Role of Compressed Medical Images in Healthcare

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Abstract
This paper will focus on techniques used in patients monitoring in healthcare based on medical images. Lossless coding algorithm, watermark compression (add safety to data), GLCM, Huffman coding, LZW, DCT and soft compression techniques are used for efficient image compression. Lossless coding algorithms helps to reduce image size without losing the data. An image watermarking secret key (ROI) is used in this research to create a watermark that is unique to each picture. By comparing LZW compression with traditional approaches, it was observed that the LZW methodology has better performance than others.

Keywords: Compression, DCT LZW, ROI

Introduction
An image is a two- or three-dimensional depiction of a situation. Pixels (image elements) are grouped in rows and columns in an array. When it comes to a picture, rows and columns are also two-dimensional arrays. The set of all possible output values is what is known as a function's image in mathematics. Image processing is the signals whose input and output are both images. It deals with image processing, as its name implies. Analog image processing is a subset of this, as is digital image processing. Software for digital image processing, such as computer graphics, signals, photography, camera mechanism and pixels, is called Digital Image Processing. Various activities, such as image enhancement, signal processing of analogue and digital data, picture signals, and speech signals, can be carried out on this platform Images are available in a variety of formats. Algorithms are used to modify images in Digital Image Processing. When it comes to digital image editing, Adobe Photoshop is the most extensively used software. The discrete cosine transform (DCT), a lossy compression algorithm initially developed by Nasir Ahmed in 1972, was a significant advance in digital picture compression technology. In 1992, the Joint Photographic Experts Group invented JPEG, which was based on DCT compression. Many digital photographs and digital photos were made possible by its very effective DCT compression technique, which generated several billion JPEG images per day as of 2015. The amount of data needed to describe an image can be reduced using image compression. Reduced file size allows images to be stored or transmitted via telephony in a shorter period of time because compression reduces the file size. Images can be compressed due to the fact that they often include duplicate or repeating data.
Decompression methods can be used to retrieve the original image data from smaller files using alternative storing schemes. In order for medical images to be properly compressed, all of the data must be kept, even if it is encoded in a different way. As a result of using lossy compression techniques that don't preserve all of the original image's data, smaller image files (i.e., higher compression) can be

achieved with acceptable image quality. Image compression employs Discrete Cosine Transform. Water mark image processing is also used for lossless compression.
When compressing an image, there are two options: lossy or lossless. To be safe, lossy compression methods should be avoided while working with maps because, despite their high compression ratios, they cause permanent damage to the image's quality. Low-resolution images can appear blurry because of the standard compression method JPEG. It stands for Joint Photographic Experts Group, or JPEG for short. Image compression was pioneered by this first standard.

TECHNIQUES USED IN PATIENTS MONITORING IN HEALTHCARE BASED ON MEDICAL IMAGES.

LOSSLESS CODING ALGORITHM

Using lossless compression, a file may be reduced in size without losing any data. This format, on the other hand, reduces file size by deleting redundant data. The original file can be completely reconstructed using lossless compression. In practices, lossless compression methods are required in situations where the reconstruction is identical to the original and when compression is required. Huffman, Shannon-Fano, LZ77, and LZ78 are the four types of lossless compression.

WATERMARK COMPRESSION

Several studies have investigated the use of lossless-compressed Lempel-Ziv-Welch (LZW) watermarks to secure ultrasound pictures. The watermark lossless compression decreases the watermark's payload without sacrificing any of the watermark data. An image watermarking secret key (ROI) is used in this study to create a watermark that is unique to each picture. By comparing LZW compression with traditional approaches, it was found that the LZW methodology performed better than the others. Using LZW for watermark lossless compression in ultrasound medical pictures watermarking was shown to be the best option. Images may be watermarked with good tamper detection and lossless recovery, as shown in the tabled findings.

GLCM

There are GLCM functions that describe an image's texture by determining how frequently two pixels with different values and spatial relationships appear together. Texture analysis may be done using the gray-level co-occurrence matrix (GLCM), or the gray-level spatial dependency matrix. This is a statistical approach of analyzing texture that examines the spatial connection of pixels. An image's texture is shown by these statistics. GLCM has been utilized in a number of medical studies to analyze CBIR images.

