Shamak Dutta

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https://shamak.github.io

Work Experience

2024 – now **Postdoctoral Scholar**, *University of Waterloo*, Canada.
Advisors: Yash Pant & Stephen L. Smith

- Building algorithms for large scale flight planning, GPU-accelerated heuristics for integer programming, and active machine learning in robotics.
- Collaborating with engineers and product managers at `Airbus` as part of a two year research project on flight planning and control.
- Mentoring graduate students on multiple research projects by providing technical guidance, sharing knowledge, and reviewing code.
- Keywords: `PyTorch`, `Gurobi`, Active machine learning, Linear programming, Integer programming.

Education

2024 **PhD in Electrical and Computer Engineering**, *University of Waterloo*, Canada.
Research: Robotics, Control, Machine Learning, Optimization
Advisor: Stephen L. Smith

Faculty of Engineering Award, Electrical and Computer Engineering ($1.5k) (2023)
Graduate Research Dissemination Award, Faculty of Engineering (2023)
University of Waterloo Graduate Scholarship ($1.2k) (2022)
Teaching Assistant Award, Faculty of Engineering (2021)
GPA: 3.9/4.0
Thesis: Resource Constrained Linear Estimation in Sensor Scheduling & Informative Path Planning

2019 **Masters in Systems Design Engineering**, *University of Waterloo*, Canada.
Research: Machine Learning, Computational Neuroscience
Advisors: Bryan Tripp & Graham Taylor

Vector Institute Research Award ($4k) (2018, 2019)
University of Waterloo Graduate Scholarship ($1k) (2019)
International Master's Student Award ($6.5k) (2018, 2019)
GPA: 3.9/4.0
Thesis: Correlated Noise in Deep Convolutional Neural Networks

2017 **Bachelors in Computer Engineering**, *University of Waterloo*, Canada.

Engineering International Student Scholarship ($20k) (2013)
President's Scholarship of Distinction ($2k) (2013)
President's Research Award ($1.5k) (2015)
GPA: 3.7/4.0 (Distinction)

Selected Publications

My research focuses on data-efficient learning subject to constraints on time, energy, and network communication. I develop optimal, approximation, and heuristic algorithms for problems in robot information acquisition.

2025 **Informative Path Planning for Active Regression with Gaussian Processes via Sparse Optimization**.
S. Dutta, N. Wilde, S. L. Smith
IEEE Transactions on Robotics (T-RO), 2025.

- Provides the first algorithm to compute optimal solutions for active learning and planning in GPs with sampling and routing constraints.
- Keywords: Active learning, Integer programming, Gaussian Processes, `Gurobi`.

2023 **A Unified Approach to Optimally Solving Sensor Scheduling and Selection Problems in Kalman Filtering**.
S. Dutta, N. Wilde, S. L. Smith
IEEE Conference on Decision and Control (CDC), 2023.

- Developed an algorithm that computes optimal solutions for active learning in the estimation of linear dynamical systems.
- Keywords: Kalman filtering, Integer programming, `Gurobi`.

2023 **Approximation Algorithms for Robot Tours in Random Fields with Guaranteed Estimation Accuracy**.
S. Dutta, N. Wilde, P. Tokekar, S. L. Smith
IEEE International Conference on Robotics and Automation (ICRA), 2023

- Developed an algorithm achieving $6\times$ data efficiency and $2\times$ shorter tours compared to existing approaches for active learning in GPs.
- Keywords: Set covering and packing, Traveling salesman problems, Approximation algorithms, Gaussian Processes.

2022 **An Improved Greedy Algorithm for Subset Selection in Linear Estimation**.
S. Dutta, N. Wilde, S. L. Smith
IEEE European Control Conference (ECC), 2022.

- Designed an algorithm achieving $2\times$ improvement in runtime and solution quality for finding the best k-measurement subset to learn a spatial field.
- Keywords: Clique covering, Greedy, Gaussian Processes.

Selected Internships

2018 **Research Intern**, *Preferred Networks*, Tokyo, Japan.
Advisors: Shunta Saito & Masaki Saito

2017 **Research Intern**, *Latent Logic (now Waymo)*, Oxford, United Kingdom.
Advisors: Joao Messias & Shimon Whiteson

2016 **Research Intern**, *Amazon Search*, Palo Alto, USA.
Advisors: Bing Yin & Erick Cantu-Paz