Improved parser for model descriptions in an open-source software for simulations in computational neuroscience

Computational research in biology commonly consists of describing a model system and its parameters, simulating the system with specialized software, and then analyzing the results. Model descriptions often make use of a domain-specific language that is parsed and interpreted by the simulation software. Such languages have the advantage that they are more accessible to researchers than code written in a general-purpose programming language; they also make it easier to discuss and share models with other researchers.

Parsing such languages is mostly straightforward with standard techniques, but these techniques often have at least two shortcomings: 1) For syntactically incorrect descriptions, e.g. a missing parenthesis, error messages are typically not very helpful and of the form "unexpected symbol at position x", and 2) annotations via comments are usually simply ignored, instead of being used to enrich a model description.

Both of these shortcomings are currently present in the Brian simulator, an open-source simulator for biological spiking neural networks written in Python, developed in our research group and used by researchers world-wide. The Brian simulator describes models with a domain-specific language that uses mathematical notation with additional annotations, e.g. to assure the consistency of physical dimensions.

The goal of this internship is to rewrite the Brian simulator’s parsing code to give clear and helpful error messages for incorrect model descriptions, as well as treating comments in the model descriptions as annotations that are stored for future usage.

This project will allow students to apply and improve their knowledge of parsing techniques in a real-world use-case by contributing to a widely used open-source research software. It will also give them valuable experience in modern techniques for software collaboration, e.g. the use of git and github, and continuous integration testing frameworks.

The internship will take place at the Institut de la Vision, 13 rue Moreau, 75012 Paris under the supervision of Dr. Marcel Stimberg, lead developer of the Brian simulator and research engineer in the "Computational Neuroscience of Sensory Systems" group headed by Dr. Romain Brette.

Links
https://briansimulator.org/
http://www.computational-neuroscience-of-sensory-systems.org/

Publication