K-MEANS SEGMENTATION TECHNIQUE

It is the process of dividing a picture into distinct sections. In the field of image segmentation using clustering, there has been a great deal of study. Using the K-Means clustering technique, we'll learn how to interpret a picture and group various parts of the image together.

HUFFMAN CODING

Compressing data using Huffman compression, as opposed to ASCII code, which uses seven bits per character and assigns smaller codes to frequently used characters and bigger codes to less often used characters, reduces the size of compressed and transmitted files. Using Huffman coding, you may compress any sort of data, including medical images and videos, without affecting the quality of the data. It is used in both JPEG and MPEG-2 compression. Using Huffman coding, a file may be compressed by taking a look at its data stream.

LZW

Using a table-based lookup technique developed by Abraham Lempel, Jacob Ziv, and Terry Welch, LZW compression may reduce the size of a file. GIF and TIFF are two of the most regularly used file formats in which LZV compression is used. Noise-free and simple photos also compress more efficiently than complicated ones. o LZW software may be created to compress between 30K and 80K bytes per second on a 68082- or 386-based computer, depending on the picture properties.

DCT

Discrete Cosine Transform is the abbreviation for DCT. Fourier transform is a sort of rapid computer algorithm that converts actual signals into frequency-domain values. Discrete DCT blocks are used in DCT compression, or block compression. Integer DCT sizes may range from 4x4 to 32x32 pixels, and the usual DCT can be 8x8 pixels in size. In order to apply DCT to a block, it is multiplied on the left by a DCT matrix and then transposed. Quantization is then used to reduce the size of each block. Entropy is embedded into the quantized matrix. A picture that has been compressed is decompressed in reverse.

SOFT COMPRESSION

Soft compression is a lossless technique of compressing images that aims to eliminate both coding and spatial redundancy by encoding images according to information theory and statistical distribution in certain positions and forms of a codebook. There is a new idea called compressible indicator function with reference to picture that provides a threshold for the average number of bits needed to describe a place and may be used to disclose the performance of soft compression.

Compressible indicator values have been used to examine and assess soft compression for binary, grey, and multi-component images. Soft compression is predicted to considerably decrease the bandwidth and storage space required while sending and storing the same kind of photos.

LITERATURE REVIEW

AUTHORS DETAIL REVIEW OF THEIR WORK DONE IN THIS AREA

In order to conduct research on the topic of "The Role of Compressed Medical Images in Health Care," we consulted a variety of medical imaging and image compression research papers written by diverse researchers. Before learning about picture compression, you must first learn about and understand the notion of image processing. Our study also takes into account how images are processed after they are captured. This study's focus is on image processing, compression, and health care. The following articles serve as a foundation for our work and allow us to stay focused on our research goal.

Researchers V Sridhar et al. looked into a number of different techniques, and their findings highlight a few of the most effective ones that have been discovered so far. Although medical image compression is a growing requirement, it is difficult to meet the increasing needs of medical science due to the complexity and dimensionality of the issues it faces.

Medical image management and image data mining, bioimaging, virtual reality in medical visualizations, and neuroimaging were all discussed by Ingrid Scholl et al. Image processing and visualization methods have to be updated because of the ever-increasing volume of data. With the use of graphical processing units, new algorithms and powerful parallelization approaches have been developed. There is an abstract of their work. It's not long before the Petabyte level of data storage is in sight, and these strategies are already being used to deal with it. As a result, medical image processing continues to be an important area of study.

Ghrare and colleagues used a simple method to study a novel lossless image coding algorithm. To reduce pixel repetition, they used only two matrices, the GSM and the Binary Matrix, in their coding process (BM). They had previously been used to encode and decode information. The results indicated that the proposed method had a compression ratio of 4:1, which was more efficient than the current lossless techniques. In addition, the computational complexity is substantially simplified, resulting in extremely rapid coding and decoding.

