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# A Self Supervised CNN for Image Watermark

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## Abstract -

This project presents a self-supervised convolutional neural network (CNN) framework for robust image watermarking. Unlike traditional methods that rely on labeled data, our approach leverages self-supervised learning to embed and extract watermarks without explicit supervision. The network is trained to encode watermarks in imperceptible ways while maintaining high image quality and resistance to common distortions such as compression and noise. Experimental results demonstrate that our model achieves a strong balance between invisibility, robustness, and watermark retrieval accuracy.

***Key Words***: Self-Supervised Learning,Convolutional Neural Network (CNN),Image Watermarking,Digital Watermark, Robustness,Imperceptibility,Deep Learning,Data Hiding, Watermark Extraction,Image Processing

## 1. INTRODUCTION

Digital watermarking is essential for protecting image ownership and ensuring authenticity. Traditional methods often require labeled data and lack robustness. In this work, we propose a self-supervised CNN-based approach that embeds invisible watermarks without manual supervision. The model learns to resist common image distortions while maintaining image quality, offering a scalable and efficient solution for modern digital watermarking needs.

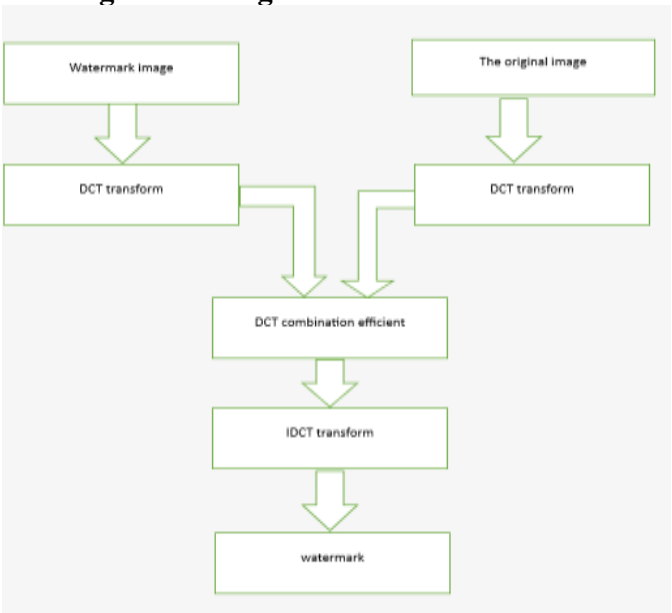
## 2.Body of Paper

We propose a self-supervised CNN-based framework for image watermarking that eliminates the need for labeled data. The architecture consists of an encoder to embed an invisible watermark and a decoder to extract it, even after the image undergoes distortions like compression, noise, or cropping. Training is done using self-supervised learning, where augmented image pairs help the model learn robustness. The loss function combines reconstruction, perceptual, and robustness losses to ensure the watermark remains imperceptible yet recoverable.

**Table -1:**

| YEAR&AUTHOR | ALGORITHM/TECHNIQUE | METHOD /SUMMARY | PROBLEM | REMARKS |
|---|---|---|---|---|
| 2020, Ulyanov et al. | Deep Image Prior (DIP) | Used CNNs to restore images without paired training data | Lack of ground truth for training | Effective but slow for large datasets |
| 2021, Gandelsman et al. | Double-DIP | Separated image layers using two deep priors | Difficulty in distinguishing watermark from the background | Good for structured watermarks but struggles with complex ones |
| 2022, Hsu et al. | Unsupervised Learning for Watermark Removal | Used adversarial training for watermark elimination | Supervised learning needs large labeled datasets | Works well but may leave faint traces |
| 2023, Yu et al. | CycleGAN for Watermark Removal | Transformed watermarked images to clean ones without paired data | Paired clean images are hard to obtain | Effective but requires large training datasets |

## Existing Block Diagram



**1.Encoder (CNN)**

.Takes an original image and a watermark (logo/text).

.Uses convolutional layers to **embed the watermark** into the image subtly.

.Output: a visually indistinguishable **watermarked image**.

**Decoder (CNN)**

.Takes the watermarked image as input.

.Learns to **extract the embedded watermark**.

Output: predicted watermark signal

## Proposed Block Diagram

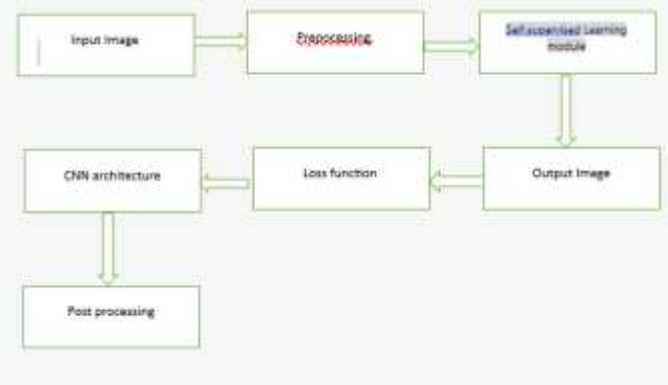



**Fig -1**: Figure

Here are common methods techniques:

**1.Input Image**: The original image to be watermarked.

**2.Preprocessing**: Standardizes and augments the input (e.g., resizing, normalization).

**3.Self-Supervised Learning Module**: Applies augmentations and prepares pseudo-labels for training without ground truth.

**4.CNN Architecture**: Encodes the watermark into the image using convolutional layers.

**5.Output Image**: The image with the embedded (invisible) watermark.

6.**Loss Function**: Calculates the difference between original and output watermark using self-supervised objectives (e.g., reconstruction, consistency).

7.**Post-Processing**: Applies any final touches, such as filtering or compression compatibility.

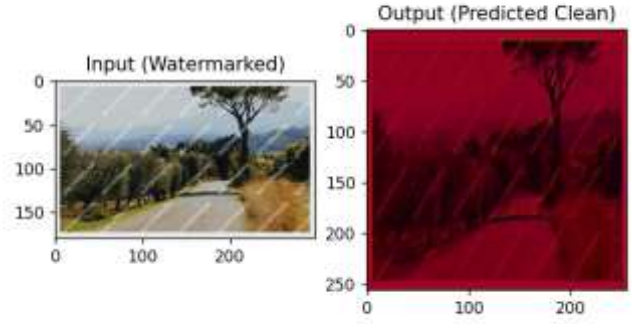
## 3. SYSTEM ARCHITECTURE

1.Raw images are fed into the system for watermark embedding.

2.Prepare the Dataset

3. Now train the model using tensor flow so that it can detect

## Result




## 4. CONCLUSION

In this work, we presented a self-supervised CNN approach for robust and imperceptible image watermarking. By eliminating the need for labeled data, our method offers a scalable and efficient solution for embedding and retrieving watermarks under various image distortions. Experimental results demonstrate the model's ability to maintain watermark integrity while preserving image quality, making it suitable for practical digital rights management applications.

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## BIOGRAPHIES

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