Security of Telemedicine Platforms for Remote Health Consultation

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The goal of this research project was to create a more secure and robust image watermarking system that provides the best possible trade-off between robustness, imperceptibility, capacity, and security at a reasonable cost. The research was driven by medical information security concerns in the field of electronic health care. In this study, we have created a wavelet-based medical picture watermarking system that is more reliable, secure, and robust. Additionally, a variety of algorithms are used to test the suggested technique on an encoded text watermark. A thorough evaluation of our approach has been conducted using various conventional image processing attacks, six medical and four general images, and the selected gain value. The investigation revealed that the suggested algorithm performed better than the previous method.

Keywords: Telemedicine, e-health care, security.

1. Introduction

The adoption of the e-healthcare paradigm has gained popularity recently across different research communities on a global scale [1]. Through the use of contemporary information and communication technology, the e-healthcare solution sends pertinent patient data to a distant healthcare facility and the right medical specialists [3]. Sensitive information access and transfer across unprotected channels, however, is dangerous and presents serious security risks [2]. Standard authorities state that safeguarding patient medical information security from unauthorised users or access is crucial [14]. Furthermore, studies have shown that identity theft related to medicine is an increasingly serious crime [4]. Three distinct methods exist for safeguarding medical data: watermarking, steganography, and cryptography [6]. Watermarking is the most widely used and has the most potential of all strategies [5]. The current situation is one in which telemedicine services are widely used and widely recognised worldwide [8]. Modern technical developments are necessary for the health business to continue expanding and to meet the needs of those who work in it.

The rest of the paper is organized as follows: Section 2 provides the classification scheme for the survey; Section 3 provides an overview of proposed architecture. Section 4 provides a

summary and comparison of the results of the various papers discussed in this taxonomy. Finally, Section 5 concludes the paper.

2. Related Works

For use in medical applications, numerous researchers have created watermarking techniques based on encryption [15]. Few research, meanwhile, have been done on dual watermarking with encryption [7]. The objective of standard watermarking techniques is to use a single watermark to enable the secure exchange of confidential information via open channels [9]. The usage of numerous watermarks is taken into consideration when the focus is expanded to include copyright protection and integrity verification at the same time. many watermarking combines the use of many implanted watermarks to accomplish multiple objectives at once. Dual watermarking can be done in three different methods generally. The watermarks in the first approach are implanted sequentially or simultaneously. The watermarks in the second scheme are continuously inserted back-to-back. The third technique entails simultaneously inserting the two watermarks instead of sequentially [16]. A fragile watermark is used in a blind watermarking approach described by the author in [10]. The ROI and EPR information is hashed, compressed, and inserted into the cover picture to create the watermark data. The findings suggest that the reported method can be used to tele-care settings [12]. The author created the wavelet domain embedding of several watermarks in [11]. Before the embedding procedure, the EPR data is encrypted using a straightforward encryption algorithm. The method's experimental demonstration on a variety of images demonstrated that it provides superior outcomes than previous approaches in terms of NC and BER [17].

3. Methodologies

A significant amount of medical data is transmitted by information and communications technology (ICT) in tele-health services in order to facilitate consultation, examination, and occasionally distant diagnosis. However, a high level of security and privacy is necessary for the transfer of such medical data or records in an open environment. Owing to the significant security and privacy concerns associated with medical applications, we urgently require a viable solution to safeguard sensitive patient data. It's also intriguing to note that thefts with a medical theme are becoming more common and serious crimes. Two common techniques for ensuring the security of data connected to medicine are encryption and watermarking [13].

Different types of medical pictures and patient reports are sent between healthcare facilities or medical experts via tele-health services. The tremendous advancement of ICT tools has made it simple to transfer this data via a network. At first, the channel can be noisy, and any skilled hacker could change, remove, or modify the data that is transmitted. As a result, these instruments are untrustworthy for communicating information. In the medical field, watermarking is used to protect patient-related data. Medical image watermarking aims to meet the fundamental security needs in addition to offering security. The three most important security criteria are availability, confidentiality, and reliability. Reliability determines how reliable and correct the information is. Confidentiality, which prevents information from being disclosed to unauthorised parties, determines the privacy or secrecy of shared information.

Availability determines whether information is available continuously and promptly.

- Proposed procedure

The primary goal is to suggest a strong and secure watermarking while maintaining an acceptable level of marked image quality. DWT is used by the method to break down the cover image during the embedding phase. With SVD, the chosen DWT component is changed. Each equal portion of the less durable watermark (image form) is inserted into one of the two distinct segments of the SVD cover picture. On the other hand, a stronger watermark is included within the second level DWT cover image and encoded using the Hamming method. Lastly, the designated image is encrypted using a cryptographic process guided by chaos theory before being sent over the network. The designated image's encryption procedure strengthens the applicability of our method.

