Multi-Modality Image Data Fusion and Machine Learning Approaches for Personalized Diagnostics and Prognostics of MCI due to AD

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USA

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Multi-Modality Image Data Fusion and Machine Learning Approaches for Personalized Diagnostics and Prognostics of MCI due to AD

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1

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Research Abstract

Alzheimer’s Disease (AD) is the most common form of dementia and the sixth leading cause of death in the US. More than 5 million people in the US currently have AD and the direct health care cost is over $200 billion per year. Detection of early phase of AD, namely Mild Cognitive Impairment (MCI), can delay, prevent, and treat this serious disease. The project will develop a clinically-feasible system for Mild Cognitive Impairment (MCI) diagnostics and prognostics, by integrating multi-modality imaging data such as MRI and PET as well as non-imaging data such as clinical assessments, biomarkers, demographics, and genetic information. This project involves three Aims. In Aim #1, we will develop the system by designing diagnostic and prognostic modeling using cross-sectionally incomplete multi-modality data by multitask learning. Our multitask-learning approach that will simultaneously model multiple related tasks by allowing effective knowledge and data sharing to jointly estimate the diagnostic/prognostic models for each patient cohort. In Aim #2, we will update diagnostic and prognostic model using longitudinally incomplete multi-modality data by transfer learning. We will integrate the model of an old domain (e.g., the diagnostic/prognostic model obtained at an earlier time point) and the data of a new domain (e.g., new data obtained at the a follow-up visit), in order to obtain an updated model with better accuracy. This can take care of incomplete longitudinal data due to patient drop-off, because it transfers the old- domain model not the data. In Aim #3 we will conduct validation for the proposed models using the MCI data collected by Alzheimer’s Disease Neuroimaging Initiative (ADNI) for all phases of AD. The current project is novel in creating a first-of-its-kind clinically-feasible technology for personalized MCI diagnostics and prognostics as well as in using “multitask learning” and “transfer learning” machine learning methods for modeling cross-sectionally and longitudinally incomplete multi-modality data. It is innovative in using multitask learning to model incomplete cross-sectional data (e.g., baseline data) and using transfer learning to model the incomplete longitudinal data.

Further information available at:

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