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ACM Transactions on Evolutionary Learning and Optimization (TELO)

Special Issue on Large Scale Optimization and Learning

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Many real-world optimization problems involve a large number of decision variables. The trend in engineering optimization shows that the number of decision variables involved in a typical optimization problem has grown exponentially over the last 50 years, and this trend continues to accelerate. Moreover, the proliferation of big-data analytic applications has led to the emergence of large-scale optimization problems (LSOP) at the heart of many machine learning problems. Recent advances in the field of deep learning have also led to the emergence of very large-scale optimization problems encountered in training deep neural network architectures where the number of decision variables can surpass one billion.

The curse of dimensionality has made large-scale optimization an exceedingly difficult task, and current optimization methods are often ill-equipped to deal with such problems. To over- come this scalability issue, a wide range of mathematical, metaheuristics, and learning-based optimization algorithms have been developed. For example, decomposition methods based on variable interaction analysis have been developed for black-box LSOPs that learn and exploit problem structures. Similarly, there is an emerging set of techniques that leverage machine learning and data mining to significantly reduce the problem size for large-scale combinatorial optimization problems. This sort of ML-based methods can be incorporated into EAs to boost their performance for solving large-scale combinatorial optimization problems.

In recent years, there has been a growing recognition of the synergy between optimization and learning. Machine learning techniques can be used effectively to solve large-scale continuous and combinatorial problems by learning and exploiting problem structures, predicting optimal solutions using data extracted from solved problem instances, reducing problem size, and boosting the performance of existing optimization algorithms. In turn, large-scale optimization can help machine learning by providing the backbone for many learning algorithms and applications. For example, large-scale optimization is essential for training deep neural networks, where optimization problems with billions of decision variables need to be solved. Therefore, the integration of optimization and learning will play a critical role in addressing the scalability issues that arise in many real-world applications, and there is a need for research that explores the intersection between these two fields.

Topics

We invite interested researchers to submit original and unpublished work that advances our understanding of the interplay between optimization and learning and their effective couplings to address large-scale problems in various domains. Topics of interest include but are not limited to:

- Theoretical and experimental studies concerning tackling scalability issue using machine learning.
- ML-based adaptive and automatic decomposition methods for high dimensional continuous and combinatorial problems.
- ML-based automatic and generic problem size reduction methods for large-scale optimization.

- Hybridization of mathematical programming, meta-heuristics, and machine learning for better handling of large-scale problems.
- Novel optimization algorithms for large-scale continuous and combinatorial optimization.
- Learning and exploiting problem structures in large-scale optimization problems.
- Handling uncertainty and stochasticity in large-scale optimization and learning.
- Novel multi-objective optimization algorithms for handling decision- and objective-space scalability.
- Enhancing multi-objective optimization algorithms with machine learning.
- Large-scale dynamic optimization.
- Scalable Bayesian optimization algorithms.
- Studies on new test suites and datasets for benchmarking and comparisons of new machine learning based methods for solving large-scale problems.
- Solving challenging real-world LSOPs, especially those employing machine learning and deep learning techniques.

Important Dates

- Submission deadline: October 1, 2023
- First-round review decisions: January 1, 2024
- Deadline for revision submissions: April 1, 2024
- Notification of final decisions: June 1, 2024
- Tentative publication: September 2024

Submission Information

You are invited to submit your articles no later than the given deadline. All papers will be subject to a rigorous peer review. Manuscripts should be prepared according to the "Guidelines for Authors" section at https://dl.acm.org/journal/telo/author-guidelines and submissions should be made through the journal submission website at https://mc.manuscriptcentral.com/telo by selecting the Manuscript Type "Special Issue on Large-Scale Optimization and Learning".

For question and further information, please contact one of the guest editors.