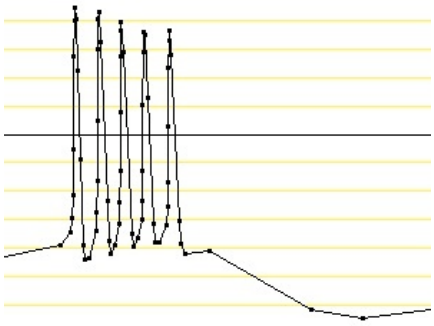

Structure and Organization of Models in a Brute-force Construction Database

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Long Term Goals

✦ Implement an auto-classification system that can classify large numbers of models quickly.

✦ Create tools to examine large-scale databases in order to answer specific questions and look for general trends in the dataset.

Summer Goals

✦ Learn about the variety of behaviors contained in this model through the following:

- Build a small-scale "practice" database
- Set up limited classification schema
- Build tools to interact with and view database

Future Work

✦ Further explore the database to see whether observed linear boundaries is the norm or an exception

✦Apply machine learning techniques to construct a rule set for efficient further classification of the database

✦Expand the functionality of current tools to add to their usability and allow them to interact with previously developed tools

Results Obtained

We used Astrid Prinz's database of model neurons constructed by independently varying the maximal membrane conductances based on lobster stomatogastric neuron measurements.

Our first challenge was to replicate the database, but compress the information so that we could work with the data in realtime and store it on an average desktop computer. We constructed several sets of models on a smaller scale, focused at predetermined areas of interest in the larger database so that we could look at a variety of information quickly.

Next, we constructed algorithms to find the period of the spontaneous electrical activity of each model and count the number of action potentials that occur within a single period. This was the basis for our preliminary auto-classifier, which can assign a "type" to neurons based on the number or lack of spikes within a period.

Finally, we built several tools to assist with the analysis and exploration of the small-scale databases and help prepare data for the next steps in our research. One tool allows a human to classify a set of neurons manually and stores them for later use in display or machine learning applications. Another tool gives the human user an overall look at a mini database, allowing him to observe trends that may lie in the models as the inputs vary.

Conclusions

Preliminary evidence suggests that the boundaries between types of neurons seem to be linear in conductance space. It is currently unknown whether this is a characteristic of the areas we have already examined, or a trend we will see in other areas.

We have gained some insight into the natural organization of different neuron types in our dataset, found many areas in which to perfect and expand on our current classification scheme, and now have a variety of tools and algorithms which prepare a foundation on which to base the next year's research.