

# SANIT GUPTA

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## EDUCATION

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**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 (Computer Science GPA: **9.6/10**)

Thesis: **PAC-Optimal MDP Planning with Policy Iteration**

*Aug '19 - Present*

(under [Prof. Shivaram Kalyanakrishnan](#))

## RESEARCH INTERESTS

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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 distributed computing, deep learning, and optimization.

## PUBLICATIONS

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- [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

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**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*

*Lybyc, 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

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- Awarded the **Undergraduate Research Award** in recognition of exceptional research '19
- 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

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### 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

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

- Designed 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

#### 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

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<b>Math &amp; Computer Science</b>	Machine Learning, Data Structures & Algorithms, 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
<b>Miscellaneous</b>	Industrial Engineering and Operations Research, Microprocessors & Automatic Control, Kinematics and Dynamics of Machines, Operations Analysis*, Economics, Philosophy
<b>Programming Languages</b>	C++, Python, R, Java, WebPPL, mySQL, HTML, CSS
<b>Programming Packages</b>	Keras, PyTorch, OpenMP, MPI, Tensorflow, SciKit Learn, NetworkX
<b>Software &amp; Tools</b>	GIT, L <sup>A</sup> T <sub>E</sub> X, MATLAB, Arduino, Visual Studio, AutoCAD, SolidWorks

## POSITIONS OF RESPONSIBILITY

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**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

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- Ranked **1st** (out of 147) in IIT-B in **American Express's AnalyzeThis**, 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

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**Shivaram Kalyanakrishnan**

Associate Professor  
IIT Bombay  
[webpage](#) ◊ [email](#)

**Falk Lieder**

Research Group Leader  
Max Planck Institute for Intelligent Systems  
[webpage](#) ◊ [email](#)

**Shivasubramanian Gopalakrishnan**

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