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Survey about Medical Image Enhancement and Hiding

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Abstract - *In this proposed work, security is improved by Visual Secret Sharing and then combine the data to achieve secure transmission and image quality. First DWT and Cuckoo algorithm is used for processing the cover image. On the other hand, Secret image is applied to Visual Secret Sharing. The visual secret sharing image is combined with a processed cover image using the Jsteg method for data embedding and data extraction. The image quality has been evaluated by performance analysis like MSE, PSNR, and hiding capacity on different types of color images, and the results were compared. Results demonstrate that the proposed method is adaptive with minimum errors and a high SNR rate at various data hiding capacities.*

Key Words: **DWT, Cuckoo algorithm, image processing, Jsteg method, MSE, PSNR, and hiding capacity.**

1.INTRODUCTION

Security is a huge issue in the present technology. To overcome those issues in various fields day by day, so many new proposed techniques are released every day. Still, in the field of medicine, security is very much important to give privacy and security for the patient details to avoid data hacking and data surfing in the hospital database. For example, a Patient MRI scan e image report can be placed in a database to give more security for the biomedical images for the patient's betterment, confidentiality, and privacy. Hospital staff should not directly see them without permission from the patient as well as the doctor. Any intruder trying to see the report cannot see the report as it is in the form of a hidden state in another image. MRI scan image of a patient should be pre-processed and then convert into steganography technique it is in the form of two things first one is in image form another type is in the form of text form each time MRI image has been converted into text or image form. . Then, encrypt those images by using proposed cryptography algorithm and place in the database. Cryptography algorithm converts those unknown forms into another form for the purpose of security to give privacy and authentication for the patient as well as a hospital for a high quality of service. Image processing now turned into the main field amongst the most important fields of computer sciences. Computer equipment and programs developed in response to technological advancements have rearranged image-related efficiency and attracted more significant considerations on these problems. Besides, scholars have been working on how to learn from image recognition methods in everyday life. The technology of image processing has given benefits and innovations in the fields of science, manufacturing, security, and medicine. The majority of the medical images have a poor ratio of noise-to-signal than the scenes carried by a digital camera, [24][25][26] which often drives a spatial resolution that is lower frustratingly and allows the difference between the objects, which are distinct anatomically and too low to be accurately computed probably. For example, in ultrasonic images, speckle noise, which is caused by the scrambling of ultrasonic signals from tissues of the microscope inhomogeneities, can cover the vicinity of low contrast lesions and reduces the capacity of a human observer to figure out the solution of last information. A similar case is shown in nuclear medicine images. In light of these considerations, image preprocessing methods used for medical image blur and noise reduction are important. Secondly, changes to an image's meaning must be done in a highly accurate and controlled manner that would not compromise clinical decision-making. Although it is usually satisfactory to clean out locally bright noise patches, attention must be given to mammography but not to evacuate microcalcifications. However, in magnetic resonance imaging, in-homogeneity in the magnetic field produces an effect of intensity non-uniformity. This general artifact shows itself as a smooth, gradual change in an image's pixels' values. It can have a negative effect on the implementation of methods dependent on automated segmentation and strength. Thirdly, data picked up from two images obtained in the clinical track of events is often complementary. A genuine mixture of useful data obtained from the respective images may be more needed.

2. LITERATURE SURVEY

2.1 Lukáš Krasula, Miloš Klíma, Eric Rogard, Edouard Jeanblanc "**MATLAB-based Applications for Image Processing and Image Quality Assessment – Part I: Software Description.**"

Several MATLAB-based applications are useful for image processing, and image quality assessment was defined by Lukáš Krasula, Miloš Klíma, Eric Rogard, Edouard Jeanblanc. The Image Processing Application makes it easy for users to modify images. The Image Quality Adjustment Application allows users to generate a sequence of images of different quality. The Image Quality Assessment Application contains objective full-reference quality metrics that will be

used to assess image quality. The Image Quality Evaluation Applications include a basic tool for comparing the subjective quality of blurred photographs to a reference image. Results of these tests can be processed by Using the Results Processing Application. All applications Provide a Graphical User Interface (GUI) for intuitive Usage.

2.2 Zhenghao Shi, Lifeng He, "**Current Status and Future Potential of Neural Networks Used for Medical Image Processing.**"

Zhenghao Shi and Lifeng He categorizes neural networks based on their processing targets and medical images' existence. The first was what was known as on-the-job testing, allowing neural networks to be used in developing settings. The author explained When a neural network was learned to classify patterns acquired from one set with a given class, the neural network's output might be weaker and likely unacceptably bad when moved to a novel setting with a different class distribution. On-the-job training could be a valuable enhancement over current systems, allowing for a transferability approach between different medical image patterns. The author also explains using emergent novel neural network methods in medical image processing, such as artificial neural network ensembles, neural network-intelligent agent combinations, genetic algorithms with fuzzy fitness and neural networks, and so on, represents a promising alternative for improving the effectiveness of medical image processing.

