

# Mantri Krishna Sri Ipsit

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Senior Undergraduate

## EDUCATION

Degree	University	Institute	Year	CPI/%
Bachelor of Technology	IIT Bombay	IIT Bombay	2022*	9.3
Intermediate/+2	BIE Telangana State	Sri Chaitanya Narayana Jr. College	2018	98.40
Matriculation	BSE Andhra Pradesh	Sri Chaitanya High School	2016	10.00

\*Majors in **Electrical Engineering** and Double Minors in **Computer Science** and **AI & Data science**

## RESEARCH INTERESTS

Social Networks, Machine Learning on Graphs and Structured Data, Applied Machine Learning, Image Processing

## INTERSHIPS

**Automation of Query Expansion Pipeline** **Microsoft IDC**  
*Software Engineer Intern, Defensive Search @ Bing* *May'21-July'21*

- Developed a framework to automate the query expansion process to improve **agility** and **quality** using crowdsource
- Reduced query treatment time from **1 day to 3 hours** by using query sampling techniques to minimize the budget
- Built a **job manager** for submitting and tracking multiple workflows enabling **concurrency** without conflicts

**Handbook on Algorithms and Digital Logic** **Unacademy**  
*Content Developer, India's largest learning platform* *December'20-January'21*

- Curated a set of practice problems on various **Data Structures** for **GATE aspirants** of Computer Science stream
- Prepared **error-free** and detailed solutions for the problems after thoroughly **reviewing** the concepts involved

**MicroMARS: Mars Rover Navigator** **Microsoft IDC**  
*The Mars Colonization Program, Engage 2020* *June'20-July'20*

- 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 **travelling salesman problem**

## RESEARCH EXPERIENCE

**Combinatorial Algorithms on Graphs** **Indian Institute of Technology, Bombay**  
*Prof. Abir De, Department of Computer Science and Engineering* *July'21-November'21*

- Goal.** Coming up with neural gadgets to solve NP-hard combinatorial graph algorithms in a supervised fashion
- Impact.** Speed up in inference on billion sized graphs with applications in areas like shortest path, node similarity etc.

**Climate risk exposure of firms in S&P 500 using NLP** **Indian School of Business, Hyderabad**  
*Prof. Nitin Kumar, Center for Analytical Finance* *April'20 - June'20*

- Reviewed literature on traditional **linguistic** analysis in finance and current S.O.T.A deep learning methods
- Extracted text from websites and various articles using **Python** and modelled the topics using **LDA** and **TSNE**
- Built a deep **LSTM** model to tag climate related words in 10-Ks to come up with a measure of risk using **PyTorch**

**Automated Gleason Grading using Deep Neural Networks** **Indian Institute of Technology, Bombay**  
*Prof. Amit Sethi, Medical Deep Learning & AI Lab (MeDAL)* *January'20 - June'20*

- Gleason grading is a prognostic technique for **prostate cancer**; based on specific patterns present in prostate biopsies
- Approached this problem separately as image **classification** and **segmentation** on whole slide images using **PyTorch**
- Experimented with attention based multiple instance learning (**A-MIL**) and achieved a patch level accuracy of **52.4%**
- Achieved 0.1 higher **Cohen's Kappa** Score of **0.53** between model and ground truth using the segmentation approach

**Multi-Organ Nuclei Segmentation** **Indian Institute of Technology, Bombay**  
*Prof. Amit Sethi, Medical Deep Learning & AI Lab (MeDAL)* *December'19*

- Trained a **sliding window** CNN and a UNet separately, on over **22,000** hand annotated nuclei spanning 4 different organs and tested them on **three unseen organs** for three classes in **Pytorch** on H&E stained images
- Implemented Structure-Preserving Color Normalization (**SPCN**) on WSIs using **SNMF** and SPAMS package
- Adopted **iterative region growing** to get n-ary Nuclear Maps and used **Aggregated Jaccard-Index** as accuracy metric

