ROMANIAN JOURNAL OF INFORMATION SCIENCE AND TECHNOLOGY
Volume **23**, Number T, 2020, T1-T4

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

Radu-Emil PRECUP[1]
[1]Politehnica University of Timisoara, Department of Automation and Applied Informatics,
Bd. V. Parvan, 300223 Timisoara, Romania
E-mail: radu.precup@aut.upt.ro

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 re 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. Muḥammad, 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.

The guest editor would like to thank the Editor-in-Chief of ROMJIST, Acad. Dan Dascălu, for his cooperation, assistance and encouragement in preparing this special issue. The involvement of the authors is appreciatively acknowledged with particular focus to their patience in waiting for the publication of the special issue. Special thanks go to the reviewers, who did an excellent job by selecting the best manuscripts and giving useful advices on how to improve them, and the fact that, although they have been offered to have their names inserted in the webpage of ROMJIST, they refused and thus preferred to remain anonymous as far as this special issue is concerned. I duly acknowledge the excellent cooperation and logistic support of Ms. Adriana Apostol, a key person in ROMJIST staff. I do hope that the readers of this special issue will find it useful and inspiring.

References

[1] R.-E. PRECUP, P. ANGELOV, B. S. J. COSTA, M. SAYED-MOUCHAWEH, *An overview on fault diagnosis and nature-inspired optimal control of industrial process applications*, Computers in Industry, **74**, pp. 75–94, 2015.

[2] N. ANDO, P. KORONDI, H. HASHIMOTO, *Networked telemicromanipulation systems "Haptic Loupe"*, IEEE Transactions on Industrial Electronics, **51(6)**, pp. 1259–1271, 2004.

[3] J. VAŠČÁK, M. RUTRICH, *Path planning in dynamic environment using fuzzy cognitive maps*, Proceedings of 6th International Symposium on Applied Machine Intelligence and Informatics, Herľany, Slovakia, pp. 5–9, 2008.

[4] T. HAIDEGGER, L. KOVÁCS, R.-E. PRECUP, S. PREITL, B. BENYÓ, Z. BENYÓ, *Cascade control for telerobotic systems serving space medicine*, IFAC Proceedings Volumes, **44(1)**, 3759–3764, 2011.

[5] S. BLAŽIČ, *On periodic control laws for mobile robots*, IEEE Transactions on Industrial Electronics, **61(7)**, pp. 3660–3670, 2014.

[6] K. BOLLA, Z. C. JOHANYÁK, T. KOVÁCS, G. FAZEKAS, *Local center of gravity based gathering algorithm for fat robots*, in: L. T. Kóczy, C. R. Pozna, J. Kacprzyk (Eds.): *Issues and Challenges of Intelligent Systems and Computational Intelligence*, Studies in Computational Intelligence **530**, Springer, pp. 175–183, 2014.
[7] R.-E. PRECUP, S. PREITL, *Development of fuzzy controllers with non-homogeneous dynamics for integral-type plants*, Electrical Engineering, 85(3), 155–168, 2003.
[8] Y.-C. WANG, C.-J. CHIEN, R.-H. CHI, Z.-S. HOU, *A fuzzy-neural adaptive terminal iterative learning control for fed-batch fermentation processes*, International Journal of Fuzzy Systems, **17(3)**, pp. 423–433, 2015.
[9] I. DZITAC, F.-G. FILIP, M.-J. MANOLESCU, *Fuzzy logic is not fuzzy: World-renowned computer scientist Lotfi A. Zadeh*, International Journal of Computers Communications & Control, **12(6)**, pp. 748–789, 2017.
[10] L.-K. WANG, H.-K. LAM, New stability criterion for continuous-time Takagi-Sugeno fuzzy systems with time-varying delay, IEEE Transactions on Cybernetics, **49(4)**, pp. 1551–1556, 2019.
[11] D. H. VU, S. HUANG, T. D. TRAN, T. Y. VU, V. C. PHAM, *A robust adaptive control using fuzzy neural network for robot manipulators with dead-zone*, International Journal of Computers Communications & Control, **14(5)**, pp. 692–710, 2019.
[12] C. ROTARIU, A. PASARICA, G. ANDRUSEAC, H. COSTIN, NEMESCU, *Automatic analysis of the fetal heart rate variability and uterine contractions*, Proceedings of 8th International Conference and Exposition on Electrical and Power Engineering, Iasi, Romania, pp. 1–6, 2014
[13] Osman ULKIR, Gazi AKGUN, Erkan KAPLANOGLU, *Real-time implementation of data-driven predictive controller for an artificial muscle*, Studies in Informatics and Control, **28(2)**, pp. 189–200, 2019.
[14] A. TAGHIYEV, A. A. ALTUN, N. ALLAHVERDI, S. CAGLAR, *A machine learning framework to identify the causes of HbA1c in patients with type 2 diabetes mellitus*, Control Engineering and Applied Informatics, **21(2)**, pp. 34–42, 2019.
[15] R.-E. PRECUP, T.-A. TEBAN, A. ALBU, A.-B. BORLEA, I. A. ZAMFIRACHE, E. M. PETRIU, *Evolving fuzzy models for prosthetic hand myoelectric-based control*, IEEE Transactions on Instrumentation and Measurement, **69(7)**, pp. 4625–4636, 2020.
[16] H. N. L. TEODORESCU, S. C. BOLEA, *Stylometric and topic analysis of a historical text*, Romanian Journal of Information Science and Technology, **21(2)**, pp. 99–113, 2018.
[17] S. PREITL, R.-E. PRECUP, Z. PREITL, S. VAIVODA, S. KILYENI, J. K. TAR, *Iterative feedback and learning control. Servo systems applications*, IFAC Proceedings Volumes, **40(8)**, pp. 16–27, 2007.
[18] J.-Y. YU, W.-J. PAIK, *Efficiency and learnability comparison of the gesture-based and the mouse-based telerobotic systems*, Studies in Informatics and Control, **28(2)**, pp. 213–220, 2019.
[19] C.-M. DUMITRESCU, I. DUMITRACHE, *Combining deep learning technologies with multi-level gabor features for facial recognition in biometric automated systems*, Studies in Informatics and Control, **28(2)**, pp. 221–230, 2019.
[20] P. BARANYI, P. KORONDI, R. J. PATTON, H. HASHIMOTO, *Trade-off between approximation accuracy and complexity for TS fuzzy models*, Asian Journal of Control, **6(1)**, pp. 21–33, 2004.
[21] K. M. DELIPARASCHOS, G. C. DOYAMIS, S. G. TZAFESTAS, *A parameterised genetic algorithm IP - core: FPGA - design, implementation and performance evaluation*, International Journal of Electronics, **95(11)**, pp. 1149–1166, 2008.
[22] G. BERUVIDES, R. QUIZA, R. DEL TORO, R. E. HABER, *Sensoring systems and signal analysis to monitor tool wear in microdrilling operations on a sintered tungsten-copper composite material*, Sensors and Actuators, A: Physical, **199**, 165–175, 2013.
[23] R. ANDOGA, L. FOZO, *Near magnetic field of a small turbojet engine*, Acta Physica Polonica A, **131(4)**, pp. 1117–1119, 2017.
[24] A. LUCCHINI, S. FORMENTIN, M. CORNO, D. PIGA, S. M. SAVARESI, *Torque vectoring for high-performance electric vehicles: a data-driven MPC approach*, IEEE Control Systems Letters, **4(3)**, pp. 725–730, 2020.
[25] M. PARIGI POLVERINI, S. FORMENTIN, L. MERZAGORA, P. ROCCO, *Mixed data-driven and model-based robot implicit force control: a hierarchical approach*, IEEE Transactions on Control Systems Technology, **28(4)**, pp. 1258–1271, 2020.
[26] R.-E. PRECUP, R.-C. DAVID, E. M. PETRIU, A.-I. SZEDLAK-STINEAN, C.-A. BOJAN-DRAGOS, *Grey wolf optimizer-based approach to the tuning of PI-fuzzy controllers with a reduced process parametric sensitivity*, IFAC-PapersOnLine, **49(5)**, pp. 55–60, 2016.
[27] L.-M. LI, K.-D. LU, G.-Q. ZENG, L. WU, M.-R. CHEN, A novel real-coded population-based extremal optimization algorithm with polynomial mutation: A non-

