Publications

- Pranav Sankhe, *An Information Theoretical Approach Towards the Reconstruction of Tempo from EEG Responses.* Accepted at **CogMIR 2019**. *Awarded the Best Paper Award*
- Pranav Sankhe, Animesh Kumar *Cortical Representations of Auditory Perception using Graph Independent Component Analysis on EEG.* Accepted at **AESOP 2019**.
- Sankhe, P., Azim, S., Goyal, S., Et al., *Indoor Positioning System using LSTMs over WLAN Network.* Submitted to **IEEE WPNC 2019.**
- Agrim Gupta, Pranav Sankhe, Et al., *Predictive Quantization for MIMO-OFDM SVD Precoders using Reservoir Computing Framework.* Submitted to **IEEE Globalcom 2019.**

Patents

- Filed a patent, *"Indoor Positioning System using LSTMs over WLAN Network"*, December 2018, **Indian Patent Office**, Mumbai.

Internships

Honda Research Institute, Saitama, Japan *May'18 – July'18*
Sign Language Translation using Deep LSTM & 3D ResNet Networks
Guide: Dr. Brock Hieke

- Implemented a **Sequence to Sequence Neural Network** to learn Sign Language translation
- Designed the encoder for motion recognition using **3D Convolutional** layers and LSTMs
- Decreased the computation time from 72 to 6 hours by implementing **ResNet** 3D Convolutions
- Used 2 channel **Optical Flow** of the videos as the input for the learning architecture

Arrow AI, A Mumbai based AI Start-Up *Dec'16 – Jan'17*
Developing APIs for commercial applications of *Machine Learning* in *TensorFlow*

- Developed and implemented a demo API for *State Bank of India*, the largest commercial bank of India, to **estimate expected business capital and time** for new clients
- Implemented various ML based APIs like **recommendation system** & **pedestrian tracker**

Research Projects

Indoor Positioning System using LSTMs over WLAN Network
QuarterFinalist of India Innovation Challenge conducted by Texas Instruments *Jan'16 – Aug'18*

- Designed and developed a **self-adaptive** WiFi based system to localize in indoor environments
- Proposed a set-up of stationary WiFi nodes to model the multipath fading and shadowing effects
- Used an **LSTM** network for time series modeling of signal strength values to estimate the location
- Achieved state of the art accuracy of **5.85** cms on a range of **10** m with a confidence interval of **93%** significantly advancing the previous state of the art accuracy of **40**cms

Polyphonic Transcription for Percussive Recordings using Deep CRNNs
Guide: Prof. Preeti Rao, IIT Bombay *Aug'18 - June'19*

- Implemented a two-stream dual objective **Convolutive Recurrent Neural Network** for transcription of recordings to the onsets and tabla *bols* jointly
- CNNs were used to build the acoustic model and Bidirectional LSTMs for sequential modeling
- Achieved state of the art F-measure of **0.97** resulting in a near-perfect transcription system

Information Theory Approach for Music Reconstrution
Guide: Prof. Prasanna Chaporkar, Electrical Engineering, IIT Bombay *Dec'18 - May'19*

- Modeled **auditory cognition** and measurement of EEG as a non-linear communication channel
- Used **Multidimensional Gaussian Mixture Model** & **Mutual Information** to quantify neural information transfer and capacity of the channel
- Established bounds on the input stimuli structure for reconstruction of input stimuli

- Identified coherent cortical regions involved in hearing and music perception tasks
- **Awarded the Best Paper Award at CogMIR 2019**

Predictive Quantization for MIMO-OFDM SVD Precoders using Reservoir Computing
Course Project: Guide: Prof. Manoj. Gopalkrishnan, IIT Bombay *Aug'18 - May'19*

- Estimated Precoding matrices of MIMO wireless channel using feedback from the receiver
- Implemented a **reservoir computing** framework to quantize precoding matrices
- Our approach achieved reduced quantization, lower BER and reduced the power consumption

Cortical representations of Auditory Perception using Graph ICA
Course Project Guide: Prof. Animesh Kumar, IIT Bombay *Aug'18 - June'19*

- Modelled the brain activity data as a Graph structure and applied **Graph Independent Component Analysis** to compute intrinsic subnetworks which underly the cognitive processes
- Identified the auditory perception subnetwork which matched with the literature
- Inferred that the activity of subnetworks increases in exact accordance with the tempo

Tempo Estimation of music recordings from corresponding EEG signals
Course Project Guide: Prof. Gaurav Kasbekar, IIT Bombay *July'17 - Dec'17*

- Applied onset detecting techniques on EEG recordings to extract the tempo of the stimulus.
- Implemented temporgram estimation using autocorrelation method
- Achieved a difference of 1 bpm in the actual tempo and the calculated tempo from the EEG data

Corrupted Speech Processing using Perceptive Models and Spiking Neural Networks
Course Project Guide: Prof. Udayan Ganguly, IIT Bombay *Aug'18 - Dec'18*

- Implemented a Source Separation system using **auditory scene analysis**
- Implemented a 2 layered Spiking Neural Network to separate speech from the background noise
- Synthesized source audio by applying the learned mask on the original audio input

TV Audience evaluation system using Computer Vision and DNNs
Secured 3^{rd} position among the 23 teams from all the 23 IITs in Inter IIT Tech Meet *Dec'18*

- Implemented a computer vision based automatic channel logo detector
- Implemented advertisement recognizer system using the **audio fingerprinting technique**
- Developed an audio-based classifier to identify TV content vs. advertisement

Imaging Sun at Microwave and Radio Frequencies
Guide: Prof. Raghunath Shevgaonkar, Electrical Engineering, IIT Bombay *Oct'16-May'17*

- Obtained trajectory of rays in the solar coronal atmosphere in the plasma environment
- Using trajectory of rays and *Radiative Transfer Theory* obtained the solar temperature profile

Member of Advitiya
Advitiya is the 2nd student satellite of IITB *Apr'17-Oct'17*

- Analyzed *Astronomical Image Compression Algorithms* to decide the optimum algorithm
- Implemented *Embedded C* code to enable *ISP* on-satellite programming of microcontrollers

Technical Skills & Courses

Programming Python, C/C++, Matlab, NumPy, SciPy and Matplotlib, TensorFlow, Scikit-learn, OpenCV, HTML/CSS, LaTeX

Hardware *Microprocessors:* 8051, 8085, AVR and PIC and CPLDs, *Embedded Platforms:* Arduino, Raspberry Pi

Key Courses Introduction to Machine Learning, First Course in Optimization, Estimation & Identification, Advanced & Recent Topics in Signal Processing, Fundamentals of Digital Image Processing, Speech Processing, Matrix Computations, Movement Neuroscience

Extra-curricular activities

- Convener of Institute Electronics Club; Organized 15+ Events
- Conducted 3 month long programming workshops for underprivileged kids
- I also enjoy classic rock and classical music, along with people who share my interests.