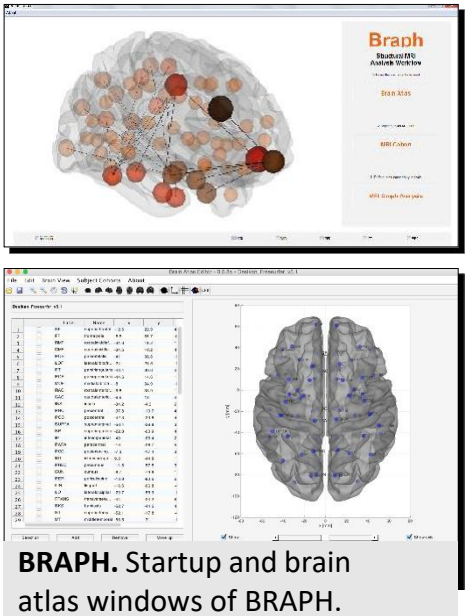
Machine learning for brain connectivity analysis

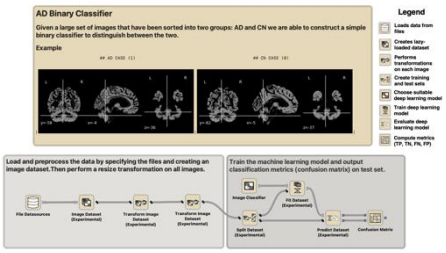
One of the current frontiers in neurosciences is to understand brain connectivity both in healthy subjects and patients. The research groups of Joana Pereira and Giovanni Volpe have in a joint collaborative effort developed the BRAPH (Brain Analysis with graPH theory) software package for extracting brain networks from structural and functional data (e.g., MRI, fMRI, EEG, PET and DTI data).



BRAPH. Startup and brain atlas windows of BRAPH.

The structural and functional data is analyzed in BRAPH by probing graph theoretical connectivity measures, which are suggested to be reliable candidate biomarkers of neuronal dysfunction and disease spread in neurodegenerative disorders. With the increasing prevalence of neurodegenerative disorders, such as Alzheimer's and Parkinson's diseases, there is an urgentneed for new biomarkers that can aid in the early diagnosis and help implementing prevention 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 for data science applications. We are now looking for students to work on a master thesis at our Lindholmen Office in Göteborg during the spring of 2022. In this project, we want to explore the potential of different machine learning techniques, such as a certain class of artificial neural networks, called Graph Neural Networks (GNNs). The project outline will include literature studies of state-of-the-art machine learning techniques, building, and testing models and comparing the results with those of classical graph theoretical methods.



Sympathy for Data. Example flow for image classification using neural networks.

For a successful thesis work, we believe that the applicants should have:

1. A broad experience and a keen interest in applied mathematics.
2. Interest in neuroscience
3. Experience of Matlab/Python programming

Do you want to know more information?

Please contact Simon Yngve simon.yngve@combine.se

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

References

http://braph.org
http://sympathyfordata.com

Mite Mijalkov, Ehsan Kakaei, Joana B Pereira, Eric Westman, Giovanni Volpe (2017).BRAPH: A graph theory software for the analysis of brain connectivity.
PLOS ONE 12.8, e0178798.
doi: **https://doi.org/10.1371/journal.pone.0178798**