CHAPTER 8

CONCLUSIONS

The aim of this research work is to explore the area of image denoising, improving the existing techniques and to develop new techniques. We focused on the problem to denoise noisy images. The novel adaptive wavelet based image denoising methods are proposed, implemented and assessed. An outline of conclusions is summarized in this chapter.

The potential of adaptive based methods for the purpose of image denoising has been investigated in detail and proposed and implemented. A new denoising algorithm based on spatial adaptation was developed. The main advantage of proposed algorithm is to use local spatial information. The algorithm uses energy and variance of local region to detect local information lead to a big improvement in denoising performance. The popularity of the 5 x 5 window, suggest that it present a good trade-off between compact locality and the window size. The use of local information has resulted in improvement in the performance of the various standard wavelet thresholding methods studied in this thesis. In spatial adaptive approach a priori information about image feature characteristics is used to distinguish feature and noise. The wavelet coefficients associated with features region are less shrinked compared to smooth noisy region. It is shown that significant improvement in the quality of the denoised estimate is gained. The reasons behind achieving image denoising through adaptive technique of the noisy image are investigated. It is observed that incorporating feature information results in significant improvement in incremental peak signal to noise ratio. The experiment results using bench mark images and various noise intensities are tabulated and shown the

improvement in incremental peak signal to noise ratio. We have also tried to establish a basic methodology to apply Differential Evolution in wavelet denoising that promises improvement upon state-of-the-art wavelet based denoising techniques. The methods were optimized in term of specific criteria, e.g., minimizing the mean squared error by Differential Evolution. The Locally adaptive variance denoising algorithm results are better than Locally adaptive energy algorithm because variance is more accurate static parameter to detect spatial image information.

Different state-of-the-art approaches have been implemented, and evaluated for denoising and compared their performance to proposed methods. From the experiments, it is concluded that superior results were obtained with the proposed methods. In terms of computational complexity as the other compared wavelet based methods, the proposed method is less computational complex.

The multiplicative noise is reduced in SAR images. SAR images have quit different statistical behavior from natural images. SAR images despeckled from speckle noise which is multiplicative in nature. The standard speckle filters were implemented and compared with wavelet based filter. The evaluation parameter such as IV, SNR, and ENL had shown significant improvement compared to several commonly used filters, including Lee, Enhanced Lee, Frost, Gamma, and Median. The filters were also tested in synthetic image which is contaminated by speckle noise. The despeckled images were used for geographical feature detection. For geographical feature detection, a wavelet-based ribbon-like structure recognition method is proposed which is simple and efficient.

Image enhancement technique is used which is based on regularity parameter. When the noise characteristic of the image is unknown, denoising by regularity analysis has

proved to be the best method. It is noted that regularity is an abstraction and is valid only asymptotically. So the true value of Holder regularity is not the point of interest but only a resultant value that is greater than that of the input signal is of interest.

We have covered range of application domains, image and noise types. An extensive performance evaluation was performed for the suppression of artificially incorporated noises on various benchmark images.