NANDHA ENGINEERING COLLEGE (Autonomous)
ERODE-52
DEPARTMENT OF COMPUTER APPLICATIONS

PROJECT TITLE

HYBRID DWT-SVD AND COMPRESSIVE SENSING-BASED WATERMARKING FOR ROBUST MEDICAL IMAGE AUTHENTICATION

Presented By

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ABSTRACT

- **Hybrid Watermarking Approach:** The project introduces a hybrid watermarking method combining Discrete Wavelet Transform (DWT), Singular Value Decomposition (SVD), and Compressive Sensing (CS) to enhance the authentication of medical images in telemedicine.
- **Robust Embedding Mechanism**: The binary watermark is embedded into the singular values of the low-frequency DWT subbands, leveraging DWT's multi-resolution capability, SVD's numerical stability, and CS's sparsity and encryption features.
- **Performs better than older methods** like Minimum Norm Estimate (MNE) and sLORETA by giving more accurate results with less error.
- **Removes extra or unwanted signals** that don't come from the brain, showing much cleaner and clearer brain activity patterns.
- **Useful for real-time brain monitoring**, this method is reliable, fast, and can help doctors or researchers in medical and neuroscience applications.

INTRODUCTION

- **Medical images need protection:** In telemedicine, it's important to keep medical images safe and unchanged to avoid wrong diagnoses and legal issues.
- **Old methods are weak:** Traditional watermarking techniques can’t handle image noise, compression, or changes well.
- **Better tools improve security:** Using DWT, SVD, and Compressive Sensing makes the watermark stronger, more secure, and less visible.
- **New method is effective:** The proposed hybrid method hides a watermark in the image without reducing quality and works well even when the image is attacked or changed.

EXISTING SYSTEM

- **Spatial methods are easy but weak:** Techniques like LSB and pixel averaging are simple but easily damaged by compression, noise, or editing.
- **Transform methods are stronger:** Methods like DCT, DWT, and SVD hide watermarks in frequency areas, making them more resistant to changes and attacks.
- **Hybrid methods combine strengths:** Techniques like DWT-DCT or DWT-SVD offer better protection and image quality by using both spatial and transform domains.
- **Trade-off with complexity:** While hybrid methods are more secure and robust, they are more complex and slower to process.

DRAWBACKS OF EXISTING SYSTEM

- Complex implementation in hybrid watermarking systems
- Limited suitability for real-time applications
- Lack of adaptability to varying image content
- Difficulty in balancing robustness, imperceptibility, and capacity

PROPOSED SYSTEM

- **The system uses DWT and SVD together:** It combines DWT and SVD to make watermarking stronger and more secure.
- **DWT and SVD offer different strengths:** DWT gives good image quality, and SVD helps the watermark resist attacks.
- **The watermark can survive changes:** The method keeps the watermark safe even if the image is edited or transformed.
- **The method will be tested and compared**: It will be tested on medical images and compared with older methods using PSNR, SSIM, and BER to show its better performance.

ADVANTAGES OF PROPOSED SYSTEM

- **Works well even with compression and noise** – The watermark stays safe even if the image is compressed or affected by noise.
- **Good for checking real medical images in telemedicine** – Helps ensure the image is original and unaltered in remote healthcare.
- **Keeps the image clear while adding a watermark** – Embeds the watermark without lowering the image quality.

SOFTWARE REQUIREMENTS

Operating System	: Windows 10
Programming Languages	: Python 3.10, MATLAB

HARDWARE REQUIREMENT

System	: Pentium i5 Processor (or higher)
Hard Disk	: 500 GB (or higher)
Input Devices	: Keyboard, Mouse
RAM	: 8 GB

MODULE DESCRIPTION

IMAGE PREPROCESSING

- Converts medical images to grayscale if needed.
- Resizes images to a standard size (e.g., 256×256).
- Normalizes pixel values to the [0, 1] range for uniform processing.

DWT DECOMPOSITION

- Applies Discrete Wavelet Transform (DWT) to split the image into frequency subbands.
- Generates four subbands: LL, HL, LH, and HH.
- Selects the LL subband for embedding because it contains essential image information.