2.3 Hamdan Lateef Jaheel and Zou Beiji, "**A novel approach of combining steganography algorithms.**"

Hamdan Lateef Jaheel and Zou Beiji worked on Steganography which is the act of hiding a message inside another message so that only the receiver can identify the hidden message. They combined two Steganography algorithms, namely JSteg and OutGuess algorithms. They used two algorithms to take advantage of the beneficial characteristics and features of both algorithms to improve the level of security for secret images. Their approach was the first secret image hidden inside another image using the JSteg algorithm. In this approach, already hidden messages were using two different algorithms increases the level of difficulty for third party users to detect the existence of a secret image in the first place or even successfully decode it. The value was given in this method on picking a good picture size and type further disguises the secret image and increases the probability that the image will go unnoticed. After the results were calculated, the capacity and PSNR for images proved that their approach was a good and acceptable steganography system. The model presented here was based on JPEG images.

2.4 Neha Solanki, Sanjay Kumar Malik, Sonam Chhikara, "**RONI Medical Image Watermarking using DWT and RSA.**"

Neha Solanki, Sanjay Kumar Malik, and Sonam Chhikara demonstrate how to store patient information in a medical image, such as a CT scan or an MRI image. They split the work into two major stages. The first was to determine the image's ROI and RONI. In this case, ROI was defined in terms of the medical image's information portion, while RONI was defined in terms of the non-information portion of the MRI image. It will stop the user from destroying the image's useful content. RSA was used to encrypt the watermark. The second was about to hide the image in RONI. To hide such detail, a DWT-based technique was used.

2.5 Rahul Saxena, Nirupma Tiwari, Manoj Kumar Ramaiya, "**Blind digital watermarking using AES technique for color images.**"

Since digital multimedia content such as text, image, audio, and video are commonly used and easily transmitted over the internet, copyright protection is attracting and growing attention these days. Digital Watermarking is also used for Digital Marketing and Advertising Services in addition to copyright protection. To make it more secure, Rahul Saxena, Nirupma Tiwari, Manoj Kumar Ramaiya authentic and copyright a Blind digital watermarking using AES technique for color images was proposed. This technique improves the security of transmitted secret information while still reducing image distortion. The simulations were carried out in MATLAB. After using the Advanced Encryption Standard (AES) technique and noise filters, the total PSNR was increased.

2.6 Muley Jayant Arun, Dr. S G Kejgir, "**New Robust Digital Image Watermarking using DWT, DCT, and SVD.**"

Muley Jayant Arun and Dr. S G Kejgir proposed a robust digital image watermarking algorithm based on DWT, DCT, and SVD domain coefficients. The discrete wavelet transform(DWT) was used to improve the algorithm's robustness. DCT was used to convert only the low-frequency coefficients (LL band) of DWT into a frequency domain. The watermark image was embedded in a singular diagonal matrix of SVD decomposition of LL band DCT frequency representation. Since the algorithm does not modify any pixel information in the cover image, it does not affect its quality. This was a blind watermarking algorithm. The use of a special similarity key technique improved security. The results showed that this algorithm was resistant to compression, noise, and geometric attacks. By measuring the correlation coefficient between embedded data and derived data, they were able to show their inspiration for image authentication.

2.7 S. Sivasankari, S. R. Sophiya, "**MATLAB Implementation of Invisible Watermarking using LSB and Lifting Wavelet Transform Technique.**"

Watermarking is a method of embedding hidden information, such as an image, into the cover video. Watermarking embedding is performed in the frequency domain using a

discrete wavelet transform. S. Sivasankari, S. R. Sophiya proposed a system architecture that uses a pipeline structure to improve performance. The discrete wavelet transform is used in the invisible digital watermarking transform (DWT). The image was hidden in an image of a video using the least important bit algorithm. Matlab has been used to boost total video authentication performance evaluation. This results in minimal video quality loss while increasing speed, lowering costs and power consumption, and improving PSNR and MSE resolution.

2.8 E.Sangeetha Devi, "**Enhanced Visual Secret Sharing Scheme via Halftoning Technique.**"

To achieve visual cryptography through halftoning, E.Sangeetha Devi proposed a novel technique called the visual secret sharing scheme using halftoning. The proposed method, which was based on blue-noise dithering principles, uses the void and cluster algorithm to encode a secret binary image into n halftone shares (images) carrying significant visual information. The simulation demonstrates that the visual QUALITY of the obtained halftone shares was noticeably higher than that of any other available visual cryptography method.

