KARAN SINGH

PERSONAL INFORMATION

Princeton University
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RESEARCH INTERESTS

Theoretical and applied Machine Learning, with a focus on **Reinforcement Learning** and **Dynamical Systems**. Generative Models, Online Learing, Learning with Partial Feedback, Optimization.

EDUCATION

2015-Present — PRINCETON UNIVERSITY

PhD Candidate in Computer Science

Dynamical Systems, Reinforcement Learning

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 **interactive learning algorithms**. My prior research efforts have yielded provable methods for learning **Linear Dynamical Systems** (**Spotlight** at NIPS 2017, **Oral** at NIPS 2018) and designing controls for the same, despite the non-convex nature of the maximum likelihood problem. My upcoming works seek to address issues that arise when dealing with continuous state and action spaces in Reinforcement Learning.
Advisor: Prof. Elad HAZAN

2011-2015 — INDIAN INSTITUTE OF TECHNOLOGY, KANPUR

Bachelor of Technology, Computer Science

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

GPA: 10.0 · *Bachelor of Technology* · Computer Science
Following a rigorous introduction to computer systems and engineering, 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.

PUBLICATIONS

NIPS 2018 ***Oral Presentation***

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*.

NIPS 2018 ***Spotlight***

Elad Hazan, **Karan Singh** and Cyril Zhang. Online Learning of Linear Dynamical Systems. 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*. PDF

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*. PDF

DEML Workshop, ICML 2016

Irineo Cabreros, **Karan Singh** and Angela Zhou. A Mixture Model for Crowdsourcing. A preliminary version appeared at the *ICML Workshop on Data Efficient Machine Learning, 2016*.

Preprint

Naman Agarwal, Brian Bullins, Xinyi Chen, Elad Hazan, **Karan Singh**, Cyril Zhang and Yi Zhang. The Case for Full-Matrix Adaptive Regularization

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EXPERIENCE

Summer 2014 Intern, Microsoft Research, Redmond

Microsoft Research Redmond

Developed a Programming-by-Natural-Language framework to synthesize programs in targeted domain-specific languages given intents expressed as natural language prompts. The system supported multiple rounds of end-user interactions making it more robust than traditional NLP approaches. Concrete instantiations of the framework offer an interactive experience for repetitive data manipulation and summarization tasks.
Host: Dr. Sumit Gulwani

AWARDS AND DISTINCTIONS

Awards for Exceptional Academic Performance

- **Ranked 1st** in the department (among 96 students) and the institute **(among 820 students)** at the Indian Institute of Technology, Kanpur.
- Awarded the **President's Gold Medal** for the best academic performance in the graduating class in all disciplines.
- Awarded the **General Proficiency Medal** for the best academic performance in the discipline of Computer Science.
- Awarded the **Academic Excellence Award** for 3 years and the grade A* for **exceptional performance** in 14 courses.

Science Olympiads and Scholarships

- Awarded the **Gold Medal** for being in the **top 35 (0.1%)** students in Indian National Physics Olympiad 2011.
- Secured **All India Rank 14** in All India Engineering Entrance Examination 2011 **among 1,050,000 students**.
- Secured **All India Rank 140** in Indian Institute of Technology Joint Entrance Examination 2011 **among 485,000 students**.
- Awarded KVPY Fellowship (2009), the most prestigious scholarship in the discipline of science offered by Government of India at high school level.
- Awarded National Talent Search (NTS) Scholarship in 2007.

COURSEWORK

Princeton University & IIT Kanpur

Theoretical Machine Learning | Statistical Learning and Non-parametric Estimation | Fairness in Machine Learning | Coding Theory and Random Graphs | Advanced Algorithm Design | Convex and Conic Optimization | Data Streaming Algorithms | Randomized Algorithms | Algorithmic Game Theory | Linear Programming | Mathematics for Machine Learning | Machine Learning for Computer Vision | Linear Estimation

TEACHING EXPERIENCE

Princeton University

- Teaching Assistant, Introduction to Machine Learning (COS 324).
- Teaching Assistant, Artificial Intelligence and Machine Learning (COS 402).

IIT Kanpur

- Teaching Assistant for the Data Structures and Algorithms course as one of the few undergraduate students selected.