

Study on the Transition to Pacemaker of Two Coupled Neurons

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Abstract : The research of neural network is very important for the development of advanced next generation intelligent devices and the medical treatment. The most important part of the neural network research is the learning. The process of learning in our brain is essentially several adjustment processes of connection strength between neurons. It is very difficult to figure out how this mechanism works in the complex network and how the connection strength influences brain functions. For this reason, we made a model with only two coupled neurons and studied the influence of connection strength between them. To emulate the neuronal activity of realistic neurons, we prefer to use the Izhikevich neuron model. This model can simulate the neuron variables accurately and its simplicity is very suitable to implement on computers. In this research, the parameter ρ is used to estimate the correlation coefficient between spike train of two coupling neurons. We think the results is very important for figuring out the mechanism between synchronization of coupling neurons and synaptic plasticity. The result also presented the importance of the spike frequency adaptation in complex systems.

Keywords : neural networks, noise, stochastic processes, coupled neurons, correlation coefficient, synchronization, pacemaker, synaptic plasticity

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