Project 1.4. Deep learning techniques in the studies of cortical circuitry remodeling following damages to the primate visual cortex

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WWW: https://neuroinflab.wordpress.com/

Background:

This data-analysis oriented project will investigate the anatomical reorganization of the visual system following damage to the primary visual area. This kind of damage is a common consequence of stroke in adults, as well as one of the most frequent forms of perinatal brain damage. The project will involve an array of advanced image processing and neuroinformatics approaches (performed at the Nencki Institute) combined with neuronal tracing techniques (performed by partner at Monash University, Australia) to establish the anatomical plasticity that occurs after V1 lesions at different ages.

The project will involve a non-human primate animal model (marmoset monkey), which provides an accurate model of the human visual pathway. Marmosets are valuable organisms for understanding brain development and plasticity, among other reasons, due to the abbreviated life cycle in comparison with other primates. They are rapidly becoming the animal model of choice for studies of sensory and cognitive functions that are particularly well developed in primates.

Aim:

The tasks of the PhD student will involve the state-of-the-art development of machine-learning approaches for detection, classification, and analysis of the morphology of labeled cells somata, extraction of axonal bundles and fibers, as well as image registration methods in the context of high throughput processing of microscopy imaging datasets. Upon establishing the necessary computational methods, the PhD candidate will pursue two specific research tasks:

1. Obtain a comprehensive view of the large-scale remodeling of afferent neuronal connections across the visual cortex after V1 lesions.
2. Establish the extent of changes in neuronal composition occurring in different parts of the visual system following perinatal and adult V1 lesions.

Requirements:

An ideal candidate should demonstrate

- motivation for scientific research.
- Master of Science degree (or equivalent), preferably in a quantitative field.
- ability to use Python and Linux shell scripting. Knowledge of C++ and experience in high-performance computing would be considered an additional strength.
- at least working knowledge of numerical and digital image processing methods is required.
- fluency in spoken and written English to communicate with foreign partners.