

F3 Wearable-Derived Biosignatures for Early Detection of Arrhythmia and Heart Failure



HOST ORGANISATION

Maastricht University
(UM), Netherlands

PHD AWARDING INSTITUTION

Maastricht University
(UM), Netherlands

Supervisory Team

Lead Supervisor

- Prof. Dominik Linz (Maastricht University)

Co-Supervisors

- Prof. Joost Lumens (Maastricht University)
- Lars Grieten (Qompium NV)

Project Description

Atrial fibrillation (AF) and heart failure (HF) are two of the most common cardiovascular diseases and frequently occur together. Their interaction creates a vicious cycle in which each condition can worsen the other, leading to increased hospitalisations, reduced quality of life and poorer clinical outcomes. However, the early stages of disease progression often remain difficult to detect, particularly outside the clinical setting. This project aims to develop innovative methods for the early detection of arrhythmias and heart failure using data collected from wearable devices.

The doctoral candidate will combine biosignals obtained from technologies such as photoplethysmography (PPG) and electrocardiography (ECG) with echocardiographic imaging and advanced computational modelling. Using the CircAdapt cardiovascular modelling platform, the project will create personalised virtual representations of cardiovascular function that can help reveal the mechanisms linking arrhythmias and heart failure.

A key objective is to identify novel biosignatures that can predict future clinical events before symptoms become severe enough to require medical intervention. By combining data-driven analysis with mechanistic cardiovascular models, the project will move beyond simple detection toward a deeper understanding of the physiological processes driving disease progression. These newly discovered biosignatures will then be prospectively validated in patient cohorts to assess their ability to predict arrhythmia and heart failure events.

The project benefits from access to several large-scale datasets, including the ISOLATION and TeleCheck-AF registries, as well as international resources such as the UK Biobank and National Sleep Research Resources databases. The successful candidate will have the opportunity to work with extensive real-world healthcare data while contributing to the development of digital technologies that could support preventive and personalised cardiovascular care.

F3 Generating Synthetic Data for Valve Condition Analysis



Planned Secondments

- University of Bordeaux, France (2 months): collection and analysis of integrated smartwatch ECG and PPG recordings in patients with atrial fibrillation.
- Qompium NV, Belgium (4 months): validation of wearable-based methods for the early detection of arrhythmia and heart failure events using real-world patient data.

Desirable Project-Specific Qualifications and Skills

In this project, collaboration, scientific curiosity and translational impact are central. We are looking for someone who enjoys working at the intersection of engineering, physiology and clinical application, and who is motivated to contribute to research with real-world impact.

- Curious and translationally minded
- Research-minded and analytical
- Technically creative and hands-on
- Independent and proactive
- Strong communicator and team player
- Open to learning

Your background should include:

- A Master's degree in a relevant field such as Biomedical Engineering, Electrical Engineering, Mechanical Engineering, Medical Technology, Mathematics, Physics, Computer Science, Cardiovascular Science or related field.
- Proven interest in cardiovascular physiology, heart failure, cardiac arrhythmias, cardiac (electro)mechanics/hemodynamics and/or related therapies.
- Experience in or affinity with medical imaging analysis, wearable technologies, and signal processing.
- Programming and quantitative data analysis skills, preferably in Python, MATLAB, C/C++ or similar.
- Proven interest in computational modelling and simulation, digital twins or in-silico testing.
- Good organisational, project management and scientific writing skills.
- Excellent English language skills, both written and spoken.

Please direct any query regarding this project to:

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