Dhruva Kartik Mokhasunavisu

Contact Information

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Research Interests

Autonomous Systems	Information theory
Artificial intelligence	Statistics
Reinforcement learning	Game theory
Decentralized decision-making	Decision theory

Education

University of Southern California, Los Angeles, California USA (2015-present)
Ph.D. Student, *Ming Hsieh Department of Electrical Engineering*
Advisors: Dr. Urbashi Mitra and Dr. Ashutosh Nayyar
Major: Electrical Engineering
Minor: Computer Science and Mathematics

Indian Institute of Technology Guwahati, Guwahati, Assam India (2011-2015)
Department of Electronics and Electrical Engineering
B. Tech., Electronics and Communication Engineering

Honors and Awards

USC Annenberg Graduate Fellowship, 2015-2019

Viterbi-India Scholarship for research internship at USC, 2014

Research Experience

Analysis of active hypothesis testing November, 2018 - present
Advisor: Dr. Urbashi Mitra and Dr. Ashutosh Nayyar
We consider an hypothesis testing problem in which the agent actively gathers data and based on this data, it can decide on a hypothesis or declare inconclusive. The objective is to minimize misclassification probability while ensuring that the true hypothesis is declared conclusively with high probability. For this problem, we characterize lower and upper bounds on optimal misclassifcation probability which are asymptotically tight. In the analysis, we formulate a sub-problem, which can be seen as a generalization of the classical Chernoff-Stein lemma. We obtain tight upper and lower bounds for this sub-problem. We also design deterministic and adaptive strategies that are asymptotically optimal. They achieve better non-asymptotic performance. For some special kinds of hypothesis testing problems, we can show that these deterministic strategies are second-order optimal.

Dynamic zero-sum games with asymmetric information structure September, 2017 - present
Advisor: Dr. Ashutosh Nayyar
We consider a general model for sequential zero-sum games with asymmetric information structure. We design a dynamic programming approach to find the value of such zero-sum games. When one player has complete information, we show that a Nash equilibrium *exists* and we can use the dynamic program to find the value and the more-informed player's Nash equilibrium strategy. We discuss applications of this approach to some network interdiction problems. We also provide a framework for computing the value and the more-informed player's strategy.

Active hypothesis testing: a computational framework January, 2018 - November, 2018
Advisor: Dr. Urbashi Mitra and Dr. Ashutosh Nayyar
We model the problem of active hypothesis testing as an infinite-horizon POMDP using a confidence measure. We define notions of *exploration* and *verification* and characterize optimal solutions for

the verification problem using dynamic programming. Two new asymptotic optimality criteria arise from our solution: the critical experiment and the stability criterion. The stability criterion provides insights into the non-asymptotic performance of an experiment selection strategy. We provide two new heuristics: one based on a Kullback-Leibler divergence zero-sum game and the other based on deep reinforcement learning. We demonstrate numerically that these heuristics outperform existing strategies in some scenarios.

Active sensing for peak localization January, 2016 - October, 2017
Advisor: Dr. Urbashi Mitra
We address the problem of localizing the peak of a unimodal signal from noisy measurements. The aim is to minimize the number of measurements without compromising accuracy. Exploiting unimodality and the concentration properties of noise, we demonstrate the robustness and sample efficiency of our greedy algorithm.

Real-time coordination over communication channels September, 2015 - March, 2016
Advisor: Dr. Ashutosh Nayyar
We formulated a two-agent real-time coordination problem where both agents must take identical actions. Only one agent can observe the system state and can communicate with the other. We derive structural properties of optimal communication and decision policies for various channels.

Publications

Kartik, D., Nayyar, A. and Mitra, U. Non-asymptotic Analysis of Anomaly Verification. 2020 IEEE International Symposium on Information Theory (ISIT). (Submitted)

Kartik D. and Nayyar A. Zero-sum stochastic games with asymmetric information. Dynamic Games and Applications. (Submitted)

Kartik, D., Nayyar, A. and Mitra, U. Fixed-horizon Active Hypothesis Testing. IEEE Transactions on Automatic Control. (Submitted)

Kartik D. and Nayyar A. Zero-sum stochastic games with asymmetric information. IEEE Control and Decision Conference (CDC) 2019.

Kartik, D., Nayyar, A. and Mitra, U. Active Hypothesis Testing: Beyond Chernoff-Stein. 2019 IEEE International Symposium on Information Theory (ISIT).

Kartik, D., Nayyar, A. and Mitra, U., 2018, October. Sequential Experiment Design for Hypothesis Verification. In 52nd Asilomar Conference on Signals, Systems and Computers, 2018.

Kartik, D., Sabir, E., Mitra, U. and Natarajan, P., 2018, October. Policy Design for Active Sequential Hypothesis Testing using Deep Learning. In 2018 56th Annual Allerton Conference on Communication, Control, and Computing (Allerton).

Mokhasunavisu, D. and Mitra, U., 2017, October. Non-parametric active target localization: Exploiting unimodality and separability. In Communication, Control, and Computing (Allerton), 2017 55th Annual Allerton Conference on (pp. 346-353). IEEE.

Kartik D. and Nayyar A., 2016, Equivalent static and dynamic games. In Signals, Systems and Computers, 2016 Asilomar Conference on. IEEE.

Choudhary, S., Kartik, D., Kumar, N., Narayanan, S. and Mitra, U., 2014, September. Active target detection with navigation costs: A randomized benchmark. In Communication, Control, and Computing (Allerton), 2014 52nd Annual Allerton Conference on (pp. 109-115). IEEE.

Kartik, M.D., Kakileti, S.T., Bose, S.K. and Shen, G., 2015, December. Link-state routing protocol

for flow optimization in delay-constrained queueing networks. In Information, Communications and Signal Processing (ICICS), 2015 10th International Conference on (pp. 1-5). IEEE.

Papers in preparation

Kartik D. and Mitra U. Greedy sampling for robust peak localization.

Kartik D. and Nayyar A. Real-time coordination over communication channels.

Relevant Courses

Stochastic systems	Analysis of algorithms
Probability	Real analysis
Random processes	Information theory
Convex optimization	Statistical learning theory

Computer Skills

- Languages: C/C++, Python, MATLAB
- Operating Systems: Unix/Linux, Windows
- APIs: Keras, Tensorflow, PyTorch.

References

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