



Preface

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1 Preface

This special issue is based on a collection of selected papers presented at the annual International Conference on Membrane Computing in 2022, both at the European chapter (CMC), and 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 2022 editions of the Conference on Membrane Computing (CMC) and the Asian Conference on Membrane Computing (ACMC) were organized as a partially joint event in Trieste, Italy and Quezon City, Philippines under the umbrella event of ICMC 2022.

The conference aims at continuing the fruitful tradition of previous editions enriched by some new ideas and inspirations emphasizing multidisciplinary and innovative capacity. The conference is intended to bring together researchers working in Membrane Computing and related areas in a friendly atmosphere enhancing communication and cooperation.

This special issue is composed of five articles with both theoretical and practical results, ranging from the study of languages generated by P systems to the optimizations for efficient simulations.

In *Parallel Contextual Array Insertion Deletion P Systems and Array Rewriting P Systems with Pure 2D Context-free Rules*, the authors explore and compare the languages generated by parallel contextual array insertion deletion P Systems and array rewriting P Systems with pure 2D context-free rules, showing that the family of picture languages

generated by the latter is properly contained in the family of languages generated by the former class of P systems.

In *On Evolving Environment of 2D P Colonies - Ant Colony Simulation*, the authors explore two-dimensional P colonies as a simulation tool for multi-agent systems. In particular, they focus on the definition of the rules for the simulation of an ant colony, including movement and following pheromone trails. The study is not only theoretical, but it also includes the actual implementation and experimental simulation of the ant colony.

In *Modeling Markov sources and Hidden Markov Models by P systems*, the author studies a stochastic version of P systems, called stochastic transition P systems, where the choice of rules to be applied is given by a probability distribution (while the application remains maximally parallel). More in detail, the author shows two ways in which it is possible to define such a P system starting from an m -th order Markov source and one way to define it from an hidden Markov model.

In *A Grammatical Evolution Approach to the Automatic Inference of P Systems*, the authors employed an evolutionary computation method, namely grammatical evolution, to perform an automatic inference of rules for P systems with active membranes having as the only data available a sequence of configurations. The authors provide promising experimental results showing that, at least for small problems, the system is able to correctly infer all necessary rules.

In *Improving GPU Web Simulations of Spiking Neural P Systems*, the authors describe how they were able to implement a simulator for spiking neural P systems accelerated via GPU. In particular, they show how it was possible to use WebGL in the implementation. Due to an optimized sparse matrix representation, the authors were able to obtain a significant speedup for both CPU and GPU runtimes.

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