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Purpose: To evaluate traditional 3D/3D and 3D/2D rigid registration strategies for tomosynthesis images obtained from the Nanotube Stationary Tomosynthesis (NST) geometry.
Method and Materials: NST is a multi-source kV imager which is mounted on a linear accelerator gantry. The multiple sources allow imaging without gantry motion before and concurrent with radiation treatment. Due to the nature of the reconstructed images, it is not immediately clear how to register tomosynthesis images to planning CTs. Depending on the amount of angular sampling in the geometry, better performance can be achieved with 3D/3D registration, as is the case with cone-beam CT, or 3D/2D registration, as is the case with portal imaging. Tomosynthesis images contain angular sampling somewhere in between these two extremes. The question remains whether NST images should be considered a set of 2D projections or a 3D volume for the purpose of rigid registration. Simulated NST images were used to evaluate treatment time rigid registration for patient setup. Two GPU-accelerated planning CT to tomosynthesis rigid registration methods were considered, characterized by the domain in which the similarity metric is computed.
Results: Simulated data sets suggest that evaluation of the similarity metric in projection space reduces mean target registration error (mTRE) and increases speed over reconstruction space methods. A rate limiting step of the 3D/3D method is the requirement for repeated iterative reconstructions.
Conclusion: We have demonstrated that 3D/2D methods are faster and result in decreased mTRE over 3D/3D methods for rigid registration of NST images. It is suggested that 3D/2D methods will be faster in cases where a significant number of reconstructions must be generated.
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