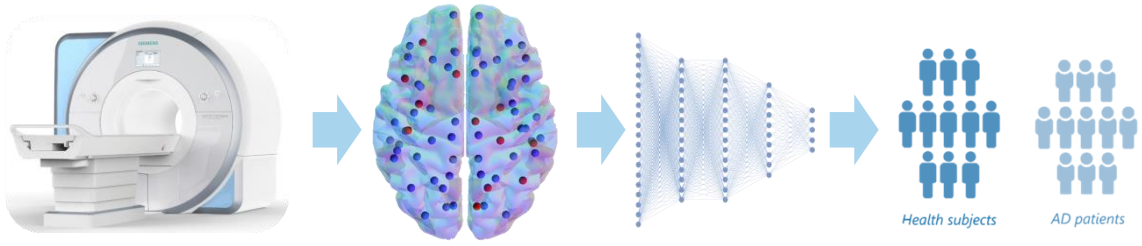
Predicting neurodegenerative diseases with graph neural networks

One of the current frontiers in neuroscience research is to understand alterations in brain connectivity in patients suffering from neurodegenerative diseases. The research groups of Joana Pereira at the Karolinska Institute and Giovanni Volpe at the University of Gothenburg have developed the software package BRAPH (Brain Analysis with graPH theory), for analyzing brain networks derived from structural and functional brain imaging data (e.g., MRI, fMRI, EEG, PET and DTI).

Structural and functional brain networks are examined with BRAPH by analyzing graph theoretical connectivity measures, which have been shown to be promising biomarkers of neuronal dysfunction and disease progression in neurodegenerative disorders. With the increasing prevalence of neurodegenerative disorders, such as Alzheimer's and Parkinson's diseases, there is an urgent need for new biomarkers for early diagnosis and to help implementing preventive treatments before damage is widespread. BRAPH has already been successfully applied to the study of neurodegenerative diseases (Parkinson's and Alzheimer's disease).



Combine Control Systems AB have recently joined the collaborative effort of developing an AI-based assistive tool for the diagnosis of neurodegenerative diseases. Their software, Sympathy for Data, is an intuitive graphical platform that enables the implementation of reusable machine learning workflows and data science applications. In this master thesis project, we want to investigate how accurately Graph Neural Network (GNN) algorithms can identify Alzheimer's disease. The project will be based on a previous study showing very promising results using Graph Convolutional Neural Networks (GCNs); a class of GNNs that generalize Convolutional Neural Networks to graph structured data. The project will include literature studies of state-of-the-art machine learning techniques, building, and testing the performance of new models and comparing the results with those of previously tested methods.

To achieve a successful thesis result, we believe that the applicants should have:

1) A broad experience and a strong interest in applied mathematics.
2) Interest in neuroscience.
3) Experience in Python programming

Do you want to know more information?

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Apply through: https://combine.se/career/students/

References

http://braph.org
http://sympathyfordata.com
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doi: **https://doi.org/10.1371/journal.pone.0178798**