MANTRI KRISHNA SRI IPSIT

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Research Interests

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

Education

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

1. Pritish Chakraborty, Sayan Ranu, **Ipsit Mantri**, Abir De, "**Learning and Maximizing Influence in Social Networks Under Capacity Constraints**", in 16th ACM International WSDM Conference, 2023.

Research Experience

Learning and Maximizing Infl. 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 γ-**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

Software Engineer | **Texas Instruments** | **Power Interfaces Firmware Team** — *July'22 – Present*
TI designs and manufactures semiconductors, 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,PrimSidewinder
- 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 over 0.2 million candidates (*2018*)
- Secured an **All India Rank of 123** in JEE Mains (Engineering) among over 1.3 million candidates (*2018*)
- Placed in the **national top 1%** in NSEC and NSEA and selected to appear for INChO and INAO (*2018*)
- Recipient of the **KVPY Fellowship** by Department of Science and Technology, Government of India (*2016*)

Key Technical Projects

Efficient Matroid-Constraint-Based Submodular Maximiation | *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 wrt 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** μC 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
Machine Learning: PyTorch, TensorFlow, Keras, OpenCV, Numpy, Pandas, Seaborn, Sklearn, PyTorch Geometric
Web Development: HTML, CSS, JavaScript, Angular, Flask
Software: Git, GNURadio, NgSpice, LaTeX, GNUPlot, XCircuit, BitBucket, Jira, Confluence
Embedded: Keil μVision, TI Code Composer Studio, MSP430, CM3, FreeRTOS, Saleae Logic Analyser

Key Coursework

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

Electrical Engineering: Nonlinear Dynamical Systems, Wavelets, Control Theory, Comminucation 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 etc.,

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 info 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

Achievements	• Was among the **top 3** teams who presented their work to students from various colleges of India as a part of **Immersive Pedagogy Workshop** under the **'KITE'** initiative of the **MHRD, GoI**
Volunteering	• Instructor at **MastAI ki paathSHALA** - 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 • Organizer at IIT Bombay Half Marathon organized by IIT Bombay Sports
Mentorship	• Mentored **12 freshmen** on a **3** projects in the areas of **object detection & localization** • Guided 1 freshman with reading project on **Deep Learning**
Technical	• Constructed an all-terrain obstacle manoeuvring bot controlled using a mobile application • Participated in the **Web Development** Bootcamp at Technical Summer School, IIT Bombay • Completed a reading project on the use of Deep Learning in **Computer Vision** under SoS 2019
Others	• Participated in the online winter school **Russian As a Foreign Language** organized by Komsomolsk-na-Amur State Technical University • Successfully completed an year-long training in **Lawn Tennis** under **National Sports Organization** • Co-founded **AISRG** – a student reading group on Artificial Intelligence at IIT Bombay