Prannay Khosla

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Interests

Broadly I am interested in mathematics and theoretical computer science, specialized to Number Theory, Complexity Theory, Algebra and Geometry, Algorithmic Randomness and Combinatorics
As a hobby I read up on evolution, decision making, game theory, machine learning and linguistics in my free time and have recently started reading advanced algebra.

Education

Indian Institute of Technology, Kanpur July 2015 - April 2019*
Bachelor of Technology, Computer Science and Engineering with minor in *Linguistics*
CPI : **9.62** (Top 10 in the Department)
Delhi Public School, R.K. Puram April 2002 - March 2015
Junior, Middle, High School
High School passing percentage : **96.4%**
Middle School passing GPA : **9.8/10**

Awards and Achievements

Academic Excellence Award for years 2015-16, 2016-17
*A**(Above exceptional performance grade) for undergraduate research work
Best Student award by Microsoft Research, India for work done in Summer of 2017
MITACS scholarship for summer research for 2018
Indian National Physics Olympiad awarded top 1% certification (2015)
Indian National Mathematics Olympiad awarded top 1% certification (2014)
All India Rank 192 Joint Entrance Examination - Main (2015)
All India Rank 548 Joint Entrance Examination - Advanced (2015)
All India Rank 412 Kishore Vaigyanik Protsahan Yojana (2015)

Publications

Accented Speech Generation using Generative Adversarial Networks with Prof. Preethi Jyothi, Prof. Vinay P. Namboodiri *submitted to ACL 2018*
Text to Video generation using Generative Adversarial networks with Prof. Vinay P. Namboodiri *submitted to CVPR 2018*
Microblog Retrieval for Post-Disaster Relief: Neural IR Models with Kripabandhu Ghosh, Moumita Base and Saptharishi Ghosh *published in SIGIR 2017 (NeuIR workshop)*

Ongoing projects

Theoretical Analysis of Disentangled Representations March 2018 - Present
Prof. Bernhard Scholkopf
The project is aimed at formally analysing the theoretical properties we aim for while working with representations in Deep learning and other Bayesian Machine Learning systems. The aim is to charactecterise the representations using specific quantities that are consistent with more natural notions of representation. We further aim to theoretically prove / analyze representations to empirically evaluation if two distributions are disentangled.

Optimization by exploring energy landscapre January 2018 - Present
Prof. Somenath Biswas IIT Kanpur (Emeritus)

Analysis of Hamiltonian dynamics for Convex and Non Convex optimization using Markov chains over constraint sets. We analyse the Cheeger constant (under mild assumptions about them) to bound the hitting time of the process with good probability.

Fast Rates of convergence for Convex Optimization January 2018 - Present
Prof. Purushottam Kar
Investigation into faster rates of convergence for strongly convex or regularized objectives using Langevin Dynamics based algorithms by getting bounds on the restricted Cheeger constant for strongly convex or smooth functions.

Sparsification Techniques for Fast Flow algorithms January 2018 - Present
Prof. Rajat Mittal
There has been recent work that uses gives faster algorithms that run in $\mathcal{O}(n)$ time to compute maximum flow in undirected graphs by graph sparsification techniques. The project is aimed at understanding and extending the work to acheive stronger bounds.

Algorithmic Randomness January 2018 - Present
Prof. Satyadev Nandakumar
Analysing different notions of randomness for computable infinite binary sequences and differentiating between random sequences that can be generated from different complexity classes. More specifically the project is aimed at presenting a seperation between sequences that are random under polynomial time resource bounds and under polynomial space resource bounds.

Previous projects

Post Disaster MicroBlog retrieval May 2017-August 2017
Prof. Saptarshi Ghosh IIT Kharagpur
This was a social project aimed at using social media for efficient information retrieval during a disaster situation and using that data for emergency relief operations. This research was conducted at Microsoft Research India, and the results were published in SIGIR 2017.

Optimizing MaxSAT using Parallel Algorithms May 2016-August 2016
Prof. Subhajit Roy IIT Kanpur
Proved reduction for MaxSAT to set cover which could be parallelized (NC^0 uniform circuits) and implemented using parallel programming libraries, therefore making use of efficient set cover solvers to give approximate solutions of MaxSAT.

Inferring Grammars May 2016 - August 2016
Prof. Subhajit Roy IIT Kanpur
Using that fact that for $LL(1)$ grammars, the problem of finding a grammar that fits instances (given as input) can be put in the class NP, we built a reduction that allowed us to solve a SMT system in order to infer the grammar from given inputs, and construct the true grammar. It was a crucial intersection between systems and software.

Zero Shot Learning July 2017 - November 2017
We did Zero shot learning by learning a distribution from the class specific variables to the parameters of the distribution that defined the class conditional distribution by using straightforward linear regression. The key problem that hindered us from coming to a conclusion was the need for very high regularization that made the model not very good for scale.

Unsupervised Text to video generation May 2017- September 2017
Prof. Vinay P. Namboodiri IIT Kanpur
We used Generative Adversarial networks for Text to video generation. It involved developing robust techniques for generating disentangled representations for the style and content of video and learning from those rich distributions to reccurrently generate frames of the video.

Game Theory December 2015-April 2016
Prof. Sunil Simon IIT Kanpur
Using the power of functional programming and efficient solution construction using lambda calculus we were able to implement approximate algorithms for PSL hard problem instances.

Relevant Courses **Discrete Mathematics**, Abstract Algebra, Computation Number Theory, Statistical Learning Theory, Markov Chains and applications, Spectral Tools in Theoretical Computer Science, Computational Complexity, **Advanced Algorithms**, Measure Theory, **Game Theory**, **Logic, Linear Algebra, Programming**, Ergodic Theory, Galois Theory
Bold signifies exceptional performance

Positions of Responsibility

Science Coffeehouse, *Head of Web Development*	May 2017 - April 2019*
Programming club, *active member and secretary*	May 2016 - April 2017
Science and Technology Head, *Hall of Residence 2*	May 2016 - April 2017
EXUN *Head of Web Development*	April 2014 - December 2014