Pranav Page

+91 9370255659 • pranavpage33@gmail.com

Education

Indian Institute of Technology Bombay (IITB) **Mumbai, India**
B.Tech + M.Tech in Electrical Engineering *July 2018 - June 2023*

- Specialized in Communications and Signal Processing with a CPI of 9.20/10
- Completed a **minor** degree in **Computer Science**

Publications and Patents

- **Page, P.** *et al* 2023, *Node Cardinality Estimation in the Internet of Things Using Privileged Feature Distillation*, submitted to *IEEE Internet of Things Journal*, doi: arXiv:2310.18664 [cs.NI]
- **Page, P.** *et al* 2022, *Distributed Probabilistic Congestion Control in LEO Satellite Networks*, *15th International Conference on COMmunication Systems & NETworkS (COMSNETS)*, Bangalore, India, 2023, pp. 335-339, doi: 10.1109/COMSNETS56262.2023.10041374
- Sharma, Y., Marathe, A., Bhalerao, V., Shenoy, V., Waratkar, G., Nadella, D., **Page, P.** *et al* 2021, *The Search for Fast Transients using CZTI*, *J Astrophysics Astron*, 42, 73, https://doi.org/10.1007/s12036-021-09714-6
- **Page, P.**, Jeurkar, S., 2021, *Low Cost Bio-waste Fuel Briquettes and Method of its Manufacturing thereof*, Patent Number 378827, filed 8 July'16 and issued 7 October'21.

Work Experience

Packet detection in WLAN PHY Layer **Research Internship**
Dr. Ashutosh Gore, Wireless R&D, Qualcomm, Bangalore, India *May'22 - July'22*

- Studied various channel models for the **WLAN PHY** layer and methods to correct for impairments such as **carrier frequency offset** in MIMO systems with cyclically shifted transmissions from Tx antennas
- Developed new methods for **Fine Symbol Timing**, producing significant improvements in detection via simulations

Feature Engineering for Yield Prediction using ML **Internship**
Prathamesh Joshi, Carnot Technologies, Mumbai, India *April'23 - July'23*

- Built a framework in Python 3 to extract **features** from satellite imagery, weather and agronomy databases
- Designed **new features** based on analysis of the sugarcane life cycle and trained machine learning regression models to achieve **high accuracy** with sugarcane **yield** prediction

PHY Modeling **Engineer**
Dr. Ashutosh Gore, Wireless R&D, Qualcomm, Bangalore, India *July'23 - present*

- Part of a team focused on building models of the Physical layer in **WiFi** as per the upcoming IEEE 802.11 standards
- Designing receiver time domain **algorithms** for packet detection and correction in C++

Research Experience

Node Cardinality Estimation in Wireless Networks **Masters Thesis**
Prof. Gaurav Kasbekar, Prof. Vivek Borkar, EE Dept., IIT Bombay *Jan'23–July'23*

- Researched methods for estimating **number of active devices in coverage area** of a stationary base station
- Developed **machine-learning methods** for node cardinality estimation using fewer slots than analytical methods
- Trained neural networks using **knowledge distillation** by training a teacher model on privileged features and using the teacher model to train a student on real-time general features
- Demonstrated **faster and more accurate node cardinality estimation** by the trained neural networks than existing methods in networks with different types of devices by building a simulation framework in Python 3

User Scheduling in mmWave networks **Masters Thesis**
Prof. Gaurav Kasbekar, Prof. Vivek Borkar, EE Dept., IIT Bombay *Sept'22 - Dec'22*

- Investigated the problem of **scheduling** transmissions in a wireless network
- Used the **restless bandits** framework to transform the problem into a cost minimization problem
- Designed **Whittle-index** based policies for scheduling in **mmWave** networks which are directional in nature.
- Performed simulations using a **Markovian model** for the interference constraints faced in mmWave transmissions to compare with existing scheduling algorithms

Routing in Satellite Networks **Research Project/Masters Thesis**
Prof. Gaurav Kasbekar, EE Dept., IIT Bombay *May'22 - Aug'22*