2.9 Suchethana H C, "**visual cryptography and its challenges.**"

Suchethana H C worked on pixel expansion and proposed a technique for using color images, which decreased the resulting image's degradation. A hidden image was captured and divided into RGB elements. Each part was treated separately. The Bit Plane Decomposition technique was used to decompose each pixel. To remove the presence of noise, ATMF and Denoising were performed. This result was then encrypted with the Chaotic Random Number Generator, and the bit planes were re-ordered and re-combined. Pixel Index Reversal was performed to increase protection by reversing the index of the pixel.

2.10 Stelvio Cimato, Roberto De Prisco, and Alfredo De Santis "**Colored visual cryptography without color darkening.**"

Stelvio Cimato, Roberto De Prisco, and Alfredo De Santis considered the case when the secret image was colored. Colored visual cryptography allows the superposition of pixels of the same color, as long as the resulting pixel has the same color since superimposing two pixels of the same color results in a darker version of that color, which is truly a new color. They proposed a model in which the reconstructed secret pixel was the same color as the original one, rather than a darker version of it.

2.11 Stelvio Cimato, Alfredo De Santis, Anna Lisa Ferrara, and Barbara Masucci, " **Ideal contrast visual cryptography schemes with reversing.**"

Stelvio Cimato, Alfredo De Santis, Anna Lisa Ferrara, and Barbara Masucci designed VCSs with reversing and perfect reconstruction of both black and white pixels. Each participant was allowed to store a certain number of transparencies, each with the same number of pixels as the original secret image, in their schemes. Their schemes guaranteed no lack of resolution since the reconstructed image was similar to the original secret image.

2.12 Roberto De Prisco and Alfredo De Santis, " **Color visual cryptography schemes for black and white secret images.**"

Roberto De Prisco and Alfredo De Santis proposed the use of colors in visual cryptography schemes for black and white images to reduce pixel expansion. Because of the extra power that comes with all of the shares being colored images, they were able to provide schemes with a smaller pixel extension (compared to the schemes that one can obtain using only black and white shares). They gave a direct construction of (2,n)-threshold schemes and construction by transforming a current (k,n)-threshold scheme for the case of a scheme with a perfect reconstruction of black pixels. They had also spoken about the contrast property and the role of colors in it.

2.13 Roberto De Prisco and Alfredo De Santis, "**On the relation of the random grid and deterministic visual cryptography.**"

Roberto De Prisco and Alfredo De Santis showed that there was a strong relationship between these two models. They showed, in particular, that every random grid scheme corresponds to a deterministic scheme and vice versa. This helped them to use the results from one model in the other. They developed many schemes and provided several upper bounds for the random grid model by using several results known in the deterministic model. They were also able to provide new schemes for the deterministic model using several results known in the random grid model.

2.14 Chih-Ming Hu and Wen-Guey "**Cheating prevention in visual cryptography.**"

Chih-Ming Hu and Wen-Guey Tzeng proposed three methods against VCS and EVCS. They studied previous cheat prevention systems and discovered that they were either insufficiently robust or even improvable. They demonstrated an enhancement to one of these cheat prevention programs. They highlighted an important principle for an effective cheat preventing VCS through their attacks. Finally, they proposed an efficient VCS transformation for cheating prevention. Their transformation has a low overhead in terms of contrast and pixel expansion. It only added two subpixels to each pixel in the image and decreased the contrast significantly.

2.15 Gwoboa Horng, Tzungher Chen And Du-Shiau Tsai "**Cheating in visual cryptography.**"

Gwoboa Horng, Tzungher Chen, and Du-Shiau Tsai have proven that cheating was possible when cheaters form when cheaters join together to trick honest participants. As a result, VC-based applications became vulnerable. They also proposed two anti-cheating schemes. Logically, one requires the principle of verification to ensure that shares have not been tampered. The other one uses 2-out-of-(n+l) VC rather than 2-out-of-n VC. The results of the experiments showed that the proposed schemes were well protected against cheating.

