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Using Neurofitter to fit a Purkinje cell model to experimental data

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The cerebellar Purkinje cell is a highly complex neuron that has different firing behaviors, that contains many different ionic mechanisms and that has a complicated dendritic morphology. Therefore models of this neuron are difficult to hand-tune. We used Neurofitter [1], an automated neuron model parameter search tool, to fit both the passive parameters of a neuron model and the maximal conductances of the ion channels to an experimental data set.

The approach is based on the phase-plane trajectory density method [2] that evaluates the difference between the experimental voltage traces and the model output. Optimization algorithms like Evolution Strategies and Mesh Adaptive Search were used to search the parameter space of the model.

The Neurofitter method was already tested before by fitting the parameters of a Purkinje cell model [3] to output generated by the model itself [4], but now we show results that also use experimental data to fit a new version of the Purkinje cell model with updated kinetics. The traces that were used as goal of the optimization consisted of voltage responses of a Purkinje cell neuron to current steps with different amplitude.

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