AbstractID: 10922 Title: 4D CT sorting based on patient internal anatomy

Purpose: To obtain a robust 4D CT sorting algorithm based on patient internal anatomy by combining multiple respiratory features and to compare with sorting algorithms based on external surrogates.

Method and Materials: A four-slice GE LightSpeed™ CT scanner was used to acquire the CT data in cine mode and respiratory signals were synchronously recorded by the Varian RPM system for comparison purposes. To generate respiratory signals directly from the axial CT images, five respiratory features have been evaluated, namely, air content, body area, lung volume, conditional mean with threshold and conditional mean with percentile. For each four-slice couch position, a quantitative measure called spatial coherence was used to select the optimal internal features for generation of respiratory phases for slice sorting, which, along with the sorted CT images were compared with those obtained from RPM, respectively.

Results: Patient studies showed that the respiratory signals generated from internal features are similar to RPM signals for patients with regular breathing patterns (average correlation with RPM signals at all couch positions is above 0.92 in 9 out of 10 patients) and result in sorted images with fewer motion artifacts for patients who exhibited relatively irregular breathing patterns.

Conclusion: This work demonstrates the feasibility and potential benefits of using internal anatomy for 4D CT sorting in thoracic and abdominal cancer patients. The sorting results are similar to those obtained with RPM signals for regular breathing patterns and better when irregular ones occur. The proposed algorithm is simple and robust, which makes it amenable for clinical implementation. In the future, alternative measures for the quality of respiratory signals may be investigated in the temporal domain, e.g., smoothness. In parallel, other useful respiratory features may be combined easily with existing ones for better accuracy and more robustness.