

JAPNEET SINGH

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EDUCATION

Ph.D. in Electrical and Computer Engineering - <i>Purdue University, West Lafayette</i>	GPA: 4.0/4.0 2022 - Present
Masters of Technology (M.Tech.) and Bachelor of Technology (B.Tech.) Both in Electrical Engineering (Dual Degree Program). - <i>Indian Institute of Technology, Kanpur</i>	UG: 9.6/10 PG: 10/10 2017 - 2022

RESEARCH INTERESTS

Machine Learning and Statistics, Information and Coding Theory, Large Scale Optimization

PUBLICATIONS

Contraction of Doeblin Coefficient over Bayesian Networks

Japneet Singh, Anuran Makur; Under review

Hypothesis Testing for the Bradley-Terry-Luce Model

Japneet Singh, Anuran Makur; Under review

Secure and Private Fountain Code Based Architecture for Blockchains

Japneet Singh, Adrish Banerjee, Hamid Sadjadpour; Proceedings of IEEE WCNC-2022 [Link]

Conditional generative models for sampling and phase transition indication in spin systems

Japneet Singh, Mathias S. Scheurer, Vipul Arora; *SciPost Physics*, 2021 [Link]

RESEARCH EXPERIENCE

Purdue University, Graduate Research Assistant

Aug 2022 - present

Advisor: Prof. Anuran Makur

- Working on problems in ranking and preference learning, high-dimensional estimation.
- Developed a hypothesis testing framework to determine whether a BTL model accurately fits the data generated from a pairwise comparison model.

Indian Institute of Technology Kanpur, Graduate Researcher

Advisor: Prof. Adrish Banerjee and Prof. Ketan Rajawat

Jan 2021 - Apr 2022

- Developed the result on the unique recovery of the underlying matrix for universal weighted matrix completion where the revealed entries may not be oblivious to underlying matrix.
- Developed a scalable algorithm for solving the Weighted Nuclear Norm Minimization problem using Augmented Lagrangian and provided its convergence analysis.

University of California Santa Cruz, International Summer Research Program

Advisor: Prof. Hamid Sadjadpour,

May 2021 - Jul 2021

- Introduced two new architectures which reduce the storage and communication costs associated with blockchain's historical data and simultaneously improves privacy of the stored data.

Indian Institute of Technology Kanpur, Students-Undergraduate Research Graduate Excellence

Advisor: Prof. Vipul Arora

May 2019 - Jul 2019

- Explored the use of conditional Generative models to generate lattices for a given temperature for XY lattice model to mitigate the critical slowing down of MCMC algorithms near phase transition.
- Proposed a conditional GAN model, which integrates with MCMC and breaks the markov chain by doing an over-relaxation step, and also adapts to the errors in the learned distribution.

RESEARCH TALKS AND POSTER PRESENTATIONS

- Secure and Private Fountain Code Based Architecture for Blockchains** (talk and poster)
2022 IEEE WCNC conference and JTG/IEEE ITSoc Summer School 2022 2022
- Online Matrix Completion Algorithms for Topological Interference Management** (talk)
Qualcomm, India 2022

SCHOLASTIC ACHIVEMENTS

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|---------|---|-------------------|
| 2022 | Received Dr. Vijay K. Varma Talent Award | <i>IIT-Kanpur</i> |
| 2019 | Summer Undergraduate Research Grant for Excellence (SURGE) | <i>IIT-Kanpur</i> |
| 2017-21 | Academic Excellence Award , for 4 consecutive academic years. | <i>IIT-Kanpur</i> |
| 2017 | All India Rank 644 , JEE Advanced 2017, out of 160,000 candidates | <i>India</i> |
| 2017 | All India Rank 776 , JEE Mains 2017, out of 1.2 million candidates | <i>India</i> |
| 2016 | KVPY scholarship Awardee , All India Rank 280 | <i>India</i> |

