ABSTRACT

Digital watermarking techniques are utilized recently to protect the integrity, validity, security and ownership of multimedia data such as text, digital images, audio, video and software. These techniques need enough security and robustness to avoid the embedded information from being destroyed and removed. There are several other areas like broadcast monitoring, fingerprinting, authentication and covert communication, e-commerce, e-governance that make the extensive use of digital watermarking technologies. That's why the research on digital watermarking methods has received considerable attention in recent years.

Wavelet based watermarking techniques have multiresolution hierarchical characteristics and provide sufficient information both for analysis and synthesis of the original signal, with a significant reduction in the computation time. To overcome the problems involved in enhancing security levels, robustness and image quality in DWT, the present thesis worked in this direction to develop novel schemes.

To achieve further success rate in image manipulations or attacks, the present study intelligently applied preprocessing methods on DWT, which smoothens the image, by reducing noise, and by increasing the contrast and intensity of the image by preserving the significant characteristics of the image without any loss of image content or the information. To increase the embedding capacity, to maintain the watermarking characteristic and to simultaneously decrease the destruction of the original image, the present thesis proposed Wavelet based Threshold on Intermediate Bit Values (WTIBV) of image pixels to select the pixel location to insert the watermark.

To achieve flexibility, to alter the cover image in order to embed the hidden information and to make the watermark more robust to attacks, the present thesis proposed Significant Wavelet Hierarchical (SWH) approach. The SWH divides Hierarchical Regions into Significant Hierarchical Regions (SHR), where watermark is
embedded, and Unused Hierarchical Regions (UHR) where next level of hierarchy is placed. The watermark is embedded by using a novel approach called REO.

To make the extracted watermarks visually recognizable to make them hard to detect the embedded watermark by human visual perceptivity, and to meet the upcoming image/video compression standards, the present thesis extended the concept of zero wavelet tree, by proposing two novel schemes called Simplified Significant Wavelet Tree (SSWT) and Complete Qualified Significant Wavelet Tree (CQSWT). So far no researcher has attempted to use fuzzy logic in the spatial domain. The present thesis developed a new technique called Fuzzy Wavelet (FW) approach for selecting the pixel locations to insert the watermark. The FW approach overcomes the weak robustness problem of the spatial domain and the watermark extraction does not require the original image as in the case of many digital watermarking methods. Further the FW approach eliminates the requirement of repeated embedding process, as in the case of self reference scheme.