

# SAQIB AZIM

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## EDUCATION

**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

- **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

## WORK EXPERIENCE

**Hitachi, Ltd. Research and Development Group**

Oct '19 - Present

*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

- **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, Android Studio, Unity Engine, Scilab, VHDL, Wireshark, GNU Radio, Quartus, Arduino

## RESEARCH EXPERIENCE

**Indoor 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** (3<sup>rd</sup>/23 teams), 7<sup>th</sup> 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<sup>nd</sup>/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

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- 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]
- **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

## REFERENCES

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Available on request