Abstract

A spiking neuron is a simplified model of the biological neuron as the input, output and internal representation of information, which is the relative timing of individual spikes, is more closely related to that of a biological network.

In this paper we present a biologically plausible unsupervised learning rule for clustering data with spiking neurons based on the idea presented in (Hopfield 1995) that a radial basis function (RBF) neuron encodes a particular input spike pattern in the delays available across its synapses. We develop an algorithm for learning the delays by using locally available information as the time difference between the pre- and post- synaptic spike.

We extend the learning mechanism developed in (Gerstner et al. 1996) for a single neuron by considering also a neuron firing time and designing a multi-layer RBF network. The learning rule is a variant of the Hebb law. It is applied to the synaptic weights of the neuron that fired when the input was presented to the network. The weights are changed in a way that moves the RBF neuron’s centre closer to the input pattern. Synapses, which contributed to the neuron’s firing, are strengthened and synapses, which did not contribute are weakened. The computer simulations were performed for RBF neural networks with 20 inputs and the delay interval of 15 ms. The duration of each learning cycle was fixed to 50 ms. Our simulations showed that the clustering is possible even in the presence of noise.