2.16 Kai-Hui Lee and Pei-Ling Chiu. "**An extended visual cryptography algorithm for general access structures.**"

Conventional visual secret sharing schemes generate noise-like random pixels on shares to hide secret images. This scheme has a management problem. It was an extended visual cryptography scheme(EVCS). Approaches involving the EVCS for general access structures, on the other hand, it suffers from a pixel expansion problem. For various schemes, the visual cryptography (VC)-based approach requires a sophisticated codebook design. Kai-Hui Lee and Pei-Ling Chiu proposed a general solution to the problems described above. The method can be used in non-computer-aided decryption environments for binary secret images. It consists of two phases. In the first step, they built meaningless shares based on a given access structure using an optimization technique and the construction of conventional VC schemes. In the second step, a stamping algorithm directly added cover images to each share. Their experimental results showed that they had solved the EVCS pixel expansion problem for GASs. Lastly, the recovered image's display output was very similar to that achieved using conventional VC schemes.

2.17 P. Tuyls, H. D. L. Hollmann, J. H. Van Lint, And L. Tolhuizen "**XOR-based visual cryptography schemes.**"

Threshold Visual Secret Sharing schemes associated with XOR-based VC systems were explored By P. Tuyls, H. D. L. Hollmann, J. H. Van Lint, And L. Tolhuizen. They first showed that there were n out of n schemes with optimum resolution and comparison, and that (2,n) schemes were similar to binary codes. These schemes turned out to have much greater resolution than their OR-based counterparts. Secondly, they provided two explicit constructions for general k out of n schemes. Finally, they defined bounds on the contrast and resolution of XOR-based schemes. These bounds imply that the comparison for kn was purely less than one. The bounds imply that the XOR-based k out of n schemes for even k differed fundamentally from those for odd k.

2.18 Tjokorda Agung B. W, Adiwijaya, and Fri Puguh Permana, "**Medical Image Watermarking with Tamper Detection and Recovery Using Reversible Watermarking with LSB Modification and Run Length Encoding (RLE) Compression.**"

Tjokorda Agung B. W, Adiwijaya, and Fri Puguh Permana examined and tested a watermarking system based on LSB Modification to detect and recover tampering in the ROI. RLE was used to insert the original LSBs in the RONI to improve embedding capacity, making this watermarking scheme reversible. Their experimental results showed that this watermarking system can detect and localize tamper with up to 100% accuracy and perform image recovery with up to 100% recovery rate until 20% of the tempered region in ROI.

2.19 Chunhua Dong, Jingbing Li, Mengxing Huang, and Yong Bai, "**The Watermarking Medical Image Algorithm with Encryption by DCT and Logistic.**"

When medical images are transmitted and stored in a hospital, strict protection, confidentiality, and integrity are required. The transmission of wireless and wired networks has been tampered with, hacked, and so on, and the ROI of medical was unable to tolerate significant changes. To fix these issues, Chunhua Dong, Jingbing Li, Mengxing Huang, and Yong Bai proposed an algorithm based on digital watering technology to improve medical images' security. As the feature vector of images, this scheme used a part of the sign sequence of DCT coefficients. It can avoid the complex process of finding the region of the internet (ROI) of medical images. At the same time, the logistic map encrypted the watermarking image to increase its confidentiality. Their results revealed that the scheme is highly resistant to common attacks on existing medical watermarking methods. It can embed much more data with less difficulty and embed any watermarks.

2.20 Jingbing Li and Yaoli Liu "**The Medical Image Watermarking Algorithm Using DWT-DCT and Logistic.**"

Jingbing Li and Yaoli Liu proposed a strong watermarking algorithm for medical image authentication and security. DWT-DCT was used in the scheme to achieve the visual function vectors of the medical image. Logistic Map encrypted the watermarking image to increase its security. They made the watermarked image resistant to common and geometric attacks by combining the zero-watermarking concept. The proposed algorithm had strong invisibility and robustness, according to simulation results.

2.21 G. Prabakaran, Rajeswari P Sand R. Bhavani, "**Multi Secure and Robustness for Medical Image Based Steganography Scheme.**"

Rajeswari P. G. Prabakaran, G. Prabakaran Sand R. Bhavani proposed a viable steganography technique based on Integer Wavelet Transform (IWT) to secure the MRI medical image into a single container image. The container image was captured, the flip left was added, and the dummy container

image was collected. The patient's medical diagnosis image was used as the secret image, and the Arnold transform was used to create a scrambled secret image. The scrambled secret image was inserted in the dummy container image in the first case, and Inverse IWT was used to extract a dummy secret image. In the second case, the container image was captured and merged with the dummy secret image to create the stego image. The visual quality of the restored medical image was satisfactory. When compared to the current algorithms, the consistency parameters improved with suitable PSNR.

