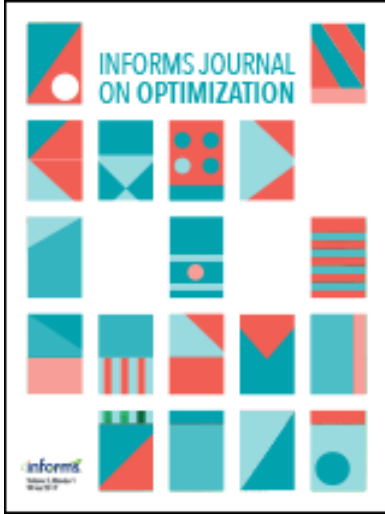




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Machine Learning and Optimization: Introduction to the Special Issue

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Machine Learning and Optimization: Introduction to the Special Issue

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Machine learning has been in recent years in the forefront of significant research activity. A key component of these research developments is the interplay with optimization. This special issue, which will span this issue and the next journal issue of the *INFORMS Journal on Optimization*, aims to present research developments on the interplay between optimization and machine learning. The papers below constitute the first installment of this two-part series of articles.

1. Convergence Rate Analysis of a Stochastic Trust Region Method via Supermartingales

Katya Scheinberg, Jose Blanchet, Coralie Cartis, Matthew Menickelly

The paper is part of general research efforts to develop a general theoretical framework based on stochastic process properties to analyze stochastic optimization methods using the analysis of deterministic methods in a novel way. It aims to provide theoretical foundation for trust region methods for stochastic optimization problem, where the objective values, its gradients, and its Hessian can be approximated by sampling. Related methods have been proposed in the machine learning community but without similar convergence results.

2. A Deterministic Nonsmooth Frank Wolfe Algorithm with Coreset Guarantees

Sathya Narayanan Ravi, Maxwell Collins, Vikas Singh

The paper is part of the authors' broader investigation to investigate computationally inexpensive methods for problems in machine learning and computer vision that encompass many application domains. Non-smoothness has been a difficult property to analyze in many contexts. A key aspiration of the paper is to shed light on many more applications such as deep learning from a deterministic perspective. Both Sathya and Maxwell were students of Vikas's.

3. REPR: Rule-Enhanced Penalized Regression

Jonathan Eckstein, Ai Kagawa, Noam Goldberg

The paper is part of a broader investigation on the applications of classical optimization techniques in machine learning. The paper revisits certain kinds of "free form" regression from an optimization perspective. Ali and Noam were doctoral students of Jonathan's.

4. Optimal Prescriptive Trees

Dimitris Bertsimas, Jack Dunn, Nishanth Mundru

The paper is part of a broader investigation on the applications of classical optimization techniques in machine learning. It extends the work of the first two authors on Optimal Predictive Trees that appeared in *Machine Learning*, 2017, in the direction of prescriptive analytics. The proposed Optimal Prescriptive Trees (OPTs) are interpretable, highly scalable, accommodate multiple treatments, and provide high-quality prescriptions. OPTs are an attractive alternative for personalized decision making in a variety of areas such as online advertising and personalized medicine. Jack and Nishanth were doctoral students of Dimitris's.

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