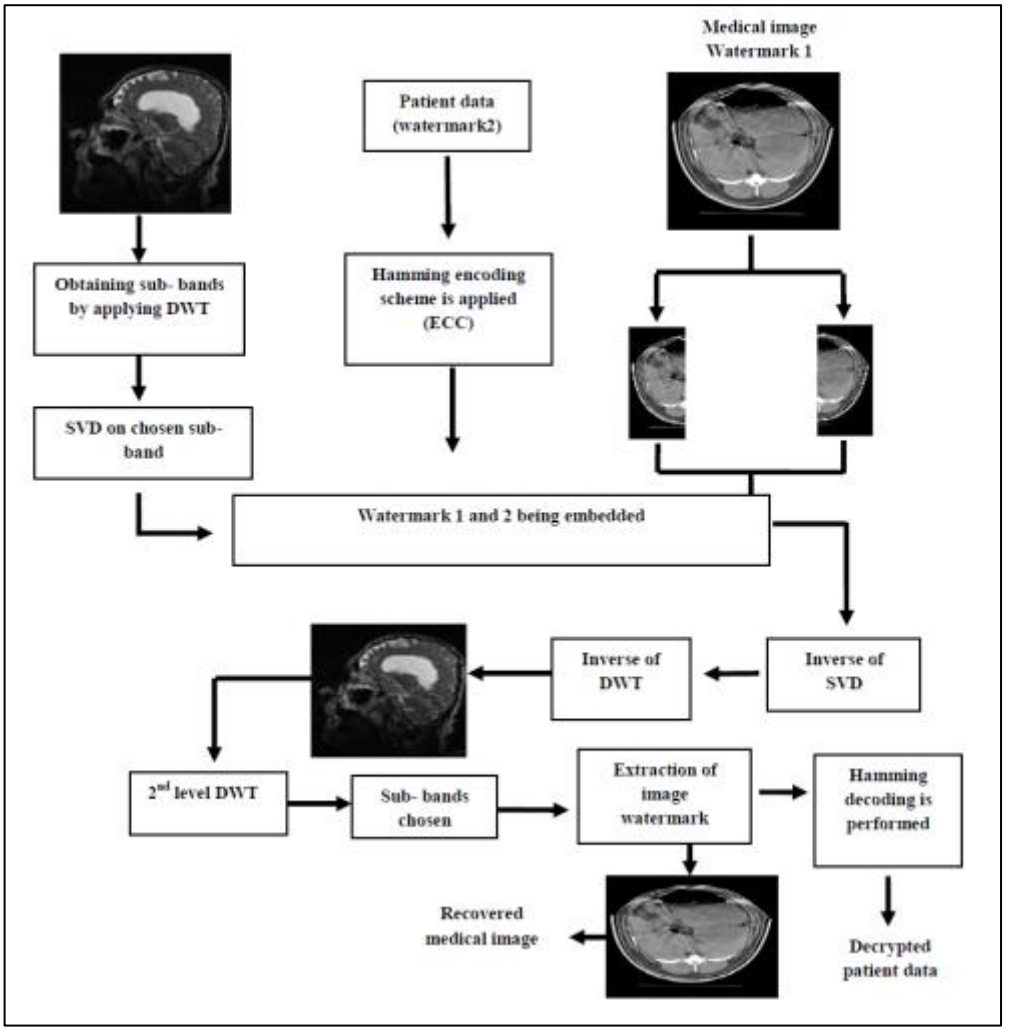
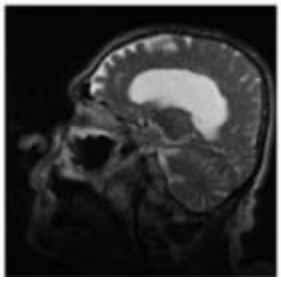


Figure 1: Framework of Proposed Method

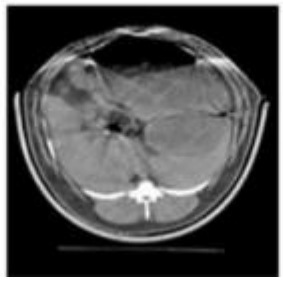
4. Results and Discussion

The results of the combined DWT-SVD-ECC with chaotic encryption are shown in this section. The performance of the DWT-SVD-ECC with the rotation-13 algorithm is then covered in a different subsection. A cover image measuring 512 × 512, a hidden image measuring 256 × 256, and a 12-character text watermark are used in the experimental verification. A thorough evaluation of our approach has been conducted using various standard image processing attacks, six medical and four non-medical images, and a specified gain value. Additionally, we have compared our Caesar cypher and chaotic encryption algorithms with the suggested method, respectively.