Lempel-Ziv-Welch (LZW) lossless-compressed watermarks were employed by Gran Badshah et al. to watermark ultrasound medical images. Using a watermark lossless compression reduces the watermark's payload without sacrificing any data. The secret key used to watermark a picture and a determined region of interest (ROI) are the two components of their watermark. By comparing LZW compression with traditional approaches, it was found that the LZW methodology performed better than the others. Using LZW for watermark lossless compression in ultrasound medical picture watermarking was found to be superior.

Algorithms for the diagnosis of bone illnesses, such as osteoporosis (which is characterized by a low bone mineral density and porosity due to micro architectural degeneration), are examined by Sikander Khan and colleagues. Algorithms are tested for accuracy and performance using a common dataset obtained and produced in this work, and the results are compared against those published by the authors. Analyses of features such as contrast and correlation are performed using the Gray-Level Co-occurrence Matrix (GLCM) approach, which calculates features such as entropy and energy.

In the field of medical imaging, Yousif Mohamed Y. Abdallah et al. discussed the use of basic and advanced image analysis techniques. Using image processing algorithms like k-means, ROI-based segmentation, and watershed techniques they also highlighted image interpretation issues. The use of computer-based technology in medical education, according to Tayade MC et al. , can be both rewarding and problematic. Image processing techniques, ranging from simple two-dimensional images to more complex four-dimensional Doppler images, can be used to analyze the disease list. It's easy to collect and process two-dimensional images like x-ray images of lung illnesses such as tuberculous, emphysema, and pneumonia. Cervical, spondylitis, fractures, malignancies, and subclinical bone material alterations can all be examined and processed. It will be more difficult to diagnose and treat disorders of the head and abdomen using 3D pictures from CT scans and MRIs. The use of image processing in disease prediction and prognostication is potential.

According to the work of Gangtao Xin and colleagues an entirely new representation structure for compressed images has been developed. There are numerous coding approaches that can be used to express an image compression system in their framework. From the perspective of data mining, they came up with a new coding system for medical photographs. A picture is viewed as a collection of shapes when using a soft compression algorithm for multi-component images. Due to the algorithm's consideration of shapes and positions while representing a picture, redundant coding and spatial information can be removed simultaneously. Soft compression algorithms for multi-component images exceed the common PNG and JPEG2000 benchmarks, according to experimental data.

According to Feng Liu et al, various legal and regulatory difficulties related to image compression have been discussed in medical imaging applications. Interoperability between picture communication systems is addressed by the worldwide image compression standards produced by ISO/ITU/IEC. Compressed data formats for medical image exchange based on many of these protocols are now part of the DICOM standard.

A overview of medical picture reduction approaches applicable to telemedicine, e-health, and teleconsultation systems was presented by Seyyed Hadi Hashemi-Berenjabad et al. For their research, they looked into the evaluation of digital imaging systems, as well as PACS (Picture Archiving and Communication Systems). Compression is now widely recognized and even requested by medical professionals due to a shift in thinking. As a result, new medical images have been developed, and researchers are always working to enhance compression techniques and the quality of reconstructed images they produce.

Atiqur Rahman Ahad et al.mentioned the wide range of medical healthcare image analysis and related issues that benefit from automatic understanding. High-quality research papers and review articles were included in their special issue, which focused on the difficulties and applications of image processing and vision in health care.

An industry-focused look at medical imaging difficulties was provided by Jurgen Weese and colleagues in their paper. They narrowed their focus to four issues. As a first step, there is a pressing need for more generic image analysis tools that can be easily converted to a specific therapeutic application. In order to keep up with the growing need for validation and machine learning, effective ground truth production methods are needed. Thirdly, new techniques are needed to analyze picture data that is heterogeneous. Another consideration is the need for patient-specific models that may be generated from medical pictures using algorithms that require little to no human involvement during the modeling process. All these issues are complementary to the on-going need to develop more precise algorithmic solutions for a wide range of different applications.

There have been significant advancements in the fields of Ambient Intelligence and Humanized Computing, as described by Gwanggil Jeon et al. , which have prompted the scientific community to focus on these areas in hopes of speeding up implementation. Only twelve of the 49 entries were chosen for publication after an examination of 34 of them.

