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Secured And Robust Medical Image Watermarking

Chandrakant Pandharinath Pawar, Dr. Baisa L. Gunjal

PG Student, Dept. of Computer Engineering, Amrutvahini Collage of Engineering, Sangamner, Maharashtra, India

Head, Department of Information Technology, Amrutvahini Collage of Engineering, Sangamner, Maharashtra, India

ABSTRACT: This is need of telemedicine domain to transmit medical images of patient from one hospital to other for analysis. For transfer images mostly physician are uses Internet. As all of us knows internet is commonly used but it's not much secure to transfer such confidential information like medical images. But physician doesn't have simpler way than internet for transfer medical images between hospitals which are located at different geographical locations. While transfer medical image physician can use techniques of watermarking for providing security to confidential information like hospital logo or patient information. So provide security to image while transfer over network is simplest solution. ROI also known as Region of interest is way to provide clarity to actual sensitive area of medical image and information which we want to transfer with medical image is combined with medical image as a watermark in his way we able to provide security to watermark information.

I. INTRODUCTION

Digital Watermarking is method of hide information in digital media like audio, video or images. And information may be may be in any digital format such as image, audio or video and information we want to hide inside digital media is called as Watermark. There are two main types of Digital watermarking known as Visible watermarking and Invisible watermarking. In Visible type of watermarking watermarked which we embed is visible in Digital media. Mainly used in copyright protection and in Invisible watermarking embedded watermark is hidden inside digital media commonly used in telemedicine domain.

Due to popularity, availability and as a fastest communication medium mostly everyone use internet for communication, because of that Digital watermarking is having great demand and very vast topic for research because everyone sharing files images etc. over the internet and having queries regarding copyrights as well as security to data. But digital watermarking provide solution for the same.

Medical Image Watermarking

A. Digital watermarking in Telemedicine domain.

In telemedicine domain, the different types of medical information and images shared with different physician which are located for getting the opinion regarding the decease in that case security of medical image and watermark plays an important role which is fulfill by digital watermarking.

B. Need of ROI And RONI Separation

Issue with Digital watermarking is when we embed watermark inside Digital signal the quality of digital signal is slightly degrades. For other domain it's acceptable. But in Medical image watermarking if the quality cover image i.e medical image is degrades after embedding watermark then it's difficult to physician for analysis due to bad quality medical image. For this issue ROI (Region of interest) i.e actual sensitive area from which physician can analyze the disease is separate from medical image. And watermark is embedded into RONI (Region of Non interest) i.e Area rather than ROI.

It helps us for fulfillment of our main issue i.e quality degrades. As we can able to embed watermark into RONI region it only affect the quality of RONI and we combine ROI into watermarked medical image so the quality of ROI remain as it is.

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II. LITERATURE SURVEY

Wakatani algorithm [1] proposed the distortion of the ROI is avoided in this technique by embedding signature information into other area than the ROI. Signature image compressed by a progressive coding algorithm is used as the signature information. The most significant information of the signature information is embedded in the nearest area to the ROI. Authors claimed that the method can detect the signature image with moderate quality from a clipped image including the ROI. The signature image with moderate quality can be acquired from a clipped image including only part of the ROI. Wavelet transform is used.

Hyung et al algorithm [2] define to avoid illegal forgery, ROI information is embedded in the no-ROI region. This technique is implemented in wavelet transform for high robustness. Initially, the medical image is separated into two parts, ROI and non-ROI. Then the ROI image is embedded into the non-ROI part. ROI image is transformed into three level DWT and the wavelet coefficients in third level approximation coefficients are represented to 8bit plane. Then each of bit-plane information is matched to the size of non-ROI region and it is used as the watermark in the non-ROI using the embedding equation.

Giakoumaki et al algorithm [3] simultaneous embedding of three types of watermarks is proposed by giakoumaki et al. A robust watermark containing doctor's identification code to achieve confidentiality and authentication, a caption watermark conveying patient's information and a fragile watermark for tamper detection. The method is implemented in wavelet transform domain. Watermarks are embedded in selected detail coefficients based on a key.

Hiral et al algorithm[4] proposed the method provides exact authentication to medical image through reversible or erasable watermark. This method provides exact recovery of the original image at recipient end after the removal of watermark from the image. The technique discussed is based on correlation watermarking. The merits of this method are very good perceptual transparency for watermarked image, recovery of the original cover image, and high value of PSNR. The digital signature is computed using all information in image and then embeds signature in an erasable manner within the image. This signature is unique for each image. At the receiving side the recipient computes a one way Hash and compare it with a Hash decoded from the signature. If the two hashes are identical received image is considered authentic.

Wang and Rao algorithm [5] proposed the fragile watermarking algorithm suitable for real-time diagnosis based on least significant bit (LSB), hash function and chaotic sequence. To resist counterfeiting attack, the watermark signal is extracted from the original image. The watermark signal is then processed by exclusive-OR (XOR) operation with the chaotic sequence in order to increase the security of the watermarking algorithm. Further it is embedded in the LSB of the host image. The experimental results showed that the watermark is imperceptible and robust.

