AbstractID: 4346 Title: Automated texture based CT segmentation by Gabor filtering and Fuzzy clustering

Purpose: To automate segmentation of lesion and organs at risk in lung patients by using Gabor filtering and fuzzy clustering for 4D CT image data and to check the usefulness of segmentation by using these methods.

Method and Materials: Image was pre-processed with contrast enhancement and median filtering in order to prepare it for feature extraction. By filtering the enhanced image by Gabor filtering, texture features were extracted. Three fuzzy segmentation algorithms were selected including Fuzzy C-Means (FCM) , Gustaffson Kessel and Gath Geva (GG). Optimal number of clusters is determined by using validity criterion including Partition coefficient (F), Classification entropy (H), Xie Beni index (XB) and Partition index (SC). Images were then clustered and clusters visualized by using Principle Component Analysis (PCA). Finally, Performance of the algorithms was calculated by plotting the Receiver Operating Curves (ROC).

Results: It was found that different clustering algorithms are best suited for different tissue/Organ segmentations. Furthermore, ROC curves indicated that FCM segmented the left lung with a True Positive (TP) rate of 94.72%, GK segmented Lesion with a TP rate of 88% and GG segmented heart with a TP rate of 74.8%. Fuzzy clustering methods in conjunction with Gabor filters are seen to completely outperform traditional Hard clustering methods like K-Means and K-Mediod. Finally, there is a marked difference seen between the fuzzy clustered regions and oncologist marked GTV.

Conclusion: Texture based segmentation using Gabor filtering and fuzzy clustering perform quite well for Lesion and organs at risk segmentation, however, different fuzzy clustering methods should be combined for optimal segmentation. As Gabor filters use different frequencies and orientation for filtering, they reveal hidden structure, which may contribute to a more precise delineation of tissue/lesion structure.

Conflict of Interest (only if applicable):