AbstractID: 3625 Title: Improved Target Localization in Low Field MR Using Local Weighted Mean(LWM) for Spatial Distortion Correction

Purpose:
A methodology using local approximation method is presented for improving spatial distortion correction of Philips Panorama 0.23T MR-Simulator. The effect on accurate MR based segmentation is evaluated.

Method and Materials:
Standard T2 MR data was collected using the 0.23T MR-Simulator. For spatial distortion evaluation/ correction, a standard phantom with dimension of 14"*17"*1" containing a grid of MR markers at 2.5cm spacing was imaged. The spatial fidelity of the MR data was compared with the physical measurements of marker position using both the vendor supplied spatial distortion correction algorithm and our LWM algorithm, which employs local polynomial fitting and marker centroids serving as control points. The markers are automatically detected using a Gaussian kernel. CT-MR image registrations using normalized mutual information were applied to estimate the effect of spatial distortion on image registration.

Results:
Using LWM, the diameter of the imaging region with minimal spatial distortion (marker localization error < 1mm) increased to 300mm, in contrast to the Philips' correction method characterized by diameter=70mm. Visual inspection of clinical imaging data, including a case of craniopharyngioma, indicated such distortion is not readily discernible to the human eye. CT-MR registration results indicated that the normalized mutual information (NMI) increased about 5% after applying LWM to the MR data compared to using the vendor supplied algorithm. Shifts of up to 3mm were observed in segmentation involving off-axis target regions between LWM and vendor corrected MR data.

Conclusion:
LWM provides a significantly superior correction for spatial distortion associated with low field MR imaging compared to the vendor supplied correction. This improves target localization accuracy based on segmentation of off-axis structures, and increases NMI value of CT-MR registration. MR imaging with minimal spatial distortion allows the MR-simulator to be used to monitor tumor regression during radiotherapy.