

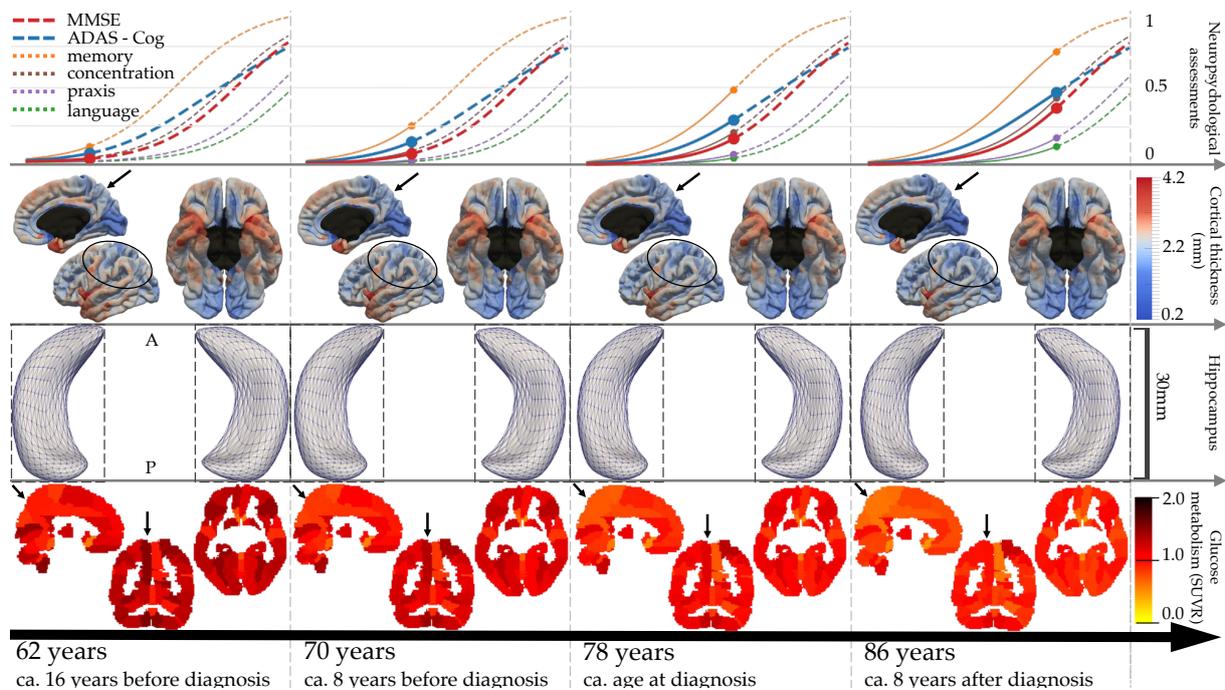
ARAMIS Lab (Paris, France) offers Master 2 internship

Using digital brain models to compare multiple cohorts of patients developing or at risk of developing Alzheimer's disease

Keywords: statistical learning, neuroimaging, models of disease progression, personalization, brain diseases, bias detection, meta-analysis

The topic: We have developed **personalized models of disease progression** which accurately reproduce the alterations in the brain and in the cognition due to the Alzheimer's disease (see Figure). These models can be **personalized** to imaging and clinical data of unseen subjects. The resulting individual parameters indicate differences with respect to a normative scenario of disease progression in terms of earlier/later disease onset, faster/slower progression, specific patterns of lesion propagation in the brain or specific timing in the degradation of cognitive functions. We have shown that these models could simulate **virtual patients** developing the disease. This virtual cohort reproduce the statistics of the cohort on which the model was trained.

These models were trained on the Alzheimer's Disease Neuroimaging Initiative (ADNI), a public data set including several thousands of patients followed in the USA. The goal of this internship is to use these models to compare and pool data from two other cohorts: the **INSIGHT-preAD** cohort from the Pitié-Salpêtrière hospital with about 400 subjects followed over two years with subjective memory complaints; and the **Pharma-Cog** study which aims to replicate the ADNI cohort with European participants.



ARAMIS Team

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The objectives are:

- to assess whether the personalization of the models to subjects of the other cohorts yield **reconstruction and prediction errors** of the same order as the ones obtained when personalizing the models in a cross-validation setting in the training cohort,
- to position the subjects of each cohort with respect to each other, highlight the different **characteristics** of each cohort and detect possible **biases** in the cohorts,
- to validate that our simulation framework of virtual patients can adjust to **replicate** the characteristics of different cohorts without the need to fully re-train the cohort, and that it could provide an efficient way to perform **meta-analysis** combining multiple cohorts.

The team: The **ARAMIS lab** is ideally located at the **Brain and Spine Institute (ICM)**, one of the major research institute for neurosciences in Europe, which located at the heart of the Pit -Salp tri re hospital, downtown Paris. The lab gathers researchers with background in applied mathematics and computer science, research engineers and clinical experts in the field of neurodegenerative diseases. The lab is also part of **INRIA**, the French national research institution for computer science.

Your profile: You are interested in working on projects that may change the way we understand brain disease and treat patients. You are passionate about learning. You are motivated by working at the interface between **mathematics, computer science, and medicine**. You are enrolled in a master program in statistical learning, image computing, data science, optimization methods or related fields. You have strong experience of **python** in the context of data science and machine learning.

Possible extension to PhD: yes

For more information and to apply, contact Stanley.Durrleman@inria.fr

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ARAMIS lab web page: www.aramislab.fr

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