Chayut Wongkamthong
cw403

Alzheimer's Phase Detection without Biomarkers

I. Overview:
Alzheimer's disease is a fatal disease that develops through an irreversible process that could span over several years. It affects patient's memory, cognitive ability, general quality of life causing stress and family issues. Even though over 5.8 million Americans are suffering from it, the general diagnosis plan has only been updated once in 2011 since 1984 and still cannot capture the spectrum of the disease. Particularly, it fails to detect early stage of Alzheimer's (Mild Cognitive Impairment or MCI) resulting in late treatment.

The diagnostic process also takes time and involves several rule-based metrics including standardized test by clinicians, interviews, and CT, MRI or PET scan to collect biomarkers to determine the progress of the disease. As ones can see, these rule-based system are highly subjective and inefficient. In this project, we try to build statistical model based on some basic tests that could possibly be administered online without clinician supervision and compare their predictive capability with several other diagnostic techniques within research community.

II. Research questions (the 2nd and 3rd questions are tentative):

1. Is it possible to reliably use basic tests to diagnose Alzheimer's disease phase in the absence of standard scores/ interviews/ biomarkers.
2. Is it possible to reliably use basic tests to estimate some of the biomarkers that are typically required intrusive or expensive approach to obtain.
3. Can we use these metrics to create risk factor in determining potential conversion to other degrees of Alzheimer's in the future.

III. Data:
The data used is provided by The Alzheimer's Disease Neuroimaging Initiative (ADNI) and it is under data usage agreement. Specifically, a data set corresponding to ADNI1 cohort (783 participants) will be analyzed including demographic information of participants, diagnostic results, vital signs, biomarkers, and Neuropsychological test results. Potential problems are the size of samples and the way each was selected (enrollment and screens).

IV. Project Plan:
Proportional odds model will be used to model the possibility of having different degrees of Alzheimer's disease. The models that rely on different metrics and information will be created. Specifically, one model with basic tests and 2-3 others that utilize standard scores will be created. Comparison will be done in these model, together with, some other advanced approach that people use in the field (like deep learning with neuroimaging). All models should be done in 2-3 weeks. If time permits, the other research questions will be addressed.