Chapter 7
CONCLUSION AND FUTURE SCOPE

7.1. CONCLUSION

The work presented in this thesis addresses the problem of rotation and scale invariance of the medical images. The study mentioned in this work presents various techniques for analysis and classification of the images with rotation invariance characteristics. Feature extraction based on texture analysis is implemented and considered as the best technique when compared with other existing methods. Image fusion is considered one the important steps which assists for better diagnosis through fusing various image modalities. The study also discusses various image fusion techniques. Overall the study presented in this thesis is categorised into the following points:

a) A brief study on the implementation of the log-polar mapping for rotation invariance conditions is demonstrated. An insight into several drawbacks of the same procedure are also cited where, row shifting is one of the major issues. In order to ensure better results, this step is followed by efficient transformation method that substantially mitigates this row shifting. Wavelet, Curvelet and Non-subsampled contourlet transformation techniques are implemented and applied for such problems mentioned above.

b) An effective wavelet energy feature for rotation and scale invariant texture extraction and classification is implemented for the problem of rotation and scale invariance. A review of the existing wavelet packet decomposition techniques are listed and discussed as an initial step. This step involves various wavelet transform techniques and compare their performance. Then a systematic framework is set up to extract the rotation and scale invariant log-polar wavelet energy signatures for a given image. The feature extraction process involves applying a log-polar transform and an adaptive row shift invariant wavelet packet transform to obtain rotation and scale invariant wavelet coefficients. This methodology appeared to be quite efficient. The
wavelet transform produced a PSNR of 54.45 when applied to 2D images. The efficiency of the same is tested on medical images which produced PSNR of 57.52 competitively while fusing 3 modalities.

c) A comparative study is performed on wavelet transformation by implementing the Curvelet and NSC Transformations. The techniques are applied similarly to the 2D images for validation and later extended to medical image fusion with at least three modalities of images. The results are analysed. It is interesting that these two techniques have reported PSNR of 61.00 and 61.82 which are better than the wavelet transformation. This is due to the advantages of these latest techniques with the capability of overcoming several limitations of the wavelet transformation which are listed in the literature survey thoroughly.

This thesis presents a concise presentation of the complete thesis. The importance of study considered in this thesis is given at the beginning of this Chapter. An exhaustive literature survey followed by research gaps and motivation is presented. The objectives of the proposed research is also mentioned. The Chapter wise work distribution is outlined and organization of the thesis is presented.

7.2. FUTURE SCOPE

Considering the above conclusions in regard to the work presented in this thesis, the author would like to suggest the following extensions to this work as future scope.

i) Further research could be focused on investigating the impact on classification performance for different choices of techniques mentioned and comparing them with existing conventional techniques. Currently, orthonormal wavelets were selected for the feature extraction. Other wavelets, such as biorthogonal wavelets, could have even better performance.

ii) Implementation of the unconventional and evolutionary techniques and validating their performance would be a very good scope of work, as these techniques have evolved as simple but computationally efficient in handling problems in several areas of image processing.