



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 6, June 2023

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

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# Watermarking Techniques with Yuv Layered Approach

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**ABSTRACTS:** Watermarking is a technique used to embed hidden data or identification information within digital multimedia. With the rise of the internet, the creation and distribution of digital data (images, video, and audio files) have significantly increased, leading to issues concerning content protection and ownership proof. Digital image watermarking addresses these issues by embedding a watermark into the data to assert ownership and protect rights. To safeguard the watermark from counterfeiters, it must be embedded in locations resilient to various attacks (rotation, scaling, compression, cropping, filtering, and blurring). Effective watermarking hides a message signal within a host signal without perceptual distortion. This paper adopts a hybrid transformation approach to modify the cover image's singular values rather than the DWT sub-bands, making the watermark resistant to attacks while maintaining the image's original state. Simulation results support the effectiveness of the proposed methods.

**KEYWORDS:** DWT, DCT, SVD, PSNR, MSE, NC

## I. INTRODUCTION

Digital watermarks are information embedded in digital data (audio, video, or images) that can later be detected or extracted to validate ownership. This information can include author details, copyright data, or even another image. The watermarking process involves altering the digital content to embed this information, allowing identification of the original owner and tracking illicit duplications. Watermarks can be visible or invisible; the latter are preferred as they do not degrade the data's quality. Effective watermarks must be robust, recoverable, and non-intrusive while providing reliable embedded information.

### Watermarking Applications

1. **Copyright Protection:** Watermarking protects copyrighted material from unauthorized redistribution on the internet and P2P networks.
2. **Content Archiving:** Embeds digital identifiers or serial numbers for archiving and organizing digital content.
3. **Meta-data Insertion:** Embeds descriptive data, such as image content labels or audio file details.
4. **Broadcast Monitoring:** Ensures that scheduled broadcasts are accurately aired, crucial for commercial advertisements.
5. **Tamper Detection:** Uses fragile watermarks to detect tampering, important for sensitive data like satellite or medical imagery.
6. **Digital Fingerprinting:** Identifies the owner of digital content, with unique fingerprints for different users.

## II. WATERMARK FRAMEWORK

A watermarking scheme involves three components: the watermark, the encoder (insertion algorithm), and the decoder (verification/extraction algorithm). The watermark is unique to each owner and is embedded in the digital object using the marking algorithm. The verification algorithm authenticates the object, confirming both the owner and the integrity of the object.

