



Thesis Project Form

Title (tentative): Advanced MRI Techniques for the Evaluation of Neonatal and Fetal Brain Vascularization:
Towards a Population Atlas

Thesis advisor(s): TrÃ² Rossella

E-mail: rosella.tro@dibris.unige.it

Address:

Phone:

Description

Motivation and application domain

Understanding the neonatal and fetal brain vascular system is crucial for studying normal development and pathological conditions. Despite advances in neuroimaging, reliable methods for extracting and analyzing brain vessels are limited. This project leverages advanced MRI protocols on the SIEMENS VIDA 3T to contribute to the development of reproducible frameworks for vascular analysis, with potential applications in neonatal and fetal care.

General objectives and main activities

The thesis will focus on the design, implementation, and validation of MRI protocols dedicated to neonatal and fetal brain vascularization. Building on existing neonatal protocols (T1, T2, DWI/DTI, SWI, and angio-MRI), the work will explore the feasibility and optimization of angio-MRI during fetal development, including 2D TOF MRA. Activities will include data acquisition in collaboration with the Neuroradiology Unit in Turin, image preprocessing and vessel extraction, and quantitative evaluation of vascular structures. The student will also contribute to methodological developments that align with the project's long-term goal of building a population atlas of brain vascular ageing, ensuring reproducibility and clinical applicability.

Training Objectives (technical/analytical tools, experimental methodologies)

The student will acquire expertise in advanced MRI acquisition, neurovascular image analysis, and quantitative evaluation of cerebral vascularization. They will gain hands-on training in MRI protocol implementation (SIEMENS VIDA 3T), image processing, vessel segmentation, and statistical analysis, preparing them for translational research at the interface of medical imaging, computer vision, and neuroscience.

Place(s) where the thesis work will be carried out: DIBRIS, UNiversity of Genoa

Additional information

Pre-requisite abilities/skills: Basic knowledge of MRI physics, medical imaging, and image processing.
Programming skills (Python/Matlab) are an asset.

Curriculum: 2

Maximum number of students: 1