Matlab/Web based toolbox for models of the heart

Background

Despite extensive research efforts, the mechanisms underlying cardiac arrhythmia, the most common cause of sudden cardiac death, are poorly defined. Major difficulties lie in the complexity and nonlinearity of the cardiac system, which spans different spatial and temporal scales, and species-specificity of several electrophysiological processes, which often precludes translation of results obtained in animal models to humans. Our lab utilizes emerging tools of systems biology, including mathematical modeling and simulation, as an interpretative and predictive science to investigate the mechanisms of cardiac arrhythmias.

Despite the fact that many computational models of the cardiac cells and tissues have been developed in past decades, implementation of these models by non-expert users remains challenging. Most of these models are implemented in C/C++ or Matlab, and thus require programming experience in order to make use of them.

Project Description

This project aims to 1) develop a Matlab/Web based front end for models of the heart; 2) construct toolboxes for implementing standard electrophysiological protocols and optimizing the existing models.

Core Functions:

- A nice, easy to use user interface for several models of the heart developed in our lab
- Plotting high quality figures from one click
- Automatic, fast parameter optimization for models representing important properties of the heart
- Toolboxes for analyzing these models
- Automatic generation of summary documents for the analysis