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RESEARCH ARTICLE

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WATERMARKING ENHANCE THE ABILITY OF MEDICAL IMAGES

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ABSTRACT

Healthcare world very progressively lead digital system. Every type of information exchanges through internet with the help of digital system. Data embedding with medical images will have applications such as compact storage, efficient transmission and confidentiality of the patient records. Medical images are highly sensitive hence secured transmission and reception of data is needed with minimal distortions. These medical images will be in large size and it is stored in PACS.As these images are in large size so it occupies more space in database and it requires more bandwidth over internet. Because of this problem, compression of medical image is required and with the help of watermark we can solve the problem of compression.

Keywords—Watermark; Compression; Least Significant Bit, Steganography, Image, Bits, Pixel.

INTRODUCTION

Medical images are highly sensitive hence secured transmission and reception of data is needed with minimal distortion .Medical image security plays an important role in the field of healthcare line. Healthcare line is legally regulated by laws and constraints regarding the access of data contained in Personal medical files. The transmit of medical transcription through online provides efficient clinical interpretation without carrying the documents. The diagnosis needs confidentiality, availability, and reliability .Confidentiality means that only the original users have access to the information .Availability, guarantees access to medical information. Reliability is based on integrity that the information has not been modified by unauthorized persons; and authentication intends that the information belongs indeed to the correct patient.

The purpose of the watermarking method is to check the integrity and preservation of the confidentiality of patient data in a network sharing.

We propose a watermarking method for medical images based on the LSB in order to:

- Check the integrity and confidentiality of medical information.
- Maintain confidentiality for patient and hospital data.

This approach allows patients to insert data into a set of different types of images. Obviously, all of the data included (Signature, Address, Patient Record, Hospital Signature ,medical diagnostic) should be hidden protected and correctly transmitted.

watermarking

The process of embedding information into another object/signal can be termed as watermarking. It is used to provide copyright protection and also robustness against various attacks. It is a procedure of embedding data into multimedia elements like image, audio, video. A digital watermark is an unnoticeable signal added to digital data, known as cover work. Data to be inserting as watermark can be of text and image type, it is hidden in such a way that the intruder

cannot detect it properly. Visible watermarks change the signal altogether such that the watermarked signal is totally different from the actual signal. Eg. Adding an image as a watermark to another image. Invisible watermarks do not change the signals to a perceptually great extent, i.e. there are only minor variations in the output signal. Watermarking is a concept of one-to-many communications, in which we broadcast the watermarked data to multiple users at a time.

The information embedded as a watermark can be almost anything. It can be a bit string representing copyright message, serial number, plain text etc. However, sometimes it can be more useful to embed a visual watermark instead of a bit string as a watermark.

It is desirable that the watermark cannot be removed from the cover image. However several intentional and unintentional operations with the watermarked image may provide possibility for disabling the watermark. Commonly, these operations are referred as attacks against watermarks.

In order to evaluate the robustness and effectiveness of our watermarking method, it is necessary to investigate the influence of different attacks on image. Attacks are generally two type like innocent attacks: during the transmission phase, the image undergoes different treatments such as filtering, compression, geometric transformations. These treatments are classified an innocent attacks.

Malicious attacks prevent the reception of the signature of the watermarked image. These attacks may desynchronize or even destroy it and this will lead to the loss of coded data. Malicious attacks concerns jittering, extra marking attack and copying attack, mosaics attack etc.

The quality of the watermarked image is evaluated with subjective measure and objective measure. In which subjective measure: In the case of medical images, the subjective evaluation for image quality is defined by a group of appreciation scale experts. The format distance required is four times the height of the screen.

Objective measure: are based on the comparison between the received watermarked image and the original image. From these measures, we find the PSNR, weighted PSNR, the relative entropy, the MSE and the average absolute error.

The watermarking techniques are divided into two basic categories as spatial domain and Frequency domain watermarking. In Spatial domain LSB the image pixel is replaced with the watermark bit.

