Editorial: Special Issue on Optimization Problems in Information Science and Technology

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The idea to organize this special issue came from a discussion in May, 2020, with Acad. Dan Dascălu, the Editor-in-Chief of the Romanian Journal of Information Science and Technology (ROMJIST), when he asked me to group the papers submitted in the last two years and not included in the editorial flow in a special issue or a thematic issue with great impact. I analyzed a set of papers, was in contact with Acad. Dan Dascălu, and we finally agreed and decided to organize the papers in the hot topic of optimization with applications to information science and technology, which is a general area of fields treated in ROMJIST. An initial set of 30 papers were selected as candidates for this special issue. After the review process, conducted by anonymous reviewers, the best seven papers were accepted as they meet the standards of ROMJIST.

The optimization problems are important in many areas, and two examples are given as follows in this regard. First, the optimization problems are the core of artificial intelligence, where optimization algorithms are expressed as learning or training algorithms. Second, the optimization problems are important in modern control systems, where, as pointed out in [1], in nowadays industrial systems, the need for computers, cognition, communication and control is essential, if performance specifications, unexpected upcoming system states, changing operating conditions, or environmental influences have to be integrated into the system design. The synergy of computers, cognition, communication and control supports the increasingly demanding performance specifications of various applications and optimization problems are useful in enabling to face special situations as unexpected condition adaptations, human interaction challenges, and goal conflicts. Representative technical and non-technical applications of systems and optimization problems are robotics [2]–[6], fuzzy systems [7]–[11], medical applications [12]–[15], analysis of historical texts [16], learning systems and control [17]–[19] and mechatronics systems [20]–[25].

This special issue contains optimization problems with representative information science and technology applications, which are solved in terms of classical and also modern optimization algorithms. Nature-inspired optimization algorithms are an important set of modern optimization algorithms, which are based on biological, physical, and chemical phenomena of nature. As shown in [1], these algorithms have the distinct ability of finding the global minimum (or maximum) of certain objective functions under specific conditions. In addition, the analytical expression of the objective functions depending on other design (or tuning) parameters may be difficult or even impossible to formulate. Other important algorithms, not treated in this special issue, include gravitational search algorithms [26], population extremal optimization [27]–[29], water cycle algorithms [30] bat algorithms [31], the introduction of information feedback models in metaheuristic algorithms [32]–[34], island-based cuckoo search [35] and accelerated cuckoo optimization algorithms [36].

The special issue treats theoretical and implementation issues in optimization problems in wide areas. A large geographic covering is ensured. The brief description of the seven papers is summarised and organized as follows.

The paper Vehicles Circuits Optimization by Combining GPS / GSM Information with Metaheuristic Algorithms, by B. Beldjilali, B. Benadda and Z. Sadouni, proposes the design of an intelligent decision
system based on embedded tracked technology. The system gives users the opportunity to solve the vehicle routing problem with time windows, which is formulated as an optimization problem. Authors’ solutions consists of two parts, the tracker installed on the vehicle to follow it, and an intelligence system installed in the server side based on metaheuristic algorithms including genetic algorithm, which is able to estimate the ideal road serve with the minimum cost.

Due to the fact that the problem of finding a maximum flow in dynamic networks is more complex than the same problem in static networks, the paper Maximum Flows in Planar Dynamic Networks. The Static Approach, by C. Schiopu and E. Ciurea, gives results on flows in planar static networks. Authors’ results are motivated by the fact that more efficient algorithms can be developed by exploiting the planar structure of the graph. They treat the maximum dynamic flow model, where the transit time to traverse an arc is taken into consideration.

The paper Modified Evolved Bat Algorithm of Fuzzy Optimal Control for Complex Nonlinear Systems, by T. Chen, A. Babanin, A. Muhammad, B. Chapron and C. Chen, applies an Evolved Bat Algorithm that solves an optimization problem specific to optimal fuzzy control systems. Stability analysis results in terms of linear matrix inequalities are included.

Since transportation takes one-third of logistics costs, and accordingly transportation systems largely influence the performance of the logistics systems, the paper An Innovative Concept for Setting Up and Adjustment the Parameters of Real-world Vehicle Routing Problems: Case Study in Logistics, by E. Zunic and D. Donko, is focused on a special optimization problem, namely the Vehicle Routing Problem (VRP). The paper suggests a data-driven prediction model for adjustment of the parameters based on historical data, especially for practical VRP problems with realistic constraints in the field of freight and logistics.

The paper System Identification Using Long Short Term Memory Recurrent Neural Networks for Real Time Conical Tank System, by F. Christudas and A. Vijula Dhanraj, applies optimization to neural network training in the framework of systems identification. A real-world system identification application is included.

The paper Kohonen Neural Network Training by Cellular Automaton, by V. Anikin, O. Anikina and O. Gushchina, also deals with optimization applied to neural network training. The authors discuss the effective integral dispersion quantile measure of the quality of data topology mapping by the Kohonen neural network.

The paper HARD: Bit-Split String Matching Using a Heuristic Algorithm to Reduce Memory Demand, by X. Li, L.-S. Chen and Y.-Z. Tang, proposes a rule classifying method referred for heterogeneous bit-split string matching architectures. Authors’ method, referred to as HARD, is important in the context of high-speed content inspection, which relies on a fast multi-pattern matching algorithm to detect predefined rules. When the number of target rules becomes large, the memory requirements of the matching engine become a critical issue. Appropriate optimization is carried out.

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References


