Weekly Report: Digital Image Watermarking and Extraction

Project Number: 20

1 Introduction

This week, we focused on implementing and testing a hybrid domain watermarking technique combining the Discrete Fourier Transform (DFT) and Discrete Cosine Transform (DCT). The goal was to enhance robustness against multiple image distortions while maintaining acceptable visual quality and correlation during extraction.

2 Research

The hybrid method was designed to embed the watermark in frequency coefficients obtained after applying both DFT and DCT. The implementation involved:

- Applying DCT to image blocks and then using DFT on selected coefficients to achieve dual-domain embedding.
- Testing the watermarked images against a variety of attacks, including Gaussian noise, rotation, scaling, and JPEG compression.
- Measuring performance using PSNR and Normalised Correlation (NC) metrics.

Results showed that the hybrid method provided improved robustness compared to the DFT-only approach, particularly against compression and minor geometric transformations. However, extraction accuracy decreased slightly under strong rotation or scaling distortions, indicating the need for further normalization steps.

3 Conclusion

Work done this week:

- Implemented hybrid domain watermarking (DFT + DCT).
- Evaluated hybrid approach under multiple attack conditions.
- Compared performance metrics (PSNR and NC) with DFT-only method.
- Identified potential improvements for geometric attack resistance.

Work to be done next week:

- Introduce geometric normalization or feature-based registration to improve robustness against rotation and scaling.
- Understand the effect of three factors that influence the watermark, imperceptibility, robustness, and payload.
- Work on drafting the final results, and summing up the findings.