- Explored the problem of **minimum-delay** routing in **Low Earth Orbit** congested satellite networks
- Designed a **congestion control** algorithm performing better than previous works in congested sections of the network
- Built a discrete event simulator in Python 3 and compared the performance of the probabilistic congestion control algorithm with a previous work, resulting in **lower average end-to-end delay**

Compton Imaging and Reconstruction **Research Project**
Prof. Varun Bhalerao, Physics Dept., IIT Bombay *Jan'21 - April'22*

- Studied the need for and the use of **Compton imaging** in the hard X-ray regime for astrophysical sources
- Used MEGAlib, a GEANT4-based toolkit to simulate experiments on CZT detectors and demonstrated feasibility of Compton imaging in a laboratory setting by implementing a **back-projection** algorithm
- Presented a **poster** titled "Design and Simulations of a Compton imaging camera for Space Astrophysics" at the 40th Annual Meeting of the Astronomical Society of India in March'22

Random Access in LEO Satellite Communication — **Research Internship**
Prof. Beatriz Soret, Aalborg University, Denmark — *May'21 - July'21*

- Simulated the **S-Aloha** scheduling policy for a fixed number of nodes with exponential backoff policies.
- Studied the variation of the **age of information metric** when the base station communicated with a satellite constellation (Starlink, OneWeb, Iridium-NEXT) for uplink, along with inter-satellite hops to a fixed downlink station.

GRB Search Algorithm — **Supervised Learning Project**
Prof. Varun Bhalerao, Physics Dept., IIT Bombay — *April'20 - Dec'20*

- Implemented a **Bayesian Blocks** algorithm for detection of **Gamma Ray Bursts** in **ASTROSAT** data.
- Eliminated the need for considering the off-time for the satellite by using a block additive fitness function.
- Tested the performance of this algorithm on known GRBs, with lesser false positives than the **N-sigma** method

Key Academic Projects

Advanced Data Networks: Solving the Job Shop Scheduling Problem
- Implemented MCMC methods for solving the JSSP with different **annealing profiles** and compared them to a greedy method which did not guarantee optimality, but outperformed the MCMC methods in speed

Advanced Antennas: Performance Analysis of Phased Array Antennas
- Simulated phased array antennas with different antenna elements in the presence of **interferers** and noise and tested **beamforming** techniques such as phase shift beamforming, MVDR and LCMV beamforming

Image Processing: Image Colorization using Deep Learning
- Developed and tested **Autoencoder** and **GAN** architectures for image colorization in different color spaces

Number Theory and Cryptography: Reduced form implementation of the HC-128 cipher
- Designed a reduced HC-128 cipher and tested its performance as a **pseudorandom** sequence generator

Error Correcting Codes: Analysis of rateless codes
- Performed a **literature review** of **rateless codes** including LT codes, Raptor codes, Tornado codes

Advanced Image Processing: Deep learning based classification of real and computer generated images
- Exploited the presence of **differences** between real and computer generated images in aspects such as local fractal dimension, surface gradient, wavelet decomposition to train a Support Vector Machine classifier

Advanced Machine Learning: Identity Aware portrait generation using CycleGAN
- Modified the **CycleGAN** model using **Facenet** to extract features from images to generate **portraits** while remaining true to the facial features and the classical painting style that the model is trained on

Computer Graphics: FMX Modeling, Rendering and Animation
- Designed and animated a rider and motorbike on a freestyle motorcross track from scratch in OpenGL
- Used perspective cameras, shaders, textures and keyframe interpolation to shoot a short video of the stunts

Academic Achievements

- **AP** in Physical Chemistry, awarded to top **11** students out of **1023** in the course
- Selected in the **top 1%** nationwide in **INPhO** and **INChO** conducted for selection to International Olympiads.
- Engineering Entrance Exams
  - **All India Rank** of **275** in **JEE Advanced 2018**
  - **All India Rank** of **250** in **JEE Main 2018**
- Selected for the **KVPY** fellowship in both **SA**(2017) and **SX**(2018) streams after the written test and an interview with an **All India Rank** of **318** in 2017 and **402** in 2018 conducted by **IISc, Bangalore**
- Awarded the **NTSE** scholarship offered by **NCERT** given to **1000** students nationwide

