

Determination of Cerebral Tumor Infiltration Using a Multispectral Segmentation Method

Ideally, determining tumor infiltration using MRI will allow treatment planning and follow-up to be more accurate. An image analysis method has been developed (Eigenimage Filter) which segments tumor infiltration from normal tissue. The segmentation maintains partial volume information and therefore allows areas with little contrast to be segmented. We applied this method to cerebral tumor patients to determine infiltration into normal tissue and validated based on image directed biopsy.

Twenty tumor patients had MRI prior to surgical resection. MRI consisted of 2-T2 FSE, 1-flair, and 2-T1 SE (pre- and post-Gd). Following MRI regions of interest (ROI) were created within lesion and normal tissue. The average signal under these ROI is used in the Eigenimage Filter. The resulting segmented images are combined with post-Gd SE for display in surgery. In surgery biopsy sites are chosen from the images using an ISG/Elekta Viewing Wand. The number of biopsy samples taken was 2-5 tumor and 0-4 normal samples/patient. A Receiver Operating Characteristics (ROC) test was done to validate the segmentation. Biopsy samples were scored on a scale of 1-10 for presence of tumor with a score of 1 being 100% confidence.

The sensitivity was 91%, specificity was 44%, and accuracy 71%. The area under the ROC curve was 0.848. These results demonstrate that the segmentation is accurate and sensitive at determining lesion infiltration.