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OptoAnalyzer: a code-free MATLAB toolbox for semi-automated registration, fluorescence quantification and 3D reconstruction of variably sized mouse brain sections

OptoAnalyzer is a MATLAB-based toolbox for semi-automated analysis of fluorescence microscopy images of mouse brain sections. It supports (i) registration of individual slices to reference templates/atlases using rigid alignment with optional non-rigid refinement, (ii) definition and editing of discrete anatomical ROIs, and (iii) extraction of quantitative signals, including mean intensity in RGB channels within each ROI, enabling region-resolved comparisons across slices and subjects. The pipeline emphasizes traceability of transformations and ROI definitions to improve reproducibility of atlas-informed quantification. In addition, OptoAnalyzer includes a 3D reconstruction module that stacks registered sections and generates a volumetric representation (and exportable meshes) to support spatial visualization of ROI-wise signals across the sampled brain volume.

Short Biography

I am currently in the third year of a PhD program in Neuroscience, and my thesis focuses on sensorimotor circuits and the pathogenesis of migraine. I hold a background in Veterinary Medicine, but over the past several years I have increasingly specialized in neuroscience research. During my undergraduate training, I spent three years in a neuroanatomy laboratory for my thesis, investigating cytoarchitectonic complexity in the bovine motor cortex. Earlier, I completed a four-month research training in a physics laboratory, performing in vitro patch-clamp recordings in human neuroblastoma cells. After graduation, I spent six months in Cagliari in a neuropharmacology and electrophysiology laboratory, working on an atypical dopamine transporter inhibitor and conducting in vivo electrophysiology experiments and behavioral testing. In parallel, I have run (CEO) a software development company (untill december 2020) and earned certificates in Python and MATLAB, gaining substantial programming experience.

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