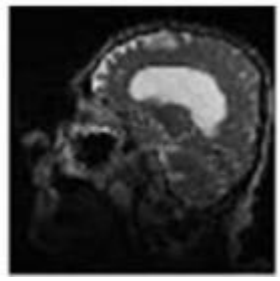
The 12-character watermark only is encrypted using a simple substitution cypher in the second technique. This version of our method does not encrypt the watermarked image. The text watermark was first encrypted using a hamming error-correcting code, and then it was encrypted again using rotation -13 methods. Using a straightforward encryption approach over the text information decreased the overall processing time of our methodology, as the watermarked image in the second method is not encrypted. The encryption algorithm employed to increase security is the primary distinction between the first and the second approach. The first approach encrypts the watermarked image using chaotic encryption based on a two-dimensional logistic map. However, a straightforward replacement encryption mechanism is employed in the second approach. This method is used over the EPR watermark and functions by substituting the thirteenth letter of each related alphabet for each alphabet in the text watermark. Because it is applied over the text watermark, the complete process took less time.



(a)



(b)



(c)

ALICE

(d)

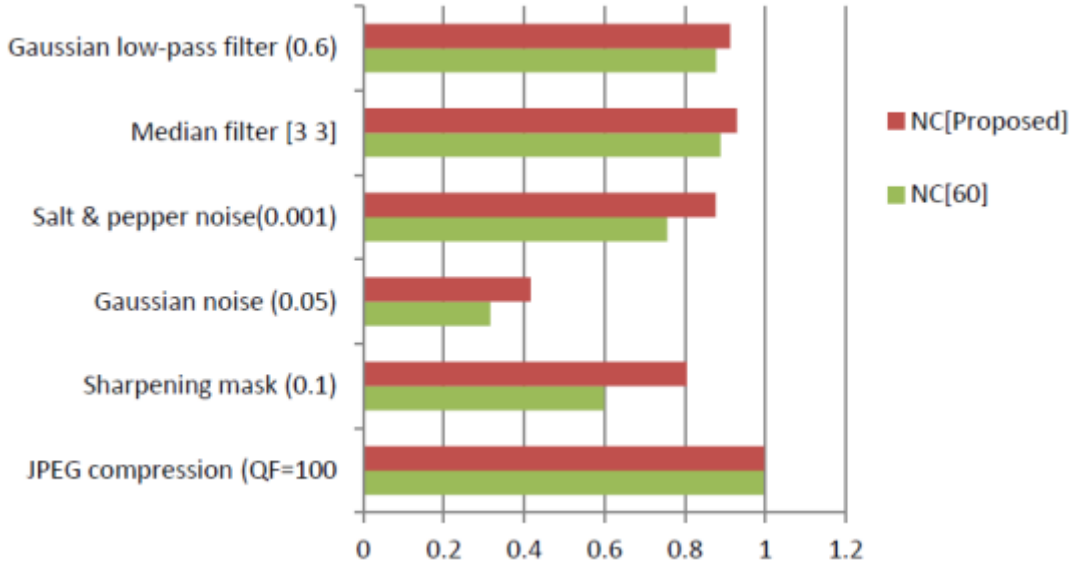
Figure 2: (a) cover object, (b) watermark image, (c) watermarked image and (d) patient name

Table 1 illustrates the measure NC and BER, which we use to estimate the robustness of our method. Table 1 makes it evident that, with the exception of rotating attacks, the values obtained for NC are larger than 0.80 and the BER value is 0.

Table 2: Robustness analysis results

Types	NC	BER
Salt and pepper noise	0.97	0
Gaussian noise	0.98	0
Rotation	0.91	0

Comparative evaluation of our method to related method is depicted in figure 3. From this table it is clearly observed that the NC and BER performance is better when compared with the method.



An enhanced DWT-SVD based watermarking using hamming code and chaotic encryption is created because of the critical relevance of dual watermarking in conjunction with encryption and error correction code in the medical area. The results demonstrate the robustness, security, and imperceptivity of the suggested approach. The robustness comparisons further demonstrated our technique's superiority over other methods for a range of attacks.

5. Conclusions

The goal of this research project was to create a more secure and robust image watermarking system that provides the best possible trade-off between robustness, imperceptibility, capacity, and security at a reasonable cost. The research was driven by medical information security concerns in the field of electronic health care. In this study, we have created a wavelet-based medical picture watermarking system that is more reliable, secure, and robust. Additionally, a variety of algorithms are used to test the suggested technique on an encoded text watermark. A thorough evaluation of our approach has been conducted using various conventional image processing attacks, six medical and four general images, and the selected gain value. We found that the suggested methodology performed better than the previous method. As a result, our techniques are appropriate for use in the medical field and yield valuable results in preventing identity theft related to medical issues. We aim to: 1) create more secure algorithms for

medical and other new applications; 2) create effective watermarking techniques using current technologies; and 3) evaluate our approaches for other multimedia applications in the future.

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