

AbstractID: 3428 Title: Evaluation of Two Image Registration Systems

Purpose: We compare the performance of image registration algorithms adopted by BrainScan and Philips Syntegra and give a general guide when using these systems.

Methods and Materials: BrainLab BrainScan System and Philips Syntegra System apply volume-based automatic rigid image registration algorithms. Philips Syntegra provides Cross Correlation (CC), Local Correlation (LC) and Normalized Mutual Information (NMI) as optimization metrics and BrainScan applies Mutual Information as an optimization metric. These algorithms are compared for: 1) synthesis images, i.e., the images obtained by applying known transformations to a set of original images, 2) phantom images and 3) patient images.

Results: For synthesis images, sub-voxel accuracy is achieved. The maximum discrepancies between the registration results of translations and rotations and the known values are less than 0.5 mm and 0.5° for all algorithms. For phantom images, manual registration based on external markers is served as a gold standard to compare with the registration results. The discrepancies are at the order of 2 mm and 2° . For patient images, two radiation oncologists manually registered images independently and compared their results with the results by an automatic image registration system. The discrepancies become much larger due to the complexity of patient setups and density distributions. The capture regions and speeds of these algorithms are compared.

Conclusion: The algorithms themselves can reach the accuracy of sub-millimeter in translation and sub-degree in rotation. But for clinical uses, the accuracy is reduced because of many errors introduced by positioning and patient motion. Preprocess is important to avoid being trapped in a narrow capture region. Final visual assessment is essential to guarantee reasonable and desired results.