Dhruv Patel

Email | LinkedIn | GitHub | Website

Education

Sardar Vallabhbhai National Institute of Technology(SVNIT) — Surat, India
Bachelor's of Technology, Electronics and Communication; CGPA: 8.39/10 — *2016 - 2020*

Experience

Robotics Research Centre, IIIT Hyderabad — July 2021 - Present
Research Associate — *Hyderabad, India*

- **Scene Understanding in Adverse Conditions** *Status: Ongoing*
  → Working with the ZF Friedrichshafen (ZF) group and QUT Centre for Robotics, Queensland University on improving scene understanding for adverse weather conditions like Fog & Low-lighting.
  → Proposed Gated Differentiable Image Processing (GDIP), a domain-agnostic architecture, for object detection in adverse conditions. It significantly improves the detection performance over current state-of-the-art by 5.84 and 16 mAP on real-world foggy and dark condition respectively. (Submitted to **ICRA2023)**
- **DodgeDrone** *Status: Ongoing*
  → Working on the intersection of vision, Imitation Learning (IL) and Reinforcement Learning (RL) to navigate UAVs in static/dynamic environments at high speeds, avoiding obstacles.
  → Devising a high-level control strategy through waypoint prediction using imitation from egocentric videos of UAV, and motion control by leveraging servoing framework with RL.
- **UAV-based Assessment of Civil Structures** [Website]
  → Developed a vision pipeline for automated building inspection using UAV-based visual remote sensing.
  → Utilized Structure-from-motion, RANSAC-based Plane Fitting and Odometry in conjunction with detection and segmentation algorithms to estimate structural parameters of the building critical for earthquake risk assessment.

Amdocs — Aug 2020 – June 2021
Associate Software Engineer — *Pune, India*

- Wrote production-level software for full-stack development - developing backend APIs (Java), user-friendly frontend UI (ReactJS) and writing SQL scripts for adding/updating large chunks of data in the production database.
- Conducted knowledge transfer sessions of various internal Amdocs applications and followed programming practices for the fresher batch. Manager **Ben Shasha** commended me for my consistent exceptional performance among the batch mates.

Swaayatt Robots — April 2020 – July 2020
Research Intern, advised by Founder Mr. Sanjeev Sharma — *Bhopal, India*

- Worked on improving individual algorithms in the traditional Visual Odometry (VO) and SLAM pipelines for Level-5 Autonomous Driving task.
- Proposed a semantic variant of Iterative Closest Point (ICP) algorithm by implementing a mathematical formulation taking class-specific loss function. It outperformed vanilla ICP, improving the point cloud matching accuracy and convergence time by 97% and 50% respectively on the Semantic KITTI dataset.
- Developed a low-level C++ library for our work. [Report] [Appreciation Letter]

SVNIT — May 2019 – July 2019
Summer Research Intern, advised by Dr. K.P. Upla — *Surat, India*

- Built a Face Recognition system using Deep Learning by implementing an NN4 variant of inception network.
- Validated the system on a custom-made facial image dataset of 25 students. Worked on different modules - Face Detection, Alignment and Recognition along the way.

Publications

Kalwar S*, **Patel D***, Aanegola A, Konda KR, Garg S, Krishna KM, "GDIP: Gated Differentiable Image Processing for Object Detection in Adverse Conditions", Submitted to ICRA 2023. [WebPage] [Paper]

Srivastava K*, **Patel D***, Jha AK, Jha MK, Singh J, Sarvadevabhatla RK, Ramacharla PK, Kandath H, Krishna KM, "UAV-based Visual Remote Sensing for Automated Building Inspection (UVRSABI)", accepted at the CVCIE Workshop, ECCV 2022. [WebPage] [Code] [Paper]

*equal contribution

Patel D*, Jain A*, Bawkar S, Khorasiya M, Prajapati K, Upla K, Raja K, Ramachandra R, Busch C, "SRTGAN: Triplet Loss based Generative Adversarial Network for Real-World Super-Resolution", Accepted at the 7th International Conference on Computer Vision & Image Processing (CVIP) 2022. [Paper]

