SAQIB AZIM

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EDUCATION

Indian Institute of Technology Bombay, *Mumbai, India*   Jul '15 - Jun '19
Bachelor of Technology
- **CPI**   : 8.46/10
- **Major** : Electrical Engineering
- **Minor** : Computer Science and Engineering
- **Award** : Undergraduate Research Award (URA 01) *(for excellent research contribution)*   [2019]

PATENT & PUBLICATION

- **Indoor Distance Estimation using LSTMs over WLAN Network**
  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
  P. Sankhe, **S. Azim** and S. Goyal

WORK EXPERIENCE

Human Navigation Support using Visual-Inertial SLAM   Feb '20 - Present
Artificial Intelligence Lab   *Hitachi Central Research Lab, Tokyo*

· Developed a robust and reliable human navigation support system in unfamiliar dynamic real-world environments using visual-inertial SLAM and deep-learning based object detection
· Implemented feature-based SLAM algorithm performing device tracking, 3D mapping
· Integrated a system for moving object detection into the visual-SLAM pipeline to mitigate inaccuracies from dynamic scenes, and demonstrated performance improvement on public datasets
· Built a smartphone application for real-time device localization in a pre-built 3D map

Risky Activity Detection in Factories   Oct '19 - Jan '20
Artificial Intelligence Lab   *Hitachi Central Research Lab, Tokyo*

· Developed method for quantitative risk estimation of human workers in factory environment based on positional relationship between a person and dangerous heavy objects
· Implemented camera-based system to estimate position of human and dangerous objects in factories
· Established proof-of-concept for the successful working of this technology at a Japanese Factory
· Presented this research technology at Hitachi Image Processing Research (IPR) Symposium 2020

RESEARCH INTERNSHIPS & PROJECTS

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

· Prototyped an end-to-end IMU-based handwritten character recognition system using a smartwatch
· Employed frequency-based filters followed by adaptive thresholding to improve raw signal SNR
· Learned the mapping between IMU signals and character pattern using an SVM classifier to detect valid handwritten character patterns, which were fed to an LSTM model for recognition
· Achieved 87% accuracy for english alphabet recognition on a custom-made dataset

Indoor Positioning System over WLAN Network Jan '17 - Dec '17

Prof. Sukumar Srikant, Supervised Research Exposition *Electrical Engineering, IIT Bombay*

· QuarterFinalist of India Innovation Challenge conducted by DST & Texas Instruments
· Developed a self-adaptive WiFi based system to locate a target wireless node in indoor environment
· Proposed stationary WiFi reference nodes setup to model the shadowing and multipath fading effects
· Used an LSTM network for time-series modeling of signal strength received at all nodes to estimate target object distance from the reference node
· Demonstrated superior performance of our approach compared to CNN and FCN based network by achieving mean localization error of 5.85 cm with 93% confidence on a scale of (8.46 x 6.98) m

Optimal Pursuer-Evader Shepherding Problem Aug '18 - Apr '19

Undergraduate Thesis under Prof. Debraj Chakraborty *Electrical Engineering, IIT Bombay*

· Defined a novel pursuer-evader problem involving aggregation of multi-evader system to a destination using pursuer-evader, evader-evader interaction, and simultaneously optimizing pursuer trajectory
· Formulated the task as constrained optimization problem and generated optimal solutions
· Proposed to learn the optimal trajectory patterns (generated with optimization solvers) using time-series based LSTM module, producing promising results for various initial pursuer-evader positions

Zero-Shot Learning (ZSL) for Object Recognition [Github] May '17 - Nov '17

Prof. Subhasis Chaudhury, Vision & Image Processing Lab *Electrical Engineering, IIT Bombay*

· Proposed a semi-supervised VGG16-based encoder-decoder network to learn the mapping from visual-to-semantic space, and predict unseen class instance labels
· Improved recognition performance from 58.7% to 65.3% on the Animals with Attributes dataset over existing methods with effective use of hinge-rank loss, hyperparameter tuning, and combining human-annotated and Word2Vec embeddings as semantic information

Mentoring & Responsibilities

- **Teaching Assistant** at IIT Bombay in *Signals and Systems* Spring 2019
  - Responsible for evaluating and helping students with basic concepts of signals and systems

- **Teaching Volunteer**, *National Service Scheme, IITB* [2015-16]
  - Completed one year teaching Maths and Science to secondary school students

- **Mentored** four UGs, two Masters' IITB students on their *Summer of Science* projects (Summer 2019 & 20), and guided two freshmen group in *Institute Technical Summer Project* (Summer 2017)

- **Web Coordinator** for Mood Indigo 2017 at IIT Bombay

Relevant Courses

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

Technical Skills

- **Advanced** - Python, C++, MATLAB, Java (Android), Git, Docker, OpenCV, LaTeX

- **Intermediate** - Assembly, Scilab, AutoCAD, VHDL, Arduino, Quartus, Wireshark, GNU Radio

Miscellaneous Projects

Image Registration using FFT (*Selected in Top 5/40 projects*)   Jan '18 - Apr '18
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 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 2018
Bronze Medal (3rd/23 teams), *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

Simultaneous sensing & sparsifying dictionary optimization   Feb '18 - Apr '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

Music Information Retrieval from EEG signals   Sep '17 - Nov '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   Aug '17 - Nov '17
Microprocessors under Prof. Virendra Singh   *Electrical Engineering, 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.

Driverless Car (SeDriCa)   Sep '17 - Mar '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

Open Source Contribution   Dec '16 - Apr '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