



SINAPSE PhD

Name of Primary Research Base:

Institute of Neurological Sciences, Glasgow

Name of Secondary Research Base:

Division of Psychiatry, The University of Edinburgh

First Discipline:

MRI

Second Discipline:

Image analysis

SINAPSE Centre Lead:

Glasgow

PROJECT

Title:

Assessment of ANATOMIST and warping to Talairach space in the accurate identification of eloquent brain areas from fMRI studies

SUPERVISORS

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Planned start date (year of intake):

2007

Summary (approximately 200 words):

Software packages such as Statistical Parametric Mapping (SPM) are used to identify activated areas during functional magnetic resonance imaging (fMRI) experiments by spatially normalising individual brains to a reference (Talairach) space (1). This has the advantage that grouped responses can be pooled, thus providing more statistical power to differentiating between groups. However such spatial warping can be prone to considerable error (2, 3) and hence misidentification of activated areas. Such localisation errors in individual brains will therefore undermine many grouped results. Most commonly this might mean activations can be mislocated to the wrong side of a gyrus or to an adjacent gyrus or that spatial blurring will result in reduced functional sensitivity.

Recently a new software package called ANATOMIST has been produced (4) which identifies the individual's sulcal and hence gyral patterns extracted from 3D data sets. Once the gyri (and side of the gyri) has been located, precise anatomical areas can be identified for each individual. This data may be used to devise structural approaches of anatomical normalisation (5).

The first aim of this project is to use both prospectively and retrospectively acquired fMRI data sets to quantify the inaccuracies of warping approaches compared to the ANATOMIST approach either by further developing recent approaches to this problem (5) or by devising new methodologies. The second aim is to try to produce a means of grouping ANATOMIST produced data by constructing a new gyral based reference space.

Key references (up to five):

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| 1. SPM website: http://www.fil.ion.ucl.ac.uk/spm/ |
| 2. A Cartesian coordinate system for the human cerebral cortex. Li D., Freeman A., Tran-Dinh H., Morris J. Journal of Neuroscience Methods 2003;125:137-145 |
| 3. Estimation of Spatial Registration Error for Talairach-Transformed MR Images Mario Dzemidzic, Mark J. Lowe, Vincent P. Mathews, Joseph T. Lurito, Micheal D. Phillips HBM 1999:poster 60 |
| 4. A structural browser of brain anatomy. D. Rivière, D. Papadopoulos-Orfanos, J. Régis and J.-F. Mangin. NeuroImage, 11(5), HBM, San Antonio, 2000 |
| 5. Coordinate-based versus structural approaches to brain image analysis. J.F. Mangin, D. Riviere, O Coulon, et al. Artificial Intelligence in Medicine, 2004;30:177-197 |