

# SAQIB AZIM

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## EDUCATION

### University of California San Diego

Sep '21 - Aug '23

Master of Science (MS) in *Electrical and Computer Engineering*, GPA : 3.92 / 4.0

Advisor : [Prof. Nikolay Atanasov](#)

### Indian Institute of Technology Bombay

Jul '15 - Jun '19

Bachelor of Technology (B.Tech) in *Electrical Engineering* with Minor in *Computer Science*

Advisor : [Prof. Debraj Chakraborty](#)

**Undergraduate Research Award** (*for excellent research contribution*)

[2019]

## RESEARCH INTERESTS

Machine Learning, Computer Vision, Robotics, Reinforcement Learning

## PATENT & PUBLICATION

### • Visual Localization in Dynamic Environments with Targeted-Inference SLAM

[[report](#)]

[Saqib Azim](#), Takumi Nito and Katsuyuki Nakamura

*Japan Patent Application, filed Aug '21 (pending)*

### • Indoor Distance Estimation using LSTMs over WLAN Network

[[arXiv/paper](#)]

Pranav Sankhe, [Saqib Azim](#), Sachin Goyal, Tanya Choudhary, Kumar Appaiah and Sukumar Srikant

*In IEEE Workshop on Positioning, Navigation and Communications (WPNC 2019)*

*India Patent Application, filed Dec '18 (pending)*

## INDUSTRY EXPERIENCE

### HITACHI, LTD. R&D GROUP

Oct '19 - Sep '21

*Assistant Researcher, Intelligent Vision Research Group*

*Tokyo, Japan*

- Developed a **Visual Localization and Navigation** system using **SLAM** and deep learning for dynamic environments.
- Implemented ORB-keypoint based camera pose estimation, keyframe-based 3D mapping, trajectory optimization and loop detection and closure in **C++**.
- Engineered a novel time-efficient targeted inference **semantic segmentation** network to efficiently detect dynamic scenes which **reduces computation time by 5x** leading to patent submission in Japan.
- Achieved **47% reduction** in localization error in dynamic environments over real-time state-of-the-art methods.
- Developed an **Android App** (in **Java** and **C++**) to deploy the **deep-learning localization** system on smartphones leading to significant product impact.
- Created visual hazardous activity detection system using **Mask RCNN segmentation** and depth estimation. Successfully demonstrated a prototype at a Railway Factory.
- Implemented an interactive game in **Unity3D** graphics engine to generate synthetic data for deep learning training.
- Trained an end-to-end **MobileNet SSD** and **UNet** model to semantically segment hands using egocentric images, perform gesture classification, and identify hand-pointed objects with **94%** accuracy.

### SAMSUNG R&D INSTITUTE

May '18 - Jul '18

*Machine Learning Intern, Advanced Technology Lab*

*Bengaluru, India*

- Prototyped a **handwritten text recognition** system by estimating wrist movements using Samsung smartwatch sensors.
- Improved raw IMU signal-to-noise ratio using adaptive filters and devised an automated data-collection framework.
- Trained a pipelined **SVM** and **attention-LSTM** model to learn the relation between hand movement and character patterns, and achieved **93%** text recognition accuracy.

## TECHNICAL SKILLS

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- **Programming** - Python, C & C++, MATLAB, Bash, Java, HTML, CSS
- **Frameworks** - TensorFlow, PyTorch, Scikit-Learn, NumPy, Matplotlib, Scipy, Pandas, CUDA, OpenCV, MLOps
- **Tools** - Git, Github, Docker, Android Studio, Google Colab, Jupyter, Kubernetes, Unity, Linux, ROS, Arduino
- **DL Models** - MLP, CNN, RNN, LSTM, Transformer, VAE, GAN, Diffusion models, ResNets, LLMs

## SELECTED COURSES

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- Deep Generative Models
- Deep Learning for 3D Data
- Advanced Machine Learning
- Deep Reinforcement Learning
- Statistical Learning
- Computer Vision
- Advanced Computer Vision
- Sensing and Estimation in Robotics
- Maths for Robotics
- Convex Optimization and Applications
- Parameter Estimation
- Advanced Image Processing
- Statistical Signal Processing
- Linear Algebra and Applications
- Data Structures and Algorithms

## SELECTED PROJECTS

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### Robot Manipulation using Deep Reinforcement Learning

Graduate Student Researcher at [Existential Robotics Lab](#)

Dec '22 - Jun '23

UC San Diego

- Developing and improving deep RL models for wide-range of dexterous manipulation tasks.
- Employed **Soft Actor-Critic** and **Adversarial Imitation learning** algorithms (GAIL, AIRL, VMAIL) to learn optimal task-policy in **Robosuite** and **DeepMind** environments.
- Successfully transferred learned policies to a real-world Panda robot arm (**Sim2Real**) using computer vision algorithms.

