Summer Solstice 2018 Conference on Discrete Models of Complex Systems
Gdańsk, June 25-27, 2018

Biological lattice-gas cellular automaton models for the analysis of collective behaviour in interacting cell populations

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As a cellular automaton, a BIO-LGCA is defined on a regular lattice, where the nodes of the lattice take a certain number of discrete states. As a lattice-gas, the state space of a BIO-LGCA is related to the lattice geometry. Each node can be occupied by "biological agents", e.g. biological cells, characterized by their velocities which are restricted to the unit vectors connecting a node to its nearest neighbors. Agents move along the links and interact on the nodes of the lattice. This interaction can change the number of agents at individual nodes (birth/death processes) and may depend on the states in neighboring nodes which allows to model collective effects. Meanwhile, the BIO-LGCA has been established as discrete lattice- and agent-based model which permits multi-scale analysis and efficient large-simulations.

Ref.: Deutsch, A., Dormann, S.: Cellular automaton modeling of biological pattern formation: characterization, applications, and analysis. Birkhauser, Boston, 2018