

Boundaries of membranes in P systems relying on multiset approximation spaces in language R

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Abstract

The Membrane computing is an area within computer science which aims to develop a new computational model through the study of the characteristics of biological cells. Membrane computing deals with distributed and parallel computing models. A separate compartment models were carried out on the tests. Communication between the compartments and the environment (via borders) play an important role in the process. Combination of P systems with multiset approximation spaces leads to an abstract model in which can be interpreted a concept of 'to be close enough to a membrane'. We designate goal is to perform these calculations in R. Some packages can perform calculations with multisets (such as 'sets' package), but they are more closely linked to fuzzy systems. To perform the calculations, we have created a library for the R language. We developed an appropriate data structures and algorithms for multisets and approximation spaces. We created a function library that contains functions for multiset relations and operations (multiplicity relation; n-times multiplicity relation; equality relation; inclusion relation; intersction; addition; subtraction; etc.) This function library still contains functions to compute the lower- and upper approximations and the inside and outside membrane boundaries in P systems. Using the calculated membranane boundaries we can give constraints for rule executions: a rule of a membrane has to work only in the membrane boundary of its region. We introduce data structures and functions by examples.

Keywords: membrane computing, multiset approximation spaces, R language

MSC: 68U20

References

- [1] T. MIHÁLYDEÁK, Z. E. CSAJBÓK, P. TAKÁCS, Communication Rules Working in Generated Membrane Boundaries. In: A. Alhazov, S. Cojocaru, M. Gheorghe, Y. Rogozhin (eds.), 14th International Conference on Membrane Computing CMC14, Chisinău, Moldova, August 20-23, 2013, Proceedings. Institute of Mathematics and Computer Science, Academy of Sciences of Moldova, Chisinău, Republic of Moldova, 2013, 241-254.
- [2] W. N. VENABLES, D. M. SMITH AND THE R DEVELOPMENT CORE TEAM, An Introduction to R - Notes on R: A Programming Environment for Data Analysis and Graphics, <http://cran.r-project.org/doc/manuals/r-release/R-intro.pdf>.