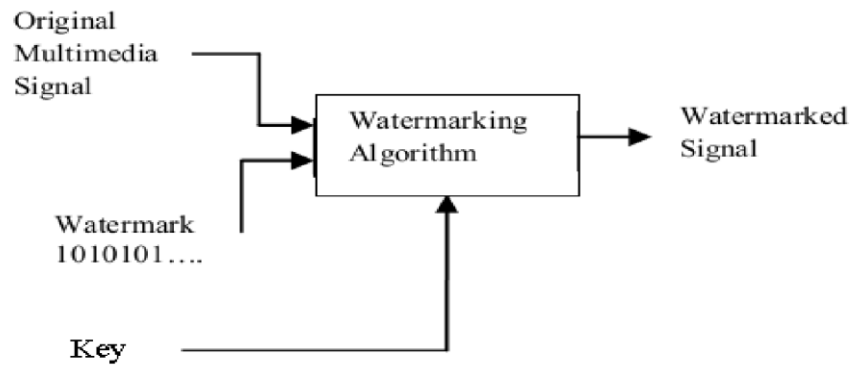


Fig 1: Watermark embedding process

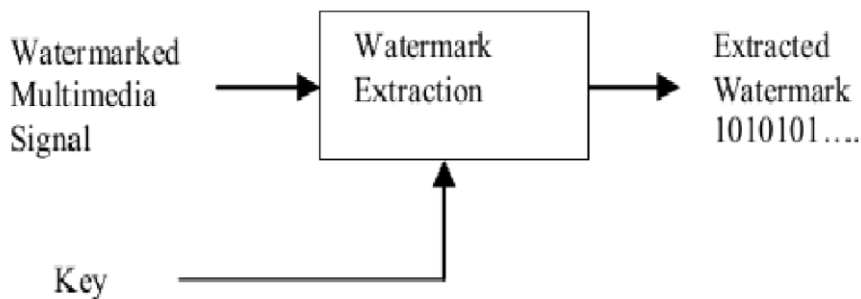


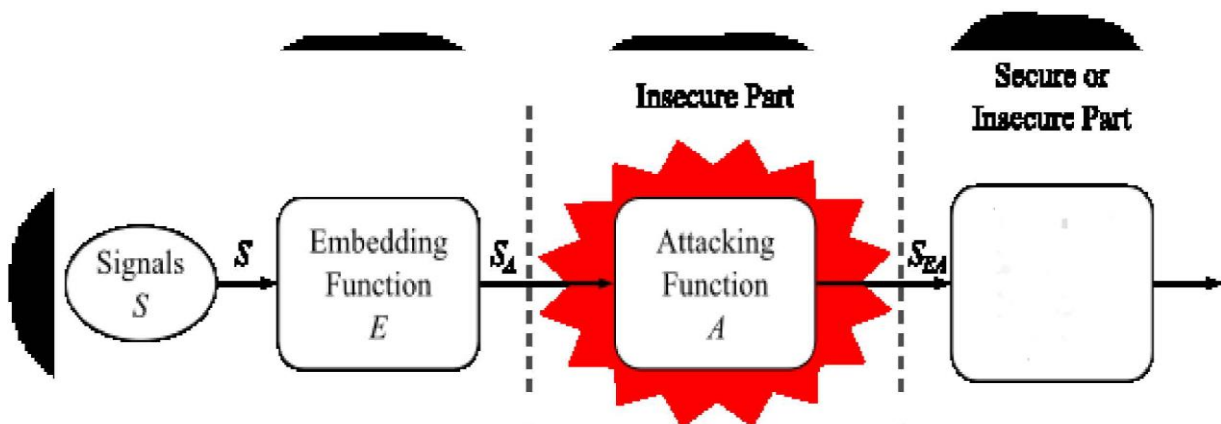
Figure 2: Watermark extraction process

**Designing Principles of Image Watermarking Algorithm**

1. **Imperceptibility:** The watermark should not affect the quality of the original image.
2. **Robustness:** The watermark should resist unauthorized removal or modification.
3. **Capacity:** The number of bits that can be embedded in the host signal.
4. **Security:** The watermark should be detectable only by authorized persons.

**Digital Watermarking Life Cycle**

1. **Embedding:** Embedding the watermark into the host signal.
2. **Attack:** Unauthorized attempts to modify the watermark.
3. **Extraction:** Extracting the watermark to verify authenticity.



Digital watermarking life-cycle

### III. WATERMARKING ALGORITHMS

1. **DWT Watermarking Algorithm:** Uses wavelets to decompose an image into frequency components, embedding watermarks in high-frequency components.
  - a. Advantages: Good localization, flexibility, and reduced computational time.
  - b. Disadvantages: Higher cost, blurring, and noise near edges, longer compression time.
2. **SVD Watermarking Algorithm:** Utilizes singular value decomposition to embed watermarks in the singular values of the image matrix.
  - a. Advantages: Stability against small perturbations, robust against various attacks.
  - b. Disadvantages: Higher complexity compared to simpler techniques like Fourier Transform.
3. **DCT Watermarking Algorithm:** Divides the image into blocks, using mid-frequency DCT coefficients for embedding.
  - a. Advantages: Fast, robust against JPEG compression.
  - b. Disadvantages: Block effects, sensitivity to cropping.

### IV. MOTIVATION

Watermarking addresses data security and copyright protection issues. This paper proposes a hybrid transformation method, modifying the cover image's singular values rather than DWT sub-bands to enhance robustness and maintain the watermark's integrity. Simulation results demonstrate the method's effectiveness.

