





# MANTRI KRISHNA SRI IPSIT

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## RESEARCH INTERESTS

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Social Networks, Submodular Optimization, Machine Learning on Graphs, AI in Healthcare, Signal Processing

## EDUCATION

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**Indian Institute of Technology Bombay**

Mumbai, India

*Bachelor of Technology in Electrical Engineering*

*July'18 – May'22*

- Cumulative GPA: **9.36/10.0**
- Minor Degrees: (1) Computer Science and Engineering (2) Artificial Intelligence and Data Science

## PUBLICATIONS

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1. Pritish Chakraborty, Sayan Ranu, **Krishna Sri Ipsit Mantri**, Abir De, “**Learning and Maximizing Influence in Social Networks Under Capacity Constraints**”, in the [16th ACM International Web Search and Data Mining Conference, 2023](#).

## RESEARCH EXPERIENCE

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**Learning and Maximizing Influence in Social Networks Under Capacity Constraints** *Jan'22 – May'22*

*Bachelor's Thesis, Guide: Prof. Abir De, Department of Computer Science and Engineering*

*IIT Bombay*

- **Introduction:** Influence maximization refers to the problem of finding a subset of nodes in a network through which we could maximize our reach to other nodes in the network. **TopK-InfluMax** aims at finding this set of nodes and **TopK-InfluNet** is a GNN framework to learn the process of information spreading in the network.
- Assisted in framing the objective as a difference between  $\gamma$ -weakly submodular function and a modular function
- Performed a thorough literature survey on **influence maximization** and **submodular optimization**
- Extracted novel datasets from **Digg**, **Weibo** and **Cit-HepPh** networks employing node and cascade pruning
- Developed the TopK-InfluNet by exploiting the **deep submodular** nature of NNs with non-negative weights

**Learning for Combinatorial Optimization on Graphs**

*Aug'21 – Nov'21*

*Guide: Prof. Abir De, Department of Computer Science*

*IIT Bombay*

- **Introduction:** Graph is a universal language for describing complex systems and relations between them and several applications can be modeled as combinatorial algorithms. As the practical ones are NP-hard, we try to find a learning framework to circumvent the design of heuristics and approximation algorithms on graphs. In this work, we tried to propose **SPNet**, a neural model to learn the shortest path between two nodes in a graph.
- Assisted in framing the problem as a GNN based version of **Floyd-Warshall** algorithm
- Developed the **proof-of-concept** by training it on **Barabasi-Albert**, **Facebook**, **Twitter** and Forest Fire graphs

**Automated Gleason Grading of Whole Slide Images using Deep Learning** 

*Jan'20 – Jun'20*

*Guide: Prof. Amit Sethi, Department of Electrical Engineering*

*IIT Bombay*

- **Introduction:** The Gleason Grading System was developed to find the severity of prostate cancer and grade them accordingly based on some specific heterogeneous pattern. We eliminate the need for a highly trained pathologist by proposing image classification and segmentation models to automate it.
- Experimented with attention-based multiple instance learning (**A-MIL**) and achieved a patch level acc. of **52.4%**
- Achieved **0.1 higher** Cohen's Kappa Score of 0.53 between model and ground truth using the segmentation model

## PROFESSIONAL EXPERIENCE

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**Software Engineer | Texas Instruments | Power Interfaces Firmware Team**

*July'22 – Present*

*TI designs and manufactures semiconductor chips, focusing on analog chips and embedded processors*

- Working on **FW validation** of **Power over Ethernet** Power Sourcing Equipment controller chip [TPS23881](#)
- Using **Pytest** and **Jenkins** automation framework to detect and validate the correct state machine execution
- Gained a deep understanding of PoE PSE specs, TPS EVM datasheets, **FW debugging**, among others
- Gained knowledge of **new product development**, **interaction with customers** and FW release process

## Software Engineer | Microsoft | Defensive Search @ Bing

May'21 – Jul'21

Microsoft is a multinational technology company producing computer software, consumer electronics, personal computers

- **Automated** the query expansion pipeline that is used in enabling safe search in the Bing search engine using **C#**
- **Reduced** query treatment time by **62%** using sampling techniques to minimize the budget for crowdsourcing
- Built a **job manager** for submitting and tracking multiple workflows to improve **agility** and **quality**

## Winter Intern | Unacademy

Dec'20

Unacademy is an Indian online education technology company with **6+** million active users

- Curated a set of practice problems on various **Data Structures** for **GATE aspirants**