Mentorship Experience

Institute Student Mentor
Student Mentorship Program, IITB — *July'21 - present*

- Part of a **133** member team selected from 300 applicants through extensive interviews and peer reviews
- Mentoring a group of **12 freshmen** in academics and extra-curricular activities, helping them adjust to college life and monitoring their progress throughout the first year
- Performing the duties of a senior mentor responsible for managing a group of 12 mentors, selected for a second term

Graduate Teaching Assistant
EE340 : Communications Lab — *July'22 - Nov'22*

- Conducted **weekly lab sessions** comprising of software and hardware components
- Responsible for guiding students through the lab tasks and evaluating their performance based on vivas and exams

Department Academic Mentor
D-AMP, Department of Electrical Engineering, IITB — *July'20 - April'21*

- Part of a 35 member team selected from the EE department through **interviews** and **peer reviews**
- Responsible for **mentoring 6 sophomores** and providing help to students who struggle with their studies

Teaching Assistant
PH108: Basics of Electricity and Magnetism, Department of Physics, IITB *Jan'20 - April'20*

- Conducted **weekly classes** for a batch of 40+ students
- Resolved doubts, cleared concepts and **graded** the quizzes and the mid-semester examinations

Convener
Krittika-The Astronomy Club, IITB *July'19 - April'20*

- **One out of six** conveners responsible for organizing technical events and competitions on an **institute level** to increase awareness and inculcate enthusiasm and passion for astronomy among students
- Entrusted with **maintaining the telescopes** and improving the proficiency of telescope handling of astronomy enthusiasts, and **organizing trips** to dark sites for **night sky observations**

Relevant Courses

Communications: Communication Systems, Advanced Data Networks, Markov Chains and Queuing Systems, Digital Communications, Error Correcting Codes, Wireless and Mobile Communication, Communication Networks, Advanced Antennas

Signal Processing: Signals and Systems, Digital Signal Processing, Image Processing, Advanced Image Processing

Computer Science: Computer Programming and Utilization, Data Structures and Algorithms, Computer Networks, Intro to ML, Design and Analysis of Algorithms, Operating Systems, Advanced ML, Computer Graphics

Electrical Engineering: Digital Systems, Network Theory, Microprocessors

Statistics and Probability: Data Analysis and Interpretation, Probability and Random Processes, Advanced Probability and Random Processes, Introduction to Stochastic Optimization, Online Learning and Optimisation

Physics: Electricity and Magnetism, Electromagnetic Waves, Quantum Physics and Applications, Astrophysics

Mathematics: Calculus, Differential Equations, Linear Algebra, Complex Analysis, Applied Mathematical Analysis in Engineering

Technical Skills

Languages: C, C++, Python, MATLAB, Bash, VHDL, Octave, Assembly, SQL*, ArduinoCode*

Packages and Softwares: ns3, Tensorflow, opencv, Flask, AutoCAD, Solidworks, LaTeX, GNURadio, MEGAlib, HFSS, OpenGL

*basic proficiency

Extracurriculars

- Participated in the **Inter-IIT Tech Meet** in March'22 and won the **Gold** medal for **ISRO**'s problem statement which involved **automatic detection** of solar flares in the X-ray spectrum
- - Learned **Abacus** upto the last level G8 (Ideal Play Abacus) and received certification for the same by the GuangXi Zhusuan Association, China
  - Passed the International Standard Of Abacus Mental Arithmetic Proficiency Examination and bagged the **fourth** place in the **National Abacus and Mental Arithmetic Competition** in Chennai in 2008
- Designed and built a prototype of a **solar dehydrator** for drying vegetables to **preserve nutrients** like Vitamin C which deteriorate on exposure to sunlight, in order to **reduce wastage and losses** during harvest due to improper storage and provide farmers with an **alternate source of income**