The work in the thesis has successfully achieved following objectives:

i. The epsilon-median filtering based subband-dependent thresholding scheme improves the conventional thresholding schemes that can remove high frequency components, such as edges due to usage of a global (universal) threshold to filter small wavelet coefficients. Another suggested coefficient-dependent thresholding scheme which inherits some features from the first scheme and incorporates some new aspects, can further improve it. In addition to this, the approach of replacing the wavelet transform by a redundant tetrolet transform (for both the schemes) also independently helped in achieving better denoising results. [Jain and Tyagi (2015a), Jain and Tyagi (2015d)]

ii. The locally adaptive patch-based thresholding scheme which is neighborhood-dependent in nature and relies on aggregating multiple thresholded estimates of the coefficients, enhances the denoising performance as it can characterize the local features better than a subband-dependent (and/or coefficient-dependent) thresholding. [Jain and Tyagi (2015b)]

iii. The block SVD-based thresholding scheme which adopts divide-and-conquer strategy and applies edge-adaptive thresholding to each block, enhances the denoising performance as it better characterized the local features; adapts to the inhomogeneous nature of natural images.
iv. The weighted-SVD filtering based thresholding scheme which uses the approach of obtaining the filtered outcome of a local patch by considering the aggregative effects of its non-local similar patches, improves the conventional block SVD-based filtering in wavelet domain.

v. The arbitrarily shaped locally adaptive windows-based thresholding scheme which obtains nearly accurate local statistics of the image and considers the edge strength of each pixel, achieves better denoising performance over the state-of-the-art locally adaptive thresholding schemes. [Jain and Tyagi (2015c)]

In the future, work can be done to provide more effective solutions for the identified problems. In addition the presented image denoising techniques can be tested on other grayscale image datasets for further establishing their efficacy. Also the work can be extended to denoising of color images as well as video sequences.

The proposed techniques in tetrolet domain are well suited for denoise square natural grayscale images with dimensions in the exponential order of two. However, if image is not a square then it has to be extended to make it a suitable input image. After denoising, the image is cropped to get the original size. But such adjustment may severely affect the denoising performance. Also choosing an appropriate number of tetromino coverings being averaged is a crucial point. In future, the work can be done to resolve these issues.

All the denoising techniques presented in this thesis have developed using Discrete Wavelet Transforms (DWT) which, due to its filter-bank implementation, offers a high flexibility in implementation and the possibility of using a wide number of wavelet families. Besides all the benefits of this transform, it has also a series of limitations such as its shift sensitivity and its
poor directional selectivity. These limitations can be somewhat overcome by using some of DWT’s extensions, such as the Undecimated Discrete Wavelet Transform (UDWT) which is translation invariant or the Discrete Wavelet Packet Transform, that offers a better directional selectivity. Another way of overcoming these limitations is given by the use of Complex Wavelet Transforms (CWT). These variants of wavelet transforms can be used for future enhancement of denoising techniques.