SAQIB AZIM

sazim@ucsd.edu ◇ 858-319-6910 ◇ saqib1707.github.io ◇ linkedin.com/in/saqibazim ◇ Bay Area, CA

Interests: Visual Perception, Robot Planning and Learning, Reinforcement Learning, Deep Learning, Generative AI, LLMs

Education

University of California San Diego Sep '21 - Sep '23

- Master of Science (MS) in *Electrical Engineering*, **GPA : 3.92 / 4.0**
- **Courses:** Deep Generative Models, Deep Learning for 3D Data, Deep Reinforcement Learning, Statistical Learning, Advanced Computer Vision, Natural Language Processing, Sensing and Estimation in Robotics, Maths for Robotics, Convex Optimization and Applications, Search and Optimization, Statistical Signal Processing, Linear Algebra

Indian Institute of Technology Bombay Jul '15 - Jun '19

- Bachelor of Technology (B.Tech) in *Electrical Engineering* with Minor in *Computer Science*
- **Undergraduate Research Award** *(for excellent research contribution)* [2019]
- **Courses:** Deep Learning, Advanced Machine Learning, Computer Vision, Advanced Image Processing, Data Structures Algorithms

Technical Skills

- **Programming** - Python, C, C++, MATLAB, Bash, HTML, CSS
- **Frameworks** - PyTorch, TensorFlow, HuggingFace, Scikit-Learn, NumPy, Pandas, OpenCV, CUDA, Docker, Kubernetes, Open3d

Patent & Publication

- **Real-time WildFire Damage Assessment using Aerial Imagery and Deep Learning**
  Saqib Azim, M. Nguyen, D. Crawl, J. Block, F. Hart, M. Campbell, R. Scott, I. Altintas
  Submitted to 2024 IEEE International Conference on Big Data
- **Visual Localization in Dynamic Environments with Targeted-Inference SLAM** [report]
  Saqib Azim, Takumi Nito and Katsuyuki Nakamura
  Japan Patent Application, filed Aug 2021 (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)
  Indian Patent 467255, Granted November 2023

Selected Projects

Robotic Manipulation using Deep Reinforcement Learning Dec '22 - Aug '23
Graduate Student Researcher at Contextual Robotics Institute *UC San Diego*

- Researched Deep RL methods for dexterous manipulation tasks, focusing on real-world robotics applications, addressing challenges in high-dimensional action spaces and continuous control tasks.
- Employed **Soft Actor-Critic** (SAC) and **Adversarial Imitation learning** methods (GAIL, VMAIL) to learn optimal task-policies from expert demonstrations in **Robosuite** and **DeepMind** simulation environments.
- Enhanced agent robustness and task generalization by incorporating multi-view camera inputs, diverse object shapes, and pose data across four challenging manipulation tasks, improving agent's ability to handle real-world variability.
- Transferred learned policies to a Panda robot (**Sim2Real**) using vision algorithms for object detection and pose estimation.

Object Pose Estimation and Neural Radiance Field (NeRF) Fall '22

- 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 **85%** test accuracy.
- Implemented **NeRF** to fit and generate photorealistic views of a scene, described by images and their poses.

Autonomous Vehicle Localization and Mapping Winter '23

- 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.

Robot Path Planning and Optimization Fall '21

- Generated and visualized **configuration space** for a differential-drive robot in a 2D obstructed environment.
- Implemented and optimized path planning algorithms - greedy search, probabilistic roadmaps (**PRM**), rapid exploring random trees (**RRT**) - to estimate shortest and safest paths.
- Performed comparative analysis by contrasting PRM and RRT for efficient robot path planning.

Autonomous Self-Driving Car – Member at Innovation Cell, IIT Bombay Aug '17 - Jul '18

- Contributed to developing deep learning algorithms for vision and navigation pipeline of an autonomous self-driving 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.

Enhancing Road-Scene Understanding using Image Inpainting Winter '22

- Integrated state-of-the-art **DeepLabV3** segmentation model to remove undesired objects, combined with a Fourier-Convolutional Inpainting Network for missing region completion in image restoration tasks.
- Trained, fine-tuned and evaluated the model on the **CityScapes** dataset, generating superior image quality and scene consistency.

Work Experience

San Diego Supercomputer Center, UC San Diego – AI/ML Engineer Nov '23 - Present

- Developed a deep learning pipeline using **Vision Transformers** (ViTs) for real-time wildfire structural damage assessment, integrating multimodal data from aerial images, CalFire damages, and satellite-based building footprints, evaluated across multiple wildfires.
- Designed and deployed a citywide **AI-based Power Outage Prediction System** using weather forecasts and vegetation indices. Optimized feature generation, deep learning model prediction, and real-time inference pipelines, achieving a 10x throughput boost via advanced parallel computing and resource-efficient batch processing.
- Leveraged **LLMs (Llama-3-70B)** for synthetic data generation in information extraction tasks, enabling the fine-tuning of downstream models for enhanced task-specific performance.
- Implemented **GPT-3** 124M, trained on 10B tokens using PyTorch DDP, achieving robust eval results on Hellaswag benchmark.
- Applied ConvLSTM and Video Vision Transformer spatiotemporal models in an autoregressive framework for **Fuel Density Prediction** during prescribed fires. Optimized the models by integrating physics-informed constraints, significantly reducing MSE.
- Awarded the employee **Performance Award** from UCSD in May 2024

Hitachi R&D, Japan – Assistant Researcher, Intelligent Vision Research Group Oct '19 - Sep '21

- Developed a **Visual-Inertial Localization and Navigation** system using **SLAM** and deep learning for dynamic environments.
- Implemented ORB keypoint-based camera pose estimation, keyframe 3D mapping, trajectory optimization, and loop closure in C++.
- Engineered a novel time-efficient targeted inference **semantic segmentation** for dynamic scene detection, integrated it with localization pipeline to **reduce computation time by 5x** leading to **patent** submission in Japan.
- Achieved **47% reduction** in localization error compared to state-of-the-art real-time SLAM methods in dynamic settings.
- Developed and **deployed** the real-time visual navigation system on Android devices leading to significant product impact.
- Created a Visual Hazardous Activity Detection system using **Mask RCNN** segmentation and depth estimation. Successfully demonstrated a prototype at a Railway Factory and presented at the *Hitachi Research Symposium 2020*
- Developed an end-to-end deep learning pipeline using MobileNet SSD for hand detection and U-Net for segmentation from egocentric videos, achieving 94% accuracy in hand-gesture classification and hand-pointed object identification for industrial automation tasks.

Samsung R&D Institute – Machine Learning Intern May '18 - Jul '18

- Prototyped a **handwritten text recognition** system by estimating wrist movements using Samsung smartwatch sensors.
- Devised an automated data-collection framework and trained a pipelined **SVM** and **attention-LSTM** model to learn the relation between hand movement and character patterns, and achieved **93%** text recognition accuracy.

Teaching & Mentorship

- **Graduate Teaching Assistant**, 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**, IIT Bombay - *Signals and Systems* (Spring '19)