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Poster presentation

Evaluating feedforward spiking neuron networks using a novel decoding strategy

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Introduction

Investigating how information is represented within a population of model neurons is a primary focus of computational neuroscience research. In feed-forward systems, a fundamentally related question is how this representation changes as it advances through the network. In this letter, we explore the capabilities of several kinds of feed-forward network architectures at transmitting complexly coded information using a large, heterogeneous populations of model neurons. For a suitably elaborate input, we employ a realistic model of the auditory periphery, the Meddis Inner-Hair Cell Model [1]. To interpret the spike train responses for sizeable neuronal populations, we introduce a novel method for decoding based on a discrete version of the reconstruction method [2]. By combining an interspike interval (ISI) representation with support vector machine (SVM) classifiers, we successful decode information from layers of 200 spiral ganglion cells of 20 different types. Furthermore, this method makes no assumptions about the spike train's encoding.

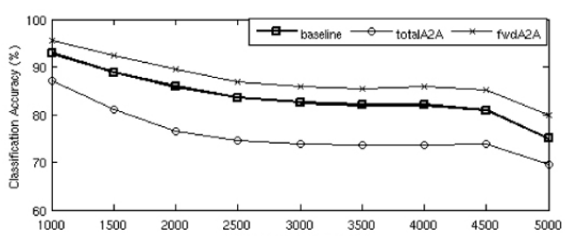

Figure 1
Accuracy for various frequency split points.

Results

We judge the performance of several candidate networks using a two-tiered system. For our discrete task, we ask whether each stimulus, a pure tone blip, is higher or lower than some predetermined split point frequency. To obtain a baseline, we measure the classification accuracy for this task on our simulated auditory nerve. Next, we use this spike signal as an input to our candidate architectures and record the output spike trains. We can now evaluate our architectures' performances by decoding the output with respect to the initial sound stimulus. A graph of our results for various frequencies is shown in Figure 1.

References

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