III. EMBEDDING AND EXTRACTION PROCESS

A. Embedding Algorithm

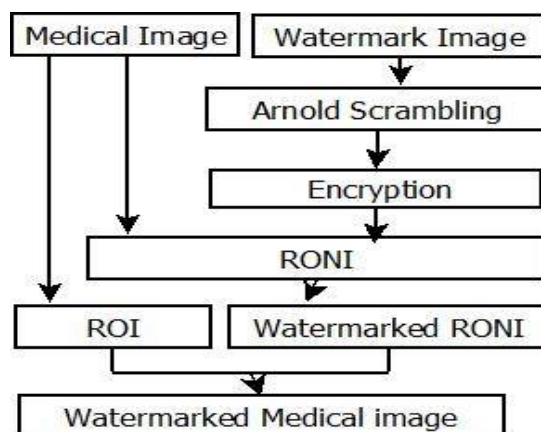


Figure 1 : Proposed System embedding process

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- Input - Medical image and Watermark Image.
- Output –Watermarked Medical image.
 1. Separate ROI and RONI from Medical image.
 2. Scramble watermark image by Arnold scrambling.
 3. Encrypt that scrambled watermark Image.
 4. Embed inside RONI of medical image it gives Watermarked RONI image.
 5. Combine separated ROI into watermarked RONI image. It gives output as watermarked medical image.

B. Extraction Algorithm

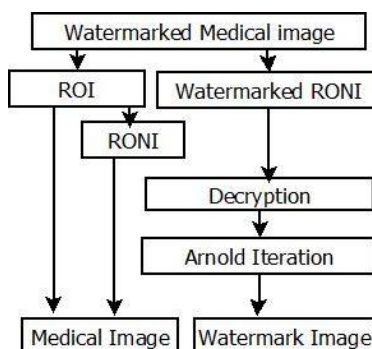


Figure 2 : Proposed System extraction process

- Input – Watermarked Medical Image.
- Output –Medical image and watermark Image.
 1. Separate ROI and Watermarked RONI from Watermarked Medical image.
 2. Separate RONI and Encrypted Watermark from Watermark RONI.
 3. Combine RONI and ROI which gives us First output as a Medical image.
 4. Decrypt Watermark image it gives Scrambled watermark image.
 5. Perform Arnold iteration it gives us our second output as watermark image.

IV. SECURITY TO WATERMARK

Security to confidential information such as hospital information or patient information over network is one of the vast area for research. As per our algorithm Arnold scrambling is watermark is scrambled and encrypted that scrambled watermark.

Arnold scramble algorithm used for scramble the image. It first divides images into different images according to their decimal value. And then scramble that image.

Again encrypt that Scrambled image For Provided security to Watermark. Combination of scrambling and encryption of scrambled watermark image provide more security. As attacker can get actual watermark by using trial and error method combination of Arnold scrambling and encryption technique provide security to watermark over network.

V. RESULTS

A. Result metric

The evaluate the performance of the watermarking algorithm done in terms of Peak signal to noise ratio (PSNR).Here is the robustness for above algorithm against different rotation attack. And it gives better result against Different rotation

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attacks and it proves that above algorithm is robust against different attacks like rotation and noise attack. But when we test against crop attack it destroys the watermark.

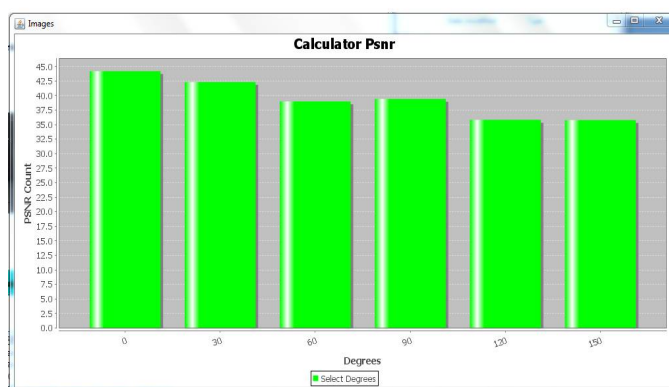


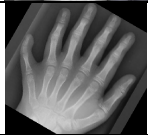











Figure 3 : PSNR Ratio

Table 1 : PSNR with different rotation attack

Sr. No	Rotation Angle	Watermarked Medical Image	Extracted Watermark	PSNR
1.	0			44.10
2.	30			42.33
3.	60			38.99
4.	90			39.44
5.	120			35.81
6.	150			35.37

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VI. CONCLUSION

The proposed system provides the approach of security of medical images in network environment. Basically it is a need of healthcare industry to transmit medical images from one user to another using different communicate channels. Improvement in information and communication technologies made it possible to handle such applications through mobile phones. But security is essential factor. This is the strongly robust 'Digital Image Watermarking' with increased security levels and producing exact recovery of original watermark for standard image database, giving correlation factor equals to 1 and different PSNR rates. The overall system provide the results on satisfactory level. To increased robustness with all type of images that will be a future work for this system.

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