

# Efficiently detecting cardiovascular diseases from ECG using active and reinforcement learning

Debabrota Basu

debabrota.basu@inria.fr

**Where:** Scool (previously SequeL), Inria Centre at the University of Lille, Villeneuve d'Ascq, France

**Expected background:** Master in CS, specialised in machine learning and AI. This work will require the candidate to be comfortable with coding efficiently.

**Keywords:** AI for health, Cardiac diseases, Electrophysiology, Active learning, Reinforcement learning.

**Objective:** The increasing incidence of cardiovascular diseases constitutes a public health problem, due to their impact on vital prognosis and quality of life. Accident prevention through early detection and therapeutic monitoring must be done in a medical office or at home. It is today hampered by the lack of medical equipment, for acquiring cardiac signals, as well as interpretation experts. The abundance of smart devices promises to compensate for it, if algorithms make poor quality acquisition and automation of interpretation more reliable. Because of its ergonomics, the recording of rhythmic sequences must be used.

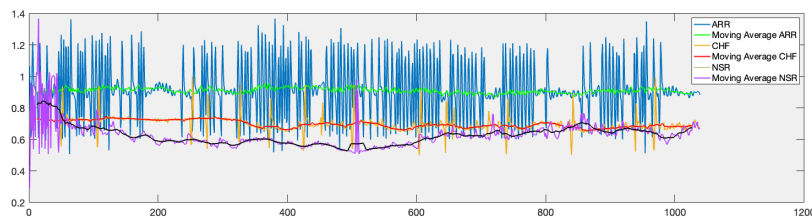


Figure 1: Different rhythmic time series for two diseases and the normal condition.

The primary practical objective is to combine variational methods to curate labelled datasets of electrocardiograms, in order to map them onto datasets of rhythmic sequences, but in which the appropriate labelling differs slightly. Robustness to outliers and noise is an important metric.

Synthetic data from simulations can further help to fill in the gaps in the sample distribution and loss landscape before batch normalisation, for deep supervised learning.

The next objective will be to devise a strategy of automated labelling. Based both on some known key features and the previously gathered data sets, we seek to devise a strategy with reinforcement (or active) learning in dynamic contexts, such as an evolving disease.

The interested candidate will work at this exact juncture of turning algorithmic developments into efficient and extensive software.

**Roadmap:** As an end result, we aim to achieve a practical and theoretical understanding of classifying and labelling ECG data from patients, and to design an algorithm for these problems.

If we are successful at this, we aim to develop a code base usable in practice and to publish the findings in premier machine learning venues like ICML, NeurIPS, AAI, AISTATS etc. This internship also comes with an opportunity to do CIFRE PhD with the Bits2beat in this topic depending on the performance of the candidate. Also, for internships, we are going to be remunerate according to industry salary scale, i.e. higher than the public internship salary.