Nitish Vikas **Deshpande**

Junior Undergraduate Student

Indian Institute of Technology, Kanpur · Electrical Engineering

(+91) 9769839971 | nitishvd@iitk.ac.in | home.iitk.ac.in/ nitishvd/ | NitishVikasDeshpande | nitishvdeshpande

Education

Indian Institute of Technology, Kanpur — *Kanpur, India*

Bachelor of Technology, Major in Electrical Engineering — *July 2017 - PRESENT*

- C.G.P.A of **9.2/10** at the end of 5th semester with **A*** **(Outstanding performance)** in course of **EE698V (Machine Learning for Signal Processing)**

R.W.J.C College — *Mumbai, India*

HSC 12th STD — *July 2015 - April 2017*

- Scored 94 % in Science Stream with Electrical Maintenance as vocational subject

S.E.S High School — *Mumbai, India*

SSC 10th STD — *2005 - 2015*

- Scored 96 %, School Topper

Research Interest

Signal Processing and Communication, Wireless Networks, Stochastic Geometry, Optimisation in Machine learning, Reinforcement learning

Honors & Awards

International

2020	**6th Place**, IEEE International Conference on Acoustics, Speech, and Signal Processing, Signal Processing Cup Challenge (7th Edition)	*Barcelona, Spain (Virtual Conference)*
2019	**3rd Place**, IEEE International Conference on Robotics and Automation, Robomaster AI Challenge	*Montreal, Canada*

Domestic

2020	**The Fourth Paradigm Conference(Data Science)**, Research work of "PSYCHOMETRIC PROFILE CAPTURE BY TRACKING INVOLUNTARY PHYSIOLOGICAL RESPONSE TO VIDEO STIMULUS" selected for poster presentation (Poster)	*Bhopal, India*
2019	**2nd Award**, for the research problem statement of **"Outreach exercise in Psychographic Profile Capture"** in the 8th INTER IIT Tech Meet held at IIT Roorkee	*Roorkee, India*
2019	**SURGE scholarship awardee**, Students-Undergraduate Research Graduate Excellence, IITK	*Kanpur, India*
2019	**Best Research and Development project award**, for the project "**Through the wall human tracking**" among 45+ projects in Science and Technology Council, Students' Gymkhana, IITK	*Kanpur, India*
2019 & 2018	**Academic Excellence Award**, Awarded to top 10% of the batch for distinguished **Academic Performance** in IITK	*Kanpur, India*
2018	**2nd Award**, for the research problem statement of **"Television Audience Measurement"** by **BARC INDIA** in the 7th INTER IIT Tech Meet held at IITB	*Mumbai, India*
2017	**All India Rank 656**, Joint Entrance Exam, Advanced, 2,50,000 candidates	*India*
2017	**All India Rank 1621**, Joint Entrance Exam, Mains, 1.4 million candidates	*India*
2016	**KVPY Scholarship Awardee**, Indian Institute of Science and Government of India	*Banglore, India*
2015	**Regional Mathematics Olympiad**, Homi Bhabha Centre for Science Education, Tata Institute of Fundamental Research	*Mumbai, India*
2014	**INSPIRE Scholarship Awardee**, Department of Science and Technology, Government of India	*Mumbai, India*

Projects

Spectral Efficiency Analysis of HETNETS using POISSON CLUSTER PROCESS

IIT Kanpur, Kanpur, India

EE698O(Analysis of Modern Wireless Networks using stochastic geometry) Term project under guidance of **Prof. Abhishek Gupta**

March.2020-Present

- Derived exact expressions for average ergodic rate for a typical user under a K tier Heterogeneous Network model using **Poisson Cluster Process** and a max-power association scheme.
- Performed Monte Carlo Simulations of the network to validate the theoretical calculation of average ergodic rate.
- Ongoing work on effect of densification in networks modelled using Poisson Cluster Process

Regret Analysis for Bandit Convex Optimisation with and without projection

IIT Kanpur, Kanpur, India

EE609O(Convex Optimisation for SP-COM) Term project under guidance of **Prof. Ketan Rajawat**

March.2020-Present

- Studied the class of **Projection-free** algorithms and **Bandit Convex Optimisation algorithms**
- Derived regret bounds for the projection-free version of Bandit Convex Optimisation

Unsupervised abnormality detection by using intelligent and heterogeneous autonomous systems (Paper)(Code)

IIT Kanpur, Kanpur, India

Signal Processing Cup @ICASSP 2020 under guidance of **Prof. Vipul Arora**

Nov.2019-March.2020

- Using gyroscope, accelerometer, magnetometer data as well as the video feed from a drone to predict anomalies in the drone behaviour using unsupervised machine learning techniques.
- Implemented and tested 3 different anomaly predictors: **Isolation Forest** classifier, CNN based time-forecasting and ARIMA based time-forecasting.
- Secured **6th rank** at the international level in the first phase of SP Cup Challenge.

