Heterogenous Automata-Based Multi-agent Systems

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We present a theoretical framework and an experimental tool to study a behavior of heterogeneous multi-agent systems composed of two classes of automata-based agents: cellular automata (CA) and learning automata (LA) - based agents. The common feature of both systems is an ability of a collective behavior which, however, is understood diïňĂerently. We focus on a collective behavior understood as an ability of distributed optimization of some global criterion. It is natural for LA-based agents which are able to learn and adapt but for the case of CA-based agents, it opens the issue of development of the second order CA. We create a theoretical framework of the system based on a spatial Prisoner's Dilemma (PD) game in which both classes of players may participate. We introduce to the game some mechanisms like local proïňĄt sharing, mutation, and competition which stimulate the evolutionary process of developing collective behavior among players. We present some results of an experimental study showing emergence of collective behavior in such systems.

Keywords: Collective behavior, Learning automata, Multi-agent systemsSpatial prisoner's dilemma game, Second order cellular automata.