

Master 2 internship offer (2024)

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SV3M & NeuroAI Teams



Modelling cortical reorganizations in patients with visual field deficits

Starting date: First semester of 2024

Supervisors: Benoit Cottureau, research director at CNRS (CerCo & IPAL, contact: benoit.cottureau@cnrs.fr) and Timothée Masquelier, research director at CNRS (CerCo, contact: timothee.masquelier@cnrs.fr)

Keywords: *Computational neurosciences, Vision, Artificial intelligence (AI), , Spiking neural networks, Neuro-ophthalmology.*

A M2 fellowship is available to work at the CerCo laboratory under the supervision of **Benoit Cottureau** (CNRS research director) and **Timothée Masquelier** (CNRS research director). The aim of the project is to develop computational models that explain how the visual system evolves following the onset of pathologies associated with visual field deficits (e.g., in patients with macular degeneration or retinis pigmentosa). We will be specifically interested in the neuroplasticity mechanisms that may underly the visual rehabilitations observed in some animal models of these pathologies (see e.g., Shao et al., 2014; Burnat et al., 2017). It will be realized using artificial neural networks (and in particular spiking neural networks) trained with occluded images and/or videos (see e.g., Moore et al., 2021). The outputs of the networks after training will be compared to those observed in neural recordings and/or in behavioural experiments realized in patients (the CerCo has a privileged connection with the Retina Center of the Purpan hospital in Toulouse).

The candidates should be willing to work in a multidisciplinary environment which combines neurosciences, ophthalmology and AI, have a good level in English with very good programming skills. Some knowledge in neurosciences/ cognitive sciences would be a plus.

The research will take place in Toulouse, a student city (Toulouse is the second university hub in France) with high quality of life located in the south west of France (close to the Pyrenees, the Mediterranean Sea and the Spanish border).

Applications should be sent to benoit.cottureau@cnrs.fr and timothee.masquelier@cnrs.fr

References:

- Burnat, K., Hu, T. T., Kossut, M., Eysel, U. T., & Arckens, L. (2017). Plasticity beyond V1: reinforcement of motion perception upon binocular central retinal lesions in adulthood. *Journal of Neuroscience*, 37(37), 8989-8999.
- Moore, J. A., Tuladhar, A., Ismail, Z., Mouches, P., Wilms, M., & Forkert, N. D. (2023). Dementia in Convolutional Neural Networks: Using Deep Learning Models to Simulate Neurodegeneration of the Visual System. *Neuroinformatics*, 21(1), 45-55.
- Shao, Y., Keliris, G. A., Papanikolaou, A., Fischer, M. D., Zobor, D., Jäggle, H., ... & Smirnakis, S. M. (2013). Visual cortex organisation in a macaque monkey with macular degeneration. *European journal of neuroscience*, 38(10), 3456-3464.