

KARAN SINGH

PERSONAL INFORMATION

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RESEARCH INTERESTS

Theoretical and applied Machine Learning, with a focus on **Reinforcement Learning** and **Control** of Dynamical Systems. Online Learning, Learning with Partial Feedback, Optimization, Private Learning.

EDUCATION

2015-Present **PRINCETON UNIVERSITY**

Advisor: Prof. Elad HAZAN

Reinforcement
Learning,
Control Theory

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 research efforts have yielded provable methods for learning **Linear Dynamical Systems** (**Spotlight** at NeurIPS 2017, **Oral** at NeurIPS 2018) and designing **data-driven robust controls** (**Oral** at NeurIPS 2019, ICML 2019, ICLR 2018) for the same, despite the non-convex nature of the problem. Some of my work also offers principled solutions to task-agnostic **exploration** in Reinforcement Learning (ICML 2019) via algorithmic reductions.

Awarded the **Jacobus Fellowship** by the Princeton University in 2019 for the highest scholarly excellence, the **SEAS Award for Excellence** in 2018, the **Spotlight Prize** at the New York Academy of Sciences' 12th Annual ML Symposium, and the **ICML 2017 Travel Award**; and titled as a **top reviewer** for NeurIPS 2019. **Twice** selected for an **Oral Presentation** at NeurIPS – top 0.5% of the submissions.

2011-2015 **INDIAN INSTITUTE OF TECHNOLOGY, KANPUR**

Academically
Ranked 1st
(among 820
students)

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

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 Synthesis.

PUBLICATIONS

NeurIPS 2019
Oral Present.

Naman Agarwal, Elad Hazan, **Karan Singh**. Logarithmic Regret for Online Control. In the *Advances in Neural Information Processing Systems 31 (NeurIPS)*, 2019.

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 (NeurIPS)*, 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), Artificial Intelligence and 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.