## SCHOLASTIC ACHIEVEMENTS

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- Received a **certificate of merit** for extraordinary performance in 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 **national top 1%** in NSEC and NSEA and selected to appear for Indian National Chemistry Olympiad (INChO) and Indian National Astronomy Olympiad (INAO) (2018)
- Recipient of the **KVPY Fellowship** by Department of Science and Technology, **Government of India** (2016)

## TECHNICAL SKILLS

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**Languages:** C++,Python,MATLAB,C#,VHDL

**ML:** PyTorch,Tensorflow,Scikit-Learn,NLTK,Gensim

**Boards:** Arduino, Raspberry Pi, 8051 $\mu$ C

**Web Dev:** HTML,CSS,JS,TS,Angular,Flask,MySQL

**Software:** Git,GNURadio,NgSpice,L<sup>A</sup>T<sub>E</sub>X,GNUPlot,XCircuit

**Others:** Cirq, Tensorflow Quantum, DGL, PyG

## KEY PROJECTS

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### Quantum Machine Learning for HEP at LHC

*Evaluation Task, Google Summer of Code 2021*

### Machine Learning for Science Umbrella Organization

*March'21-April'21*

- Implemented basic **quantum circuits** involving different gates and measured probability of states using **Google Cirq**
- Implemented a Quantum Generative Adversarial Network (**QGAN**) using Cirq and **Tensoflow Quantum** (TFQ) to seperate signal events from background events from High Energy data
- Implemented a Quantum Convolutional Neural Network (**QCNN**) using TFQ to perform **binary classification** on particle physics data
- Implemented a **Node Classification** and **Graph Classification** Graph Neural Networks (GNN) using **Deep Graph Library** (DGL) for quark/gluon jet classification

### Autorickshaw Fare Simulator using 8051

*Microprocessors, Wadhwani Electronics Lab*

### Indian Institute of Technology,Bombay

*March'21-April'21*

- Programmed an 8051  $\mu$ C in embedded C to simulate real-time fare calculation modelling traffic delays and waiting times
- Employed the concepts of timers and interrupts to make efficient use of resources available on the  $\mu$ C to increase throughput

### Lazy Prices

*Mr.Anand Sekhar, Center for Analytical Finance*

### Indian School of Business,Hyderabad

*April'20-June'20*

- Lazy Prices is a **trading strategy** based on the reporting practices of firms; using the complete history **regular filings**
- **Backtested** this strategy on **Indian Equity Market** by reviewing a paper by **Prof.Lauren Cohen** of HBS using **python**

### Constellation Detection

*Institute Technical Summer Project, Institute Technical Council*

### Indian Institute of Technology,Bombay

*June'19-July'19*

- Devised a mechanism to detect constellations from an image, irrespective of rotation or scaling
- Processed images using OpenCV library and implemented **Geometric Hashing** for every 4-tuples of stars
- Used **similarity metrics** like L1 and L2 norms, cosine similarity and gaussian similarity to compare hashcodes
- Designed a graphical user interface using **Tkinter** library in python to check for the constellations

### Sketching Images using Python

*Hobby Project, Python Art*

### Indian Institute of Technology,Bombay

*June'19*

- Developed an algorithm in python to sketch any given image using the concepts of **edge detection** from image processing
- Used **OpenCV** library to detect the edges in an image and **Turtle** library to draw them on a blank canvas

### Bluetooth Modulated Bot

*XLR8 Competition, Electronics & Robotics Club*

### Indian Institute of Technology,Bombay

*August'18-September'18*

- Constructed a four-wheeled bot with **Differential** steering via H-Bridge motor driver
- Controlled the bot via **wireless interconnection** between onboard bluetooth module and a mobile app

## COURSE PROJECTS

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### Face Recognition using Tensorflow

*Prof. Abir De, Department of Computer Science and Engineering*

### CS 419: Introduction to Machine Learning

*April'21-May'21*

- Implemented the **FaceNet** model developed by Google using **Keras subclassing API** for a custom model
- Trained the model using **triplet loss** to effectively learn the embeddings of the images irrespective of **pose** and **illumination**
- **Visualized** the learnt embeddings using PCA, t-SNE and interdistance matrix and tested the model on personal photographs

