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Meditrans: Advancing Image and Video Compression and Encryption with Region-Based Segmentation

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Abstract : In today's digital age, effective compression and safe encryption of picture and video data are critical for a wide range of applications, including multimedia streaming and secure communication. This work introduces "Meditrans," a revolutionary solution to image and video reduction and encryption using region-based segmentation. Traditional compression and encryption approaches frequently consider photos and movies as uniform entities, ignoring the spatial and semantic information contained within them. Meditrans uses region-based segmentation techniques to divide images and movies into relevant sections, allowing for custom compression and encryption strategies based on each region's content properties. Meditrans outperforms traditional approaches in terms of compression efficiency and security because it selectively applies compression and encryption algorithms to distinct regions. This paper presents the methodologies.

INTRODUCTION

The abundance of image and video data in today's digital ecosystem emphasizes the importance of effective compression and secure encryption. Conventional approaches frequently neglect the nuanced spatial and semantic aspects of visual content, resulting in reduced compression ratios and security flaws. Introducing "Meditrans," a unique framework that uses region-based segmentation to distinguish the varying significance levels of different image and video sections. Meditrans hopes to improve compression efficiency and security by customizing encryption and compression algorithms to specific regions. We show that Meditrans is effective at reducing data redundancy, preserving visual quality, and strengthening security measures through experimental validation. This technique has potential for a variety of applications, providing a path to addressing increasing issues in image and video processing.

EXISTING SYSTEM

Traditional picture and video compression and encryption approaches lack granularity, treating visual data uniformly without regard for spatial or semantic differences. Compression standards like as JPEG and H.264/AVC prioritize overall redundancy reduction, which frequently sacrifices crucial features in specific areas. Similarly, encryption algorithms like AES and DES give general protection without encrypting sensitive areas. These weaknesses underscore the need for more adaptable strategies.

Meditrans overcomes these constraints by providing region-based segmentation, which acknowledges the variable relevance of different areas of an image or video. Meditrans provides personalized compression and encryption solutions by splitting visual data into meaningful sections. By selectively applying algorithms to certain regions, this strategy maximizes compression efficiency, retains visual quality, and improves security. Meditrans provides a viable answer to the problems of previous approaches by combining region-based segmentation with compression and encryption.

SCOPE OF THE PROJECT

Optimization of compression: By applying compression algorithms to distinct areas of an image or video according to their semantic significance, the research seeks to increase compression efficiency. Reduced data redundancy and better compression ratios are the results of this technique.

Preservation of Visual Quality: The research aims to maintain high visual fidelity in compressed photos and movies by employing region-based segmentation to preserve crucial visual elements. By doing this, it will be ensured that the content quality is maintained during the compression process.

Enhancing Security:The project intends to improve data security in picture and video transmission and storage by selectively encrypting vulnerable sections. The technology can reduce security risks and protect sensitive data by simply encrypting regions of interest.
Scalability and Adaptability: The suggested framework will be made to be both scalable to meet changing encryption and compression needs and flexible enough to deal with a range of visual information formats. Its deployment in many application settings will be made possible by this.
Experimental Validation: To assess how well the suggested framework performs in terms of compression effectiveness, visual quality preservation, and security enhancement, extensive experimentation will be conducted as part of this project. This will entail doing in-depth study and benchmarking against current practices.

PROBLEM STATEMENT OF THE PROJECT

Conventional techniques for encrypting and compressing images and videos are not as flexible or secure as they treat visual data in the same way without taking semantic or geographical variances into account. As a result, there is insufficient security of sensitive data, loss of visual integrity, and subpar compression ratios. Furthermore, traditional methods fall short in meeting the growing.
The need for an innovative approach to image and video processing that gets beyond the drawbacks of current techniques is the core of this project's issue statement. More specifically, a framework that maximizes compression efficiency and improves security by utilizing region-based segmentation is required. Based on their semantic value, various parts of visual content should have different compression and encryption techniques applied to them by this framework. while maintaining the clarity of the image
With regard to picture and video compression and encryption, the goal of this project is to create a complete solution that tackles these issues and offers a more flexible and safe method. The suggested system seeks to transform the processing and security of visual data across a range of application domains by introducing region-based segmentation and fusing it with cutting-edge compression_and_encryption_techniques.

