# Abstract

In recent years, due to the advancement in multimedia technology and Internet technology, a large volume of digital media such as images, audio, and video are generated, stored, and shared on various open platforms. This data may be crucial to an individual or an organization as it contains sensitive and useful information like personal information, medical information, business secrets, military information, etc. The illegal copying, modification, and forgery of digital media is a growing problem. There is a high risk of misuse of that information due to unauthorized access to the media data. As a result, it can harm personal reputation and national security, and huge financial loss in business, etc. So, issues concerning the security of these digital media are crucial.

The common approaches for information security of digital information are cryptography, steganography, watermarking, and secret sharing. In this thesis, we have focused on the security of images and audio signals. Our primary goal is to design secure watermarking techniques for images and audio signals. The watermarking techniques involve embedding the specific information (i.e., a watermark) into the digital media without perceptual degradation of the media. The ownership of media or the illegal use of the data can be established by the extracted watermark. The main target of this thesis is to use watermarking techniques for copyright protection and authentication of digital images and audio signals.

In this work, we have proposed two image watermarking techniques to achieve the goal of the thesis. The first technique is a binary image watermarking scheme, a semi-blind and robust scheme, based on the BTC-PF method where a binary image is used as a watermark. The second technique is a blind grayscale image watermarking scheme based on SVD where a grayscale image is embedded as a watermark. Both the proposed techniques are secure, provide good quality watermarked images, and are applicable for copyright protection or authentication of images. The performance of the proposed image watermarking techniques is similar to or better compared to state-of-the-art (SoA) methods.

Digital audio is an important media data and utilization of audio data is increasing day-by-day. So, it becomes mandatory to safeguard the ownership as well as the integrity of audio data. In this thesis, we have proposed an audio watermarking technique for copyright protection and authentication of audio signals. The proposed audio watermarking technique is based on SVD and quantization of the largest singular value to embed a binary watermark. The experimental output of the proposed audio watermarking technique is comparable to or better than SoA methods.

To make our proposed watermarking methods secure, the watermark images are encrypted before embedding. The proposed image encryption method is very efficient, plaintext sensitive, robust against different attacks, and gives results similar to the SoA methods. The proposed robust encryption method is further extended to achieve fragile image encryption. This is done using the concept of triple encryption: i) first encryption using a key $key_1$, ii) then decrypt using another key $key_2$, and iii) finally, the intermediate result is encrypted further using the key $key_1$, where $key_1 \neq key_2$. To achieve robust/fragile watermarking to verify copyright information and authentication of data, the watermark image needs to be encrypted by robust/fragile image encryption method, respectively.