AbstractID: 1388 Title: The application of two automated MRI segmentation methods for determining brain tumor target volume for use in radiation therapy treatment planning: technical considerations

The definition of the tumor volume in radiotherapy is still based on time-intensive, manual outlining by radiation oncologists. The effectiveness of two automated Magnetic Resonance Imaging (MRI) segmentation methods, k-Nearest Neighbors (kNN) and Knowledge-Guided (KG), in determining the brain gross tumor volume (GTV) for use in radiation therapy was assessed. Various software applications were developed to create a smooth closed contour that encompassed the tumor pixels from the segmentations and to integrate these results into the CT for treatment planning. A probabilistic measurement of accuracy was introduced to compare the agreement of the segmentation contours with those from three physicians. Finally, radiation treatment plans designed from physician tumor volumes were compared with those developed by the segmentations. The kNN method was able to segment all cases while the KG method was limited to enhancing tumors and gliomas with clear enhancing edges and no cystic formation. Both methods under-segment the tumor volume but performed within the variability of contouring performed by radiation oncologists. A planning target volume (PTV) was obtained from a vertically expanded segmentation GTV to compensate for their under-segmentation. The treatment plans were comparable to those produced from the physician contours. This study designed the technical steps needed to incorporate automatic MRI brain tumor delineation in radiation therapy. Improvements are clearly needed to the proposed automatic segmentation systems to reach the goal of fully automatic GTV determination. Nevertheless, combining the information obtained from the segmentation methods could help speed the contouring process and identify the target with greater accuracy.