ABSTRACT

The rapid growth of internet users worldwide has led to an increase in copyright violations of digital products such as audio, images, and video, including duplication, distribution, and misuse of copyright labels. To protect digital content, digital watermarking is an effective solution by embedding specific information invisibly into digital media. This study proposes an audio watermarking method using Discrete Wavelet Transform (DWT) for signal decomposition and Compressive Sensing (CS) for efficient watermark compression based on the principles of sparsity and incoherence. To enhance system performance, a Genetic Algorithm is employed to optimize watermark embedding parameters by considering three main aspects: imperceptibility, robustness, and capacity. The system is tested on three types of audio files: drum.wav, piano.wav, and orchestra.wav. The optimal result was obtained at the 35th iteration with a fitness value of 0.6544. Based on the evaluation, piano.wav demonstrated the best extraction performance with a BER of 0.07836 and an accuracy of 92.16%, as well as the highest audio quality based on Objective Difference Grade (ODG) assessment. Orchestra.wav produced the highest Signal-to-Noise Ratio (SNR) of 37.73 dB but had the lowest embedding capacity. Meanwhile, drum.wav achieved the highest payload of 361.29 bits while maintaining good audio quality.

Keywords: *Digital audio, Digital Watermarking, Discrete Wavelet Transform (DWT), Compressive Sensing (CS), Genetic Algorithm.*