## Engage Mentorship Program | Microsoft

Jun'20 – Jul'20

This is for sophomore college students who are guided by Microsoft employees on a web dev project along with various webinars

- Developed a web app in Angular to simulate the movement of a mars rover by ideating on different scenarios
- Implemented various shortest-path and maze-generator algorithms like Dijkstra, Floyd-Warshall, Prim & Sidewinder
- Modelled the terrain of Mars on a 2D grid using different types of obstacles and tackled traveling salesman problem

## SCHOLASTIC ACHIEVEMENTS

- Achieved **perfect GPA of 10.0/10.0** in the 8th semester (2022)
- Received a **certificate of merit** for extraordinary performance in the Digital Signal Processing course (2020)
- Secured an **All India Rank of 242** in JEE Advanced among 0.2 million candidates (2018)
- Secured an **All India Rank of 123** in JEE Mains (Engineering) among 1.3 million candidates (2018)
- Ranked in the **national top 1%** in NSEC and NSEA and selected to appear for INChO and IAO (2018)
- Recipient of the **KVPY Fellowship** by Department of Science and Technology, Government of India (2016)

## KEY TECHNICAL PROJECTS

### Efficient Matroid-Constraint-Based Submodular Maximization [🔗](#) | CS769: Optimization in ML Spring 2022

- Implemented the computationally efficient continuous greedy and **accelerated continuous greedy** algorithms
- Modified the **Pipage-Rounding** subroutine for efficient translation of fractional solutions to discrete subsets
- Implemented the **Submodular Welfare Problem**, **Separable** and **Generalized Assignment Problem** in [submodlib](#)

### Post-Hoc Out-of-Distribution Detection [🔗](#) | CS726: Advanced Machine Learning

Spring 2022

- Proposed a **scoring function** based on the assumption of a **Dirichlet** distribution on the DNN's softmax-ed logits for OOD detection
- Verified and validated that the score **outperformed** other OOD metrics on multiple datasets and tasks
- **Reduced** the number of hyperparameters to tune by demonstrating the efficacy of **marginless loss** functions for the task

### Statistical Compressed Sensing of Gaussian Mixture Models [🔗](#) | CS754: Adv. Image Processing Spring 2021

- Exploited **statistical properties** of natural images to reconstruct them using a linear decoder in MATLAB
- Compared SCS and conventional CS using a **dictionary learned** via K-SVD on Berkeley Segmentation dataset
- Performed **blind CS** on standard images like **Lena** and **Peppers** and contrasted the results with SCS and CCS

### Fast Texture Transfer using Wavelets [🔗](#) | CS663: Digital Image Processing

Fall 2020

- Used wavelet-based **image fusion** to transfer texture from texture image to source image in linear time w.r.t size
- Employed **CDF 9/7** wavelet decomposition on Y channel and used histogram matching for better visual appeal

### Wavelet Based ECG Delineator and ECG Data Compression [🔗](#) | EE338: Digital Signal Processing Fall 2020

- Used **Singular Value Decomposition** to compress the ECG signals by exploiting their **periodicity in time**
- Employed quadratic spline wavelet filter banks and *Algorithme à trous* to **robustly** delineate a noisy signal
- Tested our procedure on **physionet** databases and achieved accuracies greater than **95%** on signals with artifacts

## OTHER PROJECTS

- Implemented **Quantum CNN** and **Quantum GAN** using TFQ for high energy particle classification (2021)
- Programmed an **8051  $\mu$ C** to simulate real-time rickshaw fare calculation using **timers** and **interrupts** (2021)
- Backtested the **Lazy Prices** strategy on Indian Equity Market based on paper by **Dr. Lauren Cohen** (2020)
- Devised a robust **constellation detection** mechanism using **geometric hashing** and designed a GUI (2019)
- Developed an algorithm to **sketch** any image based on **edge detection** using OpenCV and Turtle libraries (2020)
- Performed **web scraping** to study climate risk exposure of firms in S&P 500 and prepared NLP datasets (2020)
- Implemented multi-organ nuclei **segmentation** and **structure preserving color normalization** on WSIs (2019)

