SAQIB AZIM

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Education

Indian Institute of Technology Bombay, *Mumbai, India* July '15 - July '19
Bachelor of Technology, Department of Electrical Engineering

- **GPA**: 8.37/10
- **Minor Degree**: Computer Science and Engineering

Patent Filed

- Pranav Sankhe, **Saqib Azim** and Sachin Goyal
  Indoor positioning system for position estimation in an indoor environment
  Filed a patent at the Indian Patent Office with Application No 201821047043

Research Internships & Projects

Airwriting Handwriting Recognition using Smartwatch Summer 2018
Dr. Shankar Venkatesan, Advanced Technology Lab *Samsung Research Institute Bangalore*

· Developed an end-to-end Airwriting Handwriting Recognition system using samsung smartwatch
· Employed frequency based filtering techniques (spectral subtraction, butterworth filter, etc,) followed by adaptive threshold algorithm to improve signal-to-noise ratio and mitigate integration-drift effect
· Developed the entire procedure for creation of dataset using Vacom Tablet. Trained an SVM on the created dataset for classification of sensor signals into handwriting and non-handwriting segments
· Implemented an LSTM-based network for furthur recognition of handwritten segments and achieved an accuracy of 87% for recognition of english alphabets

Indoor Positioning System over WLAN Network January '17 - December '17
Prof. Sukumar Srikant, Supervised Research Exposition *Electrical Engineering, IIT Bombay*

· QuarterFinalist of India Innovation Challenge conducted by DST & Texas Instruments
· Designed and developed a self-adaptive WiFi based system to locate a WiFi node in indoor environment
· Proposed a set-up of stationary WiFi nodes to model the multipath fading effects and shadowing effects
· Used an LSTM network for time series modeling of received signal strength values to estimate distance of target object from the reference node
· Achieved an accuracy of 5.85 cm with a confidence interval of around 93%

Zero Shot Learning (ZSL) for Object Recognition Summer 2017
Prof. Subhasis Chaudhury, Vision & Image Processing Lab *Electrical Engineering, IIT Bombay*

· Implemented a semi-supervised VGG16 based model (in tensorflow) to predict labels of classes unseen during training by transferring information from seen to unseen classes.
· Investigated and provided a solution to the projection domain shift problem in ZSL
· Improved accuracy from 58.7% to 65.3% on AwA (benchmark dataset) unseen classes using Deep Visual-Semantic Embedding Model

Shepherding of multiagent system with optimal pursuer trajectory July '18 - Present
Final Year Project under Prof. Debraj Chakraborty *Electrical Engineering, IIT Bombay*

- Working towards minimizing the path length of pursuer during aggregation and driving stages of shepherding of multiple evaders with puruser-evader and evader-evader interaction force
- Analyzed the trajectories of pursuer and evaders with only pursuer-evader repulsive interaction for driving evaders to predefined fixed destination
- Proposed a novel controller for the aggregation of multiple evaders and demonstrated the optimal pursuer trajectory validated by extensive simulations

Scholastic Achievements

- Ranked among the top 0.68% candidates in JEE Advanced out of 150,000 candidates [2015]
- Ranked among the top 0.15% candidates in JEE Mains among 1.4 million candidates [2015]
- **Bronze Medal (3rd out of 23 participating teams)** in the TV Audience Measurement Challenge at the 7th Inter IIT Technical Meet, IIT Bombay [2018]

Miscellaneous Projects

Image Registration using FFT (Selected in Top 5/40 projects) January '18 - April '18
Digital Signal Processing under Prof. Vikram Gadre *Electrical Engineering, IIT Bombay*

- Built a FFT based tool for registering and mosaicing images captured from different view-points and scales. Used phase correlation in log polar coordinates for rotational alignment and impulse location for translation alignment. Achieved better results than SIFT based alignment in case of aerial and satellite images. Presented this project at MHRD-TEQIP-KITE Resource Creation Workshop under the initiative of MHRD, Govt. of India

TV Audience Measurement December '18
Inter-IIT Technical Meet *IIT Bombay*

- Proposed scalable and robust solutions for various challenges put forward by BARC India such as channel identification, advertisement and content classification followed by advertisement and content recognition, age and gender recognition of viewers and providing hardware free solution in order to capture TV viewership data of the country

Simultaneous sensing & sparsifying dictionary optimization February '18 - April '18
Advanced Image Processing under Prof. Ajit Rajwade *Computer Science & Engineering, IIT Bombay*

