Accurate non-iterative modelling and inference of longitudinal neuroimaging data

Propositions

In complement of the dissertation

Accurate Non-Iterative Modelling and Inference of Longitudinal Neuroimaging Data

by

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1. Analysis of longitudinal data must account for multiple sources of variation, including subject-specific temporal evolution and group- and subject-specific noise magnitude. Analysis of neuroimaging longitudinal data must further account for spatial variation in each of these aspects.

2. Many popular longitudinal neuroimaging analysis methods use restrictive assumptions (e.g., the assumption of Compound Symmetry—the state of all equal variances and all equal covariances—or the assumption of a common covariance structure for the whole brain) and may yield invalid inferences when these assumptions do not hold.

3. The Sandwich Estimator method is a very promising approach to analyse longitudinal neuroimaging data due, mainly, to its robustness against the misspecification of the working covariance matrix and to the fact that it is free of iterative algorithms (thus, fast and without convergence issues).

4. The specification of the design matrix of a regression model is generally much more complicated with longitudinal data than with cross-sectional data. For example, a time-varying covariate should, in general, be split into a pure cross-sectional covariate and a pure longitudinal covariate.

5. The best remedy against small sample issues is to increase the sample size.

6. There is a lack of diagnostic tools (e.g., for checking model assumptions or detecting influential data) in neuroimaging.

7. There is a crisis of reproducibility in neuroimaging, a crisis that can be addressed by freely distributing the data and code used to draw scientific conclusions.

8. The number of people living with dementia and the cost associated to it are currently estimated worldwide at 44 million and at US $604 billion a year, respectively (Prince et al., 2014a), explaining the growing number of initiatives put in place to collect longitudinal neuroimaging data about it.