## TECHNICAL SKILLS

**Programming Languages:** C, C++, Python, MATLAB, Perl, C#

**Machine Learning:** PyTorch, TensorFlow, Keras, OpenCV, Numpy, Pandas, Seaborn, Sklearn, PyTorch Geometric

**Web Development:** HTML, CSS, JavaScript, Angular, Flask

**Software:** Jira, Confluence, BitBucket, Git, GNURadio, NgSpice, L<sup>A</sup>T<sub>E</sub>X, GNUPlot, Xcircuit

**Embedded:** Keil  $\mu$ Vision, TI Code Composer Studio, MSP430, CM3, FreeRTOS, Saleae Logic Analyser, VHDL

## KEY COURSEWORK

**Computer Science:** Advanced Machine Learning, Optimization in Machine Learning, Intelligent and Learning Agents - I, Programming for Data Science, Introduction to Machine Learning, ML for Remote Sensing - II, Digital Image Processing (I & II), Operating Systems, Logic in CS, Computer Networks, Data Structures and Algorithms

**Electrical Engineering:** Nonlinear Dynamical Systems, Wavelets, Control Theory, Communication Systems, Microprocessors, DSP, Probability & Random Processes, Analog Circuits, Digital Systems, Network Theory, EM Waves

**Mathematics:** Differential Equations, Calculus, Linear Algebra, Complex Analysis

## POSITIONS OF RESPONSIBILITY

**Lead Organizer, Karnataka Rajyotsava | Texas Instruments** Sep'22 – Nov'22

*Karnataka Rajyotsava is celebrated by Kannada people world-wide to commemorate their state formation on Nov 1st*

- Leading and managing a team of **8+ members** to organize **4+** events, competitions and cultural performances with a budget of over **INR 150,000** while interacting with TI management
- Involved in budget planning and approval, email communications, handling chief guest among other things

**Teaching Assistantships | IIT Bombay**

*Facilitating smooth course organization, grading papers, mentoring students, conducting tutorials and help sessions*

- **Computer Systems Bootcamp:** OS Track, Prof. Mythili Vutukuru, CSE Department Summer'22
- **CS 419M: Introduction to Machine Learning**, Prof. Abir De, CSE Department Spring'22
- **MA 108: Ordinary Differential Equations**, Prof. Prachi Mahajan, Department of Mathematics Fall'21

**Web Nominee | Institute Hostel Affairs Council, IIT Bombay** Jul'20 – May'21

*Part of the 24 member student team representing 11,000+ students to the policy-making committee of the institute*

- Maintained and developed online portals to **increase awareness** among students about hostel affairs policies
- Revamped the **Married Research Scholars Portal** for Hostel Coordinating Unit to manage accommodation
- Developed a website for the Dean of Student Affairs Office with information and PoCs of various student activities

**Class Representative | Department of Electrical Engineering, IIT Bombay** Aug'20 – May'21

*Part of the 3 member student team representing 150+ undergrad students to the professors and the EE department*

- Responsible for **bridging the gap** between students and professors pertaining to both **academics and logistics**
- Aided instructors and students to adapt to the new normal of **online education** by being their **first POC**

## EXTRA CURRICULAR ACTIVITIES AND OTHER ACHIEVEMENTS

<b>Achievements</b>	<ul style="list-style-type: none"><li>• Was among the <b>top 3</b> teams who presented their work to students from various colleges of India as a part of <b>Immersive Pedagogy Workshop</b> under the '<b>KITE</b>' initiative of the <b>MHRD, GoI</b></li></ul>
<b>Volunteering</b>	<ul style="list-style-type: none"><li>• Instructor at <b>MastAI ki paathSHALA</b> - an online initiative by experts from academia and industry to teach AI free of cost to both students and professionals during the covid-19 lockdown</li><li>• Organizer at IIT Bombay Half Marathon organized by IIT Bombay Sports</li></ul>
<b>Mentorship</b>	<ul style="list-style-type: none"><li>• Mentored <b>12 freshmen</b> on <b>3</b> projects in the areas of <b>object detection &amp; localization</b></li><li>• Guided a freshman with reading project on <b>Deep Learning</b></li></ul>
<b>Technical</b>	<ul style="list-style-type: none"><li>• Constructed an all-terrain obstacle manoeuvring bot controlled using a mobile application</li><li>• Participated in the <b>Web Development</b> Bootcamp at Technical Summer School, IIT Bombay</li><li>• Completed a reading project on the use of Deep Learning in <b>Computer Vision</b> under SoS 2019</li></ul>
<b>Others</b>	<ul style="list-style-type: none"><li>• Successfully completed an year-long training in <b>Lawn Tennis</b> under <b>National Sports Organization</b></li><li>• Co-founded <b>AISRG</b> – a student reading group on Artificial Intelligence at IIT Bombay</li><li>• Participated in the online winter school <b>Russian As a Foreign Language</b> organized by Komsomolsk-na-Amur State Technical University in December 2021</li></ul>