On Relating Brain Shape With Neurological Disorders

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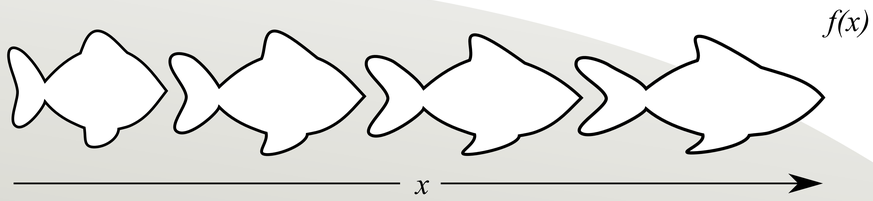
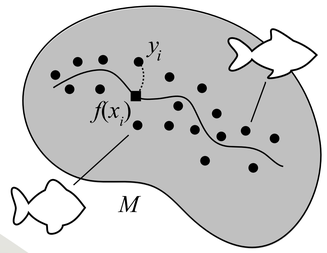
Motivation

- 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)



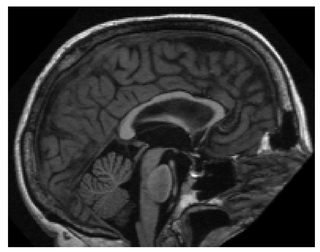
Chaging shape along a parameter.



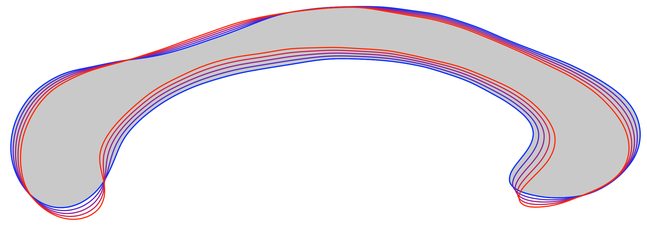
Regression in shape space.

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.



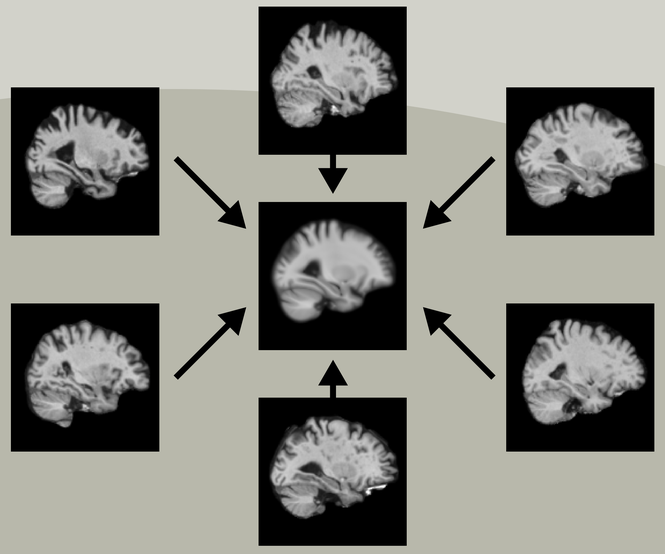
MRI - sagittal slice.



Shape variation in Corpus Callosum.

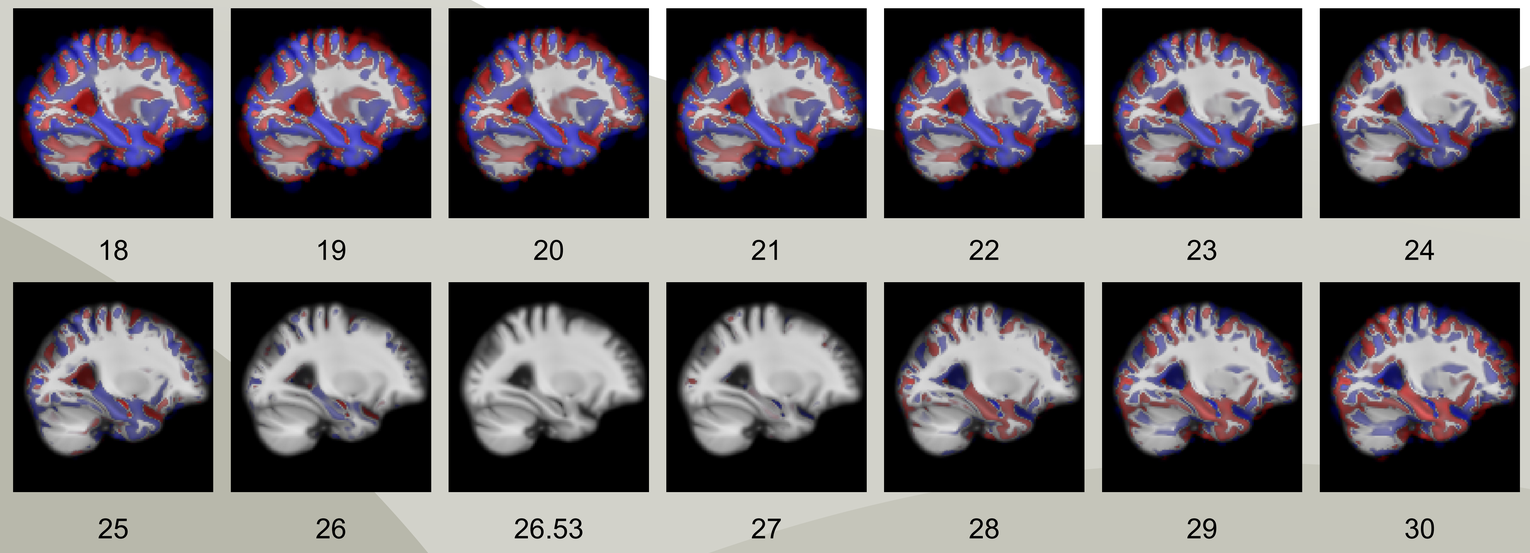
Imaging and clinical data

- 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



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

- 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.



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

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