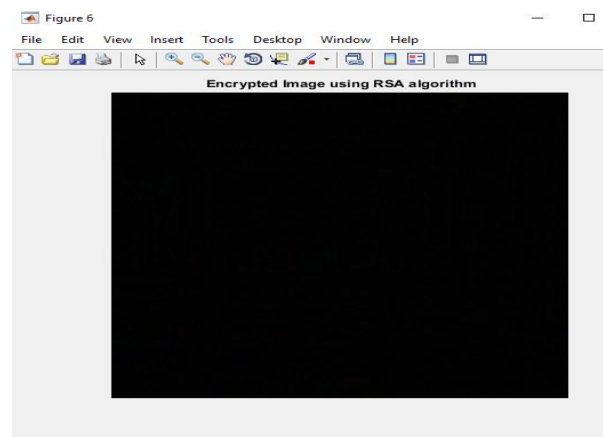


Fig.9 Encrypted Image Using Asymmetric RSA Algorithm

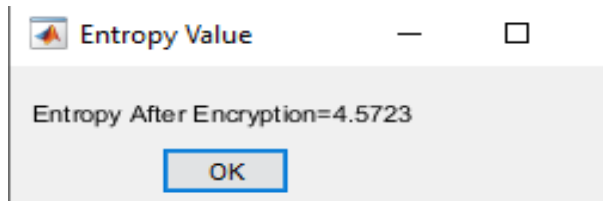


Fig.10 Value of Entropy After Encryption

At the sender end these all process done but at the receiver end reverse of this process is done to get the decrypted cover image, decoded secret image 1 and decoded secret image 2. In Fig 12, 13 and 14 displayed the decrypted cover image, decoded secret image 1 and decoded secret image 2 respectively.

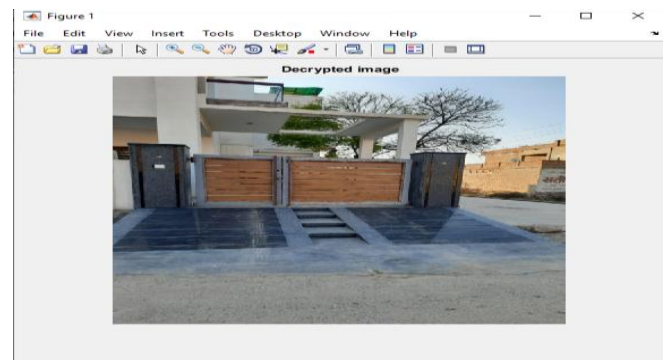


Fig.12 Decrypted Cover Image

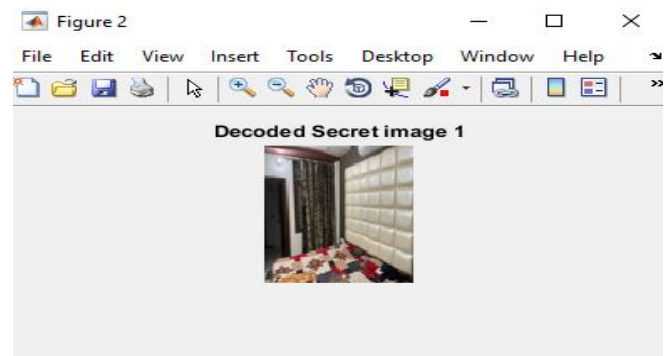


Fig.13 Decoded Secret Image 1

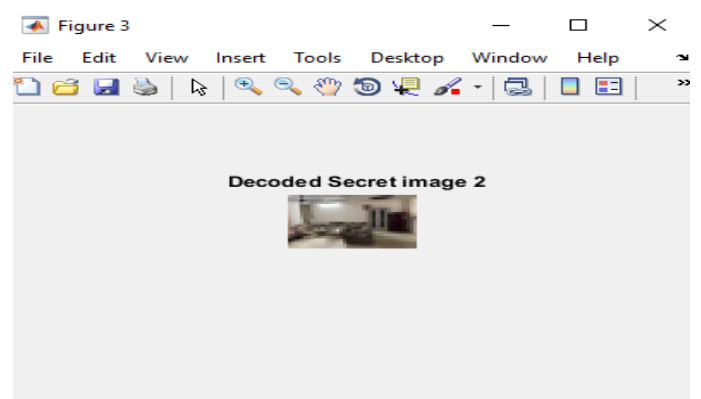


Fig.14 Decoded Secret Image 2



CONCLUSION

This work presents a hybrid approach to image security that combines steganography and asymmetric cryptography approaches. In this study, LSB steganography and the asymmetric RSA algorithm are both used for cryptography. With the suggested method, 0.088756 and 58.6488 for MSE and PSNR, respectively, were obtained. The value of MSE is low and PSNR is high for better concealment, which is what the suggested strategy achieves. Table 1 displays an examination of the planned work in terms of MSE and PSNR in comparison to earlier work. Image security is made more secure and resilient by combining the two. By combining the two methods, we create a multi-level security system that makes it very challenging for anyone not authorized to access the confidential information.

TABLE 1. MSE AND PSNR VALUE COMPARATIVE ANALYSIS PROPOSED WORK WITH PREVIOUS DONE WORK

Ref No.	Year of Publication	TechniqueUsed	Value of MSE	Value of PSNR
12	2021	LSB	0.176664	56.053304
13	2021	LSB	0.12489	57.1654
Proposed Work		LSB, RSA	0.08829	58.6418

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