SAQIB AZIM

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Education

University of California San Diego Sep '21 - Jul '23
MS in Electrical and Computer Engineering

Indian Institute of Technology Bombay, *Mumbai, India* Jul '15 - Jun '19
B.Tech: Electrical Engineering (major), Computer Science (minor)

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

Research Interests

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

Patent & Publication

- **Localization in Dynamic Environments with Targeted-Inference based SLAM**
  Japan Patent Application, filed Aug '21 (pending)
  S. Azim, T. Nito and K. Nakamura
- **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, filed Dec '18 (pending)
  P. Sankhe, **S. Azim** and S. Goyal

Work Experience

Hitachi, Ltd. Research and Development Group Oct '19 - Sep '21
Assistant Researcher, Intelligent Vision Research Group, Hitachi Central Research Lab *Tokyo, Japan*

Undisclosed

Samsung Research Institute May '18 - Jul '18
Research Intern, Advanced Technology Lab *Bengaluru, India*

· Worked with Dr. S Venkatesan to develop a handwritten text recognizer by estimating wrist movements using smartwatch IMU sensors. Improved signal-to-noise ratio using frequency filters and learned the relation between hand movements and character patterns using a pipelined SVM and LSTM network. Collected dataset of 50 people, and trained the end-to-end system achieving 87% recognition accuracy.

Relevant Courses & Skills

- **Graduate** - Statistical Learning, Deep Generative Models, Search and Optimization, Mathematics for Robotics
- **Undergraduate** - Advanced Machine Learning, Computer Vision, Advanced Image Processing, Data Structures & Algorithms, Optimization Techniques, Estimation and Identification, Probability and Random Processes, Data Analysis, Control Systems, Signal Processing
- **Programming** - Python, C/C++, MATLAB, Java (Android), HTML/CSS, Assembly, LaTeX
- **Softwares** - OpenCV, Tensorflow, Pytorch, Git, Docker, Android, Unity, Scilab, VHDL, Quartus, Arduino

Research Experience

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

- Designed and prototyped a SOTA self-adaptive system to locate an object with high accuracy ($\leq$ 10 cm) in indoor environments. Proposed a setup of stationary signal receivers to account for indoor topology and signal attenuation effects. Used a LSTM to estimate the relation between strength of received wireless signals and the distance from a wireless access point. Further, designed a bot traversing a predetermined path for training data collection. Presented at India Innovation Challenge '18 (Quarter-Finalist), Hitachi AI Conference '20.

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

- Defined a novel pursuer-evader problem of estimating an optimal control algorithm for driving a multi-evader system to destination using inter-agent interactions, and formulated as a constrained optimization task. Proposed an LSTM module to learn the time-series trajectories, generating optimal 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-semantic mapping using novel combination of hinge-rank loss and Word2Vec embeddings. Explored multiple networks for robust visual feature representations. Achieved ZSL performance improvement from 58.7% to 65.3% on the AwA dataset.

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 FFT-based tool for registering and mosaicing images captured from different viewpoints using rotation and translation alignment methods. Achieved better results than SIFT-based alignment for aerial images. Presented at TEQIP (KITE) Resource Creation Workshop under MHRD, Govt. of India Initiative.

TV Audience Measurement Winter '18
***Bronze Medal (3rd/23 teams)**, 7th Inter-IIT Technical Meet* *IIT Bombay*

- Proposed robust solutions for various challenges put forward by BARC India such as channel identification, TV ads+content recognition, viewers' age and gender recognition, providing hardware free solution to capture TV viewership data of India. 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 using coupled-KSVD and OMP algorithm for joint design and optimization of sensing matrix and non-parametric dictionary. Improved reconstruction accuracy compared to standard approach which uses gaussian sensing matrix and overcomplete dictionary learned using KSVD.

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

- Designed and developed a hardware module for faithful PPG signal acquisition with low noise and minimal filtering. Implemented baseline restoration and auto-intensity control for varying skin attributes (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 1 bpm difference 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 - Team Member Sep '17 - Mar '18
Mahindra Rise Driverless Car Challenge ***Innovation Cell**, IIT Bombay*

· Studied the effect of shadows and varying lighting conditions on roads and provided low-computation solution using image processing techniques. Collected and prepared custom-dataset of Mumbai roads and learned to detect roads, obstacles, zebra-crossing, etc. with YOLO-based network.

Achievements & Extra-Curricular

- Ranked 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 and **academic excellence** award from Humayun Kabir Institute for outstanding performance in 10th Grade Exam [2012]
- **Graduate Teaching Assistant** at UC San Diego in *Linear Systems Fundamentals* Winter '22
- **Undergraduate Teaching Assistant** at IIT Bombay in *Signals and Systems* Spring '19
  - Responsible for assisting Prof. J K Nair in evaluation and grading of papers + assignments for 140 students
- **Teaching Member**, 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 (guided 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 Mood Indigo website development