KARAN SINGH

PERSONAL INFORMATION

Princeton University
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RESEARCH INTERESTS

Provable algorithms for Statistical Estimation and Machine Learning, with a focus on **Interactive Learning** and **Dynamical Systems**. Online Learning, Learning with Partial Feedback, Optimization.

EDUCATION

2015-Present **Princeton University** Advisor: Prof. Elad Hazan

Interactive Learning, Dynamical Systems

GPA: 4.0 · *PhD Candidate* · Computer Science

My research is focused on algorithms for machine learning with *provable guarantees* on computational and statistical efficiency, with an attentive emphasis on feedback-driven **interactive learning algorithms**. My prior research efforts have yielded provable methods for learning **Linear Dynamical Systems** (**Spotlight** at NeurIPS 2017, **Oral** at NeurIPS 2018) and designing controls for the same, despite the non-convex nature of the maximum likelihood problem. My recent works seek to address issues concerning task-agnostic **exploration** and those that arise when dealing with **continuous state** and action spaces.

Awarded the **SEAS Award for Excellence** in 2018, the **Spotlight Prize** at the New York Academy of Sciences' 12^{th} Annual Machine Learning Symposium, and the **ICML 2017 Travel Award**.

2011-2015 **Indian Institute of Technology, Kanpur**

*Academically **Ranked 1st** (among 820 students)*

GPA: 10.0 · *Bachelor of Technology* · Computer Science

My coursework included 12 graduate-level courses on theoretical computer science, machine learning, and mathematics. My senior thesis details sketch-based algorithms for machine learning, and lower bounds in the streaming model.

Awarded the **President's Gold Medal** for the best academic performance in the graduating class among all disciplines, **Academic Excellence Award** for 3 years, and the grade for **exceptional performance** in 14 courses.

WORK EXPERIENCE

Summer 2018 Intern, **Google AI, Princeton** Host: Prof. Yoram Singer

Google AI, Princeton

Efficient optimizers for deep learning leveraging full-matrix adaptive regularization, achieving state-of-the-art performance on language-based tasks. Released open-source code.

Summer 2014 Intern, **Microsoft Research, Redmond** Host: Dr. Sumit Gulwani

Microsoft Research

Translating natural language prompts into domain-specific programs using Program Synsthesis.

PUBLICATIONS

ICML 2019 Naman Agarwal, Brian Bullins, Elad Hazan, Sham Kakade, **Karan Singh**. Online Control with Adversarial Disturbances. In the *Proceedings of the 36th International Conference on Machine Learning (ICML), 2019*.

ICML 2019 Elad Hazan, Sham Kakade, **Karan Singh**, Abby Van Soest. Provably Efficient Maximum Entropy Exploration. In the *Proceedings of the 36th International Conference on Machine Learning (ICML), 2019*.

ICML 2019 Naman Agarwal, Brian Bullins, Xinyi Chen, Elad Hazan, **Karan Singh**, Cyril Zhang and Yi Zhang. Efficient Full-Matrix Adaptive Regularization. In the *Proceedings of the 36th International Conference on Machine Learning (ICML), 2019*.

NeurIPS 2018 ***Oral Present.*** Elad Hazan, Holden Lee, **Karan Singh**, Cyril Zhang and Yi Zhang. Spectral Filtering for General Linear Dynamical Systems. In the *Advances in Neural Information Processing Systems 31 (NIPS), 2018*.

ICLR 2018 Workshop Sanjeev Arora, Elad Hazan, Holden Lee, **Karan Singh**, Cyril Zhang and Yi Zhang. Towards Provable Control for Unknown Linear Dynamical Systems. *International Conference on Learning Representations, Workshop Track, 2018*.

NeurIPS 2017 ***Spotlight*** Elad Hazan, **Karan Singh** and Cyril Zhang. Learning Linear Dynamical Systems via Spectral Filtering. In the *Advances in Neural Information Processing Systems 30 (NIPS), 2017*.

ICML 2017 Naman Agarwal and **Karan Singh**. The Price of Differential Privacy for Online Learning. In the *Proceedings of the 34th International Conference on Machine Learning (ICML), 2017*.

ICML 2017 Elad Hazan, **Karan Singh** and Cyril Zhang. Efficient Regret Minimization in Non-Convex Games. In the *Proceedings of the 34th International Conference on Machine Learning (ICML), 2017*.

TEACHING & EDITORIAL EXPERIENCE

Princeton University

- Reviewer for NeurIPS 2018/19, ICML 2018/19, COLT 2017/18/19, ALT 2019.
- Teaching Assistant for Introduction to Machine Learning (COS 324), Machine Learning (COS 402), and Economics and Computation (COS 445).

IIT Kanpur

- Teaching Assistant for the Data Structures and Algorithms course as one of the selected undergraduates.