SANIT GUPTA

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EDUCATION

Indian Institute of Technology Bombay, *Mumbai, India* Jul '16 - Present
B.Tech in Mechanical Engineering (*Minor* in Computer Science & Engineering)
Major GPA: 8.56/10 (Minor GPA: **9.67/10**)

Thesis: **PAC-Optimal MDP Planning with Policy Iteration** *Aug '19 - Present*
(under *Prof. Shivaram Kalyanakrishnan*)

RESEARCH INTERESTS

My primary interest is in the domain of artificial intelligence with a focus on reinforcement learning and bandits. I am also fascinated by various other fields, including, but not limited to, distributed computing, deep learning and optimization.

PUBLICATIONS

- How do people learn how to plan?
  Y.R. Jain, ***S. Gupta****, V. Rakesh, P. Dayan, F. Callaway, F. Lieder*
  CCN 2019

RESEARCH AND PROFESSIONAL EXPERIENCE

Reverse engineering how people learn to plan *May '19 - Jul '19*
Guide: Falk Lieder *Max Planck Institute for Intelligent Systems, Germany*

- Attempted to reverse-engineer the human brain's underlying learning mechanisms with some success
- Developed multiple computational models of rational strategy selection learning
- Designed **bayesian reinforcement learning** agents controlling reward signal to reflect human biases
- Trained & evaluated several candidate models of planning on various metrics of closeness to humans

Developing and Analyzing Algorithms for the Multi-Armed Bandit *May '18 - Present*
Guide: Shivaram Kalyanakrishnan *Dept. of Computer Science & Engineering, IIT Bombay*

- MAB is a problem in which resources must be allocated dynamically between competing choices
- Developing and analysing algorithms for the regular setting and a "batch-sampling" setting in multi-armed bandits, in which a batch of b $>$ 1 pulls must be executed before the outcomes of the pulls are available
- Designed new algorithms for this setting and empirically demonstrated improvements over baselines
- Have made substantial progress towards providing formal lower confidence bounds on performance

Parallel Computing for the Laplace Equation on Unstructured Grids *May '17 - Present*
Guide: Shivasubramanian Gopalakrishnan *Dept. of Mechanical Engineering, IIT Bombay*

- Solving the laplace gives us the steady state temperatures of any object given boundary conditions
- Developed a solver to iteratively compute the solution to the laplacian for arbitrarily shaped objects
- Designed parallel versions with **MPI**, distributing parts of the problem among processors and performing communication between them to speed up the solution, achieving **11x** speed-up with 16 cores
- Used graph partitioning algorithms to minimize communication volume and maximize efficiency

E-Commerce Product Classification incorporating human feedback *May '18 - Jul '18*
Data Science Intern *Lymbyc, Bangalore*

- Built an **ML pipeline** to classify e-commerce products, introduced an **active learning** component
- Impact: Active learning by **Pool-based Entropy Sampling** increased accuracy from **89.2%** to **98%**

SCHOLASTIC ACHIEVEMENTS

- Awarded the **Undergraduate Research Award** in recognition of exceptional research *'16*
- Achieved **All India Rank 567** in JEE (Advanced) and **99.6 percentile** in JEE (Main) *'16*
- **All India Rank 104** in KVPY, accepted into **Indian Institute of Science, Bangalore** *'16*
- Acquired **All India Rank 6** in VITEEE among 210,000 candidates *'16*
- One of 300 students in the country selected for the Indian National Physics Olympiad (INPhO) *'16*
- Cleared National Standard Examination in Physics (NSEP), also among the **National Top 1%** *'16*
- Achieved a perfect score in Chemistry in All India Senior School Certificate Exam *'16*
- Bagged **State Rank 4** in Jammu & Kashmir in National Talent Search Examination (NTSE) *'14*
- Secured **All India Rank 27** in National Cyber Olympiad (NCO) *'11*

OTHER KEY PROJECTS

Distributed Mixed Integer Optimization *Spring 2019*
HPC with Shivasubramanian Gopalakrishnan and Prof. Avinash Bhardawaj

- Developed a solver for mixed integer programs implementing the **Branch-And-Bound** algorithm
- Reduced runtime from **exponential** to **linear** by developing a version that could run on multiple cores

