THE UNIVERSITY OF CHICAGO | THE COMMITTEE ON COMPUTATIONAL AND APPLIED MATHEMATICS

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Near-Optimal Bayesian Active Learning and Adaptive Information Acquisition: Submodular Surrogates and Beyond

THURSDAY, February 17, 2022 at 4:00pm
Jones 303, 5747 S. Ellis Ave. Chicago, IL 60637
OR
via Zoom

How can we collect the most useful information for decision making, when facing a large volume of data? In this talk, I will introduce the decision-theoretic value of information problem, and in particular focus on Bayesian active learning and optimal experimental design, where the goal is to learn the value of some unknown target variable (e.g., a classifier) through a sequence of informative, noisy tests. We show that for structured problems where the test outcomes are correlated given the target variable, common greedy heuristics, such as uncertainty sampling or myopic value of information, often perform poorly. We then devise efficient surrogate objectives that are amenable to greedy optimization, while still achieving strong approximation guarantees. A key property we seek in the design of the greedy heuristics is submodularity, a natural diminishing returns condition common to a broad class of decision-making problems. When it is challenging to construct such surrogate functions, we further introduce a data-driven optimization framework based on a novel loss function---namely the "submodular-norm" loss---which encourages the resulting objective to exhibit diminishing returns. We demonstrate our algorithms on a variety of batched and sequential optimization tasks, including active learning, adaptive robotic manipulation, and sequential experimental design for protein engineering.

Organizer:

Yuehaw Khoo, Department of Statistics (CAMI), ykhoo@uchicago.edu
CAM Colloquium URL: https://cam.uchicago.edu/events/cam-colloquium/

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