

AbstractID: 3686 Title: Computational Study of the Rigid Body Image Registration Accuracy

Purpose:

To study, using a computational simulation, the accuracy of the rigid body based image registration of the brain with special considerations for the type of the distribution of the homologous fiducial points used in the registration. To determine how the registration affects the resultant accuracy for target points.

Method and Materials:

The condition numbers of all the combinations of at least four out of the 25 candidate fiducial points are examined. This yields the sets of points with the best and the worst condition number. The Gaussian noise is imposed on the simulation points. The algorithms' accuracy for the sought rotation matrix and the translation, fiducial registration error (FRE), and target registration error (TRE) are investigated as a function of the number of fiducial points used in the registration

Three different algorithms are used: SVD based, the subspace method for the translation computation and the simultaneous optimization of the Euler angles and translation.

Results and Conclusion:

The robustness of all the algorithms is similar. For the lower number of fiducial points there is a risk of big TREs. Thus the condition number reveals a bad prospective input for the algorithm. The number of points needed to reach 1.0 mm accuracy for 0.5x0.5x1.0 mm³ pixel size should be six points or more. This method of the condition number examination can be used to predetermine the accuracy of the registration for a given input.

Conflict of Interest (only if applicable):