

# Pranav Sankhe

## Research Interests

I am passionate about Deep Learning, Computer Vision, Optimization, Computational Neuroscience, Neuromorphic Modeling and Distributed Wireless Networks.

## Education

Indian Institute of Technology Bombay, Mumbai, India

July 2015 – Present

Third Year, Bachelor of Technology, Department of [Electrical Engineering](#)

## Scholastic Achievements

- May'15 Secured *All India rank 160* in the selection test for the IITs out of 150,000 candidates
- Feb'13 Received *Gold Medal* for excelling in the *NASA Olympiad* and selected for a visit to *NASA*
- Feb'15 Received INSPIRE scholarship for being in top 1 percentile in class 12<sup>th</sup> by Government of India
- Feb'13 Felicitated at state level for appearing in merit list at state level in MTSE

## Work Experience

- Dec'16 – **Arrow AI**, *Developing APIs for commercial applications of Machine Learning in TensorFlow.*
- Jan'17
  - Developed and implemented an API for *State Bank of India* which is the largest commercial bank of India, to *estimate expected business capital and time* for new clients
  - Designed and developed a *recommendation system* for restaurants using *SVD*
  - Designed and implemented an API to scrape transaction details from online PDF bank statements
  - Developed an algorithm to estimate the path of consumers in stores using *OpenCV*
- Apr'16 – Jun'16 **SoundREX**, Hardware Development and Testing.
  - Designed a circuit to estimate the location of the user based on the music around

## Projects

### Course Projects

- Oct'17 – **Generating Adversarial attacks on Segmentation Neural Networks**,
- Dec'17 *Research Project with Prof. Dawn Song, Computer Science Division, University of California, Berkeley.*
  - Generated adversarial attacks on the state of art image segmentation algorithm which uses dilated residual neural networks
  - Implemented the universal adversarial generation algorithm known as Dense Adversary Generation algorithm to generate examples to fail the segmentation output
  - Achieved an accuracy drop from 68.28 % to 8.06% thus pointing at the loopholes in the state of the art segmentation network
- Oct'16 – **Local Positioning System using WiFi Networks and Deep Learning**,
- May'17 *Supervised Research Exposition under Prof. Srikant Sukumar, Systems & Controls Department, IIT Bombay.*
  - Designed and developed a system to locate a specific ESP8266 device on a *WiFi network of ESP8266*
  - Implemented a *Deep Neural Network* taking as input received signal strength, phase of the signal, path loss exponent of each node in the network and various other network and environment features and predicting distance and angle of the object from the router
  - Implemented multi-array antenna model to estimate angle of the receiver w.r.t the transmitting node
  - Implemented Spatial and Time Diversity to cancel off multipath fading effects
  - Used the Python `multiprocess` module to implement parallel processing so as to combine all subsystems
  - Trained the deep network with a database created using *Computer Vision in MATLAB*
  - Achieved 4 cm accuracy on the scale of 2.16 m
  - Suggested potential applications to manoeuvre a constellation of quadcopters, cars or robots.

Aug 2017 – **Music Information Retrieval and Music Reconstruction from EEG signals**,

Present *Using Music Image Information Retrieval Techniques.*

- Applying beat tracking techniques to extract the tempo from electroencephalography (EEG) recordings using the OpenMIIR Database
- Exploring and testing various learning algorithms especially RNN's and LSTM's to improvise the system
- Implementing cross correlation with basis signals to estimate the notes present in the imagined music by the subject
- Designing an LSTM model to reconstruct perceived and imagined music

Oct'16 – **Imaging Sun at Microwave and Radio Frequencies,**

May'17 *Research Project with Prof. Raghunath Shevgaonkar, Electrical Engineering, IIT Bombay.*

- Analyzed the propagation of *Electromagnetic Waves* in the plasma environment in the *solar corona* and obtained trajectory of rays in the Coronal atmosphere
- Obtained an analytical expression for brightness temperature using *Radiative Transfer Theory* and thus obtained a temperature image of the sun

Apr'16 – **Modelling High Electron Mobility Transistors with Parasitic Capacitance,**

Oct'16 *Research Project with Prof. Dipankar Saha, Electrical Engineering, IIT Bombay.*

