AbstractID: 6942 Title: A Hybrid Multiresolution Method for Automatic Registration between Reference and On Board Digital Tomosynthesis

Purpose: Automatic registration between reference and on-board digital tomosynthesis (DTS) is a critical step for target localization using DTS. We previously developed an approximate method for automatic registration between reference and on-board DTS, in which reference DTS was not generated iteratively to match with the anisotropic resolution of on-board DTS. This study aims at developing an accurate method for automatic DTS registration with improved efficiency, robustness and accuracy.

Method and Materials: The accurate DTS registration method was realized mainly by hardware acceleration of DRR generation, which was achieved by implementing a 3D texturemap based volume rendering process in graphic card using OpenGL language. The alpha blending mode was chosen to simulate ray casting algorithm, and three color channels of graphic card were used for data storage. With hardware acceleration, the accurate method changes the CT pose and regenerates DRR and reference DTS iteratively to match reference DTS with on-board DTS based on mutual information. A hybrid multiresolution method was developed to combine approximate and accurate methods in a multiresolution scheme. It was tested on both anthropomorphic chest phantom and H&N patient data with simulated translations and rotations. The registration efficiency, attraction range and accuracy were recorded and compared with previous results.

Results: The hybrid multiresolution method is 4 times faster than approximate method. Its registration attraction range is 2-5 times larger than that of approximate method for single-axis translations and rotations, and 1.5-2 times larger for combined 6-D rotations and translations. The registration accuracy is within 1.2 deg/mm for phantom data and 1.5deg/mm for patient data through the whole attraction range.

Conclusions: The hybrid multiresolution method is much more efficient, robust, and accurate than approximate method. It is potentially a practical and reliable method to clinically implement DTS for target localization.

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