

## ABSTRACT

In the current digital era, the security of medical data has become increasingly crucial due to the growing prevalence of electronic exchange and storage of medical images. One effective method to safeguard the integrity and authenticity of medical images is by employing watermarking techniques. This research project focuses on the application of spread spectrum watermarking using Hadamard codes on medical images.

Spread Spectrum technique using Hadamard codes is employed in this study to embed watermarks into medical images. Hadamard codes are chosen for their orthogonal properties, which provide high resilience against attacks and distortions on images. Watermarks are embedded into the host image's spectrum by modulating Hadamard codes onto the image pixels. This method allows for robust data embedding while retaining the crucial image quality required for diagnostic purposes.

In this research, the Hadamard matrix is used as the code due to its strength and resilience against attacks on watermarked images. Various tests are conducted to evaluate the image quality after watermarking, the resilience against attacks like compression, cropping, and noise, as well as the watermark detection capability on attacked images.

This Final Project research concludes that the watermarking system exhibits robustness against various attacks on watermarked images. However, there are a few attacks, such as cropping with a parameter of [2] and compression (jpeg) with a parameter of [70], which pose some challenges in watermark recovery. Nevertheless, overall, the watermarking system continues to demonstrate excellent performance in recovering watermarks from various types of attacks on watermarked images. The system's quality has been tested with parameters such as PSNR (Peak Signal-to-Noise Ratio)  $\geq 30$  dB, BER (Bit Error Rate) = 0, and MOS (Mean Opinion Square) = 4.

**Keywords:** *Watermarking, Medical image, Spread Spectrum, Hadamard codes, Hadamard matrix.*