

## AbstractID: 8480 Title: Study on the correlation of diaphragm motion and lung tumor motion

**Purpose:** To assess the correlation of diaphragm motion and lung tumor motion as seen in anterior-to-posterior (AP) fluoroscopic sequences.

**Method and Materials:** Fluoroscopic sequences of 7 different lung cancer patients were used for this study. Each sequence consists of 500 to 700 frames at 15 frames per second. Diaphragm position was identified in every frame by an intensity gradient method and tumor positions were manually marked as the ground truth by an expert observer. A Principal Component Analysis model based on 225 (15sec) training frames was built for each patient for tumor tracking based on surrogates. Surrogates included the current diaphragm position alone or an optimal combination of the current diaphragm position plus the diaphragm position temporal history. This optimal set was obtained by the Sequential Forward Floating Search method for feature selection. The error of each model was computed by using the rest of each sequence as testing data.

**Results:** Results show that, in most of the patients, the diaphragm position alone is a good surrogate of the tumor motion, with an average localization error  $\bar{e}$  of 1.6mm and average error at a 95% confidence level  $e_{95}$  of 3.9mm. The model is improved in most of the patients by adding new surrogates from the diaphragm position history ( $\bar{e}=1.3\text{mm}$ ,  $e_{95}=3.5\text{mm}$ ). However, some patients, especially patients with irregular breathing, do not show a good correlation.

**Conclusion:** Gated radiotherapy of the lung relies on the correlation of the tumor motion with respect to the diaphragm. It has been observed that although this correlation is in general good, and can be improved with more sophisticated correlation models, some patients do not show a good correlation regardless of how sophisticated the model is. In future work, new surrogates which better correlate with the tumor motion will be explored for use in gated treatment.