

ANSHUMAN BARNWAL

4th Year Undergraduate - Electrical Engineering

✉ banshuman20@iitk.ac.in | ☎ +91-6205196253 | 🌐 ba-13 | in b-anshuman13 | 🌐 ba-13.github.io

Academic Qualifications

Year	Degree/Certificate	Institute	CPI/%
2020 - Present	B.Tech	Indian Institute of Technology Kanpur	9.0/10
2020	CBSE(XII)	Jawahar Vidya Mandir, Shyamali	97.4%
2018	CBSE(X)	Jawahar Vidya Mandir, Shyamali	97.2%

Scholastic Achievements

- Received **Academic Excellence Award 2021**, IIT Kanpur for the academic year **2020-21**
- Secured **All India Rank 651** in **JEE Advanced 2020** among 1,50,838 shortlisted candidates
- Secured **All India Rank 1638** in **JEE Mains 2020** among 0.8 million applicants
- Secured **All India Rank 44** in **Indian Statistical Institute Admission Test 2020** in B.Math Programme
- **KVPY SX Scholar** in 2020, awarded by **IISc Bangalore**, under the Government of India
- **KVPY SA Scholar** in 2019, awarded by **IISc Bangalore**, under the Government of India
- **NTSE Scholar** in 2018, awarded by **National Council of Educational Research and Training**, New Delhi

Work Experience

- **Fair Value Beta Automation | Goldman Sachs, Dr. Tianmiao Wang** *May 2023 — Jul 2023*
 - Developed end-to-end **ML pipeline** package that generates correlation coefficients between stocks and proxies returns
 - Created dynamic **ETL pipeline** on **Apache-Airflow** scheduler for self-updating stocks data source on **Apache-Hive DB**
 - Implemented **rolling regression** on time-series data collected with centralized configurations using **statsmodels**
 - Created GitLab **CI/CD** pipelines with **92%** coverage of automated testing for package deployment over PyPi
- **Balanced DCCA for Bird Vocalization Detection | MadhavLabs IITK, Prof. Vipul Arora** *Aug 2022 — Nov 2022*
 - Developed novel architecture for **skewed multi-modal time-series** dataset for sound event detection
 - Implemented complete model pipeline in **Tensorflow**, included non-uniform distribution sampling for optimal batching
 - Improved F1 score from **76%** to **83%**, surpassing previous SOTA CRNN performance, paper accepted in **IEEE ICASSP'23**

Key Projects

- 🔗 **WFSM Logic Locking | NeuroCHaSe Group, Prof. Shubham Sahay** *Jan 2023 — Apr 2023*
 - Developed a **novel** defense and attack **logic-locking strategy** for a custom logic architecture on 3D NAND Flash memory
 - Simulated Flash Memory architecture in Python, proved flexible and potentially **infinite key space**, protecting logic against unauthorized use **without hardware overhead**
 - Extensible to protect memory, allowing users to store data that can only be correctly read with the right key
- 🔗 **MIPS Single-Cycle Processor | Course Project, Prof. Urbi Chatterjee** *Mar 2023 — Apr 2023*
 - Developed a modular single-cycle 32-bit processor in **IVerilog** supporting execution of MIPS-I Instruction Set Architecture
 - Built a custom Assembler in Python that converts MIPS-I ISA to 32-bit binaries, demonstrated bubble sort implementation
- 🔗 **MPC-based landing on Moving Platform | Course Project, Prof. Indranil Saha** *Aug 2022 — Nov 2022*
 - Implemented a drone pipeline using RotorS framework and ROS, capable of landing on a path-agnostic moving platform
 - Demonstrated three types of path planning mechanism, given the current location of platform perceived by the drone
- 🔗 **Few shot Learning | SURGE IITK, Prof. Vipul Arora** *May 2022 — Jul 2022*
 - Replicated the result of few-shot learning on Omniglot dataset achieving 1-shot based **97.6%** test accuracy
 - Implemented sound event detection using **ProtoNets** and **Model Agnostic Meta Learning** methods in few-shot learning
- 🔗 **Pluto Drone Swarm Challenge | Inter IIT Techmeet 11.0, Drona Aviation** *Jan 2023 — Mar 2023*
 - Led a **team of 10** in **High Prep**, bagging **Bronze** among 22 participating IITs, one of the 2 IITs completing the challenge
 - Created a Python package capable of handling **MSP protocol** packets for low level communication with drone stack
 - Built a custom camera driver with **threading** reaching **60fps** with pose estimation, for adequate 30Hz feedback control
 - Created a custom controller with **Linear Kalman Filter** as state estimator, fine-tuned by logging and flight analysis
- 🔗 **Automatic identification of solar bursts | Inter IIT Techmeet 10.0, ISRO** *Mar 2022 — Apr 2022*
 - Automated demarcation of solar bursts in timeline and their classification given an open-source X-ray light curve dataset
 - Created a multi-filtering algorithm with **outlier detection** to improve performance, developed as a python package
 - Secured the **Second position** out of 22 participating IITs, on the basis of performance and the presentation
- 🔗 **Direction of Arrival Estimation | Course Project, Prof. R. Hegde** *Feb 2022 — Apr 2022*
 - Generated **Spatial Room Impulse Responses** using Image Method, which convolved with plain speech, gave directionality
 - Treated Direction of Arrival estimation as a classification problem on a spherical grid with 5° resolution
 - Implemented a **Convolutional Recurrent Neural Network** on Pytorch that takes in first order Ambisonics-B intensity vector from the above generated speech signals, and predicts one of the 684 lattice points
- 🔗 **MCMC in Julia | Stamatatics, IIT Kanpur** *Apr 2022 — Jun 2022*
 - Implemented inverse discrete/continuous transform, **accept-reject proposal**, importance sampling estimator in **JuliaLang**