Psycho-graphic profile capture by analysis of physiological signals

IIT Roorkee, Roorkee, India

8^{th} INTER IIT Tech Meet

Dec.2019

- Proposed a user friendly and non-intrusive methodology **CAPS: "Capturing Physiological Signals"** to predict the personality traits of the respondents
- Used **ECG sensor** to capture the heart beat signals and **GSR sensor** for measuring skin conductance
- Extracted features like power spectral density, inter-beat intervals, heart-rate variability from the raw analog signals, applied **dimensionality reduction using PCA** to remove the features with low variance and used **classification models like kNN, SVM, Naive Bayes** for each of the 5 personality traits (Openness, Extraversion, Agreeableness, Conscientiousness, Emotional Stability)

Score Following: Audio to Score Alignment (Poster)

IITK, Kanpur, India

SURGE 2019 project under guidance of **Prof. Vipul Arora** (MADHAV(Machine Analysis of Data for Human Audition and Vision) lab)

May.2019 - Nov.2019

- Studied and analysed various time frequency representations of audio signals and performed experiments to compare accuracy of various representations like **STFT and CQT** fed as input to conventional **automatic music transcription** systems
- Developed a score following system which uses state-of-the-art techniques like using **convolutional gated auto-encoders** for feature extraction and variants of **Dynamic Time Warping** like ShapeDTW and FastDTW for alignment of performance audio to score MIDI
- The system after evaluation on the 10 songs of Bach10 collection reports median deviation in the range of 20ms-40ms
- Also worked on the problem of Music Source separation. Focus on using techniques like **NMF** and **PLCA**.

Development of autonomous robots for AI based warfare

IITK, Kanpur, India

Member of Equipe de Robotique Autonome (ERA-IITK) under guidance of **Prof. Laxmidhar Behera** (Intelligent Systems and Controls Laboratory)

Sept.2018 - May.2019

- Formulated the 3 minute game as a **reinforcement learning problem** consisting of an **agent** which can shoot in a span of 180° and move based on a mecanum wheel system; an **environment** consisting of obstacles, enemy with similar capabilities as our agent, bonus zone and projectile supply zone; with **states** as Health Points and time left; the **rewards** as number of successful shots on the enemy; the **action space** consisting of firing speed, direction as well as the chassis speed, direction. Simulations of game done using **PyGame**. Algorithms like ***Actor-Critic*** were used
- **First Indian Team** from IITK to qualify for the competition held at Montreal, Canada

WiTrack: Through the wall human tracking

IITK, Kanpur, India

Electronics Club project under guidance of **Prof. A R Harish** (Microwave lab)

May.2019 - July. 2019

- Mentored and worked with a team of **9 second year UG students**, implemented a **Frequency Modulated Carrier Wave RADAR** capable of tracking human beings over a distance of 3m in presence of a solid obstacle between the walking human and the antenna pair
- Hardware setup consisted of a sweep generator, signal generator, mixer, a pair of antenna and oscilloscope
- Established a serial communication system between laptop and oscilloscope using **PyVISA library** for data logging
- Won the **best RnD project** award in SnT council

Television Audience Measurement

Mumbai, India

Collaboration with Broadcast Audience Research Council under guidance of **Dr. Sumit Chowdhury** *Dec. 2018 - Jan.2020*

- Implemented a non intrusive real time room occupancy estimation system using a single **PIR sensor**
- Performed the filtration of the fast motion behaviour and extracted small motion behaviour component from raw data using **infinite hidden markov model** and analysed the **Laplace Spread parameters** of the data corresponding to different number of people present in the room
- Implemented a speaker recognition system using **MFCC features and Gaussian Mixture Model**
- Used Audio fingerprinting, Remote IR decoder and Speech-to-text modules for automatic recognition of channels played on television

FPGA based Real Time Image Convolution

IITK, Kanpur, India

Project under Electronics Club, SnT council *May. 2018 - July. 2018*

- Implemented single convolution filters like sobel filter on real time video data on Virtex 5 board after performing simulations on Xilinx ISE
- Designed a data pipeline for the convolutional filter using **FIFO** (First In First Out) data structure in **VHDL** language

Extracurricular Activity

Electronics Club, Science and Technology Council, Students' Gymkhana

IITK, Kanpur, India

Coordinator and Core Team Member *March. 2019 - March. 2020*

- Working in a team of **4 coordinators and 25 secretaries** managing and maintaining Electronics Club, a hub of electronics activities and projects
- Envision, plan and organize institute wide lectures, workshops, hackathons for electronics enthusiasts, mentoring project teams and representing the club in national level competitions like INTER IIT Tech Meet
- Organized Institute wide lecture on **"Machine Learning for Signal Processing"** with demo of live training and testing of speaker recognition system
- Initiative of collaborating with faculty members and PhD students of Electrical Engineering Department for club projects

Counselling Service, IITK

IITK, Kanpur, India

Student Guide and Academic Mentor *July 2018 - LIFE LONG*

- Assisted **4 first year students** academically as well as emotionally, ensuring the smooth transition to college life
- Helped in smooth conduction of Orientation Session for the incoming batch consisting of 900 students
- Mentored academically weak students in the 1st year Institute Core Physics Course on Mechanics.

Participation in Podcasts

IITK, Kanpur, India

Initiative of SnT council and IITK Podcast Project *February 2020*

Initiated a Podcast series Industry 4.0 and hosted the Podcast on "**5G and Beyond**".

Relevant Courses

* ongoing

Signals, Systems and Networks	Probability and Statistics	Differential Equations(ODE & PDE)
Micro-Electronics(BJT & MOSFET)	Data Structure and Algorithms	Machine Learning for Signal Processing
Linear Algebra	Control Systems	Communication Systems
Digital Communication, Information Theory and Coding Theory*	Digital Electronics	Complex & Real Analysis
Digital Signal Processing*	Convex optimisation in signal processing and communication*	Analysis of Modern Wireless Networks*

Skills

Languages Python, MATLAB, C/C++, Verilog, VHDL

Software Xilinx ISE, Arduino IDE, LabView, Proteus, ROS, LaTeX

Hardware FPGA, micro-controllers boards like arduino/NodeMCU, Single Board Computers like Rpi, IOT boards like ESP, USRP software defined radio