### V. PROPOSED WORK

A hybrid watermarking scheme using SVD and DWT is introduced. The watermark is embedded in the singular values of the Y component of the cover image's DWT sub-bands and then combined with the U and V components to produce the watermarked image. This approach leverages the strengths of both SVD and DWT, improving imperceptibility and robustness. Experimental results confirm the method's efficacy

### VI. RESULTS

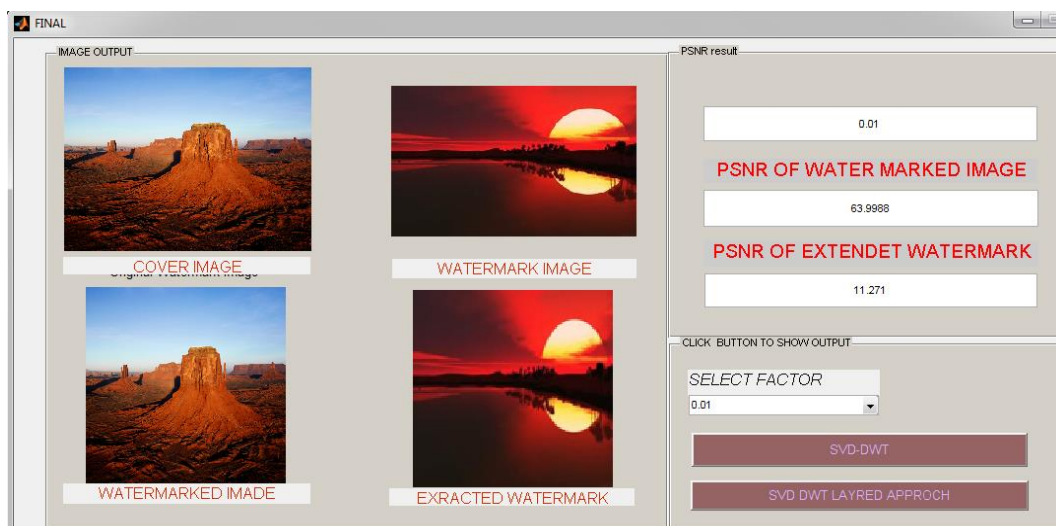


Image 1 :PSNR of the Watermarked and the Extracted Watermark Image using Layered SVD and DWT Technique for Scale Factor - 0.01

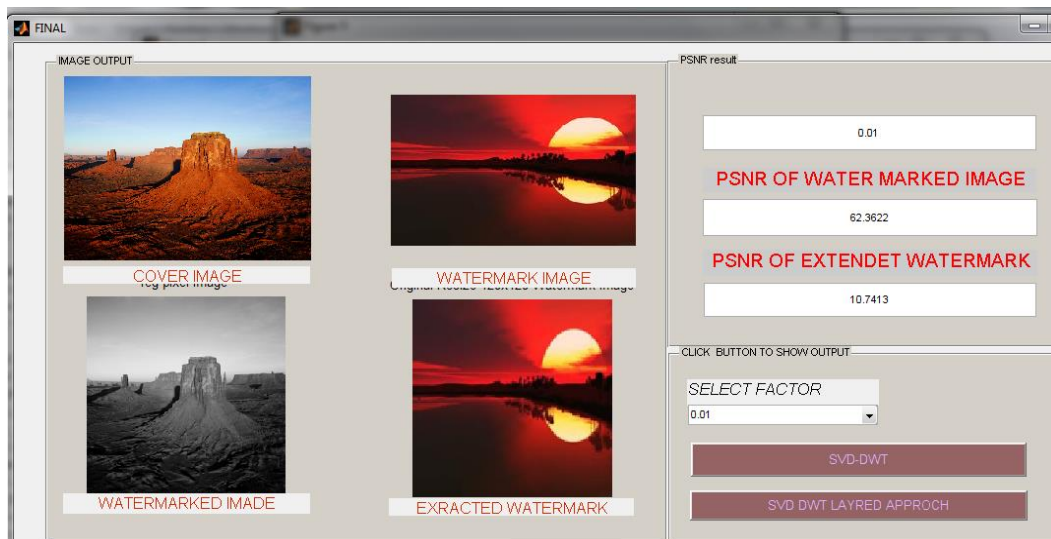


Image 2: PSNR of the Watermarked and the Extracted Watermark Image using SVD and DWT Technique for Scale Factor - 0.01

