Biostats Workshop:

Reducing Exploration in Personalized Decision-Making

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Thursday, February 14th, 1:30-2:50pm in MSOB x303

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Click here for the full Biostats Workshop calendar.

Abstract:

Recently, there has been a surge in applying statistical learning methods in healthcare, to build models for predicting adverse outcomes from patient covariates. These predictions are then used to optimize allocation of scarce resources or treatment decisions. However, when the treatments are new, decision-making should optimize a trade-off between two objectives: (1) learning decision outcomes as functions of individual-specific covariates (exploration) and (2) maximizing benefit of the decisions. Current literature on this problem, theory of contextual multi-armed bandits, focuses on algorithms that rely on forced-exploration to address this trade-off. However, forced-exploration can be considered costly or unethical in certain decision-making tasks (e.g., hospital quality improvement initiatives). In this talk, we first introduce an algorithm that leverages free-exploration from patient covariates and achieves rate optimal objective. We also show, empirically, that the algorithm significantly reduces exploration, compared to the existing benchmarks. Next, we focus on settings when past data on decision outcomes is available. Motivated by recent literature on low-rank matrix estimation, we design algorithms that
avoid unnecessary exploration by targeting the learning towards shared similarities among decisions or patients. We then demonstrate performance of the proposed methods to estimate the personalized effect of a glucose inhibitor drug (Metformin) for pre-diabetic treatment.

**Suggested Readings:**


_Katie M. Kanagawa, Ph.D._

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