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Editorial

Special issue: New trends in ambient intelligence and bio-inspired systems

Ambient intelligence (AmI) brings a vision on the future of consumer electronics and refers to intelligent environments that are sensitive and responsive to humans. In an AmI environment, devices work together to support the everyday life activities, tasks in a natural way using information and intelligence that is hidden in the network connecting these devices. Bio-inspired computing is a multi-disciplinary field based on biology, complexity, cognitive science and cybernetics. The basic idea is to develop algorithms and methodologies inspired? in living phenomena and things happening in the nature. It is one of the fastest growing fields in modern computer science. This special issue consists of papers covering the latest innovations in Ambient Intelligence and Bio-inspired systems. The articles focus on the various aspects related to Ambient Intelligence and Bio-inspired models with emphasis on their usage for practical applications. The six papers are organized as follows:

In the first contribution, Serrano and Botía introduce a new methodology based on the use of Multi-Agent Based Simulations (MABS) for testing and validation of Ambient Intelligence based Ubiquitous Computing (UbiCom) systems. An ambient intelligence based UbiCom is a pervasive system in which services have some intelligence in order to smoothly interact with users immersed in the environment. The motivation for this methodology is its applications, which deal with dangerous environments. In these cases, real tests are impractical and an artificial society is required. MABS allows building cheap and quick prototypes, which can describe UbiCom systems. Authors described two novel techniques for the analysis of general complex MABSs: forensic analysis and the use of simpler simulations. The methodology is illustrated using detailed case study that considers a building on the campus and an AmI service for evacuation in the case of fire.

In the sequel, Sánchez-Anguix et al., present a multi-issue bilateral bargaining model for Ambient Intelligence domain where it is assumed that agents have computational bounded resources and do not know their opponents' preferences. The main goal of this research is to provide negotiation models that obtain efficient agreements while maintaining the computational cost low. A niching genetic algorithm is used before the negotiation process to sample one's own utility function (self-sampling). During the negotiation process, genetic operators are applied over the opponent's and one's own offers in order to sample new offers that are interesting for both parties. Empirical results illustrate that the proposed model is capable of outperforming similarity heuristics, which only sample before the negotiation process and of obtaining similar results to similarity heuristics, which have access to all of the possible offers.

Tapia et al. in the third paper illustrate the integration of the Hardware-Embedded Reactive Agents (HERA) Platform into the Flexible and User Services Oriented Multi-agent Architecture (FUSION@), a multi-agent architecture for developing AmI systems that integrates intelligent agents with a service-oriented architecture approach. FUSION@ has the ability to manage both software and hardware agents by using self-adaptable heterogeneous wireless sensor networks. Preliminary results demonstrate the feasibility of FUSION@ as a future alternative for developing Ambient Intelligence systems where users and systems can use both software and hardware agents in a transparent way, achieving a higher level of ubiquitous computing and communication.

Goldingay and Van Mourik in the fourth paper developed an hybrid algorithm, which is shown to exhibit improved efficiency and robustness. Authors used particle swarm optimization method to obtain optimize the parameters for all algorithms within a range of representative environments. Although results are obtained for large population sizes to avoid finite size effects, the influence of population size on the performance is also illustrated. From a theoretical point of view, the authors analyzed the causes of efficiency loss and derived theoretical upper bounds for the efficiency, and also compared these with the experimental results.

In fifth paper, Zengin et al., illustrate a biologically inspired discrete-event modeling approach for simulating alternative computer network protocols. This approach identifies and incorporates the key attributes of honeybees and their societal properties into simulation models that are formalized according to the Discrete Event System Specification (DEVS) formal-

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ism. Author's emphasis how to model the individual honeybees and their cooperation for routing algorithms using adaptation and probabilistic mechanisms. A set of simulation experiments depict that the developed methodology offers favorable throughput and delay performance and also exhibit superior survivability against network load surges.

In the last contribution, Bankovíc et al. proposed an enhancement to the reputation systems traditionally deployed for securing these systems. Different anomaly detectors are combined using the immunological paradigm to optimize reputation system performance with response to evolving security requirements. Using experiments, authors illustrated how a combination of detectors based on unsupervised techniques (self-organizing maps and genetic algorithms) can help to significantly reduce the global response time of the reputation system. The proposed solution offers many benefits including scalability, fast response to adversarial activities, ability to detect unknown attacks, high adaptability, and high ability in detecting and confining attacks.

We hope that these papers will inspire the researchers to invent new ideas in the field of Ambient Intelligence and Bio-inspired Systems and develop new practical and efficient computer applications on the basis of the concepts presented in the papers of this special issue.

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