Chapter 8

CONCLUSIONS AND FUTURE SCOPE

Highlights of the Chapter

- *Discussion of Conclusion.*
- *Probable solutions and future scope*

The main objective of this thesis is to provide insights on deep learning based techniques for segmentation, denoising and classification of biomedical images. MR images were used for segmentation and denoising. The proposed methods proved to be efficient as the results produced by these methods showed remarkable improvement as compared to their conventional counter parts. The X-ray and CT modalities were used for the classification of images infected by covid-19. The results shown significant improvement in the evaluation metrics with the reduced run time. The proposed computer-aided approaches can save the time and burden on the medical system. This chapter presents the chapter-wise major observations and findings of the thesis as well as future scope related to present work as described in the following section.

8.1 Conclusion

The first segmentation method incorporates the use of residual connections and cross channel normalization in conventional deep learning architecture for accurate delineation of the brain tumour contours. The second method focuses on producing clinically accurate segmentation results by using a dual path deep learning network. Moreover, it also focuses on segmenting the real time MRI data along with the public datasets. The depth wise separable convolution with bottleneck connections along with group normalization are used in the conventional

SegNet architecture for distinguishing the pathological tissues from normal tissues in brain tumour as well as skin cancer images. The sixth chapter introduces noise stifler block in conventional U-net architecture for segmentation of noisy CMRI images. U-net architecture is also modified with depth wise separable bottleneck connections, group normalization and Scaled exponential Linear Unit (SELU). The ablation study is performed to validate the performance of the proposed changes.

The discriminative learning based deep learning denoising network is proposed for denoising of MR images. The proposed method incorporates the use of depthwise separable convolution along with local response normalization with modified hyperparameters and internal skip connections to denoise the contaminated MR images. The obtained results are found to be clinically suitable for the diagnosis of the diseases. Further, deep learning based classification network was proposed for classification of covid -19 infected images. This end to end trainable network produced the statistically significant results. Finally, a classification method based on transfer learning is proposed for fast and efficient classification od covid -19 infected images. In this method the depth wise separable convolution based model of Mobile Net V2 is exploited for feature extraction.

8.2 Future Scope

In the near future, the algorithms proposed in the present work can further be extended. The direction of work may be as follows:

- To develop deep learning based networks with reduced computational costs. So, the time and complexity of the network could be reduced.
- For real time MR images the reference data is not available so the methods with on referential indexes should be investigated.

- To regulate the parameters and hyperparameters of the model correctly, including image pre-processing, for avoiding mode collapse or unpredictable behaviour.
- To create a versatile dataset for classification of the covid-19 infected images from a set of images infected with almost similar features.