Optimal Bidding *Dec '17 - Jan '18*
6th Annual Inter-IIT Tech Meet, IIT Madras

- Solved a stochastic optimisation problem to minimize electricity bill for a gated community
- Implemented the code in Python using **Particle Swarm Optimization** and **Dynamic Programming**

Playing Pong with Reinforcement Learning *Spring 2018*
Hobby Project

- Developed and trained an intelligent agent to play Pong using **Reinforcement Learning**
- Trained the agent by **Policy Gradient** with only the pixels and whether it scored/lost a point as input

Bayesian Program Induction *Spring 2019*
Hobby Project

- Developed a program that, given a set of probabilistic context free grammars and a set of strings generated from one of them, determined the likelihood of each grammar being the source
- Performed Markov Chain Monte Carlo sampling using the Metropolis Hastings algorithm to infer maximum a posteriori parameters of a program

End-to-end Translator Models *May '18 - Jul '18*
Seasons of Code — Web and Coding Club, IIT Bombay

- Conducted a literature survey on **seq2seq** models used for program synthesis using text and vice versa
- Built an encoder-decoder model using PyTorch for English to French translation

Social Action Projects:

Smart Irrigation Control *Jan '17 - May '17*
National Innovation Club, IIT Bombay

· Developed a circuit to sense the soil moisture level and operate irrigation systems accordingly
· Developed a user-friendly Android App for the farmers to input the threshold moisture value
· Added audio instructions to the app to aid visually impaired people

Mitticool Refrigerator *Jul '16 - Nov' 16*
National Innovation Club, IIT Bombay

· Documented for smooth replication and accessibility across India including a helpful FAQ
· Implemented improvements including using an opaque door and using a finned structure for the walls

RELEVANT COURSES & TECHNICAL SKILLS

Math & Computer Science	Introduction to Machine Learning, Data Structures & Algorithms, Introduction to Stochastic Models*, High Performance Scientific Computing, Logic for Computer Science*, Data Analysis and Interpretation, Computer Programming & Utilization, Multivariable Calculus, Linear Algebra, Differential Equations, Real Analysis, Numerical Analysis
Miscellaneous	Industrial Engineering and Operations Research, Microprocessors & Automatic Control, Kinematics and Dynamics of Machines, Operations Analysis*, Economics, Philosophy
Programming Languages	C++, Python, R, Java, WebPPL, mySQL, HTML, CSS
Programming Packages	Keras, PyTorch, OpenMP, MPI, Tensorflow, SciKit Learn, NetworkX
Software & Tools	GIT, LaTeX, MATLAB, Arduino, Visual Studio, AutoCAD, SolidWorks

POSITIONS OF RESPONSIBILITY

Institute Student Mentor *Jul '19 - Present*
Institute Student Mentorship Program, IIT Bombay

· Selected from a pool of 300+ applicants via a procedure comprising of SOP, peer reviews and interviews
· Guiding a group of **12 freshmen** in their academic & co-curricular endeavours in the institute

Department Academic Mentor *Jul '18 - Apr '19*
Dept. of Mechanical Engineering, IIT Bombay

· Selected from a pool of 85+ applicants on the basis of rigorous interviews and peer reviews
· Mentored a group of **10 sophomores** to ensure their smooth transition into the department

EXTRACURRICULAR

- Ranked **1st** among 147 teams in IIT-B in **American Express's Analyze This**, a data science competition *'17*
- Part of Hostel 9's team, secured **2nd** position in IIT Bombay's Coding General Championship *'18*
- Achieved **3rd** rank in IIT Bombay's Logic General Championship *'19*
- Awarded the Hostel **Tech Special Mention** for contribution to Hostel Technical Culture *'19*
- Won the zonal level of the **Pi Quiz**, a quiz meant to test unconventional thinking, and was selected for the final round to be held at **IIM Indore** during their management and cultural festival *'15*

- Led the school team to victory in the zonal round of **Robotryst Junior** and the team was invited to participate in the final round to be held at **IIT Delhi** as a part of their technical festival *'14*
- Volunteered to be a part of **Cured**, an initiative by Techfest IIT Bombay, to conduct a mass diabetes check, successfully screening more than 100,000 people at 170+ camps across 10 states *'16*
- Completed a three year beginners' course in French having taken it as a third language *'09-'12*

REFERENCES

Shivaram Kalyanakrishnan
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Falk Lieder
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Max Planck Institute for Intelligent Systems
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