ABSTRACT

With widespread use of internet and other communication technologies, digital multimedia is easy to duplicate, but difficult to distinguish between the original and the duplicated. Hence, the protection of intellectual property has become a major problem in this digital age. Digital watermarking is an effective solution and plays an important role in copyright protection. Watermarking techniques are classified into two types, viz. Spatial domain technique and Transform domain technique. Transform domain technique achieves more robustness as compared to spatial domain technique but it needs more computational complexity.

Several important issues exist in the watermarking system. With respect to the problem of general information hiding, a trade-off is to be achieved among imperceptibility, robustness and capacity. Watermark extraction process is different for different types of watermarking schemes. Blind watermarking technique is very difficult but a necessary task for authentication and copyright protection as it may not be easy to obtain the original image or original watermark during the extraction process.
Wavelet transform is a very popular technique in image transform, especially in watermarking on images. Various watermarking methods have been proposed in wavelet domain due to their excellent multi resolution property. Haar Wavelet Transform (HWT) consistently outperforms the more complex ones when using non-colored watermark. In this research work, Double Haar Wavelet Transform (DHWT) and Complex DHWT based robust blind watermarking algorithm for 2-D and spectral images are proposed.

The Haar Wavelet based M-channel Filter bank (HWF) with M=3 is called the Double Haar Wavelet Transform. Complex Double Haar Wavelet Transform (CDHWT) combines the advantages of both CWT and M-Channel filter bank. Similar to dual tree complex wavelet transform, CDHWT is also implemented with dual DHWT. Imperceptibility and robustness are two basic properties and/or requirements of a good watermarking scheme. The proposed algorithm based on DHWT and CDHWT is evaluated against these two properties. Experimental results show that both the algorithms produce better PSNR value. The proposed algorithms are also tested against various attacks like JPEG compression, low pass filtering, median filtering, histogram equalization, cropping, rotation, addition of noise etc. From the experimental results, it may conclude that both the DHWT and CDHWT based watermarking system offers very high robustness and imperceptibility.
In the second part of the thesis, the concept of 3-D DHWT is investigated and it is extended to 3-D complex domain. Two watermarking methods based on 3-D DHWT and CDHWT combined with SVD are proposed for spectral images. SVD technique helps to reduce the number of values embedded in to the input image and also to extract the watermark perfectly during extraction. Mid-frequency band is used to embed the secret message throughout the thesis. Experimental results illustrate that the watermarking methods proposed for 2-D as well as spectral images based on DHWT fulfills the conflicting requirements of imperceptibility and robustness of watermarking scheme.