Proposal for R&D Master 2 Internship
(ANR Project - PRAnevrisme)

Starting date: as soon as possible

Duration: 6 months

Location: Ecole Centrale de Lyon, Ecully, France

Keywords: Laboratory: LIRIS Laboratory, UMR 5205 CNRS, Imagine Team

PhD follow-up: yes

Subject

Anatomical images and physical-properties correlation analysis for prediction of intracranial-aneurysms' vulnerability

Supervisors

–   Mohsen Ardabilian, MCF, mohsen.ardabilian@ec-lyon.fr (LIRIS)
–   Alexandre Saidi, MCF, alexandre.saidi@ec-lyon.fr (LIRIS)

Scientific context

An intracranial aneurysm corresponds to an anatomical anomaly resulting from a structural and residual deformation of the wall of a cerebral artery. It is estimated that between 2 and 5% of the world population has a cerebral aneurysm. The annual risk of rupture of the latter varies from 1 to 4% in the population carrying the pathology, or between 7-11/100,000, which makes it a major public health problem. Intracranial aneurysms are generally discovered when they rupture, which results, in approximately one in four cases, in the death of the patient before even arriving at the hospital. For patients treated quickly enough, approximately half of them die within the month following their hospitalization and one in three patients who survive will present significant neurological disorders. There are also cases where the aneurysm is discovered incidentally during a brain imaging examination. The practitioner must then, based on the anatomical images, assess and predict the risk of potential rupture of the aneurysm before deciding on the most appropriate treatment (neurosurgery, endovascular treatment, or conservative approach). The decision to intervene, or not to intervene (conservative approach), is based on morphological criteria (size, shape, etc.), location of the aneurysm, but also on epidemiological factors, such as high blood pressure, alcohol and tobacco consumption of the patient. While this information allows for an initial assessment of the risk of potential rupture of the aneurysm, it does not provide any information on the biomechanical quality of its wall, which nevertheless remains the predominant parameter in terms of the probability of rupture.

Knowledge of this biomechanical information concerning the vulnerability of intracranial aneurysms would be a valuable diagnostic aid for the practitioner and would allow the patient to benefit from the best care in relation to the state of maturation of their pathology.

Internship objectives

The objective of the internship is to propose a model-tool, based on machine learning, which produces for the practitioner quantitative information on the state of degradation of the vascular tissue of their patient solely from an anatomical image.

This work is organized in several stages which are:

- Organization and preparation of data from anatomical and biomechanical images.
- Application or development of a predictive model of the mechanical behavior of the cerebral vascular wall.

This research work is part of an already established multidisciplinary collaborative framework, the ANR PRAnevrisme project, between the Ecole Centrale de Lyon (LIRIS, LTDS) and the HCL.

The recruited student will work in the Imagine team of LIRIS, at École Centrale Lyon site. This work could be extended, following this internship, in a thesis funded by the ANR PRAnéurisme project.

Contact

To apply please send a CV, your Master grades and a cover letter to Mohsen.Ardabilian@ec-lyon.fr and Alexandre.Saidi@ec-lyon.fr. In order you can apply or contact us as quickly as possible, we will review applications on the fly.

About

- Ecole Centrale de Lyon (https://www.ec-lyon.fr/en). Ecole Centrale de Lyon, founded in 1857, is one of France's oldest and most prestigious engineering schools, known for its rigorous generalist engineering program that blends theoretical knowledge with practical experience. Located at Ecully, near Lyon, the school offers a diverse curriculum with specializations in fields like mechanics, energy, and environmental engineering, and is deeply involved in cutting-edge research. With strong international partnerships and a vibrant campus life, graduates of Ecole Centrale de Lyon are highly sought after by leading companies in engineering, technology, and consulting.

- LIRIS Lab (https://liris.cnrs.fr/en). The Laboratoire d'InfoRmatique en Image et Systèmes d'information (LIRIS) is a joined research unit (UMR 5205) backed by the CNRS, INSA Lyon, University Claude Bernard Lyon, University Lumière and Ecole Centrale de Lyon. It has 330 members. LIRIS research addresses a broad spectrum of computer science within its 12 research teams structured in 6 poles of expertise from database to vision and human-computer interactions.