

AbstractID: 12980 Title: External and internal surrogates for lung tumor tracking

Purpose: To compare the performance of external and internal surrogates for lung tumor tracking. **Method and Materials:** 5 healthy volunteers underwent a session of a single sagittal-slice cine-MRI with image acquisition frequency of 4Hz. A sagittal slice with a visible vascular structure was selected for imaging. The slice contained the target (vascular structure) and the surrogates (diaphragm, abdomen surface, and chest wall). Volunteers were asked to breathe under 4 different breathing conditions during the MRI session, each one of 5-minute duration: 1) free breathing; 2) normal inspiration and elongated expiration; 3) irregular breathing; 4) regular inhale through the nose and impeded exhale through the mouth. Target's location was manually identified in all the frames, and the motions of diaphragm, abdomen, and chest wall were characterized using principal component analysis of a region of interest containing them. The correlation between the motion of the different surrogates (diaphragm, chest wall, abdomen) and the target motion was calculated and compared. Artificial neural network was used to estimate the error of using the different surrogates to obtain target motion. Performance of each surrogate has been evaluated in terms of the error at 95% confidence level e_{95} . **Results:** Diaphragm is the surrogate that correlates best with target motion, even during irregular breathing patterns. The correlation of the abdomen surface with target motion is generally superior to that one obtained with the chest wall, except during some intervals in irregular breathing patterns. Diaphragm led to e_{95} of up to 1.4 pixels during regular breathing, and as large as 11 pixels during irregular breathing. Using abdomen and chest wall together improves individual tracking results, but does not achieve the performance of the diaphragm. **Conclusion:** Internal surrogates perform better than external surrogates. A combination of internal and external surrogates will be further investigated.