Peng, Hong; Bao, Tingting; Luo, Xiaohui; Wang, Jun; Song, Xiaoxiao; Riscos-Núñez, Agustín; Pérez-Jiménez, Mario J.

Dendrite P systems. (English) [Zbl 1468.68100] 
Neural Netw. 127, 110-120 (2020).

Summary: It was recently found that dendrites are not just a passive channel. They can perform mixed computation of analog and digital signals, and therefore can be abstracted as information processors. Moreover, dendrites possess a feedback mechanism. Motivated by these computational and feedback characteristics, this article proposes a new variant of neural-like P systems, dendrite P (DeP) systems, where neurons simulate the computational function of dendrites and perform a firing-storing process instead of the storing-firing process in spiking neural P (SNP) systems. Moreover, the behavior of the neurons is characterized by dendrite rules that are abstracted by two characteristics of dendrites. Different from the usual firing rules in SNP systems, the firing of a dendrite rule is controlled by the states of the corresponding source neurons. Therefore, DeP systems can provide a collaborative control capability for neurons. We discuss the computational power of DeP systems. In particular, it is proven that DeP systems are Turing-universal number generating/accepting devices. Moreover, we construct a small universal DeP system consisting of 115 neurons for computing functions.

MSC: 68Q07 Biologically inspired models of computation (DNA computing, membrane computing, etc.)

Keywords: P-systems; neural-like P-systems; dendrite P-systems; computational power

Software: CuSNP

Full Text: DOI

References:
[12] Ibarra, O. H.; Pànn, A.; Rodríguez-Patón, A., Sequential SNP systems based on min/max spike number, Theoretical Computer


Wang, J.; Shi, P.; Peng, H., Membrane computing model for IIR filter design, Information Sciences, 329, 164-176 (2016)


Xue, J.; Camino, A.; Bailey, S. T.; Liu, X.; Li, D.; Jia, Y., Automatic quantification of choroidal neovascularization lesion area on OCT angiography based on density cell-like P systems with active membranes, Biomedical Optics Express, 9, 7, 3208-3219 (2018)


Zhao, Y.; Liu, X.; Qu, J., The k-medoids clustering algorithm by a class of P system, Journal of Information \& Computational Science, 9, 18, 5777-5790 (2012)

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