Guest editorial

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Memetic automaton is a software agent/optimizer made in emulation of a human being, that autonomously acquires an increasing level of capability and intelligence through embedded memes learnt independently from the past experience, or via interactions with the others. In this place, the notion of meme is liberated from the narrow scope of a local search/individual learning operator, and embodies potentially diverse forms of problem-solving knowledge. For example, as the natural building blocks of meaningful information, the recurring real-world patterns or structures (i.e., trees, graphs, artificial neural networks) of a problem domain can be viewed as forms of meme representation that affect agents' perceptions, beliefs, minds, etc. Besides, unsupervised, supervised, reinforcement learning, etc., are potential tools that can facilitate learning pertaining to memes. Moreover, it is worth stressing that a major drawback of existing optimization approaches in the literature is the apparent lack of automated knowledge transfers and reuse across problems. Memes in memetic automaton are building blocks of meaningful information and supports reuse across problems. This capacity to draw on memes from past instances of problem-solving sessions thus allows the search to be more intelligent, leading to solutions that can be attained more efficiently on unseen problems of increasing complexity.

This thematic issue aims to explore the current and ongoing research of the advanced meme-centric computation in computational intelligence. Particular focus is placed on the new manifestation, pattern generalization, adaptation, reusability and transferability of the advanced memetic computing, as exhibited by various meme-based and agent-based evolutionary systems. After a rigorous peer review process,

six papers have been accepted to be included in the special issue.

The first paper titled “Experience Sharing Based Memetic Transfer Learning for Multiagent Reinforcement Learning” by Wang et al. proposes an experience sharing based memetic transfer learning algorithm for enhancing the learning efficiency of multi-agent reinforcement learning (MARL). By actively sharing implicit memetic knowledge (experience) among agents, the proposed methods bring highly scalable and effective acceleration of learning while reducing communication and computation costs successfully.

The second paper titled “Modelling Other Agents through Evolutionary Behaviours” by Zeng et al. resorts to evolutionary computation approaches to generate a new set of behaviours for other agents and to solve the complicated agents' behaviour search and evaluation issues. The evolutionary process is developed to expand other agents' behaviours by implementing a GA-based framework. The proposed method is examined in Triger and Unmanned Aerial Vehicle problem domains and obtained superior experimental results compared to baseline methods.

The third paper titled “Solving Vehicle Routing Problem by Memetic Search with Evolutionary Multitasking” by Shang et al. proposes memetic search with evolutionary multitasking for solving the vehicle routing problem (VRP) on multiple problem forms. Multiple simplified vehicle routing problems are constructed and act as the auxiliary tasks of original VRP. Comprehensive empirical experiments have been conducted on commonly used VRP benchmarks.

The fourth paper titled “System-in-Package Design using Multi-task Memetic Learning and Optimization” by Dai et al. proposes a multi-task memetic learning and optimization algorithm for designing System-in-Package modules. Knowledge transfer between different tasks is activated during both the surrogate modeling and model optimization procedures. Several variants of the proposed algorithm are tested, and their modeling accuracy and optimization efficiency were compared.

The fifth paper titled “The Design of Evolutionary Feature Selection Operator for the Micro-expression Recognition”

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by Zhan et al. proposes a novel feature selection operator for the Micro-Expression recognition task based on Genetic Programming, which can reduce the complexity caused by the high dimensional features. The proposed method is tested on three public data sets, and the experimental results show that it can effectively solve the class imbalance problem and lead to better performance compared with other state-of-the-art algorithms.

The last paper titled “A Particle Swarm Optimization based Multiobjective Memetic Algorithm for High-dimensional Feature Selection” by Luo et al. designs a particle swarm optimization based multiobjective memetic algorithm for high-dimensional feature selection to deal with the huge search space and highly discontinuous problem of Pareto front. The basic idea is to model feature selection as a multiobjective optimization problem by optimizing the number of features and the classification accuracy in supervised condition simultaneously, in which information entropy based initialization and adaptive local search are designed to improve the search efficiency.

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