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Using Operational Data Analytics for Planning Decisions Under Uncertainty

We consider a stochastic decision-making system with unknown parameters that need to be estimated to make appropriate decisions. We take the standard approach of exploring first and then exploiting. We start with a stylized model but present numerous applications in restaurant bookings, bike-share replenishments, customized order-fulfilment, air traffic control, virtual queueing systems, and inventory orders. In all these problems the underlying parameters of the stochastic process need to be learnt to make a decision. The approach of first estimating the parameters and then solving an optimization problem assuming those parameters are accurate does not work well. Even methods that use Bayesian analysis and bootstrapped simulations are not as effective. We discuss a promising approach called operational data analytics (ODA) where we optimally scale the estimated metrics and show that it results in much more accurate decisions. We present both simulated results where an oracle knows the underlying parameters as well as real data from bike-sharing to illustrate the effectiveness of the ODA approach.

Special/ Invited session

Editor's Corner: INFORMS Journal on Data Science

Classification

Mainly methodology

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operational data analytics; data-driven decision making under uncertainty; exploration and exploitation

Primary author: GAUTAM, Natarajan (Syracuse University)

Presenter: GAUTAM, Natarajan (Syracuse University)

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