Faculty of Engineering
Summer Research Program 2023-2024

Project Title: Developing flow models for deep learning (AI) analysis of aneurysm rupture risk
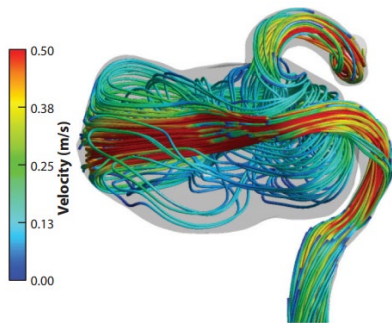
Supervisor(s): Josie Carberry

Department: Mechanical and Aerospace Engineering

Email: josie.carberry@monash.edu

Objective

Use a combination of computational fluid mechanics and AI to move towards making hemodynamic evaluation of aneurysm rupture risk clinically accessible.

Project Details

Intracranial aneurysm (brain aneurysm) occurs when a blood vessel in the brain becomes weakened, forming a balloon-like structure on the vessel wall. If the aneurysm wall becomes too thin it may rupture causing brain hemorrhage (bleeding) with high rates of death or long-term disability.

Aneurysm rupture is strongly linked to hemodynamics (blood flow patterns) and many parameters have been associated with increased rupture risk. Unfortunately none of these have developed to the point where they are routinely used in clinical practice, mainly due to the accessibility of implementation.

This project involves producing inputs to allow training of an AI network to predict rupture risk from MRI 4D flow measurements. Research steps include:

- Reviewing aneurysm parameters known to correlate with rupture risk
- Learning about MRI flow measurements and file formats
- CFD simulations of aneurysm flows to evaluate risk parameters in cases with known outcomes
- Reviewing relevant AI methods
- Assisting with AI network development

Prerequisites / Additional Information

Students should have a base knowledge of fluid mechanics (MEC2404 or equivalent), experience in CFD (ANSYS) and an interest in translating engineering innovation to patient outcomes. Medical, imaging and/or AI knowledge would be useful but is not assumed - you can learn this during the project. For further information please use the email address above.