2.22 Nisar Ahmed Memon, S.A.M. Gilani, Shams Qayoom, "**Multiple Watermarking of Medical Images for Content Authentication and Recovery.**"

When transferring medical image data from one hospital to another strict protection, confidentiality, and honesty are necessary. This can be done by introducing protocols to ensure image quality and protecting patient data from unauthorized users. As a result, Nisar Ahmed Memon, S.A.M. Gilani, and Shams Qayoom proposed multiple watermarking methods. This scheme embeds a strong watermark in the region of non-interest (RONI) for security and confidentiality. While integrity was maintained by adding a fragile watermark in the region of interest(ROI). They claimed that the ROI in the medical picture is vital for diagnosis and must be maintained. To prevent the distortion created by the watermark insertion phase in the ROI, the initial ROI data was first removed and embedded outside the ROI. They measured image quality after watermarking using the weighted-peak-signal-to-noise ratio (WPSNR).

2.23 Siau-Chuin Liew and Jasni Mohamad Zain, "**Reversible Medical Image Watermarking For Tamper Detection and Recovery.**"

Siau-Chuin Liew and Jasni Mohamad Zain proposed a reversible tamper detection and recovery watermarking scheme for medical images. The watermarking scheme used a 640x480x8 bits ultrasound grayscale image as a sample. A reversible watermarking scheme was needed to restore the original pixel values. The ROI (Region Of Interest) and RONI (Region Of Non-Interest) concepts have been used. The embedded watermark can be used to detect tampering and recover the image. The watermark was also be reversed.

3. PROPOSED SYSTEM

Half-Toning based VSS (Visual Secret Sharing) using DWT, Cuckoo Search, and Jsteg. Get any format of image/frame (Input Cover Image) from the selected directory or current working directory. First get the secret image from a directory. Then read the secret image, if not read the image didn't go to other steps. After reading the input image, it may be converted into a greyscale form. Then apply the VSS by the Halftoning process and we get the Combined Share image (share1&2). From stages 1 &2 outputs are combined by the embedding (JSteg) method, to get the embedded image.After the data embedding, the embedded image is kept for encoding. This encoding is used for data transmission. Then applies to the de-embedding scheme to get the recovered image and message image separately. After that, decrypt the message image, to get the exact message image. The main advantage of encryption through a compression process is that it reduces an image's size without losing the information provided that lossless compression. However, lossy compression can be used where a slight distortion is acceptable. The unintended user who may try to overhear this conversation can either tamper with this information to change its original meaning or it can try to listen to the message with the intension to decode it to use his/her advantage.

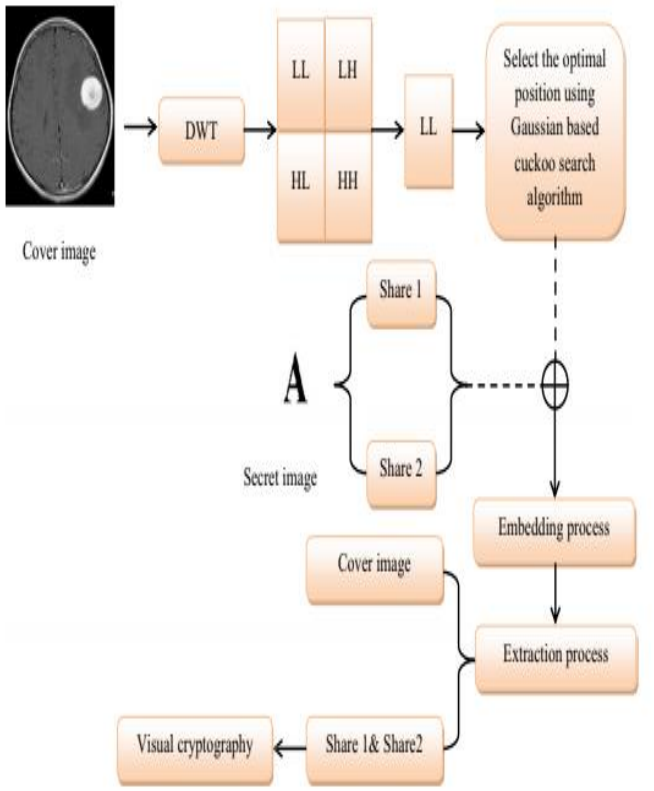

Fig-1: Proposed system

4. CONCLUSIONS

A novel visual secret sharing by using Cuckoo search & Jsteg method for medical images. Our method is implemented using MATLAB. The proposed method's effectiveness is measured using various evaluation metrics such as PSNR, Normalized correlation, and MSE value. Based on these metrics, our proposed method is evaluated ant the results were also compared with other existing methods. This work

is limited to the brain tumor images. It can also be explored to various other biomedical image processing applications, such as lung cancer images.

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