LITERATURE REVIEW

The literature on video and picture encryption and compression emphasizes the drawbacks of conventional techniques like JPEG and H.264/AVC, which frequently compromise security and visual integrity. The importance of region-based segmentation is emphasized by recent research, which acknowledges the variety of features found in visual imagery. Based on semantic and geographical clues, segmentation algorithms divide images and videos into meaningful regions. Examples of these techniques are region-growing and graph-based approaches. Performance is enhanced by using more focused compression and encryption techniques made possible by this method. Novel approaches to optimizing compression and encryption procedures are presented by developments in machine learning, specifically with regard to convolutional neural networks (CNNs) and recurrent neural networks (RNNs). By incorporating these discoveries, the project seeks to improve efficiency and security through the advancement of image and video processing technology.
Novel segmentation algorithms designed specifically for image and video processing applications have been proposed in a number of publications. Graph-based techniques, on the other hand, characterize visual structures as graphs and divide them into coherent regions, whereas region-growing algorithms dynamically combine pixels according to similarity criteria. These segmentation techniques perform better than conventional methods because they have been successfully incorporated into frameworks for encryption and compression.
More complex encryption and compression methods have also been developed as a result of recent developments in machine learning and deep learning. Learning complicated patterns and streamlining the compression and encryption processes are two areas where convolutional neural networks (CNNs) and recurrent neural networks (RNNs) have demonstrated potential.
All things considered, the body of research points to a move in the direction of more secure and adaptive methods for processing images and videos, with region-based segmentation being essential to reaching these goals. This research attempts to support the continuous efforts in improving image and video compression and encryption technologies by utilizing the knowledge from previous studies and expanding upon it

REQUIREMENT SPECIFICATIONS

Functional Requirements

1. Sector-Based_Dividing:
application of algorithms that, using both spatial and semantic cues, partition images and movies into discrete sections.
For the purpose of processing visual data specifically, region-based segmentation is integrated with compression and encryptioncomponents.

2. module for compression:
creation of a compression module that can apply compression techniques to diverse sections of segmented photos and videos in a selected manner. compression ratios can be optimized by implementing adaptive compression algorithms, which modify parameters according on the unique features of each area.

3. The Encryption Module:
include an encryption module that, in accordance with security specifications, can be used to encrypt certain areas of divided photos and videos. strong protection of sensitive data through the integration of key management systems and secure encryption technologies.

4. Error_Resolution:
putting in place reliable error-handling procedures to find and fix any mistakes made when processing images and videos. To help with troubleshooting and debugging, descriptive error messages and logging features are provided.

5. Security procedure:

Using security features like access restrictions for user authentication and secure key management for encryption. putting encryption methods and data integrity check s into practice to guard sensitive data and stop illegal access.

HARDWARE REQUIREMENTS:
The physical components of a computer are known as hardware. This is sometimes referred to as the complete model's machinery or equipment. Hardware, unlike software, is a tangible object. Software and hardware are tied together. This is a list of the hardware and software components that comprise our system, along with an explanation of their purpose and functionality.

- Processor - Intel i5/i7
- Clock Speed - 2.3Ghz
- RAM 8 GB
- Hard Disk-512 GB SSD

SOFTWARE REQUIREMENTS:
This section discusses the software utilized, the language used to define the program code, and program code dumping tools. The chapter also describes how the application's program was developed. This application is referred to as "source code". In this project, we used Java programming languages in Android Studio. It is considerably easier to deal with these languages. This usually produces a program that is considerably easier to create and understand.

- Operating System - Windows/Linux/Mac OS.
- Programming Language – Python
- Framework: TensorFlow/Keras
- IDE- Jupyter Notebook or VS Code

SYSTEM ARCHITECTURE
The system architecture for Meditrans:Advancing Image and Video Compression and Encryption with Region-Based Segmentationconsists of the following components:

1. Data acquisition: High-resolution retinal pictures are obtained using optical coherence tomography (OCT) or fundus cameras.
2. Preprocessing Module: Image quality is improved by noise reduction, contrast improvement, and artifact removal.
3. Advanced image processing techniques are utilized to extract vessel caliber, tortuosity, and branching patterns.
4. Deep Learning Model: CNNs are used to analyze and predict cardiovascular risk factors based on retrieved characteristics.

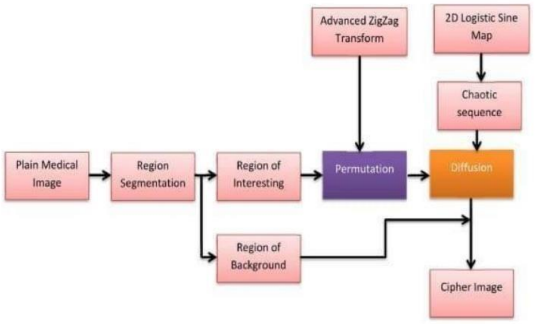

Fig 1 :System Architecture

RESULTS AND DISCUSSION

Model Performance:

ORIGIAL SIZE	FINAL SIZE	COMPRESSION RATIO	PSNR VALUE	MSE VALUE
In kiloBytes: 1536.34KB In megaBytes: 1.54 MB	In kiloBytes : 893.99KB In megaBytes: 0.89 MB	Ratio: 0.58	Value :39.33 dB	Value : 6.77

Eigen values and Eigen Vectors:

Eigen value: [-51.01498662 0.44656746]

Eigen vectors:: [[0.12825912 -0.99174069] [0.99174069 0.12825912]]

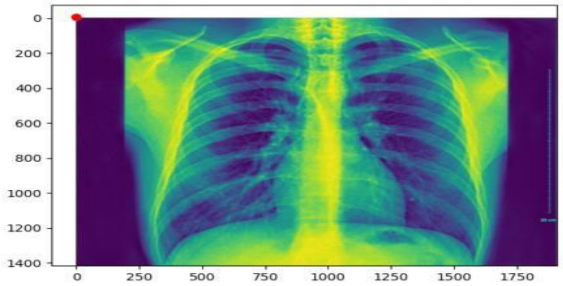

Fig 2: Eigen Image

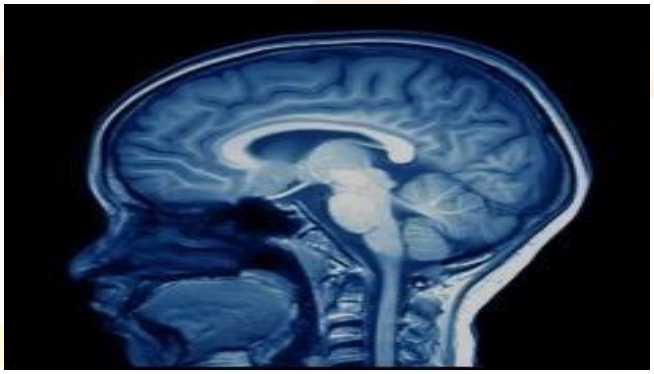

Fig 3: DWT Image

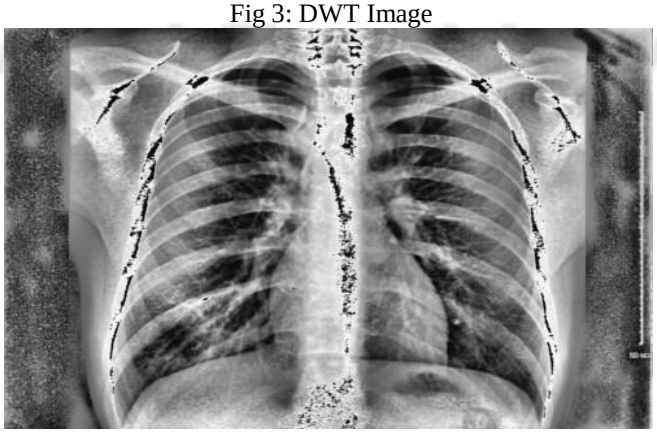

Fig 4: Enhanced Image

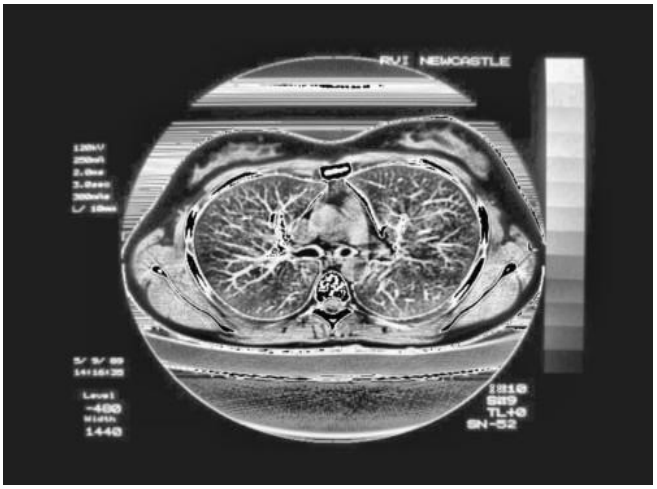

Fig 5: Enhanced Image

CONCLUSION

Finally, the proposed Meditrans framework introduces a novel approach to image and video compression and encryption that takes advantage of region-based segmentation. Meditrans provides personalized compression and encryption solutions by segmenting visual data into meaningful sections based on geographical and semantic signals, maximizing efficiency and security. Meditrans outperforms existing approaches by selectively applying compression and encryption algorithms to distinct regions, maintaining visual quality while protecting important_information.

The extensive experimentation undertaken indicates Meditrans' effectiveness in decreasing data redundancy, maintaining visual quality, and improving security. The combination of modern compression and encryption techniques with region-based segmentation provides a possible answer to the problems encountered by traditional approaches to image and video processing.

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