## Statistical Compressed Sensing of Gaussian Mixture Models

## CS 754: Advanced Image Processing

Prof. Ajit Rajwade, Department of Computer Science and Engineering

April'21-May'21

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

## Fast Texture Transfer using Wavelets

## CS 663: Digital Image Processing

Prof. Ajit Rajwade, Department of Computer Science and Engineering

November'20-December'20

- Used **wavelet-based image fusion** to transfer texture from a texture image to a source image taking **linear time** wrt size.
- Employed **Cohen–Daubechies–Feauveau 9/7** wavelet decomposition to extract the approximation and detail coefficients
- Applied 2d-DWT on Y channel of Y-Cb-Cr color space and used **histogram matching** as a post-processing technique

## Wavelet Based ECG Delineator and ECG Data Compression

## EE 338: Digital Signal Processing

Prof. Vikram Gadre, Department of Electrical Engineering

November'20-December'20

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

## KEY COURSES UNDERTAKEN

**EE:** Wavelets, Control Systems, Communication Systems, Microprocessors, Digital Signal Processing, Probability & Random Processes, Analog Circuits, Digital Systems, Network Theory, EM Waves

**CS:** Advanced ML<sup>†</sup>, Optimization in ML<sup>†</sup>, Introduction to ML, Advanced Image Processing, Digital Image Processing, Operating Systems<sup>†</sup>, Logic in CS, DSA, Computer Networks, Programming 101

**Mathematics:** Calculus, Linear Algebra, Differential Equations - I & II, Complex Analysis

**Misc.:** Quantum Physics and Applications, Basics of Electricity and Magnetism, Philosophy, Economics 101

<sup>†</sup>to be completed by May 2022

## POSITIONS OF RESPONSIBILITY

### Undergraduate Teaching Assistant

### Indian Institute of Technology, Bombay

MA 108 - Ordinary Differential Equations, Prof. Prachi Mahajan

May'21-June'21

- Conducted weekly **tutorial** sessions for a batch of 50 freshmen and helped them with through **personal interaction**
- Provided assistance to the course instructor in **course logistics** by proctoring exams and correcting the answer scripts

### Web Nominee, Hostel Affairs Council

### Indian Institute of Technology, Bombay

Tier-2 Position, Council formulates policies with Institute functionaries

July'20-May'21

- Created and **deployed** portals used by institute functionaries and students for **vital operations**
- Revamped Married Research Scholar Portal for **Hostel Coordinating Unit** to manage operations in **3** buildings
- Developed a website for **DoSA Office** with information about various student activities and respective POCs

### Class Representative

### Indian Institute of Technology, Bombay

EE Students' Association, Department of Electrical Engineering

August'20-May'21

- One of the three Class Representatives of a batch of **150** third year undergraduate students in Electrical Engineering
- Responsible for **bridging the gap** between the students and the professors pertaining to both academics and **logistics**
- Aided the instructors and the students to adapt to the new normal of **online education** by being their **first POC**

### Student Mentor

### Indian Institute of Technology, Bombay

Institute Technical Summer Project, Institute Technical Council

April'20-June'20

- Mentored **twelve** freshmen on **three** different projects in the field of object detection & localization
- Scrutinized mentees' progress periodically and provided regular **assistance** to successfully finish the projects

## EXTRA-CURRICULAR ACTIVITIES

- Volunteered as an 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 (2020)
- 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, Govt. of India** (2019)
- Contacted **100+** alumni out of a total of **12000+** as a part of Phonathon, a telephonic marathon for contacting alumni under Student Alumni Relations Cell (SARC), IIT Bombay (2019)
- Participated in the **Web Development** Bootcamp at Technical Summer School, IIT Bombay (2019)
- Successfully completed an year-long training in **Lawn Tennis** under **National Sports Organization** (2019)
- Volunteered in **IIT Bombay Half Marathon** organized by IIT Bombay Sports (2018)
- Attended the **Vijyoshi Science Camp** organized by the **Indian Institute of Science (IISc)** (2017)