

Subtypes of Alzheimer's Disease

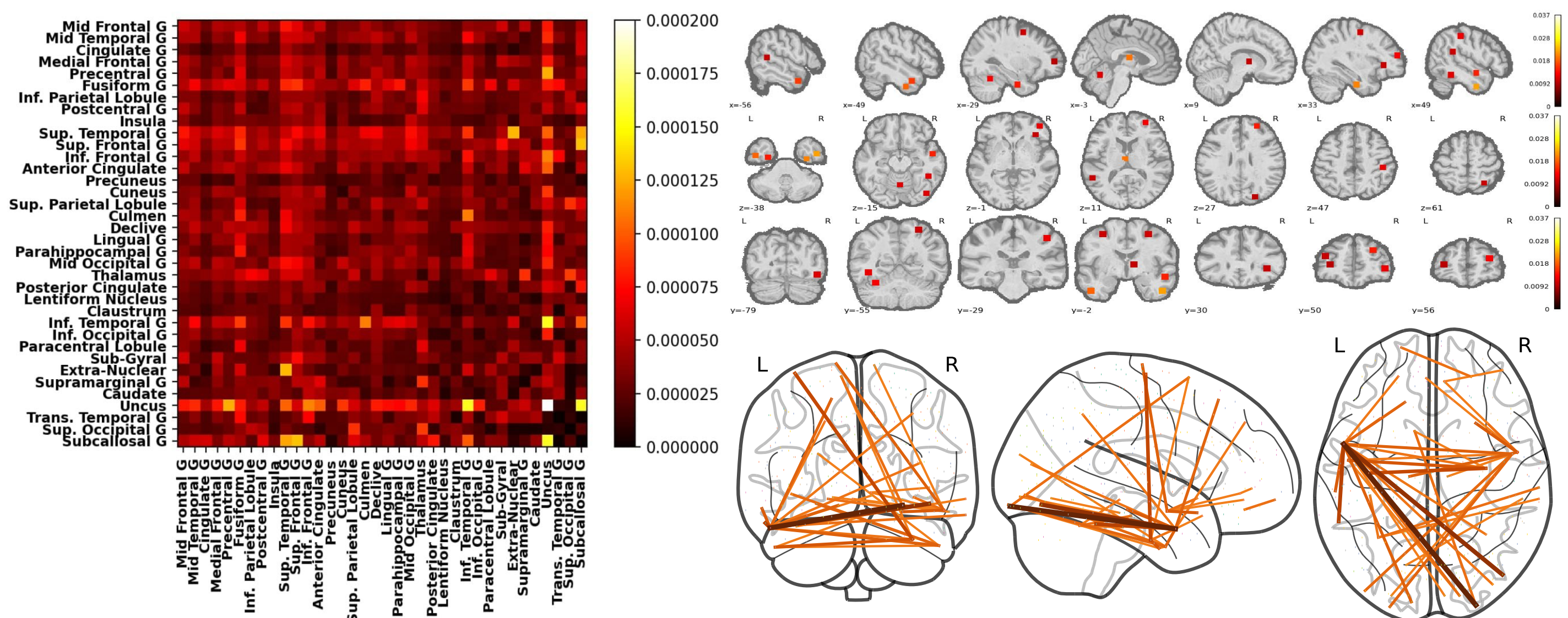
from decoding Graph Neural Networks

Student: Ang Jun Liang

Supervisor: Professor Jagath Chandana Rajapakse

Project Objective:

- Alzheimer's Disease is **heterogenous** and can manifest from different disease mechanisms resulting in different symptom profiles and treatment responses
- Multi-task learning** on disease classification and memory score prediction with Graph Neural Networks showed **improvement** over previous approaches (80%)
- The hidden activations from the trained network were clustered to identify **4 subtypes** of Alzheimer's Disease
- Integrated Gradients was used to identify **salient brain regions** that differentiate a healthy control and **each subtype** of Alzheimer's Disease
- The subtypes were validated **qualitatively** with genetic association analyses and **quantitatively** with accuracy improvement after introducing a subtyping layer



For each subtype, we can obtain a heatmap showing the importance of each anatomical region (left). They are also marked on the Axial, Coronal and Saggital axes (top right). Important functional connections (edges that connect brain regions of interest) are shown (bottom left). We found **different important regions for different subtypes**.

The proposed methods are applicable to other neurological disorders beyond Alzheimer's Disease such as Autism Spectrum Disorder and other imaging modalities such as diffusion tensor imaging. Knowledge of subtypes and their corresponding salient brain regions can improve understanding of neurological disorders.