

School of Engineering and Applied Science (SEAS), Ahmedabad University

ECE501: Digital Image Processing
WEEKLY REPORT-1

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Project: 8. Digital Image Watermarking and Extraction Embed a watermark in an image and later extract or detect it

Group Name: Pixels

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Main Problem Statement:Digital Image Watermarking and Extraction Embed a watermark in an image and later extract or detect it

Our Learnings:

Watermarking is the process of including hidden information in a subtle way for an image such that it can be traced for authentication, and ownership for third parties. It is basically a personalized symbol for a specific owner company and can be the logo of the company, its name or just a unique trait that proves the ownership. Here, for this project, we have to EMBED a word/symbol such that it can be traced and detected. This helps for patenting and proving ownership.

Furthermore we also understood the types of watermarking(spatial domain and freq domain) which will help us choose which domain we want to work with and under that domain what type of watermarking we will be working with and also the amount of dataset required. We also learnt about the visibility of watermarks that further helped us find challenges and constraints that may bound our project. Overall, this week was just theoretical understanding of the project statement and initial project planning phase for the first week.

Work done till Week-1:

1. Selection and Knowledge of the Topic:

- We studied the concept of digital image watermarking, which involves embedding the hidden information such as a watermark into an image for ownership verification or copyright protection.
- We understood how watermarking differs from steganography like watermarking focuses on robustness and copyright protection, while the steganography focuses on secrecy.
- We explored real world applications, including copyright protection, image authentication, and also tamper detection.
- We learned about various watermarking domains and techniques:
 - Spatial domain methods: It directly modify pixel values like for e.g. Least Significant Bit (LSB) method
 - Frequency domain methods: Embed watermark in the transform coefficients using DCT(Discrete Cosine Transform),DWT(Discrete Wavelet Transform), or DFT(Discrete Fourier Transform).
- We have studied research papers implementing watermark embedding and extraction using DWT and DCT methods.(<https://www.mathworks.com/matlabcentral/fileexchange/78790-digital-watermark-comparison-of-dwt-and-dct>)
- We reviewed the differences between visible and invisible watermarking and their practical use cases.

2. Tool and Library Selection:

- Language chosen: Python
- Libraries to be used:
 - OpenCV - for image processing operations
 - NumPy - for mathematical computations
 - Matplotlib - for visualization
 - PyWavelets - for DWT-based watermark embedding

3. Plan for Next Week:

- Environment setup:
 - Install Python libraries : OpenCV, Matplotlib, Numpy, Wavelets

- Setting up Github repository for team collaboration
- Defining Scope and Goals:
 - To shortlist whether we'll be working with spatial domain or frequency domain after a minor doubt clearance with the TA.
- Basic Implementation:
 - Understanding the approaches and reviewing the already existing codes from experts using their Github Repo.
 - Also create datasets for template images and watermark images.
- Future Goals:
 - Implement DWT based watermarking for better robustness.
 - Comparing different methods using PSNR metrics.
 - Develop a complete watermarking system with GUI.