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# Mantri Krishna Sri Ipsit

*Best way to predict the future is to create it.*

## Education

2018–Present **B.Tech**, *Indian Institute of Technology Bombay*, Mumbai, *9.28*.
Electrical Engineering with Minor in Computer Science & Engineering

2016–2018 **Intermediate/+2**, *Sri Chaitanya Narayana Jr.College*, Hyderabad, *98.40%*.

2016 **Matriculation**, *Sri Chaitanya High School*, Vijayawada, *10.00*.

## Interests

Machine Learning Biomedical Image Analysis, Image Classification and Segmentation

Circuit Design Analog and Digital Circuit Design

## Academic Responsibilities

March 2020 - Present **Teaching Assistant** | **Ordinary Differential Equations**, *Prof.Preeti Raman*, Department of Mathematics, IIT Bombay.

- Awarded with the position of teaching assistant for exceptional performance in this course
- Monitoring a class of 50 freshmen by taking regular tutorial sessions and helping them with the concepts and problem solving

## Projects

### Machine Learning

Present **Automated Gleason Grading using Attention** | **Medical Deep Learning and Artificial Intelligence Lab**, *Prof.Amit Sethi*, Department of Electrical Engineering, IIT Bombay.

- Automating the task of Gleason score annotation of **whole slide images** using deep neural networks along with attention, on the **Harvard Dataverse** prostate cancer data.
- Gaussian thresholding was used to remove noise, followed by Otsu thresholding to seperate tissue from the background. Further refining was done using Erosion and Dilation to subsequently extract tissue patches and compute pixel-level probability maps
- The original image resolution of individual TMA spots was 3100 $\times$ 3100 pixels. For model training, small image regions of size 750 $\times$ 750 were sampled from each TMA spot, using a step of 375 pixels
- Each patch was labeled according to the annotation in its central 250 $\times$ 250 region. Patches containing no or multiple annotations in the central region were discarded
- Only the convolutional part of MobileNet is being used followed by an attention layer at the end, following the embedding - level approach.
- A softmax layer is begin used at the end for final classificaion of the tissue sample into 4 classes, namely Benign, Gleason 3, 4 and 5.
- Image patches were initially resized to 250 $\times$ 250. Data augmentation was applied during training to combat overfitting. We performed random cropping of 224 $\times$ 224 regions followed by random rotations, flipping and color jittering
- Training the neural network with different optimization techniques and categorical cross - entropy loss is being used as minimization objective

Winter 2019 **Multi-Organ Nuclei Segmentation | Medical Deep Learning and Artificial Intelligence Lab**, *Prof.Amit Sethi*, Department of Electrical Engineering, IIT Bombay.

- Used state-of-the-art **image processing** techniques and **neural networks** for segmenting nuclei from Hematoxylin and Eosin (H&E) stained tissue images after **throughly reviewing** relevant research papers
- Implemented **Structure-Preserving Color Normalization** (SPCN) on stained whole-slide images (WSIs) as a **sparse non-negative matrix factorization** (SNMF) problem and made the use of **SPAMS** package
- Trained a **sliding window CNN** and a **UNet** seperately, from scratch on over **22,000** hand annotated nuclei spanning 4 different organs and tested them on 3 unseen organs for **3 classes** in Pytorch
- Adopted **iterative region growing** algorithm to convert the ternary class scores to n-ary Nuclear Maps
- Used **Aggregated Jaccard-Index** as proposed, as the accuracy metric

September 2019–December 2019 **Team Rakshak**, *Member*, Software Subsystem, IIT Bombay.

It is an IIT Bombay student initiative to develop a fleet of robust **Unmanned Aerial Vehicles** (UAVs) to support **Search and Rescue Operations** (SROs) in the event of disaster

- Worked on the task of classifying objects of interest detected by the onboard camera of UAV
- Used the python library OpenCV to preprocess the images before feeding it to a neural network
- Trained a neural network with architecture inspired from **VGG16** in **PyTorch** and achieved an acccuracy of 69%

## General

Summer 2019 **Constellation Detection**, *Institute Technical Summer Project*, Institute Technical Council, IIT Bombay.

- 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

Summer 2019 **Machine Learning and Convolutional Neural Networks**, *Summer of Science*, Maths n Physics Club, IIT Bombay.

