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The effect of the neural activity on topological properties of growing neural networks

Gafarov F., Gafarova V.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2016 World Scientific Publishing Europe Ltd.The connectivity structure in cortical networks defines how information is transmitted and processed, and it is a source of the complex spatiotemporal patterns of network's development, and the process of creation and deletion of connections is continuous in the whole life of the organism. In this paper, we study how neural activity influences to the growth process in neural networks. By using a two-dimensional activity-dependent growth model we demonstrated the neural network growth process from disconnected neurons to fully connected networks. For making quantitative investigation of the network's activity influence on its topological properties we compared it with the random growth network not depending on network's activity. By using the random graphs theory methods for the analysis of the network's connections structure it is shown that the growth in neural networks results in the formation of a well-known "small-world" network.

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Keywords

Average clustering coefficient, average shortest path lengths, axon guidance, node degree distribution, small-world network