In Spatial domain the watermark is directly embedded by modifying the pixels of the original image without any transformation of the image. This technique is often fragile and applied in the pixel domain and has less complex computation thus consumes less time for archiving and retrieval. The LSB technique is used to embed information in a cover image. The LSB technique of a cover image is described by changing pixels by bits of the secret message. An embedding scheme which randomly hides messages in the LSB of all component of the chosen pixel using polynomial.

In frequency domain the image is transformed to the frequency domain and then the frequency components are modified with the watermark bit. In which Frequency domain technique transformation of an image is needed to get more information about the image and to reduce the computational complexity. Even through this technique takes more time and more complex than spatial domain technique the embedded watermarked data cannot be identified easily .In transform domain the watermark is embedded after performing transformations such as DCT, DFT, and DWT etc. The watermark is embedded in the transform coefficients. When compared to spatial domain these techniques offer high security and robust to attacks.

The watermarking techniques can also be classified based on the watermarking robustness as Robust, Fragile and Semi-Fragile. Robust watermarks can resist non-malicious distortions and best suited for copyright protection. Fragile watermarks can easily destroyed by all image distortions and its suited for tamper detection and authentication .Semi-fragile watermarks can be destroyed by certain types of distortions and resists minor changes and used for some special cases of authentication.

There are three watermark detection schemes: Non-blind, semi-blind and blind. Both the

original image and secret key are needed for non-blind extraction. Semi-blind need only the secret key and the watermark .Blind extraction system needs only the secret key. The digital watermark when it is hidden in the image it generally introduces some amount of imperceptible distortion in the image. In medical images, there is a region i.e. important for diagnosis called region of interest and region of non-interest. Embedding data ROI region should not cause any visual artifacts which affect the interpretation by medical doctors. So, watermarking can be used in RONI of medical image. To achieve better performance in terms of perceptually, invisibility and robustness, adaptive quantization parameters can be used for data hiding. The embedding strength is more or less proportional to the value of energy to have better robustness and transparency.

Joint watermarking combines the watermarking of the encrypted data in medical images in order to provide more security utilizing the benefits of cryptography and watermarking techniques. Joint medical image watermarking is to encapsulate vital data inside an image in energy packed areas, which is optimized with respect to image quality and to provide a second level security by incorporation of state of the art cryptographic standard.

In which blind watermarking, it is a Zero-knowledge watermarking algorithm which does not need the original image for the detection process.

REVIEW

Hundreds of researchers in their studies have demonstrated the new advances in the field of medical image compression in both lossless and lossy categories. Lossless compression can achieve a maximum compression ratio 3:1 restoring the image without loss of information .As digital images occupy large amount of storage space, most of research is focused on lossy compression that removes insignificant information preserving all the relevant and important image information .In teleradiology applications, several scientific research studies have been performed to determine the degree of compression that maintain the diagnostic image quality(Ishigaki et al. 1990).MacMohon et al .(1991) proved that medical images with a compression ratio of 10:1 are acceptable.Cosman et al.,(1994) proved that there is no loss in diagnostic accuracy for compression ratio up to 9:1.Compression of medical images is vital in achieving a low bit rate in the representation of radiology images in order to 16 reduce data volume, without loss in diagnostic information(Wong et al.,1995) .Lee et al.(1993), Goldberg(1994) and Perlmutter et al., (1997) pointed out that lossy compression techniques could be applied for medical images without significantly affecting the diagnostic content of images. The decompression results show no significant difference with the original for compression ratio up to 10:1 in case of medical images in the work proposed by Ando et al.,(1999).Research studies(Slone et al. 2000,Skodras et al. 2001, Chen 2007 and Choong et al. 2007) showed that as digital medical images occupy large amount of storage space , at least 10:1 compression ratio has to be achieved .Kalyanpur et al. (2000) examined the effect of JPEG and wavelet compression algorithms on medical images and concluded that there is no significant loss of diagnostic quality up to 10:1 compression. Person et al.(2000) discussed diagnostic accuracy and reported that reconstructed medical images with a compression ratio of 9:1 do not result in visual degradation .Saffor et al.(2001) compared JPEG and wavelet and concluded that the wavelet could achieve higher compression efficiency than JPEG without compromising image quality .Li et al.(2001) investigated the effect of JPEG and wavelet compression algorithm on medical images and concluded that compression ratio up to 10:1 is acceptable .Hui and Besar (2002) studies the performance of JPEG 2000 on medical images and showed that JPEG2000 is more acceptable compared to jpeg as JPEG2000images could retain more detail than a JPEG image. Both lossless and lossy compression techniques are discussed in Smutek (2005) and Seeram (2006) .

