Universitat Pompeu Fabra Barcelona | Master in Bioinformatics for Health Sciences

Master project 2024-2025

Personal Information

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Project

Computational systems biology

Project Title:

Longitudinal Volume Changes in Down Syndrome Across the Alzheimer's Disease Spectrum

Keywords:

Down Syndrome, Alzheimer's Disease, Volumetric analyses, Longitudinal Neuroimaging, MRI

Summary:

Individuals with Down Syndrome (DS) are at an ultra-high risk (>90%) of developing Alzheimer's disease, and understanding longitudinal changes in brain volumes is crucial to monitor disease evolution and effective treatment. While longitudinal atrophy, detected with structural MRI, has been well described in Alzheimer's disease, little is known about the evolution of regional grey matter volumes in DS. The aim of this project is to implement and compare different pipelines to preprocess longitudinal MRI in DS and find sensitive biomarkers of Alzheimer's disease. This will include to compare different pipelines using distinct software (e.g., SPM vs Freesurfer), characterize the changes over time in different brain structures and at different clinical stages, and establish a brain signature sensitive to track Alzheimer's disease progression using >300 MRI scans. Specifically, the master student will: (1) Acquire knowledge about the pathophysiology of Alzheimer's disease and Down Syndrome in a highly interdisciplinary environment (e.g., alongside PhD researchers, engineers, neurologists, neuropsychologists, nurses and biologists). (2) Learn about longitudinal study and analyses for neuroimaging data. (3) Contribute to the implementation of state-of-art longitudinal pipelines to track Alzheimer disease in DS. (4) Learn programming skills (e.g., R, Python, Matlab) to manipulate data, display results and perform descriptive and inferential statistics (e.g., two-sample t-tests, regressions, linear models). Note that other projects related to neuroimaging in neurodegenerative diseases are also available. Please contact us if you would like additional information.

References:

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Expected skills:

Ability to interact in English, interest about the brain and neurosciences, curiosity regarding neurodegenerative diseases.

Possibility of funding:

No

Possible continuity with PhD:

To be discussed

Comments:

(1) Possibility of hybrid work: Yes (2) Remuneration: No. But the Memory Unit provides a highly stimulating research environment with interaction with clinicians, researchers, biologists, etc., as well as a wide range of opportunities including attending clinical activities and weekly scientific session. (3) A previous student from the MSc in Bioinformatics for Health Sciences is doing the PhD with us, and another is planning to start the PhD: they will be available to help with specific questions related to the project and team. (4) Focus on producing publishable work by the end of the TFM that will strengthen applications for a PhD or other research-related work. (5) Vibrant and collaborative working environment.