On Relating Brain Shape With Neurological Disorders

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Motivation

- Brain imaging as a biomarker for neurological disorders such as Alzheimer’s Disease (AD).
- Inferences from neuroanatomical shape changes for the purpose of early diagnosis and also to track disease progression.
- To study shape variation in brain structures within the population and over time (longitudinal studies).

Alzheimer’s Disease

- Dementia characterized by severe behavioural, cognitive and functional impairment accompanied by neuroanatomical shape changes.
- Accelerated deterioration of mental functions and memory loss, to that compared in normal aging.
- Shape changes that occur during disease progression can be extracted from Magnetic Resonance (MR) brain images.

Imaging and clinical data

- ADNI: about 800 subjects, structural MRI data for 6 timepoints at 6 months interval.
- Corresponding clinical test scores.
- Segmented brain structures such as corpus callosum, ventricles, etc.

We extract and identify shape deformation patterns in brain anatomy that relate to observed clinical scores depicting cognitive abilities.

The methodology also enables us to quantify the amount of deformation in units of clinical response.

Average 3D brain shape constructed from the population of 3D MRI images.

Changing MMSE (Mini-mental state examination) for the average brain (26.53): Red corresponds to local expansion and blue to local contraction.

Supported by Alzheimer’s Disease Neuroimaging Initiative (ADNI) (NIH grant U01AG024904), NIH grant 5R01EB007688, NIH grant P41 RR023853, NSF grant CNS-0751152 and the NSF CAREER grant 1054057