### Object Pose Estimation and Neural Radiance Field (NeRF)

Advisor: [Prof. Hao Su](#)

Fall '22

UC San Diego

- Developed a 6D pose estimation pipeline to predict poses of objects in a scene using RGBD images.
- Utilized **PointNet** for object segmentation, followed by 3D point cloud formation, and **Iterative closest point** algorithm for point cloud alignment and to estimate the 6D pose of segmented objects, achieving a **96%** test accuracy.
- Implemented **NeRF** to fit and generate photorealistic views of a scene, described by images and their poses.

### Autonomous Vehicle Localization and Mapping

Advisor: [Prof. Nikolay Atanasov](#)

Winter '23

UC San Diego

- Implemented a **Particle-Filter** SLAM algorithm for robot localization in an unknown environment using encoder and IMU odometry data, and generated a 2D occupancy-grid map using LIDAR measurements.
- Implemented a Visual-Inertial SLAM system for precise pose estimation of an IMU sensor attached to a car using an **Extended kalman filter** (EKF) and estimated 3D landmarks in the environment using stereo camera observations.

### Adversarial Robustness Analysis of Deep Models

Advisor: [Prof. Lily Weng](#)

Apr '22 - Aug '22

UC San Diego

- Utilized attack mechanisms, including FGSM, PGD, Auto-Attack, to generate adversarial examples.
- Developed robust **CLIP**-based classifier against  $l_2$ -norm perturbations using adversarial training and randomized smoothing. Evaluated on CIFAR10 and ImageNet datasets.
- Evaluated the effectiveness of heuristic defense mechanisms in training robust models against powerful attacks.

### Team Member - Autonomous Self-Driving Car

Mahindra Rise Driverless Car Challenge

Aug '17 - Jul '18

[Innovation Cell](#)

- Contributed to developing deep learning algorithms for vision and navigation pipeline of an autonomous driverless car.
- Used path planning algorithms (such as A\*, RRT, PRM) with **ROS** for path planning and navigation.
- Proposed a compute-efficient image processing algorithm to mitigate shadows and varying lighting conditions on roads.
- Managed collection and annotation of a road dataset used to train **YOLO** framework for road and obstacle detection.

## Pursuer-Evader Optimal Trajectory Estimation

Advisor: [Prof. Debraj Chakraborty](#)

Aug '18 - Jul '19

IIT Bombay

- Developed an optimal control algorithm to drive multi-evader agents to destination using novel inter-agent interactions.
- Utilized global iterative solvers to estimate optimal agent trajectories under diverse constrained conditions.
- Learned to accurately predict pursuer-evader trajectories using an LSTM model.

## Enhancing Road-Scene Understanding using Image Inpainting

Advisor: [Prof. Pengtao Xie](#)

Winter '22

UC San Diego

- Combined state-of-the-art semantic segmentation (**DeepLabV3**) model for removing undesired objects along with a Fourier-Convolution inpainting network for missing region completion.
- Trained and evaluated the model on the **CityScapes** dataset, generating superior image quality.

## Zero-Shot Learning (ZSL) for Object Recognition

Advisor: [Prof. Subhasis Chaudhuri](#)

May '17 - Nov '17

[VIP Lab](#), IIT Bombay

- Proposed a semi-supervised VGG16 autoencoder model to learn visual-semantic mapping using Word2Vec features.
- Improved ZSL unseen class performance from 58.7% to 65.3% on Animals with Attributes dataset.

## ACHIEVEMENTS & EXTRA-CURRICULARS

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- Secured rank of 1133 (*out of 1.5 million candidates*) in [IIT-JEE Advanced '15](#) (India's toughest entrance exam).
- Awarded **Bronze Medal (3<sup>rd</sup>/23 teams)** by [BARC India](#) for proposing innovative solutions to [TV Audience Measurement Challenge](#) at the 7th Inter-IIT Technical Meet 2018.
- Actively contributed to **Open Source** platforms such as [Kivy](#) and [KivEnt](#).
- Contributed to the development of [Mood Indigo '16](#) website using HTML, CSS, Javascript at IIT Bombay.

## TEACHING & MENTORSHIP

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- Served as a **Teaching Assistant** for the following five undergraduate and graduate courses at UC San Diego.
  - Probabilistic Modeling and Machine Learning Spring '23
  - Image Processing Winter '23
  - Probability and Statistics for Data Science Fall '22
  - Engineering Probability and Statistics Spring '22
  - Linear Signals and Systems Winter '22
- **Teaching Assistant** at IIT Bombay - Signals and Systems Spring '19
- **Mentor** at [Summer of Science '19 & '20](#), IIT Bombay (guided 4 undergraduates, 2 Masters students)
- **Mentored** two student teams at *Institute Technical Summer Project '17*, IIT Bombay.
- Taught underprivileged kids at LCCWA NGO under IIT Bombay's [Education Outreach program](#). 2015 - 16

## REFERENCES

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### Prof. Subhasis Chaudhuri

Professor of EE Dept.  
Director of IIT Bombay  
sc@ee.iitb.ac.in

### Prof. Nikolay Atanasov

Assistant Professor  
UC San Diego  
natanasov@ucsd.edu

### Dr. Katsuyuki Nakamura

Department Manager  
Hitachi R&D Group  
katsuyuki.nakamura.xv@hitachi.com