- Analysed *fringing effects* to model the resulting parasitic capacitance at scales of  $10^{-12}$
- Modelled the current-voltage characteristics of *high frequency transistors* to emphasize the significance of parasitic capacitance in their performance
- Established *techniques to reduce the transistor switching delay* introduced due to parasitic capacitance

### Technical Projects

Apr'17 – **Member of Advitiya**, *Advitiya is the 2nd student satellite of IITB, technically advanced and efficient version of the 1st, Pratham.*

- Critically analyzed Astronomical Image Processing and *Image Compression Algorithms* to decide the optimum algorithm based on parameters like compression ratio and computation time.
- Wrote *Embedded C* code to enable *ISP* programming of on-satellite microcontrollers using a master microcontroller to be able to reprogram and tweak the software while the satellite is in orbit

Jun'16 – Jul'16 **Krushimitra (The Farmer's Friend),**

*Under Technical Projects, Student Technical Activities Body, IIT Bombay.*

- Designed and implemented an easy to use, automatic system with a UI for farmers to decide the *optimal water content* and deliver it to crops.
- We considered various dynamic inputs such as soil moisture content, temperature and static inputs like crop & soil type as well

Apr'16 – Jun'16 **Hand Gesture Controlled Magnetic Levitation,**

*Institute Technical Summer Project under the Electronics Club, IIT Bombay.*

- Designed and implemented an electromagnetic system for *magnetic levitation* of magnetic object
- Implemented *PID* stabilization algorithm using Arduino microcontroller board.

May 16 – Jun 16 **Intervehicular Communication System**, *Project with the Innovation Cell, IIT Bombay.*

- Implemented a server-client model to manage traffic and prevent accidents
- Created a *wireless network* of Arduino microcontrollers using modules communicating over *amplitude-shift keying*

### Hobby Projects

Nov'16 **Automatic Reminder & Event Managing System.**

- Used *Google Calendar API* and *Google Speech Recognition API* to create events and set reminders from the Linux terminal and voice commands

Oct'16 **Wireless Headphones.**

- Converted my wired headphones to wireless using WiFi device ESP8266 using *socket programming*

Dec'16 **Clustering of Sales Data.**

- Explored and implemented several clustering algorithms on sales data of retail store all over the world to analyze the progress

Oct'16 **LiFi.**

- Built a visible light-based communication system to exchange text, audio and image data between 2 embedded systems and even computers

Nov'15 **Autonomous object locating & gripping robot.**

- Built an autonomous robot which locates and grips objects around it and dumps them to a predefined position
- Used ultrasonic sensors and infrared sensors along with Arduino Microcontroller to develop the bot

## Position of Responsibility

2016–2017 **Convener**, *Electronics Club, IIT Bombay*.

- Organized and mentored students in various institute-wide competitions, hackathons and workshops for 200+ participants
- Conducted sessions on topics like memristors, MEMS technology, basics of *Embedded programming*

## Technical Strengths

### Technical Skills

Languages	Python, C/C++, Embedded-C, MATLAB, Verilog, HTML, $\text{\LaTeX}$
Software Modules	TensorFlow, OpenCV, NumPy, SciPy and Matplotlib, GNUPlot, Scikit-Learn, Git, Vim, Altera Quartus, Altera ModelSim, GIMP
Hardware	Common Microprocessors, ARM processors, CPLDs and FPGAs, Embedded Platforms

### Key Courses Undertaken

#### Electrical Engineering

Digital Communication\*  
Digital Signal Processing<sup>+</sup>\*  
Microprocessors<sup>+</sup>\*  
Electromagnetic Waves\*

Electronics Design Lab\*  
Signals & Systems  
Data Analysis  
Network Analysis

#### Other

Digital Image Processing\*  
Mathematical Structures for  
Systems & Control  
Computer Programming<sup>+</sup>  
Complex Analysis

<sup>+</sup> accompanied by lab, \* to be finished by May'18.

## Extra-curricular activities

Institute Events	Awarded 1 <sup>st</sup> Prize by electrical engineering Department for designing best circuit to count the number of customers in queue
Volunteering	Conducted workshops on the Arduino microcontroller board and taught students from educationally backward areas in Mumbai the techniques of programming it
Coding	Participated regularly in <i>coding and electronics hackathons</i> and <i>workshops</i> organized in IIT Bombay
Interests	Like to read <i>novels</i> , traveling, love <i>gardening</i> and I am proud of the garden I have cultivated in front of my hostel room