

## ABSTRACT

*The development of the internet and information technology today has led to the rapid flow of digital communication widely and openly. This also results in easy manipulation, duplication, and illegal distribution of medical data, especially medical image. Copyright protection and authentication of medical image content are indispensable for confidentiality when exchanged over open networks. Therefore, a watermarking scheme is needed for copyright identification and authentication.*

*This study aims to create a safe medical image watermarking scheme. In the embedding process, the first thing to do is to get the mid-band frequency of the medical image that has been divided into many  $8 \times 8$  blocks using Discrete Cosine Transform (DCT). The watermark image in binary form will be subjected to Compressive Sensing (CS) and converted into bipolar form. The Direct Sequence Spread Spectrum (DSSS) signal generated from the key 'seed' along with the watermark is inserted at the mid-band frequency DCT. In the extraction process, the mid-band frequency of the image needs to be recovered. DSSS signal from the same key 'seed' will be needed in extracting the watermark from the mid-band frequency using a Fractional Differentiator (FD) based detector. After CS reconstruction, a watermark image will be obtained.*

*Simulation shows that the PSNR and SSIM of the carrier image can reach inf and 0.9998, respectively. BER and NC of the watermark extraction can reach 0 and 1, respectively. This scheme has good resistance to signal processing attacks, including: JPEG compression, noise addition (speckle, salt & pepper, gaussian noise), filtering (median, gaussian LPF, mean), blurring, sharpening, and histogram equalization, as well as geometry attacks, including: flipping, rotation, cropping, resizing, and translation. This scheme also has a “uniqueness” that makes it easier to identify and authenticate copyright.*

**Keyword:** *Watermarking, Medical Image, Discrete Cosine Transform, Compressive Sensing, Fractional Differentiator Based Detector.*