SELECTED PROJECTS

- Configuring Intelligent Reflecting Surfaces (IRS) for Wireless Communications** - [Report]
IEEE Signal Processing Cup 2021 under Prof. Abhishek Gupta Jan 2021- Apr 2021
- Improvised Projected Gradient Ascent and Newton's Algorithm for optimizing the IRS configuration for maximizing the Spectral Efficiency of the system.
 - Estimated Channel model using Least Squares and generalized a Dictionary Learning based scheme to the IRS system model for frequency selective channels.
- Newton's Sketch for Non-separable functions** - [Report, Slides] Oct 2020 - Dec 2020
Course project for EE698U - 'Optimization for Big Data' under Prof. Ketan Rajawat IIT-Kanpur
- Analyzed feasibility and un-biasedness of a new sketching technique for Newton's method which does not require computing square-root of the Hessian matrix.
 - Showed Local Linear-Quadratic convergence of Newton's method under this sketching scheme.
 - Developed a global convergence analysis of sketched Newton for self-concordant functions.
- On the Capacity of Computation Broadcast** - [Slides] Sept. 2020 - Nov. 2020
Course Project for EE667 - 'Information Theory' under Prof. R. K. Bansal, IIT-Kanpur
- Read about the problem of Computation Broadcast and its relation to Index Coding and some special cases of Computation Broadcast problem.
 - Gave a talk on the same, explaining how generalizing the Index Coding problem yields interesting insights about its capacity region of Index coding problem under some special cases.
- Fundamentals of Index Coding** - [Slides] Sept. 2020 - Nov. 2020
Course project for EE668U - 'Coding theory' under Prof. Adrish Banerjee IIT-Kanpur
- Read a survey paper on 'Fundamentals of Index Coding' and explored related papers.
 - Gave a talk on the same, explaining the duality between Index Coding problem and Locally Recoverable Distributed Storage Problem.
- BAJA SAE, IIT-K Motorsports** - [Report] Mar. 2018 - Mar. 2019
Member, Faculty Advisor: Prof. Santanu De, IIT-Kanpur
- Implemented and designed multi-link suspension for an All-Terrain vehicle.
 - Used MATLAB for development of suspension kinematics using numerical optimization techniques.
 - Used MATLAB for obtaining the graphs depicting the variation of various suspension parameters with travel, steer of wheel and created a program for finding suspension forces.

SKILLS

Programming	Python, C/C++, SQL
Libraries	NumPy, TensorFlow, PyTorch
Software Skills	MATLAB, Simulink, Git, L ^A T _E X, SolidWorks, Altium

RELEVANT COURSEWORK

- Statistical Machine learning[†]
- Analysis of Modern Wireless Networks[†]
- Information Theory
- Convex Optimization
- Data structures and Algorithms
- Probability and Statistics
- Principles of Communication[†]
- Machine Learning for Signal Processing
- Probability Theory 2[‡]
- Topics in Stochastic Processes
- Coding Theory
- Optimization for Big Data
- MIMO Wireless Communication[†]
- Applied Stochastic Processes
- Detection and Estimation Theory[†]
- Communication Theory[†]

[†] : A* - grade for exceptional performance | [‡] : At Purdue

MISCELLANEOUS

- Served as a TA for MOOC Information Theory Course NOC21-EE57 (Spring 2021, Spring 2022) organized by NPTEL. Created Assignments, uploaded lectures and ensured smooth running of the course.
- Served as Volunteer for ICML 2020, NeurIPS 2020, ICML 2021, NeurIPS 2021, JTG Summer school 2021, NCC 2021. Helped in arranging Zoom meetings, detecting platform bugs and interacting with authors to break the ice during online poster sessions and talks.
- Serving as a TA for e-Masters Course Digital Communication Systems-1 organized by IIT-Kanpur.
- Mentored junior members of team IITK-Motorsports in Vehicle dynamics subsystem.