

**Title:** An Online Learning Approach to Network Application Optimization with Guarantee

**Abstract:**

Network application optimization is essential for improving the performance of the application as well as its user experience. The network application parameters are crucial in making proper decisions for network application optimizations. However, many existing works are impractical by assuming a priori knowledge of the parameters which are usually unknown and need to be estimated. There have been studies that consider optimizing network application in an online learning context using multi-armed bandit models. However, existing frameworks are problematic as they only consider to find the optimal decisions to minimize the regret, but neglect the constraints (or guarantee) requirements which may be excessively violated. In this work, we first propose a novel online learning framework for network application optimizations with guarantee. To the best of our knowledge, we are the first to formulate the stochastic constrained multi-armed bandit model with time-varying “multi-level rewards” by taking both “regret” and “violation” into consideration. We are also the first to design a constrained bandit policy, Learning with Minimum Guarantee (LMG), with provable sub-linear regret and violation bounds. We illustrate how our framework can be applied to several emerging network application optimizations, namely, (1) opportunistic multichannel selection, (2) data-guaranteed crowdsensing, and (3) stability-guaranteed crowdsourced transcoding. To show the effectiveness of LMG in optimizing these applications with different minimum requirements, we also conduct extensive simulations by comparing LMG with existing state-of-the-art policies.

**Biography:**

John C.S. Lui is currently the Choh-Ming Li Chair Professor in the CSE Department at The Chinese University of Hong Kong (CUHK). He received his Ph.D. in Computer Science from UCLA. His current research interests are in network sciences with large data implications, machine learning on large data analytics, network/system/mobile security, network economics, large scale distributed systems and performance evaluation theory. Currently, John is the senior editor in the IEEE/ACM Transactions on Networking, and has been serving in the editorial board of IEEE Transactions on Mobile Computing, ACM Transactions on Modeling and Performance Evaluation of Computing Systems, IEEE Transactions on Computers, IEEE Transactions on Parallel and Distributed Systems, Journal of Performance Evaluation, Journal of Network Science and International Journal of Network Security. He is a member of the review panel in the IEEE Koji Kobayashi Computers and Communications Award committee, and has served at the IEEE Fellow Review Committee. He received various departmental teaching awards and the CUHK Vice-Chancellor's Exemplary Teaching Award, as well as the CUHK Faculty of Engineering Research Excellence Award. He is an elected member of the IFIP WG 7.3, Fellow of ACM, Fellow of IEEE, Senior Research Fellow of the Croucher Foundation and was the past chair of the ACM SIGMETRICS (2011-2015). His personal interests include films and general reading.