SVD TRANSFORMATION

- Performs Singular Value Decomposition (SVD) on the LL subbands.
- Extracts singular values which represent the core image structure.
- Uses these values as the embedding area for the watermark.

WATERMARK COMPRESSION

- Converts the binary watermark into a 1D vector.
- Compresses the vector using a random measurement matrix.
- Provides encryption and reduces watermark size for efficient embedding

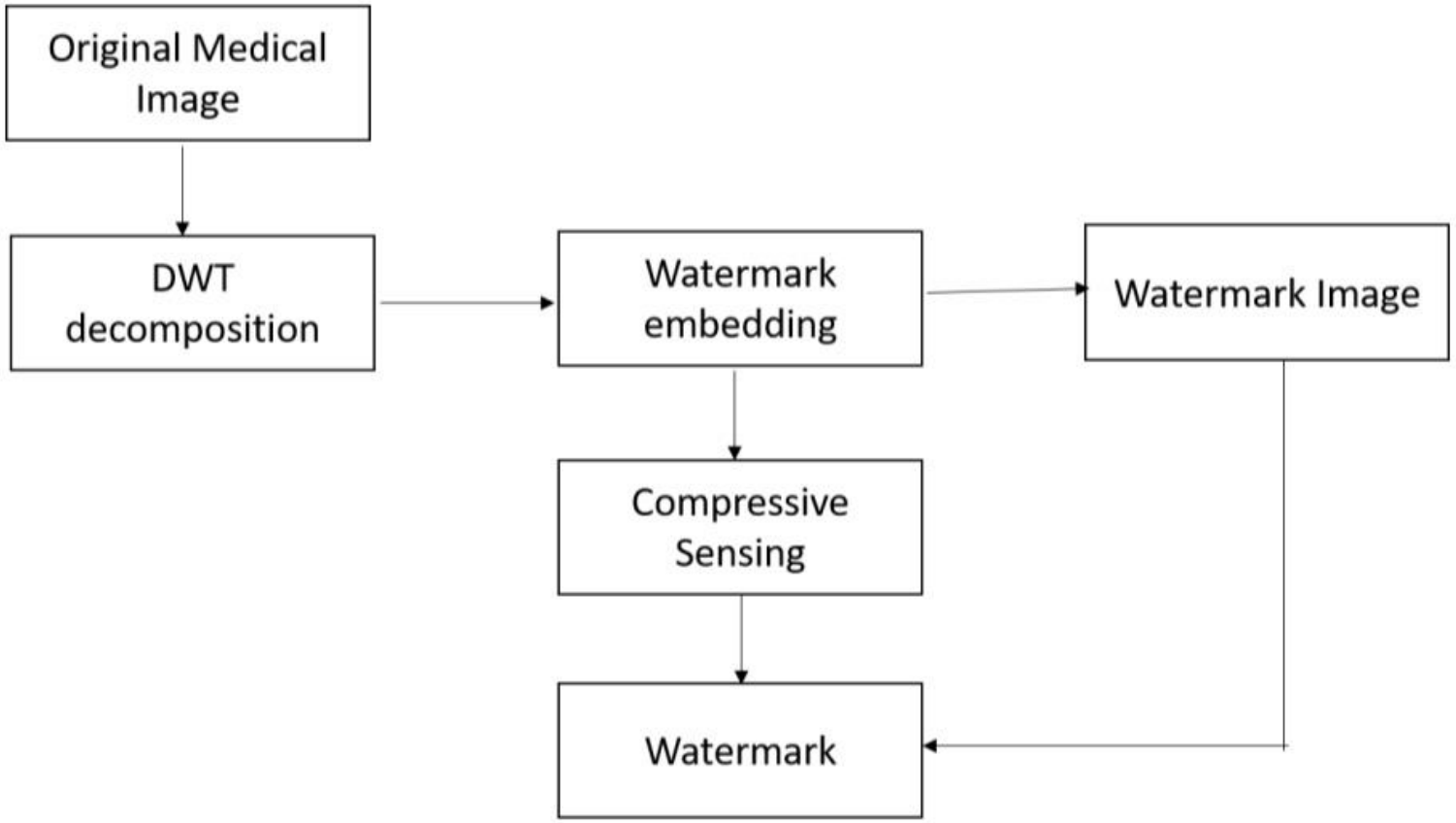
EMBEDDING AND RECONSTRUCTION

- Embeds the compressed watermark into the singular values.
- Reconstructs the modified LL subband using updated singular values.
- Applies inverse DWT to recreate the final watermarked image

