Chapter – 6: Conclusions and Future Work

Objectives

• Drawing the results and conclusions from the proposed research

• Proposing the future work with suitable options for extending the research area
6.1. Conclusions
The analysis made from experiment conducted for the analysis total of 6 CT liver images taken from different angles were used. Most of the images do contain the liver portion as a larger part for evaluation of the proposed method the images were segmented using the gradient vector flow based snake image segmentation which is a active contour model used for extraction liver portion from the given CT images. The results obtained from the different algorithms are shown in the above section. At first the image is being segmented with region based approach FCM (fuzzy c-means) which is a conventional clustering technique.

Figure - 6.1: Obtained output of FCM Algorithm with more number of segmented blobs at other than liver area.

Figure - 6.1 shows the result obtained by it we can clearly visualize that there more segmentation blobs which are not suitable for a radiologist to analyze and diagnose.
Therefore a conclusion may be considered that the region based approaches are suitable for CT images. The disadvantages of FCM can be seen very clearly in terms of handling the smallest and largest amounts of noise in the results obtained after simulation. FCM method is not effective in terms of segmenting the complex and real images of synthetic nature. More number of blobs were observed in the segmented output images. It is also covering lots of area which is not related to the liver part of a CT image.

Secondly segmentation is performed with the edge based GVF snake model approach which is considered as one of the best approaches for extracting the contour edges of the object in the images.

![Figure 6.2: Obtained output of GVF Snake model with more number of segmented blobs at other than liver area.](image+)

The experimental result is shown in the figure – 6.2 from which it is clear that though it segments more effectively than the region based, it has acquired more unwanted regions.
apart from the liver in the given CT image. So it can be concluded that when it compared with manual segmented image leads for lower correct detection ration more over segmentation error. Therefore even this is not perfectly suited for the application.

In the third case the SFCM is conducted gave good results compared with FCM method by reducing more number of blobs. However the coverage of the area was beyond the liver areas and some kind of tissues and noises are also covered in this process. In the step – 3 discussed in section 5.2.2 the values of p and q will control both the functions. By varying these two values the misclassified pixels of noise regions and the segmented blobs can be rectified. In simple words the SFCM at values of $p, q$ as 1,0 is much more identical to the conventional FCM.

Figure – 6.3: Obtained output of SFCM Algorithm with reduced number of segmented blobs of liver area.

The clustering process of this SFCM includes two – processes at both iterations. The first pass will be similar to FCM for calculating membership function at spatial domain and in
second pass information of each pixels membership function will be mapped to get computed in the spatial domain. The iterations will be stopped when the difference between two clusters centres reach to the value less than threshold values.

Finally, segmentation is performed with the level set approach without re initialization, the experimental results are shown in the figure – 6.4 the proposed approached is best suited for extraction and segmentation of the liver images from the given CT images.

Figure – 6.4: Obtained output of level set without re-initialization provides reduced number of segmented blobs of liver area.

The methods able to segment the liver portion more appropriately than the snake and FCM approaches as it has high correct detection ratio and very mere over segmentation error. This makes the present approach practically useful for radiologists to diagnose in proper way.
The proposed techniques SFCM and Region based initialization of level set function without re-initialization comes out to be an effective method of computing the signed functions and also they more flexible in differentiating the error values and desired outputs. The performance of the proposed algorithm simulated and tested for real images from well known hospitals like Apollo and Care in India. The outcomes of these algorithms proved to be giving more accurate outputs when compared with existing methods.

6.2. Future work and Recommendations

This work can be further extended for different medical images like MR brain images, Knee images. The proposed method proves to be good in extracting the liver regions this idea can be applied for the extraction of deformable masses in MR brain images. It is expected that the future research will focus on building robust statistical segmentation models.
Bibliography


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[24] T. Chakrabarty. Describe the fundamental steps of digital image processing with a neat block diagram. [Online] available on URL:


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