

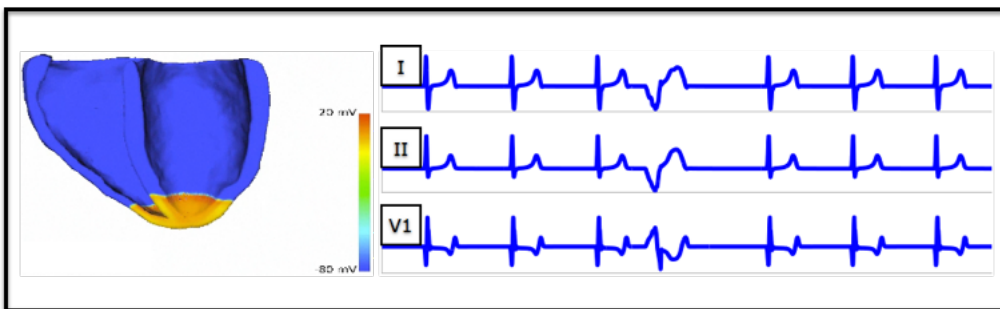
Student Research Project

Full torso mondomain simulation of the human cardiac electrophysiology during an event of heart rate turbulence

Motivation

Ectopic beats and atrial fibrillation are the most common causes of cardiac arrhythmia. However, in particular ventricular ectopic beats (VEB) can be used for diagnostic purposes. Premature ventricular contractions (PVC) trigger a characteristic response in the heart rate called heart rate turbulence (HRT). It has been shown that HRT can be used to stratify risk of sudden cardiac death. In recent years, it has been shown that not only the heart rate changes dynamically after a VEB, but also the morphology of the T wave in the ECG. This phenomenon has been called post extrasystolic T wave change (PEST). Even though, the phenomenon has been observed in the presence of other cardiac pathologies, there is no clear explanation for the mechanisms behind it. Furthermore, it is also not known if the phenomenon is also present in healthy subjects, or if it is typical only in pathological cases.

Therefore, it can be postulated that state of the art computer simulations of the human cardiac electrophysiology can help us understand PEST in a deeper manner. The degree at which pure electrophysiological processes are involved in PEST, is also a question that could be approached with this kind of simulation.



Tasks

In this project, a mondomain full torso simulation of the transmembrane voltages in the heart should be carried out. A realistic geometry together with the Ten Tusscher model should be used. Finally, using the transmembrane voltages on the surface of the heart, a projection onto the surface of the chest should make the measurement of a virtual ECG possible.

Requirements

- Literature research
- Programming skills in C++, Python and acCELLerate
- Data mining and statistics
- Fundamentals of cardiac physiology and anatomy

Field of Research

Computer simulation of human cardiac electrophysiology and signal processing of the ECG

Project

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Areas

Computer simulations
Signal processing
Software programming
Biomedical engineering

Field of Studies

Electrical engineering
Computer science

Starting Date

January 2014

Contact

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