KARAN SINGH

PERSONAL INFORMATION

Princeton University
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RESEARCH INTERESTS

Theoretical and applied Machine Learning, with a focus on Interactive Systems. **Reinforcement Learning**, Generative Models, **Online Learning**, Optimization. **Privacy** and Fairness in Machine Learning.

EDUCATION

2015-Present **PRINCETON UNIVERSITY**

PhD Candidate in Computer Science

GPA: 4.0 · *PhD Candidate* · Computer Science

Dynamical Systems, Reinforcement Learning

My research is focussed on algorithms for machine learning with *provable guarantees* on computational and statistical efficiency, with an attentive emphasis on **interactive learning algorithms**. Recent research efforts have yielded practical, yet rigorous methods for learning **Linear Dynamical Systems** (**Spotlight** at NIPS 2017), despite the non-convex nature of the maximum likelihood problem. Upcoming results outline efficient algorithms for **Reinforcement Learning** with improved generalization performance.

Privacy, Non-convex Optimization

Prior collaborations establish that **differentially private robust learning** of concepts in dynamic environments is possible at no additional cost to the computational and statistical efficiency (ICML 2017), and attempt to explain the behavior of **interactive learning agents** in repeated games with **non-convex loss** functions (ICML 2017).
Advisor: Prof. Elad HAZAN

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

Bachelor of Technology, Computer Science

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

Ranked 1st *(among 820 students)*

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 ($\alpha\beta$ ORDER)

NIPS 2017 **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*.

EXPERIENCE

Summer 2014 Research 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.

Programming Contests

- **Ranked 4th in India** in the preliminary round of Google Code Jam 2012.
- Ranked 8th in ACM Inter Collegiate Programming Contest Asia Region Finals 2013 finals at Kanpur site.

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, the most prestigious scholarship in the discipline of science offered by Government of India at high school level, in 2009.
- 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.

REFERENCES

Prof. Elad Hazan
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Prof. Sanjeev Arora
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Computer Science

Prof. Yoram Singer
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