- Analysed the importance of the proposal distributions by judging its bias and variance theoretically and simulation-based
- Implemented MCMC methods including **Metropolis Hastings** algorithm to perform **Bayesian regression**
- 🌀 **Game of Blocks | Science and Technology Council, IIT Kanpur** *May 2021 — Aug 2021*
 - Understood principles of **BlockChains**, how a system succeeds to be trustworthy in an otherwise environment
 - Implemented Alt-coin cryptocurrency with proof of work mechanism in **Solidity** and **Remix** IDE
 - Developed **ETH Smart Contracts** on Instant Run-off Voting and Dutch Auction Mechanisms using Solidity
- 🌀 **Numbers Made Dumber | Stamatics, IIT Kanpur** *Apr 2021— Jul 2021*
 - Analysed principles of Number Theory for Cryptography, including Diophantine equations and Congruence Theory
 - Implemented standard cryptographic algorithm **RSA** in Python from scratch
- 🌀 **ML with Julia | Association for Computing Activities, IIT Kanpur** *May 2021 — Aug 2021*
 - Explored Linux system with Capture the Flag challenges and scripting through Exercism
 - Implemented Polynomial Regression Models from scratch in **JuliaLang** and benchmarked using standard implementation
 - Implemented derivatives, gradients and Jacobians using concept of Duals and MultiDuals in Julia
- 🌀 **Computational Astrophysics | Science and Technology Council, IIT Kanpur** *May 2021 — Jul 2021*
 - Estimated parameters of celestial systems from inference derived by applying **FFT** and **time series kernels** on observations
 - Extracted features of datasets from sites including **Vizier** and SDSS using Python's dedicated library **Astropy**
- 🌀 **CSRT Tracking | Aerial Robotics, IIT Kanpur** *Aug 2021 — Oct 2021*
 - Developed a **ROS** Package implementing the CSRT Tracker using **OpenCV** to track objects inside an ROI
 - Implemented coordinate transformation based algorithm for global pose estimation using camera feed and UAV pose history
- 🌀 **IITK Coin | Science and Technology Council, IIT Kanpur** *Sept 2021 — Oct 2021*
 - Developed the **User Interface** of a browser and an app based application, IITK Coin, in a team of 3
 - Created a complete visual prototype with the workflow using **Figma** and developed logos using **Adobe Illustrator**

Technical Skills

Languages and Utilities

C, Javascript, Python, MATLAB, Bash, iVerilog

Software and Libraries

Pytorch, ROS, Sklearn, Git, Docker, OpenCV, Simulink

Positions of Responsibility

- 🌀 **Team Head | Aerial Robotics, IIT Kanpur** *Apr 2021 — Apr 2023*
 - Led a team that works on Autonomous Unmanned Aerial Vehicles
 - Secured **Bronze** in Inter IIT Techmeet 11.0 on **Swarm control** using single monocular camera for perception
 - Qualified for Shaastra'23 by IIT Madras, implemented and executed a complete autonomous pick-up and drop mission
 - Involved in Inter IIT Techmeet 10.0 on the problem statement provided by **DRDO** on autonomous navigation of UGV in unknown terrain, securing **Second position**
 - Implemented visual Simultaneous Localisation and Mapping for effective localisation and pose estimation
- 🌀 **Secretary | Programming Club, IIT Kanpur** *Sep 2021 — Apr 2022*
 - Conducted workshops on pillars of programming, mentored 20 freshers in a summer project on Information Security
 - Contributed to the Club's repositories based on deployable projects, directly affecting the campus community
- 🌀 **Secretary | Design and Animation Club, IIT Kanpur** *Jul 2021 — Mar 2022*
 - Took part in Team based Rebranding event, the team securing 2nd position out of 9 teams of proficient designers
 - Position of Responsibility of holding workshops and introducing freshmen to the concepts of design
- 🌀 **Senior Executive, Design | Udghosh, IIT Kanpur** *Sep 2021 — Mar 2022*
 - Involved in the regular creation of graphics for Udghosh, the Sports Festival of IITK
 - Involved in the rebranding of the fest and took part in its theme creation and designing of Udghosh'22

Relevant Courses

Introduction to Electronics	Signals and Systems	Control System Analysis
Real Analysis	Complex Analysis	Probability and Statistics
Microeconomics I	Macroeconomics I	Digital Electronics*
Principles of Communication	<i>Speech Signal Processing</i>	Electromagnetic Theory
Data Structures and Algorithms	Computer Organisation*	Computer Architecture ⁱ
Digital Signal Processing	Operating Systems ⁱ	Computer Graphics ⁱ
<i>Cyberphysical and Embedded Systems</i>	<i>Introduction to Machine Learningⁱ</i>	Physics of Information Processing ⁱ

* - Outstanding Performance, *italics* - Graduate Course, *i* - Ongoing

Extra-Curricular Activities

- Mentored a project HackIT'22 under Programming Club IITK to introduce freshers to different aspects of Jeopardy based CTFs
- Bagged 1st position in Takneek'22, for Evolution Simulation in Python in Neuro-economics problem statement
- Achieved 2nd position in a team based rebranding contest organised by Design and Animation Club IITK in 2021