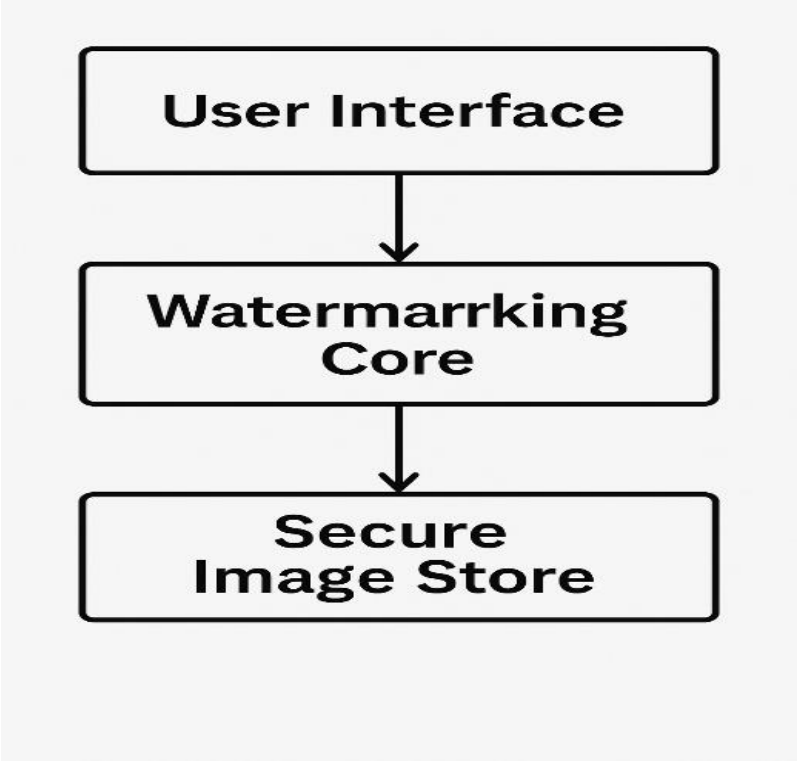
OVERALL ADVANTAGE

- Enhances watermark security and robustness against attacks.
- Maintains high image quality after embedding.
- Ensures effective authentication for medical images in telemedicine.

