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Preface

György Vaszil[1] · Claudio Zandron[2] · Gexiang Zhang[3]

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Membrane computing is a branch of natural computing that studies models of computation inspired by the functioning of the living cell and by cooperation of cells organized in different ways, such as in tissues, organs, or populations. The basic model was introduced by Gheorghe Păun in 1998, as a distributed and parallel computing device, handling multisets in compartments defined by membranes.

This special issue is based on a collection of selected papers presented at the annual International Conference on Membrane Computing in 2021, both at the European chapter (CMC), as well as at the Asian chapter (ACMC). Organized since the year 2000, the International Conference on Membrane Computing is the main event covering membrane computing, where scientists meet to present current research results, to discuss actual trends and to exchange ideas on various research questions. The 2021 edition was organized in August as online event (due to the pandemic situation) by the University of Debrecen, Hungary, and the Chengdu University of Information Technology, China.

From the set of 29 full papers and 6 short papers presented at the conference, 5 papers were selected for this special issue, together with 4 papers from the invited speakers. Moreover, 6 invited contributions are included by researchers working in the area, but not present at the conference. All papers, including those presented at the conference, went through an independent review process.

✉ Claudio Zandron
claudio.zandron@unimib.it

György Vaszil
vaszil.gyorgy@inf.unideb.hu

Gexiang Zhang
gexiangzhang@gmail.com

[1] University of Debrecen, Debrecen, Hungary

[2] University of Milan-Bicocca, Milan, Italy

[3] Chengdu University of Information Technology, Chengdu, China

In "Solving Subset Sum by Spiking Neural P Systems with Astrocytes Producing Calcium", Aman considers spiking neural P systems with astrocytes producing calcium and provides semi-uniform and uniform solutions to the subset sum problem in a polynomial number of steps.

In "On the Power of Boundary Rule Application in Membrane Computing", Battyányi discusses how to simulate maximal parallelism by non-cooperative boundary rules applied only in sequential mode, as well as by membrane dissolution, promoters, and inhibitors.

In "About reversibility in sP colonies and reaction systems", Cienciala, Ciencialová, and Csuhaj-Varjú study reversibility in both sP colonies and reaction systems.

In "Spiking Neural P Systems and their Semantics in Haskell", Ciobanu and Todoran design a semantic interpreters for Spiking Neural P systems using the language Haskell.

In "Automatic Design of Arithmetic Operation Spiking Neural P Systems", Dong, Luo, and Zhang describe an automatic design method of Spiking Neural P systems to achieve arithmetic operation.

In "Estimation of Minimum Viable Population for Giant Panda Ecosystems with Membrane Computing Models", Duan, Rong, Zhang, Qi, Valencia-Cabrera, and Pérez-Jiménez present a membrane computing model based on behavioral biology to evaluate the Minimum Viable Populations of giant panda.

In "On the power of membrane dissolution in polarizationless P systems with active membranes", Gazdag and Hajagos show that the NL-complete reachability problem can be solved in polynomial time by polarizationless P systems with active membranes using only dissolution rules.

In "Face Illumination Normalization based on Generative Adversarial Network", Guo, Ling, Li, Yang, Zhu, Ma, Zhang, Jiang, and Wu present a novel architecture based on deep fully convolutional neural network and generative adversarial networks for illumination normalization of facial images.

In "Tissue P systems with evolutional communication rules with two objects in the left-hand side", Orellana-

Martín, Valencia-Cabrera, Song, Pan, and Pérez-Jiménez approach the problem of defining narrow frontiers between efficiency and non-efficiency in the framework of Membrane Computing.

In "Bio-Inspired Modelling as a Practical Tool to Manage Giant Panda Population Dynamics in Captivity", Rong, Duan, Valencia-Cabrera, Zhang, Qi, and Pérez-Jiménez propose a new way to study population dynamics of giant pandas in captivity by means of membrane systems, modeling the intrinsically stochastic real-life evolution processes of giant pandas.

In "Feature Selection Algorithm Based on P systems", H. Song, Huang, Q. Song, Han, and Xu propose a feature selection algorithm based on P systems, that exploits the parallelism of cell-like P systems and the advantage of evolutionary algorithms to implement feature selection on big datasets.

In "Morphogenetic computing: computability and complexity results", Sosík concentrates on computational aspects of morphogenetic (or M) systems, an abstract computational model combining properties of membrane systems with algorithmic self-assembly.

In "GPU simulations of spiking neural P systems on modern web browsers", Valdez, Wee, Odasco, Rey, and Cabarle, present and discuss a novel simulator for Spiking Neural P system that runs on modern web browsers and makes use of graphics processing units.

In "Tutorial on the Formal Framework for Spiking Neural P Systems", Verlan and Zhang provide a tutorial explaining the model of networks of cells and the basic concepts used in the formal framework for Spiking Neural P systems, with a series of examples for the analysis of existing models.

In "Deep Learning Networks with Rough-refinement Optimization for Food Quality Assessment", Zhou, Zhou, Zhang, Liu, and Shen propose a food quality assessment neural network model based on data mining that achieves and sometimes improves the accuracy of existing technologies.

The editors express their gratitude to the Program Committee, the invited speakers, the authors of the papers, the reviewers, and all the participants for their contributions to the success of ICMC 2021. The support of the University of Debrecen and the Chengdu University of Information Technology are gratefully acknowledged.