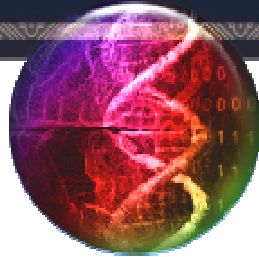


Center for
**Computational
Biology (CCB)**



Presents

Arno Klein, PhD

New York State Psychiatric Institute, Columbia University

Thursday, April 30, 2009 at 11 AM

LONI DIVE Theater, 635 Charles E. Young Drive South, Suite 225

Evaluation of human brain MRI registration algorithms

Abstract:

All fields of neuroscience that employ brain imaging need to communicate their results with reference to anatomical regions. In particular, comparative morphometry and group analysis of functional and physiological data require coregistration of brains to establish correspondences across brain structures. It is well established that linear registration of one brain to another is inadequate for aligning brain structures, so numerous algorithms have emerged to nonlinearly register brains to one another. This study is the largest evaluation of nonlinear deformation algorithms applied to brain image registration ever conducted. Fourteen algorithms from laboratories around the world are evaluated using 8 different error measures. More than 45,000 registrations between 80 manually labeled brains were performed by algorithms including: AIR, ANIMAL, ART, Diffeomorphic Demons, FNIRT, IRTK, JRD-fluid, ROMEO, SICLE, SyN, and four different SPM5 algorithms ("SPM2-type" and regular Normalization, Unified Segmentation, and the DARTEL Toolbox). All of these registrations were preceded by linear registration between the same image pairs using FLIRT. One of the most significant findings of this study is that the relative performances of the registration methods under comparison appear to be little affected by the choice of subject population, labeling protocol, and type of overlap measure. This is important because it suggests that the findings are generalizable to new subject populations that are labeled or evaluated using different labeling protocols. Furthermore, we ranked the 14 methods according to three completely independent analyses (permutation tests, one-way ANOVA tests, and indifference-zone ranking) and derived three almost identical top rankings of the methods. ART, SyN, IRTK, and SPM's DARTEL Toolbox gave the best results according to overlap and distance measures, with ART and SyN delivering the most consistently high accuracy across subjects and label sets. Updates will be published on the <http://www.mindboggle.info/papers/> website.

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<http://www.ccb.ucla.edu>

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