SAQIB AZIM

Email: azimsaqib10@gmail.com ◇ Homepage: saqib1707.github.io ◇ Github: github.com/saqib1707

Education

Indian Institute of Technology Bombay, *Mumbai, India* Jul '15 - Jun '19
B.Tech in Electrical Engineering, Minor in Computer Science

- **Award :** Undergraduate Research Award (URA 01) *(for excellent research contribution)* [2019]

Work Experience

Hitachi Central Research Lab, *Tokyo, Japan* Oct '19 - Present
Assistant Researcher in the Intelligent Vision Research Group advised by Dr. Katsuyuki Nakamura

Samsung Research Institute, *Bengaluru, India* May '18 - Jul '18
Summer Internship in the Advanced Technology Lab working under Dr. Shankar Venkatesan

Research Interests

Theoretical and Applied aspects of Machine Learning, Deep Learning, Optimization, Statistics, Computer Vision, Robotics, Signal and Image Processing

Patent & Publication

- **Indoor Distance Estimation using LSTMs over WLAN Network** [**arXiv**/**paper**]
  IEEE Workshop on Positioning, Navigation and Communications (WPNC), 2019
  P. Sankhe, **S. Azim**, S. Goyal, T. Choudhary, K. Appaiah and S. Srikant
- **Indoor Positioning System for position estimation in an indoor environment**
  Indian Patent Application - 201821047043, *filed Dec '18 (pending)*
  P. Sankhe, **S. Azim** and S. Goyal

Research Experience [1]

Handwritten Character Recognition using Smartwatch Summer Internship '18
Advisor: Dr. Shankar Venkatesan ***Samsung Research Institute***

· Prototyped a handwritten text recognizer by estimating wrist movements using smartwatch IMU sensors
· Employed learned frequency filters followed by adaptive thresholding to improve raw signal SNR
· Learned the relationship between hand movements (IMU signals) and character patterns using a pipelined SVM classifier (detecting valid IMU segments), and an LSTM (for character recognition) network
· Trained the end-to-end system on a custom-created dataset and achieved 87% recognition accuracy

Indoor Positioning System over WLAN Network [paper] Jan '17 - Dec '18
Advisors: Prof. Kumar Appaiah & Prof. Sukumar Srikant *IIT Bombay*

· Quarter-Finalist of India Innovation Challenge conducted by DST & Texas Instruments
· Developed a self-adaptive system to locate a wireless device in indoor areas using wireless networks
· Proposed a stationary wireless device setup to model the multipath fading and shadowing effects
· Used windowed-LSTM for time-series modeling of wireless received signal strengths recorded throughout device's trajectory to estimate the distance of target device from reference point
· Achieved state-of-the-art accuracy of 5 cms (on scale of 10 m) with 93% confidence interval, significantly advancing the previous state of art accuracy of 40 cms

[1] *Excluding research work conducted at Hitachi Research due to information security protocols*

Optimal Pursuer-Evader Shepherding Problem [report] Aug '18 - Jul '19
Advisor: Prof. Debraj Chakraborty *IIT Bombay*

- Defined a novel pursuer-evader problem of estimating optimal pursuer strategy for driving a multi-evader system to destination using inter-agent interactions, and formulated as a constrained optimization task
- Generated optimal trajectories and introduced dipole analogy to find pursuer control algorithm
- Proposed to learn the optimal trajectory patterns (generated with optimization solvers) using time-series based LSTM module, producing promising results for various initial conditions

Zero-Shot Learning (ZSL) for Object Recognition May '17 - Nov '17
Advisor: Prof. Subhasis Chaudhuri *VIP Lab, IIT Bombay*

- Proposed a semi-supervised VGG16-based encoder-decoder network to learn visual-to-semantic space mapping using novel combination of margin-based hinge-rank loss and Word2Vec embeddings
- Explored multiple networks for better visual feature representations. Achieved improvement in recognition performance from 58.7% to 65.3% on the Animals with Attributes dataset over existing methods

Miscellaneous Projects

Image Registration using FFT (*Selected in top* 5/40 *projects*) Jan '18 - Apr '18
Advisor: Prof. Vikram Gadre, Digital Signal Processing *EE, IIT Bombay*

