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Department of Statistics

Aaditya Ramdas
Department of Statistics
Carnegie Mellon University

Estimating means of bounded random variables by betting

Wednesday, September 28, 2022
12:00 PM

110 Frelinghuysen Road, Hill Center, Room 552

Zoom Meeting: Meeting ID: 99075124232
Password: 952486

https://rutgers.zoom.us/j/99075124232?pwd=UDdPVjRncXZFcXpvbFE0OWJyMVdSUT09

Light refreshments will be served

Abstract: This paper derives confidence intervals (CI) and time-uniform confidence sequences (CS) for the classical problem of estimating an unknown mean from bounded observations. We present a general approach for deriving concentration bounds that can be seen as a generalization and improvement of the celebrated Chernoff method. At its heart, it is based on a class of composite nonnegative martingales, with strong connections to testing by betting and the method of mixtures. We show how to extend these ideas to sampling without replacement, another heavily studied problem. In all cases, our bounds are adaptive to the unknown variance, and empirically vastly outperform existing approaches based on Hoeffding or empirical Bernstein inequalities and their recent supermartingale generalizations. In short, we establish a new state-of-the-art for four fundamental problems: CSs and CIs for bounded means, when sampling with and without replacement.
This is joint work with my student Ian Waudby-Smith, and has been accepted as a JRSSB discussion paper in 2023 (https://arxiv.org/abs/2010.09686).

Bio: Aaditya Ramdas (PhD, 2015) is an assistant professor at Carnegie Mellon University, in the Departments of Statistics (75%) and Machine Learning (25%), and an Amazon Visiting Academic (20%). He was a postdoc at UC Berkeley (2015–2018) and obtained his PhD at CMU (2010–2015), receiving the Umesh K. Gavaskar Memorial Thesis Award. His undergraduate degree was in Computer Science from IIT Bombay (2005-09), and he did high-frequency algorithmic trading at a hedge fund (Tower Research) from 2009-10. Aaditya was an inaugural inductee of the COPSS Leadership Academy, and a recipient of the 2021 Bernoulli New Researcher Award. His work is supported by an NSF CAREER Award, an Adobe Faculty Research Award (2019), a Google Research Scholar award (2022) for structured uncertainty quantification, amongst others. Aaditya's main theoretical and methodological research interests include selective and simultaneous inference (interactive, structured, online, post-hoc control of false decision rates, etc), game-theoretic statistics and safe anytime-valid inference (confidence sequences, e-values/e-processes, test martingales, etc), and distribution-free black-box predictive inference (conformal prediction, calibration, etc). His areas of applied interest include privacy, neuroscience, genetics and auditing (elections, real-estate, financial), and his group's work has received multiple best paper awards.