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EDITORIAL

Guest Editorial on "Knowledge fusion intelligent optimization for complex systems"

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Due to various complexities in real-world industry and service systems, many optimization problems cannot be solved effectively by traditional methods. Intelligent optimization technique including evolutionary computation and swarm intelligence has been successfully applied to complex systems in a variety of engineering fields. To enhance the optimization capability in solving particular problems, it is very important to incorporate specific knowledge in intelligent algorithms. Knowledge fusion intelligent optimization is concerned with the use of the problem-specific properties and the prior information for the strategy design in the framework of intelligent optimization. The key issues of knowledge fusion optimization include knowledge representation, knowledge utilization, model management, strategy design, learning mechanism, and the related control scheme. During the past few years, increasing attention has been paid to the theoretical analysis, algorithm design, and performance improvement of knowledge fusion optimization as well as a wide range of applications in complex engineering systems.

This special issue intends to give the state-of-the-art of knowledge fusion intelligent optimization for complex systems. It aims to provide a platform for researchers to share innovative work in such an emerging area. Interdisciplinary methodologies may be given based on innovative intelligent optimization and knowledge engineering for complex systems. After a double-blinded peer-review process, nine papers have been accepted and included in this special issue, covering various innovative intelligent optimization techniques fusing with knowledge for solving different kinds of complex problems.

The first paper titled "An estimation of distribution algorithm with branch-and-bound based knowledge for robotic assembly line balancing" by Sun et al. proposes an estimation of distribution algorithm (EDA) fusing branch-and-bound (B&B) based knowledge to minimize the assembly line cycle time by determining the task and robot assignment in each workstation under precedence constraints. Performance comparisons show that the fuse of B&B-based knowledge is able to reduce the search space of EDA while focus the search on the promising area.

The second paper titled "Artificial bee colony algorithm based on knowledge fusion" by Wang et al. proposes an artificial bee colony (ABC) algorithm fusing with three kinds of knowledge. The proposed algorithm outperforms nine ABC algorithms and three differential evolution algorithms in solving 32 benchmarking function optimization instances.

The third paper titled "Multi-objective microservice deployment optimization via a knowledge-driven evolutionary algorithm" by Ma et al. presents a knowledge-driven evolutionary algorithm to solve the problem model and seek the optimal deployment and startup strategy of microservice instance in different resource centers. The proposed algorithm converges to the optimal solutions much quicker than NSGA-III.

The fourth paper titled "An improved simulated annealing algorithm based on the residual network for permutation flow shop scheduling" by Li et al. proposes a simulated annealing algorithm based on the residual network for solving the large-scale machine scheduling problem. The effect of network structure and parameter selection is investigated via numerical simulation in addition to the performance comparison with the existing algorithms.

The fifth paper titled "Genetic programming with separability detection for symbolic regression" by Zhong et al. proposes a separability detection method to detect additive separable characteristics of input features from observed

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data which is able to enhance the search efficacy of genetic programming for symbolic regression.

The sixth paper titled "FMCGP: frameshift mutation Cartesian genetic programming" by Fang et al. proposes an improved genetic programming inspired by DNA mutation mechanism in biology and the frameshift mutation caused by insertion or deletion of nodes. Numerical results show that the proposed algorithm can achieve better performance without exhibiting a bloat problem.

The seventh paper titled "Knowledge-guided multiobjective particle swarm optimization with fusion learning strategies" by Li et al. proposes a knowledge-guided multiobjective particle swarm optimization that presents a knowledge-based leadership selection strategy to select the appropriate global leader for improving the convergence ability of the algorithm. In addition, a diversity-enhanced learning strategy is suggested to maintain population diversity.

The eighth paper titled "Explainable recommendation based on knowledge graph and multi-objective optimization" by Xie et al. proposes an explainable recommendation framework based on the knowledge graph. The framework simultaneously optimizes the precision, diversity and explainability about recommendations. The explainable candidates are optimized by means of a multi-objective optimization algorithm to achieve the final recommendation list.

The last paper titled "Solving two-stage stochastic route-planning problem in milliseconds via end-to-end deep learning" by Zheng et al. addresses the complex stochastic online route planning problem and designs an end-to-end deep learning model composed of an encoder and a decoder to solve the problem in milliseconds. Numerical results based on real-world data sets show that the proposed model is more efficient than meta-heuristics and is able to yield higher quality solutions than heuristics.

We would like to thank Professor Yaochu Jin, the Editor-in-Chief, for providing us the opportunity to guest-edit this special issue. We are also grateful to all the authors for their strong contributions and to the reviewers for their constructive comments that have greatly helped improve the quality of the accepted papers. We hope that the papers included in this special issue would promote the research of knowledge fusion intelligent optimization for complex systems.

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