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

TV Audience Measurement Winter '18
Bronze Medal (3rd/23 teams), *7^{th} 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 and recognition, age and gender recognition of viewers and providing hardware free solution in order to capture TV viewership data of the country. Helped IIT Bombay achieve overall Runner-up (2^{nd}/23 IITs) at the event

Simultaneous sensing & sparsifying dictionary optimization Feb '18 - Apr '18
Advisor: Prof. Ajit Rajwade, Advanced Image Processing *CSE, IIT Bombay*

- Implemented a compressed sensing framework for joint design and optimization of sensing matrix and non-parametric dictionary. Used coupled K-SVD and OMP algorithm on image patches to improve reconstruction accuracy compared to standard gaussian sensing matrix and over-complete dictionary

Photoplethysmogram (PPG) Signal Acquisition Module [report] Jan '18 - Apr '18
Advisor: Prof. P C Pandey, Electronics Design Lab *EE, IIT Bombay*

- Developed a hardware module for faithful PPG signal acquisition with low noise and minimal filtering. Implemented baseline restoration and auto-LED intensity control for varying skin color & shape. Provided bluetooth connectivity to display the acquired PPG signal on mobile devices

Music Information Retrieval from EEG signals Sep '17 - Nov '17
Advisor: Prof. Gaurav Kasbekar *EE, 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 Aug '17 - Nov '17
Advisor: Prof. Virendra Singh, Microprocessors *EE, IIT Bombay*

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

Autonomous Self-Driving Car Sep '17 - Mar '18
Mahindra Rise Driverless Car Challenge ***Innovation Cell**, IIT Bombay*

· Studied the effect of shadows and varying lighting conditions for road, lane and zebra-crossing detection. Provided solution using image processing techniques. Developed proof-of-concept with YOLO network trained on our custom-created Indian Road Dataset for detection of roads, obstacles, person, etc.

Achievements

- Among top 0.75% *(out of 150000)* candidates in JEE Advanced '15
- Ranked among top 0.15% *(out of 1.5 million)* candidates in JEE Main '15
- Awarded financial scholarship from Educational Co-ordination Committee for outstanding performance in 10th Grade Exam [2012]
- Received **academic excellence** award from Humayun Kabir Institute in 2012

Extra-Curricular

- **Undergraduate Teaching Assistant** at IIT Bombay in *Signals and Systems* Spring '19
  - Evaluation and grading of papers, assignments for 140 students; Helped students with basic concepts
- **Teaching Volunteer**, Educational Outreach, *National Service Scheme IITB* [2015-16]
  - Completed one year teaching Maths and Science to underprivileged secondary school students
- **Mentor**, *Summer of Science '19 & '20*, IIT Bombay (4 undergraduates, 2 Masters students)
- **Mentor**, *Institute Technical Summer Project '17*, IIT Bombay (guided 2 UG student teams)
- **Open Source** - Actively contributed to Kivy, Kivent [2016-17]
- **Web Coordinator** - Mood Indigo '16, IIT Bombay
  - Contributed to the development of Mood Indigo (Asia's largest college cultural festival) website

Relevant Courses & Skills

- **Computer Science** - Advanced Machine Learning, Computer Vision, Advanced Image Processing, Data Structures & Algorithms, Operating Systems, Computer Networks, Optimization Techniques
- **Electrical Engineering** - Estimation and Identification, Probability and Random Processes, Data Analysis, Control Systems, Signal Processing, Digital & Analog Communication, Microprocessors
- **Programming** - Python, C/C++, MATLAB, Java (Android), HTML/CSS, Assembly, LaTeX
- **Softwares Tools** - OpenCV, Tensorflow, Pytorch, Numpy, Git, Docker, Scilab, VHDL, Wireshark, GNU Radio, Quartus, Arduino

References

Subhasis Chaudhuri
Director, IIT Bombay
Professor, EE Dept, IIT Bombay
webpage ◇ *email*

Debraj Chakraborty
Associate Professor
EE Dept, IIT Bombay
webpage ◇ *email*

Kumar Appaiah
Assistant Professor
EE Dept, IIT Bombay
webpage ◇ *email*