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Spatial evolution of Hindmarsh–Rose neural network with time delays

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Spatial relations between neurons in the network with time delays play a crucial role in determining dynamics of the system. During the development of the nervous system different types of neurons group together to enable specific functions of the network. Right spatial distances, thus right time delays between cells are crucial for an appropriate functioning of the system. To model the process of neural migration we proposed simple but effective model of network spatial evolution based on Hindmarsh–Rose neurons and Metropolis–Hastings Monte Carlo algorithm. Under the specific assumptions and using appropriate parameters of the neural evolution the network can converge to the desirable state giving the opportunity of achieving large variety of spectra. We show that there is a specific range of network size in space which allows it to generate assumed output. A network or generally speaking a system with time delays (corresponding to the arrangement in the physical space) of specific output properties has a specific spatial dimension that allows it to function properly.