**PhD Thesis – LTSI INSERM 1099**

# Development of a hybrid machine learning model for predicting response to cardiac resynchronization therapy

**Context**

The LTSI (Signal and Image Processing Laboratory) is a research laboratory at the University of Rennes and INSERM, at the interface of information science and health technologies.

**Subject**

Cardiac resynchronization therapy (CRT) is based on a stimulation device that can be implanted in heart failure patients. Identifying CRT candidates remains a challenging task. Currently, approximately 30% of the patients are non-responder and the mortality rate is high even after CRT implantation. Patient selection prior to implantation is essential to improve and personalize the treatment, while preventing complications.

This thesis work is part of the EXPERT project, funded by the French National Research Agency (ANR). The project aims at providing a Decision Support System (DSS) to predict patient response to CRT, in order to help the clinician taking the decision to implant the patient. The DSS will be developed using explainable artificial intelligence methods, integrating machine learning and physiological computational models (patient digital twin) to: 1) combine physiological knowledge and clinical data; 2) improve model interpretability; and 3) minimize overfitting. The models will primarily be based on myocardial deformation analysis, measured by echocardiography (speckle-tracking).

This work will be based on previous work and expertize from our team in modeling, signal processing and machine learning applied to CRT [1-7]. First, the methodology proposed in this thesis will be assessed on a retrospective clinical database of 250 CRT candidate patients. Then, the DSS will be implanted in three French University Hospitals and used in a multicentric prospective observational clinical study, in order to assess its performances. The thesis results could therefore have a direct clinical impact on the management of heart failure patients.

**Profile**

We are seeking a candidate with skills in numerical analysis, signal processing, and programming. Motivation for biomedical engineering is required, although knowledge in physiology is not mandatory.

**Location / Start date / Duration**

Rennes, Campus de Beaulieu / October 2024 / 36 months

**Contacts**


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**References**


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