Call for papers: IEEE TEVC Special Issue on Evolutionary Bilevel Optimization

I. Aims and scope

Bilevel optimization is a specialized class of problems that involves optimizing a nested set of tasks, referred to as upper and lower levels, or the leader and follower, respectively. The hierarchical structure of the problem requires that every feasible solution to the upper-level problem should satisfy the optimality conditions of the lower-level problem. Such a requirement makes bilevel optimization problems difficult to solve, and it has been shown that the problem is NP-hard even when both levels have linear functions. These problems are commonly found in many practical problem-solving tasks, which include optimal control, process optimization, game-playing strategy development, transportation problems, coordination of multi-divisional firms, machine learning, and others. Due to the computation expense, nature of response functions and other difficulties involved in handling such problems, they are often solved using approximate solution procedures, making evolutionary computation methods more suitable. There is an ongoing need for theoretical as well as methodological advancements to handle such problems efficiently. Some recent papers to introduce interested researchers to theory and applications of bilevel optimization include [1]–[3], along with additional resources at the website https://bi-level.org/. Special sessions and tutorials are also regularly organized by the IEEE CIS task force on evolutionary bilevel optimization (http://mdolab.net/Hemant/bilevelTF.html) on the topic at IEEE Congress on Evolutinary Computation (CEC).

This special issue aims to bring together contributions from researchers working on various aspects of bilevel optimization with relevance to evolutionary computation to be within the scope of TEVC.

II. Topics

The topics of interest include, but are not limited to:

- Population-based methods for single, multi, and many-objective bilevel optimization problems
- Approximate and hybrid approaches to handle bilevel optimization problems
- Theoretical developments on bilevel optimization problems
- Handling of aspects such as constraints, expensive evaluations, multiple followers, uncertainties, dynamics, (non-)co-operation between different levels
- Hierarchical decision-making suiting bilevel optimization
- Real-world applications of bilevel optimization
- Extended algorithms for more generalized multi-level optimization problems
- Machine learning methods for improving bilevel optimization (and vice-versa)

III. Submission

Manuscripts should be prepared according to the information given at the website https://cis.ieee.org/publications/t-evolutionary-computation. The submission must be authors' original work and not published previously or under review for possible publication elsewhere. Please follow the submission instructions, select the article type as "EBLO", and add "Special Issue on Evolutionary Bilevel Optimization" to the comments for the Editor-in-Chief. The manuscripts will be rigorously peer-reviewed in accordance with the IEEE TEVC norms.

IV. Timeline

The key dates relating to the SI are as follows:

- Submission opens: 01 February 20224
- Submission deadline: 01 August 2024
- Review timeframe: Each review cycle will take approx. 2-3 months
- (First) revised version due: Approx. 01 December 2024
- Tentative publication: Late 2025/Early 2026

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References

[1] J.-A. Mejía-De-Dios, A. Rodríguez-Molina, and E. Mezura-Montes, "Multiobjective bilevel optimization: A survey of the state-of-the-art," *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, vol. 53, no. 9, pp. 5478–5490, 2023.

[2] A. Sinha, P. Malo, and K. Deb, "A review on bilevel optimization: from classical to evolutionary approaches and applications," *IEEE Transactions on Evolutionary Computation*, vol. 22, no. 2, pp. 276–295, 2018.

[3] M. M. Islam, H. K. Singh, and T. Ray, "A surrogate assisted approach for single-objective bilevel optimization," *IEEE Transactions on Evolutionary Computation*, vol. 21, no. 5, pp. 681–696, 2017.