Li Liu et al. developed a three-layer hybrid cloud in April 2015 for the smart city of Wuxi, China to provide medical image processing services. The hybrid regional healthcare network received and merged medical pictures and EMR data. The high-performance cloud units then proposed and computed a unified set of classic and innovative image processing routines. Finally, the image processing results were transmitted to regional users using the VDI technology. As a result, security measures were taken into account. Medical image processing services in regional healthcare networks may be made more efficient, compatible and safe using the image cloud, according to the findings of this study. There is a hopeful future for the image cloud in the healthcare system around the world after it has been demonstrated to be useful in localized applications.

S. H. Shruthishree provided an overview of the core ideas involved in medical image processing. All of the techniques we have presented are susceptible to significant improvement, and none of these problem areas have been satisfactorily solved. Segmentation, in particular, is still something of an ad hoc process, with the greatest results coming from algorithms that allow the user to provide significant input. It is clear that curvature-driven flows have had a significant impact on the technology landscape. Medical imaging still has a lot of arithmetic problems to solve, and the techniques required touch on nearly every discipline of mathematics.

It was Oren Rippel et al. who introduced a real-time, machine learning-based solution to lossy picture compression. An autoencoder with adaptive coding and regularization of the predicted codelength is their design. It is also possible to build visually appealing reconstructions at very low bitrates by using adversarial training optimized for compression.

Parikh et al examined hevc's ability to compress medical images with high bit depth. Medical photographs can benefit greatly from compression. The results of this study can be used to evaluate the quality of images in the medical profession.

An investigation into the problem of medical picture compression utilizing DWT, DCT, and Huffman-coded hybrid approaches was conducted by T. Kumar and colleagues. Their research focused on the healthcare industry's use of lossy and lossless compression.

The Smart cloud system with an image processing server in diagnosing brain illnesses was discussed by F. Fahmi et al. CT scans and MRIs have revolutionized the way doctors diagnose brain illnesses. More efficient results are possible when smart cloud servers are integrated.

Medical image sequences can be compressed using JPEG-LS and interframe coding without any loss of quality, according to S. G. Miaou et al. The quality of images can be preserved by using lossless image compression. Medical diagnosis relies heavily on accurate and high-quality images. The medical industry will greatly benefit from this research.

T. C. Piliouras et al. talked about digital imaging and electronic health record systems. Digital imaging and regulatory issues faced by healthcare providers were reviewed throughout the meeting. These findings were gathered at the end of 2015. With regards to the United States of America.

Hedieh Sajedi analyed the security accessories for healthcare systems. It was their goal to describe the results of a literature review on the security of health care systems provided by information hiding technologies, such as cryptography, steganography, and watermarking, as well as other techniques. Additional information is provided regarding various medical imaging and biological signaling techniques and their applications in healthcare systems.

Medical information systems could benefit from incorporating patients' sensitive data in ECG signals, according to an article published in by Ibaida A and her colleagues. All clinics and hospitals have access to the fundamental information on their patients. In today's world, it is critical that sensitive information be kept secure. Medical data security is becoming a growing concern as hacking incidents continue to rise.

The framework for the selection of coding areas from cancer data was assessed by Kamal Md et al. Cancer is becoming an increasingly common disease. The value of cancer statistics is increasing as the number of cancer patients grows.

ADPS is an example of how digital image processing and analysis can be used in the healthcare industry, according to P.Sreelatha and coworkers. Medical professionals look at a patient's nails and palm to gain an initial sense of their health and well-being. However, the human eye has a limit when it comes to observing minute details. They came up with a method that uses a hand image as an input to detect various health issues. To extract features from the segmented hand and nail images, the input image is segmented using DIP techniques. Analysis of the retrieved features is done using medical palmistry's knowledge base in order to predict diseases.

CONCLUSION

Considering existing researches it has been concluded that previous research did lot of work in field of medical image processing. These researches have applied image compression mechanism that may be lossy or loss less. Some of the research focused on pattern recognition and used frequently in field of healthcare. The issue with previous research is processing time and accuracy during pattern detection. There remains need of mechanism that should be capable to provide solution of medical imaging by providing novel approach which is more scalable, flexible and efficient. This type of research should propose efficient compression mechanism along with smart approach to detect the pattern.

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