Patel D*, ShankaraNarayanan H.*, Gandhi M* & Darji A, "Design of an Autonomous Agriculture Robot for Real Time Weed Detection using CNN", presented at the AVES 2021 conference. [Code] [Paper]

Projects and Extra-Curricular

UG Project- Autonomous Agricultural Robot (TEQIP III Funded) [Code] Oct 2019 – June 2020
Funded by TEQIP-III, Featured in ROS Agriculture Community

- Developed the software stack for autonomous navigation and teleoperation of a 4-wheel skid-steer drive using RGB camera, GPS and IMU.
- Implemented 2 semantic segmentation models: UNet and Bonnet for Crop Weed Classification task. Bonnet performed better class-wise prediction achieving 96.48% accuracy and 0.0168 units loss on CWFID whereas 99.471% mean accuracy, 98.035% mean IoU and loss of 0.0035 units on Bonn dataset. Has low real-time latency of ∼2.5 fps (on an Nvidia 940MX) due to its 100x lesser parameters than UNet.
- Involved in structural design of Robot using URDF and SDF modeling.

UG Seminar/Thesis - Computer Vision for Farm Robot [Report] [Presentation]

- Prepared a seminar report on the robotic vision system design, primarily focusing on semantic segmentation and classification algorithms for the Crop Weed classification problem.

National Robotics Contest - Robocon [Project Page] Aug 2017 - June 2019

- Represented SVNIT at Robocon 2018 & 2019, a robotic contest organized by Asia-Pacific Broadcasting Union.
- Developed the autonomous motion of Holonomic drives using Line Following and Odometry through feedback from line sensor, Gyroscope, IMU and Encoders.
- As a senior member of 15-person team, oversaw technical and managerial aspects in building 2 robots: 4-wheel Holonomic Drive and Quadruped Robot in Robocon 2019.
- Developed manual control of Robots using a bluetooth remote controller, and vision system with 2 cameras interfaced and parallely threaded on Raspberry Pi 3B+.
- Built the software stack on Atmel AVR and ARM microcontrollers, and also designed hardware circuitry using General Circuit Boards.

Drishti - Tech Club SVNIT [Website] July 2017 - June 2019

- As a core member, worked and mentored projects related to Embedded systems, Computer Vision and Robotics.
- Built & mentored several mini projects - RFID-based Identification system, Wireless control of mobile Robot.
- Conducted workshops on Embedded C, Sensor Interfacing, and Computer Vision for fellow juniors.
- Represented SVNIT at National Robotics Contest Robocon 2018 & 2019.

Certifications And Awards

Deep Learning Specialization, Coursera
Academic & Business Writing, UC Berkeley, EdX [certificate] Score: 93%
Fundamentals of Reinforcement Learning, Uni. of Alberta, Coursera [certificate] Score: 98.98%
Deep Learning & Applications, MeitY, Govt. of India [certificate]
Attended the 6th CVIT Summer School on AI [certificate]

Key Achievements

- *UAV-based Visual Remote Sensing for Automated Building Inspection* was selected for spotlight presentation at the CVCIE Workshop at ECCV 2022.
- Secured 13th rank in the final round of Robocon 2019 nationals clearing Design Details & Video Submission round among over 100+ participating universities.
- Secured 12th rank in the Robocon 2018 nationals out of 120 participating universities.
- Best Working Model - Stirling Engine at the National Science Day Celebrations, Physical Research Laboratory (PRL) during 12th grade.

Technical Skills

Languages: C, C++, Java, Python, Embedded C, SQL
Tools & Frameworks: git, MATLAB, PyTorch, TensorFlow, Keras, Robot Operating System (ROS), Spring, Jenkins
Libraries: pandas, NumPy, Matplotlib, OpenCV