- Implemented a framework for joint design and optimization of sensing matrix and non-parametric dictionary. Improved reconstruction accuracy on image patches using Coupled K-SVD and OMP Algorithm compared to using gaussian sensing matrix and overcomplete dictionary learned using KSVD

Photoplethysmogram (PPG) Signal Acquisition Module January '18 - April '18
Electronics Design Lab under Prof. Prem C Pandey *Electrical Engineering, IIT Bombay*

- Developed a hardware module for faithful acquisition of PPG signal with low noise and minimal filtering. Implemented baseline restoration and Auto-LED intensity control to account for varying skin color, shapes & pressure. Provided bluetooth based connectivity to display the acquired PPG signal on smartphone and laptop

Music Information Retrieval from EEG signals September '17 - November '17
Probability & Random Processes under Prof. Gaurav Kasbekar *Electrical Engineering, IIT Bombay*

- Applied onset detection techniques on EEG recordings to extract tempo of the corresponding stimulus. Implemented tempogram estimation using autocorrelation technique assuming EEG as the novelty curve. Achieved a difference of 1 bpm in actual tempo and calculated tempo from the EEG data

Pipelined Reduced Instruction Set Computer August '17 - November '17
Microprocessors under Prof. Virendra Singh *Electrical Engineering, IIT Bombay*

· Designed and implemented a 6-stage pipelined multicycle RISC processor in VHDL, consisting of arithmetic, logical and branching instructions, and tested on DE0-Nano FPGA board. Implemented the NMRU scheme and developed fully associative cache, flushing, data-forwarding, etc. to maximize the theoretical throughput of the processor.

Driverless Car (SeDriCa) September '17 - March '18
Mahindra Rise Driverless Car Challenge *Innovation Cell, IIT Bombay*

· Studied the problem of shadow effect and lighting conditions on roads, lanes and provided solution using image processing based techniques. Developed proof-of-concept with Neural Network trained on Indian Road Dataset (created by our team of 10 students) for road and obstacle classification

Hand Gesture Recognition System May '16 - June '16
Institute Technical Summer Project *Electronics Club, IIT Bombay*

· Built hand gloves for transliterating Sign Language (hand gestures in ASL) into text and speech in order to help differently abled people communicate. Developed an android app using java based android studio to interpret the sensor signal and convert it to speech

Open Source Contribution December '16 - April '17
Kivy, Kivent

· Contributed to several open source projects for Kivy. Merged 9 pull request (PR) to Kivy and 2 PR to Kivent. Introduced a new feature in Kivent to get tile index given the pixel values for orthogonal, isometric, staggered isometric and hexagonal game maps by analyzing their geometrical construction

Relevant Courses

- **Electrical Engineering** - Probability & Random Processes, Data Analysis & Interpretation, Estimation & Identification, Image Processing, Control Systems, Digital Signal Processing, R&D Project[1], Digital & Analog Communication, Microprocessors.
- **Computer Science & Engineering** - Advanced Machine Learning[1], Computer Vision[1], Advanced Image Processing, Introduction to Machine Learning, Data Structures & Algorithms, Operating Systems, Computer Networks.
- **Miscellaneous** - Optimization Techniques, Multivariable & Vector Calculus, Linear Algebra, Differential Equations I & II, Complex Analysis.

Technical Skills

- **Experienced** - Python, C/C++, MATLAB, VHDL, Arduino
- **Familiar** - Java (Android), Javascript, Assembly, Scilab, Spice, AutoCAD
- **Tools** - TensorFlow, OpenCV, Git, Quartus, Wireshark, GNU Radio, Eagle, LaTeX

Mentoring & Outreach

Teaching Assistant
EE 210 (Signals and Systems) Prof. Jayakrishnan Nair Spring 2019

[1]Course taken in Spring 2019

- Mentored 2 freshmen teams in XLR8 '16 in building their obstacle avoiding remote-controlled bots. Helped a freshmen team during ITSP '17 w.r.t the ideation and implementation of their project.
- Completed **one** year teaching Maths and Science to NGO students as a Volunteer of Educational Outreach under **National Service Scheme**, IIT Bombay [2015-16]
- Presented Indoor Positioning System at **Tech & Rnd Exposition**, IIT Bombay [2017]

References

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Electrical Engineering, IIT Bombay
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