Investigation of Generalization Capabilities of a Trained Stochastic Kinetic Model of Neuron

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Abstract

Nowadays biological neural networks are increasingly considered as a tool for solving many computational problems. Tasks like classification, identification and control of dynamic processes are commonly solved with, due to their flexibility, introduction of these kind of tools. It is well known that a problem of training a neural network (and not only) is ill conditioned due to ambiguity of its solution [**?**]. It is necessary then to apply some adequate criterion to perform a test during training of performance of a neural network. Natural case is to consider generalization ability of a specific neural network.

One of the simplest methods of testing generalization capabilities of a neural network is to examine the Vapnik-Chervonenkis dimension which, unfortunately, requires the knowledge of a sufficiently large training set. Another approach assumes modifying the functional error of a neural network by an additional performance index.

In this paper we are considering a model of a Hodgkin-Huxley type of a biological neuron, based on Markov kinetic schemes, trained with the descent gradient method [**?**]. We are investigating its generalization capabilities by adding to the error function of the model of a neuron a performance index [**?**] which has an influence on the changes in the variance of the neuron's output. This is the first attempt of combining these two issues: training the Hodgkin-Huxley type of neuron with test of its generalization capabilities. The trained model of neuron is then examined in a control problem.

References

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