WATERMARKING SCHEME	PSNR WITH $\alpha = 0.01$	PSNR WITH $\alpha = 0.05$	PSNR WITH $\alpha = 0.09$	NOISE $\alpha = 0.01$ SPECKLE	SALT & PAPER NOISE $\alpha = 0.05$
DWT-SVD	62.3621	48.6281	43.5079	19.34	17.23
PROPOSED LAYERED APPROCH	63.9988	50.4752	45.5949	21.80	20.98

TABLE:1 shows the comparison results of PSNR values of proposed method with SIMPLE DWT and SVD based colour image watermarking methods. Values of PSNR are desired for good image watermarking. From TABLE, it can be said that in case of PSNR values the proposed method outperforms the existing methods

Comparison Plot of Varying PSNR with Scale Factor of Watermarked Image for SVD - DWT and Layered SVD - DWT Technique

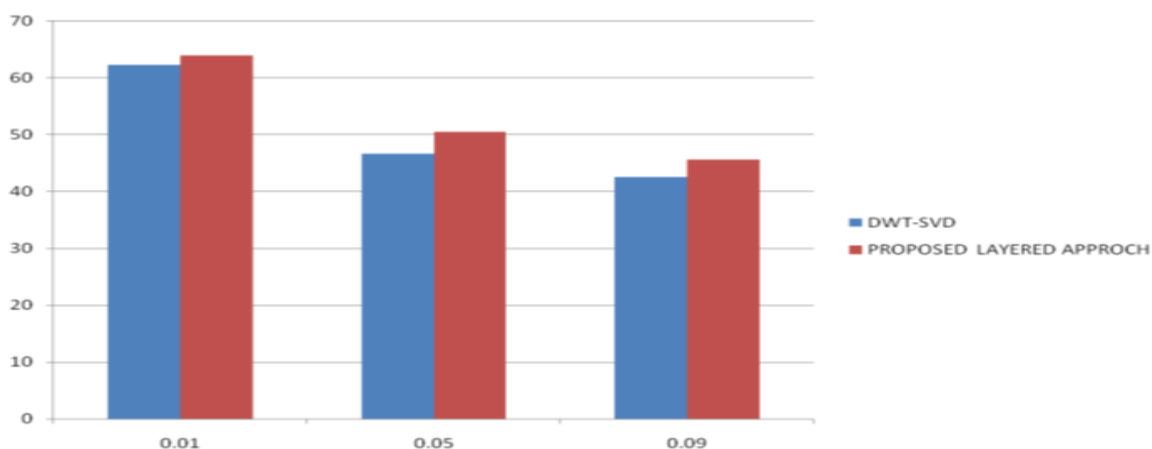


Figure : Plot of Varying PSNR with Scale Factor of Watermarked Image for SVD -DWT and LayeredSVD - DWT Technique



## VII. CONCLUSION

TABLE shows the comparison results of PSNR values of proposed method with SIMPLE DWT and SVD based colour image watermarking methods. Values of PSNR are desired for good image watermarking. From TABLE, it can be said that in case of PSNR values the proposed method outperforms the existing methods.

In preset work a hybrid watermarking scheme using Layered SVD and DWT has been introduced, where the watermark is embedded in the singular values of the red component of the DWT sub bands and then combined with the other two i.e. green and blue components to yield the watermarked image. The methods adopted fully exploit the features of the SVD and DWT transform. The intrinsic algebraic properties of the image represented by SVD and the spatial-frequency localization of DWT are well utilized. Experimental results are made available which depict the improved imperceptibility and robustness under attacks and preserve copyrights by using this technique. In this present approach for robustness we can apply various attacks on the images and check the correspondent PSNR values. Further work of integrating human visual system (HVS) characteristics into our approach is in progress for robustness and more secure application.

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