The lossless compression techniques discussed achieve overweening results with maximum compression ratio of 3:1 and the lossy compression techniques with high compression ratios cause distortion in decomposed image. The more advanced technique for compressing medical images is JPEG2000(Krishnan et al. 2005) which combines

integer wavelet transform with EBCOT.Asraf et al. (2006) proposed a compression technique, which is a hybrid of lossless and lossy techniques using neural network vector quantization and Huffman coding .This high complexity technique is tested for medical images achieving compression ratio of 5 to 10.Chen (2007) proposed a new algorithm for medical images compression that is based on SPIHT algorithm.Dragan and Ivetic (2009) said that the issue is not whether to compress medical images using lossless or lossy techniques but preferably which type of compression can be used without compromising image quality. For medical images, only a small portion of the image contributes diagnostically useful information. Compression methods providing higher reconstruction quality for the diagnostically important regions are advisable in this situation.Hu et al.(2008) and Babu and Alamelu (2009) worked on ROI compression and explained the clinical importance of ROI of the medical images through diagnostic.

Proposed method

With the help of watermark we can solve the problem of compression. When working with larger images of greater bit depth, the images tend to become too large to transmit over a standard internet connection .In order to display an image in a reasonable amount of time ,techniques must be incorporated to reduce the images file size-these techniques make use of mathematical formulas to analyze and condense image data, resulting in smaller file sizes . This process is called compression.

Compression plays a very important role in choosing which steganographic algorithm to use.Lossy compression techniques result in smaller images file sizes, but it increases the possibilities that the embedded message may be partly lost due to the fact that excess image data will be removed. Lossless compression through ,keeps the original digital image intact without the chance of lost although is does not compress the image to such a small file size.

In our proposed method we are work on digital image because digital image are in binary language i.e. 0 and 1 form. Using LSB we are work on binary language. Images are a set of pixel and it support bit format.

If the text is displayed correctly, there should be no visual difference from ordinary text. In case of digital images the embedded information can be either visible or hidden from the user. In which binary format it is important to determine the window size. If the window is too small, the distribution of feature point is concentrated on text used areas. Otherwise, the feature becomes isolated.LSB modification is based on the substitution of LSB plane of the cover image with the given watermark.

Lsb insertion is a common, simple approach to embedding information in a cover image. The LSB of some or all of the bytes inside an image is changed to a bit of the secret message .LSB steganography has been used, he has no way of knowing which pixels to target without the secret key.

Modulating the LSB does not result in human perceptible difference because the amplitude of the change is small.

A large amount of data can be embedded by LSB without observable changes..In general, areas with high contrast and noise like region are selected for embedding to avoid distortion. Modification to low contrast regions will be perceptible to the human eye easily here we are uses low frequencies to represent the secret message.

It is very effective, easy to implement and takes very less space but it has low imperceptibility. The goal of the manipulation in image can be divided into three categories:

Image Processing: image in -> image out

Image Analysis: Image in -> measurement and

Image Understanding: Image in -> high level description.

We will focus on fundamental of image processing. Correlation factor describes the degree of closeness of the images. Its value is unity when the cover and stego images are completely correlated and it is zero when both are completely uncorrelated. Using PSNR penalizes the visibility of noise in an image. The quality of watermarked image with reference to the original image can be measured with the MSE and MSE used to find the degradation level .Minimum MSE indicates the acceptable degradation.

Conclusion

This method is perfectly suited to medical imaging because it benefits from the use of LSB of the image, allowing you to insert the patient's own information while keeping a quality of the watermarked image. Data hiding watermarking methods must have high robustness to provide resistance against the attempt of removing and modification of a hidden message. Watermarking is used to protect media file from being pirated whereas steganography is used to protect the secret message behind media file.

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