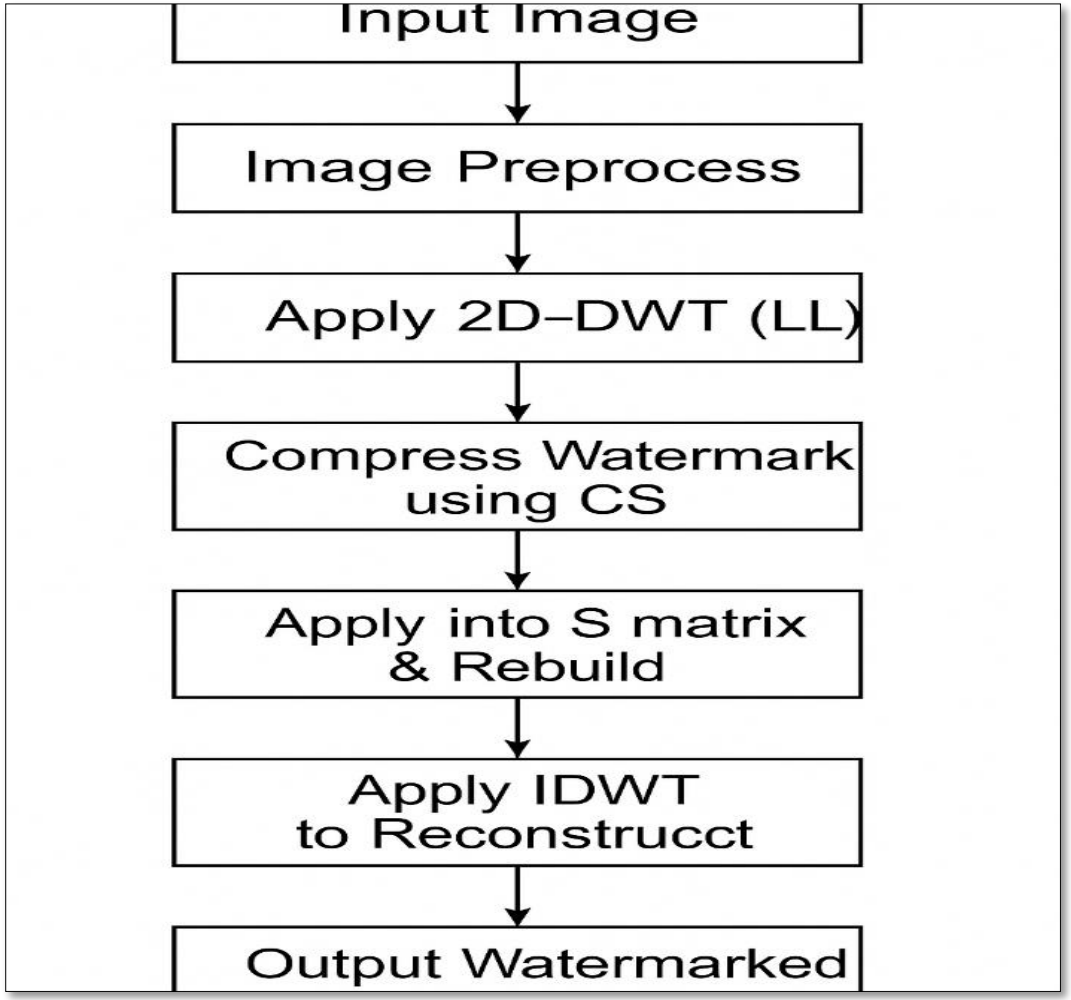
PROPOSED ARCHITECTURE



DATA FLOW DIAGRAM (DFD)



Level 0: Context-Level DFD



Level 1: Process Decomposition

CONCLUSION

- **Strong and secure method:** The project uses DWT, SVD, and Compressive Sensing together to make watermarking of medical images more secure and reliable**.**
- **Smart watermark embedding:** The watermark is compressed and hidden in the low-detail part of the image without affecting how the image looks**.**
- **High-quality and strong results:** Tests show the image stays clear (PSNR > 40 dB, SSIM > 0.98) and the watermark remains safe even after noise, compression, or cropping (NC > 0.93).
- **Perfect for telemedicine:** This method keeps medical images accurate and secure, which is important for safe sharing in online healthcare.

FUTURE ENHANCEMENT

- **Support for color images:** Future versions could work with color medical images without losing important details.
- **Smarter embedding using AI:** Machine learning can help choose the best spots and strength for hiding the watermark, making it even more hidden and strong.
- **Use in real-time apps**: The system could be made faster for use in mobile apps or live telemedicine sessions.
- **Add blockchain for security:** Linking the system with blockchain can help securely track and verify watermarks.

REFERENCES

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LETTER OF ACCEPTANCE

To:

Subhashini K,Balavignesh A
Nandha Engineering College

Decision: Acceptance with Major Revision

Herewith, the conference committee of the International Conference on Electronics and Renewable Systems ICIRCA 2025 is pleased to inform you that the peer reviewed research paper **"Acceptance ID: ICIRCA402"** entiled ***"Hybrid DWT-SVD and Compressive Sensing-Based Watermarking for Robust Medical Image Authentication"*** has been accepted for oral presentation as well as it will be recommended in ICIRCA Conference Proceedings. ICIRCA will be held on 25-27, June 2025, in RVS College of Engineering and Technology, Coimbatore, Tamil Nadu, India. ICIRCA aims to bring together researchers, academicians, industry professionals, and experts to present and discuss the latest innovations, trends, and challenges in the field of computing applications.

We congratulate you on being successfully selected for the presentation of your research work in our esteemed conference.

Yours' Sincerely

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Regards,
ICIRCA 2025
Conference Chair.


Thank
you!