parametric statistical study on continuous optimization problems, Neurocomputing, 174, 577–587, 2016.
[28] G.-Q. ZENG, X.-Q. XIE, M.-R. CHEN, J. WENG, *Adaptive population extremal optimization-based PID neural network for multivariable nonlinear control systems*, Swarm and Evolutionary Computation, **44**, pp. 320–334, 2019.
[29] M.-R. CHEN, G.-Q. ZENG, K.-D. LU, *A many-objective population extremal optimization algorithm with an adaptive hybrid mutation operation*, Information Sciences, **498**, pp. 62–90, 2019.
[30] E. OSABA, J. DEL SER, A. SADOLLAH, M. N. BILBAO, D. CAMACHO, *A discrete water cycle algorithm for solving the symmetric and asymmetric traveling salesman problem*, Applied Soft Computing, **71**, pp. 277–290, 2018.
[31] E. OSABA, X. S. YANG, I. FISTER JR, J. DEL SER, P. LOPEZ-GARCIA, A. J. VAZQUEZ-PARDAVILA, *A discrete and improved bat algorithm for solving a medical goods distribution problem with pharmacological waste collection*, Swarm and Evolutionary Computation, **44**, pp. 273–286, 2019.
[32] G.-G. WANG, Y. TAN, *Improving metaheuristic algorithms with information feedback models*, IEEE Transactions on Cybernetics, **49(2)**, pp. 542–555, 2019.
[33] Z.-M. GU, G.-G. WANG, *Improving NSGA-III algorithms with information feedback models for large-scale many-objective optimization*, Future Generation Computer Systems, **107**, pp. 49–69, 2020.
[34] Y. ZHANG, G.-G. WANG, K.-Q. LI, W.-C. YEH, M.-W. JIAN, J.-Y. DONG, *Enhancing MOEA/D with information feedback models for large-scale many-objective optimization*, Information Sciences, 522, 1–16, 2020.
[35] B. H. ABED-ALGUNI, *Island-based cuckoo search with highly disruptive polynomial mutation*, International Journal of Artificial Intelligence, **17(1)**, pp. 57–82, 2019.
[36] A. GOLI, A. AAZAMI, A. JABBARZADEH, *Accelerated cuckoo optimization algorithm for capacitated vehicle routing problem in competitive conditions*, International Journal of Artificial Intelligence, **16(1)**, pp. 88–112, 2018.

October 30, 2020
Radu-Emil Precup