- In-depth study of topics like regression, classification, Support Vector Machines, K - Means clustering, **Principal Component Analysis** and regularization
- Endeavoured to understand and implement various aspects like **backpropagation**, dropout, different activation functions like **ReLU**, gradient killing, adaptive learning rate algorithms like Momentum, Adagrad and **Adam**
- Explored CNNs like **AlexNet** and VGG16 and tried to implement them on CIFAR-10 dataset in **Tensorflow**

Autumn 2018 **Bluetooth Modulated Bot**, *XLR8 Competition*, Electronics and Robotics Club, IIT Bombay.

- 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

Autumn 2019 **Fourier Analysis and ECG | Network Theory**, *Prof.Vikram Gadre*, Department of Electrical Engineering, IIT Bombay.

- Made a **detailed study** on different components of the electric circuitry of an ECG machine
- Demonstrated different applications of Fourier analysis in electrical engineering and in ECG
- 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**

Spring 2019 **1 Hz MM:SS Stopwatch | Introduction to Electronics**, *Prof.Mahesh B Patil*, Department of Electrical Engineering, IIT Bombay.

- Designed an **IC555 timer circuit** in order producing a 1 Hz clock signal, dual-IC counter circuit in order to provide mod-6 and mod-10 counting mechanisms, a start-stop mechanism and a reset mechanism
- **Simulated the circuit components** of the circuit in EAGLE in order to test results of the hence designed circuit, and eventually created a **working model** of the same

### Self

Summer 2019 **Python Art**, *Sketching Images using Python*, IIT Bombay.

- Developed an algorithm to sketch any given image
- **OpenCV** was used to detect all the edges in the image.**Turtle** library was used to draw them edges on a canvas
- Suitable adjustments were made to handle *.png* and *.jpg* formats

## Academic Achievements

2018 **All India Rank 242**, *JEE Advanced*, Among over 0.2 million candidates.

2018 **All India Rank 123**, *JEE Mains*, Enginieering Stream, Among over 1.3 million candidates.

2018 **All India Rank 630**, *JEE Mains*, Architecture Stream, Among over 0.1 million candidates.

2016 **Kishore Vaigyanik Protsahan Yojana Fellowship**, *KVPY*, Department of Science and Technology, Government of India.

2018 **National Top 300**, *NSEC*, Selected to appear for INChO, Conducted by Homi Bhabha Centre For Science Education.

2018 **National Top 300**, *NSEA*, Selected to appear for INAO, Conducted by Homi Bhabha Centre For Science Education.

## Languages

C++
MATLAB
VHDL
Python
Julia
HTML,CSS

## Softwares

| | | | |
|---|---|---|---|
| EDA | Eagle,Xcircuit | Web Dev | Django |
| Device Simulation | Quartus | Circuit Simulation | NgSpice |
| CAD | AutoCAD,Solid Works | Documentation | MS Office, Libre Office, LaTeX |
| ML | Pytorch,Keras | Application | GNU Plot |

## Key Courses Undertaken

Signals and Systems*
Logic in Computer Science
Analog Circuits & Lab*
Data Analysis & Interpretation
Network Theory
Calculus
Differential Equations-1
Quantum Physics & Applications
Machine Learning for Remote Sensing*
Data Structures & Algorithms*
Digital Systems & Lab*
Electronic Devices
Linear Algebra
Complex Analysis
Differential Equations-2
Electricity & Magnetism

*to be completed by Fall 2020

## Positions of Responsibility

2018 **Event Organizer at Techfest**, *IIT Bombay*, Asia's Largest Science and Technology Festival, Footfall:175,000.

- Helped carry out the event **Speak - Stand to Express**, hosted by Bollywood Actress **Ms.Yami Gautam**
- Personally contacted **50+** journalists from various agencies to cover the event

2018 **Event Organizer at Mood Indigo**, *IIT Bombay*, Asia's Largest College Cultural Festival, Footfall:143,000.

- Helped carry out the event of India's **first** and only comedian illusionist **Karan Chauhan** during the fest
- Actively handled a large crowd duing various other events along with **15+** fellow organizers

## Extra Curriculars

- **Class Representative** of the students from various departments and years of study taking the course **CS228 : Logic in CS**, as a minor; scheduled tutorials and quizzes
- Successfully finished year-long training in **Lawn Tennis** under **National Sports Organization**
- 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
- Volunteered in **IIT Bombay Half Marathon** organized by IIT Bombay Sports
- Participated in the **Web Development** Bootcamp in Technical Summer School, IIT Bombay
- Volunteered in organizing the **Guinness World Record** event that happened at IIT Bombay where **5700** students gathered to light solar lamps together under the **Solar Urja Lamp** (SoUL) project
- Attended the **Vijyoshi Science Camp** organized by the **Indian Institute of Science** (IISc)