Chapter 6 : CONCLUSION AND FUTURE WORK

Medical image denoising plays a crucial role in computer aided diagnostic (CAD) system where a good quality image can better be utilized in disease identification, segmentation of normal and abnormal tissues etc. This work started with some notion of restoration and enhancement problems in medical images preceded by noise removal. In this chapter, the conclusions of the thesis are stated and the scope for future research has been discussed.

6.1. Conclusions

The research contributions and research achievements of this thesis are as follows:

Chapter1 discussed the motivation, background and problem description for the presented work including thesis scope/objectives, and contributions.

Chapter2 discussed the theoretical background for restoration and enhancement of magnetic resonance images. In this chapter, we have also given an overview of magnetic resonance images. Further, in this chapter a literature survey of prominent approaches for restoration and enhancement of magnetic resonance images were given.

Chapter3 presented design and development of nonlinear partial differential equations based filter for restoration and enhancement of magnetic resonance images. Further, in this chapter two new methods were proposed, the first one is an efficient partial differential equation based nonlinear filter adapted to Rician noise for restoration and enhancement of magnetic resonance images. Second one was the modified complex diffusion based nonlinear filter adapted to Rician noise for restoration and enhancement of magnetic resonance images.

Chapter4 presented orientation dependent anisotropic adaptive fuzzy diffusion based filter for restoration and enhancement of magnetic resonance images. Further, the proposed method was compared with other standard methods in terms of performance metrics and found that the proposed method performing better.

Chapter5 presented a partial differential equation based general framework adapted to Rayleigh's, Rician's and Gaussian's distributed noise for restoration and enhancement of magnetic resonance images. In this chapter, a general filter have been designed which filters out the Rayleigh's, Rician's and Gaussian's distributed noise one by one distinctly from various noise corrupted magnetic resonance images.

Finally, the overall conclusion of this thesis is being summarized as follows:

- Investigated and presented a comprehensive literature review and comparative study of various classical as well as state-of-the art methods for restoration and enhancement of magnetic resonance images. Further, a new method for restoration and enhancement of MRI using PDE based various priors developed. The proposed method had been tested with several existing methods and was found to have better performance as compared to other representative state-of-the-art methods.
- Developed and implemented two new methods for restoration and enhancement of MRI based on anisotropic diffusion and complex diffusion were proposed. First method handles an efficient PDE based nonlinear filter adapted to Rician noise for restoration and enhancement of magnetic resonance images. Second method deals with modified complex diffusion based nonlinear filter adapted to Rician noise for restoration and enhancement of magnetic resonance images.

- A new method orientation dependent anisotropic adaptive fuzzy diffusion based filter for restoration and enhancement of magnetic resonance images was developed and presented. The proposed method was found better in terms of all qualitative as well as quantitative performance metrics as compared to other methods.
- Design and Development of a new method for a partial differential equation based general framework adapted to Rayleigh's, Rician's and Gaussian's distributed noise for restoration and enhancement of magmatic resonance images. The proposed method was suitable for multiple noises present in MR images. The proposed method is found better in terms of all visual as well as quantitative performance metrics as compared to other methods.

The works presented in the thesis, brings important contributions to computer vision and medical image reconstructions. A detailed study of the literature was performed for all the research areas addressed in this thesis. The proposed methods and algorithms have been rigorously validated and compared with recent state-of-the-art methods. The contributions of this thesis are both theoretical and applicative.

6.2. Suggestions for Future Research

The research work presented in this thesis can be taken further into different directions.

The scope for future works are as follows:

The performance comparison of image de-noising methods, on Real images like natural or medical is quite subjective if no gold standard is available. This thesis compares methods on brain web database that is similar to real human brain MRI scans; some results are also shown on Real MRI data. Brain related diseases such as brain tumor, multiple sclerosis etc. When working with huge data sets as images, it is important to develop methods which are computational efficient. In this thesis original work of the

variational problem was solved using Euler-Lagrange equations method for a more efficient solution of the problem. There is little bit scope for future work to increase the computational speed of the proposed methods.

The proposed method for restoration and enhancement of magnetic resonance images, tested only for two dimensional dataset of MRI. Still, there is scope to make it more robust and accurate for two dimensional as well as three dimensional dataset of MRI.