

AbstractID: 12722 Title: Classification of UTE-MR volumes of the head for use in radiotherapy planning

Purpose: To develop an automatic algorithm for segmentation and classification of Ultrashort TE (UTE) MRI into bone, air and water and to use these images for .dose calculation.

Method and Materials: In this work a method for segmentation of MR images of the head for use in RT planning is proposed. Three tissue class need to be segmented: soft tissue, cortical bone and air-filled cavities. A special MRI technique, ultra-short TE (UTE) imaging, is used to obtain a signal from bones, which remains dark in conventional MR sequences. The segmentation is done by fitting a Gaussian mixture model (GMM) to the data.

Results: The separation of fore- and background works reliable. Due to partial volume effects and image noise, parts of trachea are sometime falsely classified.. In a few images bone classification failed partially.

Two determine the optimum number of classes different GMM models are estimated for each patient dataset and the Bayesian information criterion (BIC) is used to determine the model with the optimum number of clusters. The optimum BIC value varied. Without normalization GMMs with three clusters are optimal, with normalization more clusters are optimal. Experimental dose calculation was performed on the MRI images and resulting distributions were compared to CT-based dose calculation results. Dose difference was below or in the range of 3-4%.

Conclusion: The presented method is fully automatic and could improve accuracy in RT planning for certain indications, e.g. existence of high-Z implants or for planning in low soft-tissue contrast regions where MR data often can only be used when rigid fusion allows to overlay MRI and CT, which is not often the case for anatomical regions outside of the head. Our method could allow for directly planning the treatment on the MR making acquisition of the CT obsolete.