

Abstract

Digital watermarking is a technique used to embed a hidden message, such as a company logo, creator's name, or other identifying information, into a cover medium like images, audio, or video. Effective digital watermarking algorithms must satisfy three key requirements: robustness, perceptibility, and payload capacity. These algorithms are categorized into two primary domains: spatial and transform. In the spatial domain, watermarking modifies pixel values directly based on the watermark. In the transform domain, the frequency components of the cover medium are manipulated to embed the watermark. Lastly, a hybrid approach combines DCT, DWT, and SVD techniques to leverage the strengths of all three methods, achieving improved performance.

To evaluate watermarking effectiveness, two metrics are calculated: (1) Perceptibility: This is assessed using Peak Signal-to-Noise Ratio (PSNR) and Mean Square Error (MSE) at the transmitter end. (2) The quality of the recovered watermark at the receiver side is determined by calculating the correlation between the recovered and original watermarks.

For assessing robustness, which measures the quality of the watermark retrieved at the receiver side, the correlation between the recovered watermark and the original message is calculated. A higher correlation indicates stronger robustness, ensuring the watermark remains intact even under various attacks or distortions.

This thesis introduces a novel method for embedding watermark messages into the crucial part of an image, specifically the region of interest (ROI). The focus is on identifying the human face within an image and embedding the watermark within this detected face. Once the watermark is embedded, the altered face image is reinserted back into the original image. To achieve this, the method employs a face identification algorithm alongside two frequency domain transforms viz. Discrete Cosine and Wavelet as well as the powerful linear algebra technique known as Singular Value Decomposition (SVD). Additionally, the thesis utilizes three widely recognized visual quality metrics to evaluate the method's effectiveness. At the transmitter side, Peak Signal to Noise Ratio (PSNR) and Mean Square Error (MSE) are used to assess the perceptual quality of the image after watermark embedding. At the receiver side, Correlation is measured to test the robustness of the algorithm.

Finally A hybrid algorithm is introduced, which integrates Discrete Cosine Transform (DCT), Discrete Wavelet Transform (DWT), and Singular Value Decomposition (SVD). This combination harnesses the advantages of all three methods, enhancing the overall performance of the watermarking process.

Experimental results demonstrate that the hybrid algorithm outperforms individual methods (DCT, DWT, or SVD alone) in both perceptibility and robustness. This makes the proposed approach a superior choice for applications requiring reliable and imperceptible digital watermarking.