Sundar Sripada V S

Research Intern

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Research Interests

3D Perception, Simultaneous Localization and Mapping (SLAM), Autonomous Navigation, Reinforcement Learning, Machine Learning, Predictive Control

Education

2016-2020 **Bachelor of Engineering** in **Electronics and Communication Engineering**
SSN College of Engineering, Granted by Anna University, Chennai
GPA : **8.54/10**, Graduated *First Class with Distinction*

Publications

2021 LADFN : Learning Actions for Drift-Free Navigation in Highly Dynamic Scenes
Accepted for publication at *American Control Conference (ACC) 2022*, pre-print available on arXiv

Research and Work Experience

Present **Research Intern, Robotics Research Center,**
International Institute of Information Technology - Hyderabad
Mentor - Dr. K. Madhava Krishna
October 2020

- Surveyed LIDAR-based SLAM systems and analyzed drift accumulation in each algorithm - LOAM, LeGO-LOAM, LIO-SAM
- Developed contrived scenes in CARLA Simulator for data collection, and for testing the performance of LIDAR-based SLAM systems
- Wrote API-level functions in Python for interacting with CARLA Simulator using custom keyboard commands to manually control vehicles
- Ported LOAM's C++11 source code to C++14 enabling usage in the new ROS version (ROS-Noetic)
- Tuned classification and regression models to predict the presence of and the amount of drift accumulated by a self-driving car, given its input pose and velocity
- Formulated a reinforcement learning model using Proximal Policy Optimization to reduce drift in highly dynamic autonomous driving scenes (In proceedings at *ACC 2022*)
- Currently working on generalizing our proposed navigation system (at *ACC 2022*) by predicting drift on-the-fly, and using it as a control cost for navigation

LOAM | Python | numpy | matplotlib | stable-baselines3 | PyTorch | CARLA

July 2019 **Summer Research Fellow, Medical Image Guidance Lab,**
Indian Institute of Technology - Madras
Mentor - Dr. Ramya Balachandran
May 2019

- Worked on tracking the tool-tip of a drill bit used in Surgical Navigation Systems (SNS) with the aid of fiducial markers for accurate tracking
- Wrote MATLAB functions for the transformation of the tool-tip from world to image frames-of-reference using homogeneous transformation matrices
- Tested the functionality on real-world data collected using a Stereo Camera

MATLAB | 2D-3D Transformation | Stereo Computer Vision

February 2019 **Project Intern, Research & Development Center,**
Bharatiya Nabhikiya Vidyut Nigam (BHAVINI) Limited, Kancheepuram
December 2018

- Built a 2-DoF wall-climbing robot using linear actuators and electromagnets for the purpose of detecting cracks inside BHAVINI's nuclear reactor
- Wrote C functions on an *Arduino Uno* board for controlling the robot's pose effectively

Arduino Uno | C

July 2018 **Application Development Intern, Ghost Vision Private Limited,**
IIT-Madras Research Park, Chennai
May 2018

- Developed an augmented reality Android app using Vuforia Engine and Unity3D
- Displayed the distance between two points in the world using ground-plane textures in AR

Unity | C# | Vuforia Engine | Android

Leadership and Volunteer Experience

April 2020 – June 2019

Head of Robotics and Computer Vision, TechClubSSN,
SSN College of Engineering, Chennai

- Conducted weekly sessions on introductory robotics and computer vision concepts, and managed several intra- and inter-collegiate technical events throughout Senior year (2019-2020)
- Co-taught a course on *Deep Learning for Visual Recognition* to introduce the basics of Deep Learning to first- and second-year undergraduates
- Organized two successful 24-hour hackathons - *HackInfinity 2019* (Inter-College) and *HackerSpace 2020* (Intra-College), obtaining external sponsorship from industries for prizes
- Mentored sophomore and junior students with their projects and courses

Leadership | Organization

May 2019 – May 2017

Student Volunteer, Entrepreneurship Development Club,
SSN College of Engineering, Chennai

- Conducted Mathematics and English classes for underprivileged children from classes 6 to 10 at schools around Chennai

Volunteering

Select Projects

Drift Heatmap Generation — November 2021

Part of current research
Generated drift heatmaps around a self-driving car using a multimodal CNN, showing regions of high and low probability of drift accumulation around the car

Python | PyTorch | numpy | matplotlib | OpenCV

Range Image Extraction — November 2021

Part of current research
Extracted 2D range images of 3D point-clouds using spherical projection from a 3D Cartesian coordiante system to a 2D image plane

Python | numpy | matplotlib

Predicting Absolute Pose Error in LOAM — July 2021

Part of LADFN Submission at ACC 2022
Used Random Forest Classification and Regression to model and predict Absolute Pose Error (drift) in a simulated self-driving car

Python | scikit-learn | matplotlib | pandas | CARLA

A-LOAM Support for ROS-Noetic — June 2021

Part of LADFN Submission at ACC 2022 github.com/ss26/A-LOAM
Ported A-LOAM for ROS-Noetic (C++14), as it was previously supported for the older ROS-Melodic and ROS-Kinetic (C++11)

C++ | ROS

Object Tracking in UAVs — September 2019 - April 2020

Undergraduate Thesis Project
Analyzed the performance of OpenCV's built-in Object Tracking algorithms to implement on UAVs

Python | OpenCV

Human Gait Energy Image Enhancement — January 2019

Undergraduate Research Project
Performed background subtraction to extract human poses from videos in the CASIA Gait Dataset (B), then superimposed these poses and enhanced the resulting Gait Energy Image for further research

Python | numpy | OpenCV

Monocular SLAM — September 2018 - February 2019

SSN Internally Funded Research Project 2018 github.com/ss26/ORB-SLAM
Received a grant of Rs. 20,000 to simulate, test and deploy monocular ORB-SLAM2 on a mobile robot

C++ | Raspberry Pi | Raspberry Pi Camera V2

Skills

Programming Languages	Python, C++, MATLAB, Java, Julia, C, Bash, LaTeX
Frameworks	Robot Operating System (ROS), PyTorch, TensorFlow, Keras
Libraries	numpy, pandas, matplotlib, OpenCV, Pillow, scikit-learn, scikit-image, Kornia
Simulators	CARLA, Gazebo
Version Control	git, GitHub
Operating Systems	Linux (Pop!_OS 20.04), Windows 10