AbstractID: 7206 Title: A feature matching approach for the automatic correlation of internal and external motion in lung tumors

Purpose: To develop an automatic procedure to correlate the motion of internal features in CT with external RPM© (Real-time Position Management) signal.

Method and Materials: A cross-correlation based algorithm was implemented to perform template matching for detecting anatomical structures in cine-mode CT data acquired for 4D-CT. The method was used to track the spatial movement of pulmonary bifurcations in 4 patients over short durations in time. For each subject, 12 points, equally distributed from top to bottom in both lungs, were selected. A graphical interface was developed to allow users to navigate through the un-binned CT images, acquired in cine-mode with a 4-slice scanner. Interactive methods were developed for temporal image browsing, template selection, definition of couch positions to be searched, and verification of results. The cross-correlation matrix was computed for each slice in the search volume. To increase the resolution along the superior-inferior (SI) direction, a 2^{nd} order spline was computed to interpolate the Z position in the 4 slices of each cine-mode chunk. The detected internal movement of features in 3D was then retrospectively synchronized with the RPM signal, and the correlation index R^2 was computed.

Results: Peak-to-peak values of feature motion, along the SI direction, ranged from 0.83 mm (upper lung) to 25.33 mm (lower lung). Some patient exhibited relevant motion also in the latero-lateral (10.60 mm) and anterior-posterior (12.22 mm) directions. The median±quartile of R^2 in SI direction was 0.89±0.09. No statistical difference was found between upper and lower lung (0.89±0.10 vs 0.89±0.08).

Conclusion: The developed automatic procedure allowed a fast analysis for external/internal correlation of lung anatomy. Such a study is particularly relevant in IGRT (Image Guided Radiation Therapy) since most techniques rely on external fiducial monitoring to assess motion.