Intelligent Agents and Evolvable Systems

Krzysztof Cetnarowicz[1], Robert Schaefer[1], Bojin Zheng[2], Maciej Paszyński[1], and Bartlomiej Śnieżyński[1]

[1] Department of Computer Science
AGH University of Science and Technology, Cracow, Poland
[2] College of Computer Science,
South-Central University for Nationalities, Wuhan, China

The workshop *Intelligent Agents and Evolvable Systems* has originated as the fusion of two former workshops: *Intelligent Agents and Evolvable Systems* and *Algorithms and Evolvable Systems*. It has been organized since 2004 within the frame of the *International Conference on Computational Science*. Mathematical considerations, algorithmic aspects and designing computer applications supporting the development and management of systems for the large scale computation have been emphasized.

Two contributions are related to the formal description of multi agent systems. The first one delivered by Smołka, concerns agents that carry tasks of distributed, parallel computation. The results ensure existence of time-optimal scheduling and locate the optimal scheduling rules among static ones. The second paper written by Capković, is devoted to the modeling inter-agents relations by Petri Nets. Main results have been obtained by using the discrete event systems control theory and illustrated on several examples.

The next three papers contain new agent-based concepts of intrusions detection (infections) in computer systems. Byrski has introduced the system which is appropriate for the specific communication in Mobile Ad-hoc Networks in his paper. Immune-inspired mechanisms allow detecting anomalies coming from communication threads. Prusiewicz has proposed in his paper another system detecting the security policy violations in computer networks. Cetnarowicz et.al. have proposed a social layer that may be used for evaluation of agents behavior. Agents learn patterns of behaviors, which may be used to detect intruders and eliminate them from the system.

The following group of papers have dealt with applications of multi-agents paradigm for solving various, complex engineering problems. Barbucha et al. have presented application of agents to creation of asynchronous team which is able to realize an optimization process and giving accessibility by WEB. Al-Kanhal et al. have proposed an application of multi-agent systems to the optimization of dynamic uncertain process occurring when optimal uncertain manufacturing process are created. Problems of uncertain, human-originated knowledge grounding, accomplished with the use of ontologies in particularly applying uncertainties and several ontologies have been discussed by Szymański et al. Turek has presented an agent-based architecture, which should provide a multi-agent system that enables management of a multi-robot team and its simple extensibility. An interesting application of multi-agent system has been

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proposed by Srovnal et. al. It is an embedded system for hydrogen powered car control. Multi-agent architecture with dynamic mutual negotiation is applied. A new interesting research area is the application of graph grammars for modeling evolvable systems. The graph grammar can be effectively utilized for modeling self-adaptive PDE solvers, as it has been presented by Paszyńska et al. The graph representation of a problem can be stored in distributed manner and maintained by intelligent agents, as it has been proposed by Kotulski.

Some papers are focused on theoretical aspects of evolutionary computation and multi-agent systems and are related to real-world applications. Mirabedini et al. have proposed an ant-based routing algorithm, inspired by swarm intelligence and enhanced by fuzzy systems, to solve the routing problem in networks. In their system, multiple constrains can be considered in a simple and intuitive way. Qin et al. have constructed an adapted dynamic vehicle routing problem model based on multi-objective optimization. Then, they have proposed a hybrid multi-objective ant colony algorithm to solve this problem. The hybrid algorithm employs an EA to speed up the convergence of the algorithm. Khelil et al. have proposed the cancer diagnostic system to classify patients who may be affected by cancer. Fang et al. have analyzed the advantage of partnership selection based on grey relation theory and ant colony algorithm. The pre-election process can help to reduce problem search space and complexity. Ciepiela et al. have presented the hierarchical approach to multi-objective optimization problem based on Hierarchical Genetic Strategy (HGS). Barabasz et al. have presented *hp*-HGS, an enriched version of the HGS algorithm, to solve parametric inverse problems. Furthermore, they have analyzed the asymptotic behavior of their algorithm. Byrski at al. have combined evolutionary algorithms and multi-agent systems to form evolutionary multi-agent systems. The parameters of such systems can be tuned on-line. Application of agent-based co-evolutionary approach to the financial-decision support enabling financial investor planning process by generation of possible investments strategies have been discussed by Dreżewski et al. The contribution delivered by Fidanova discusses special kind of the evolvable systems – the ant colony and its application to finding quasi-optimal solution to Global Positioning System surveying problems.

Several papers have touched the problem of learning in multi-agent systems. Gehrke at al. have presented an application of rule induction algorithm for traffic prediction. Agents use knowledge generated from historical traffic data for route planning. The learning process in this work is performed outside of the multi-agent system by AQ21 program. The paper presented by Śnieżyński has proposed an architecture to design an agent, which has several learning modules for a number of aspects of its activity and every module can use different learning strategy. The architecture is tested on Fish-Banks game simulator. Other papers cover the development of self-learning agents systems. The application of agents with built-in machine learning routines designed to retrieve and analyze data coming from civil engineering data-bases has been presented by Kasperkiewicz et al. The paper by Jurek focuses on self-learning schemes in agents with application to the syntactic pattern recognition.