Shelvin Pauly College Park, Maryland

(469) 922-7459 | paulyshelvin@gmail.com | linkedin.com/in/shelvinpauly | shelvinpauly.github.io

Domain Skills : Robot Software Development, Computer Vision, Deep Reinforcement Learning, Autonomous System

EDUCATION

University of Maryland, College Park (UMD) August 2021 - May 2023
Master of Engineering - Robotics

Vellore Institute of Technology, Chennai (VIT) July 2016 - April 2020
B. Tech in Mechanical Engineering

SKILLS

- **Programming & Design Languages** : C/C++, Python, Matlab, MySQL, SolidWorks
- **Software Development** : Bash, CMake, Git, TravisCI, Docker, Kubernetes, Codecov, Doxygen
- **Code Analysis and Testing** : Pytest, Gtest, Rostest, Cpplint, Cppcheck, Valgrind
- **Frameworks and Tools** : ROS/ROS2, Pandas, OpenCV, PCL, Pytorch, HuggingFace, Numpy, Keras
- **Operating Systems** : Windows Family, Ubuntu, Red Hat Enterprise Linux
- **Simulation** : Gazebo, Rviz, Mujoco, OpenAI Gym, Assistive Gym

PROJECT EXPERIENCES

Learning to Generate Code from Images with Actor-Critic

- Developed a novel approach for generating HTML code from images using Actor-Critic fine-tuning and an adapted metric called HTMLBLEU for comparing HTML code samples.
- Outperformed transformer and CNN-based baselines, with additional results showing robustness over varying sample complexity, advancing automated code generation towards applications in web development and design automation.

Federated and Ensemble Learning

- Experimented on ResNet-18 models for image classification using Federated and Ensemble Learning, exploring the impact of join ratio, client number, and task split overlap on model accuracy.
- Achieved higher accuracies in the overlapping task split experiment, providing insights on optimizing image classification with Federated and Ensemble Learning.

Analyzing BERT models for Various Natural Language Processing tasks

- Compared various paradigms such as transfer learning, multi-task learning, and few-shot learning for various NLP tasks such as Named Entity Recognition (NER), Natural Language Inference (NLI), and Machine Reading Comprehension (MRC).
- Engineered a method to train pre-trained BERT models for improved multi-task performance using dynamic task weights.

Inventory Management Automated Guided Vehicle

- Designed and developed an inventory management system using an Automated Guided Vehicle (AGV) equipped with a manipulator arm that can navigate and manipulate packages in a warehouse environment, using ROS, Gazebo, Rviz, SLAM, MoveIt, Google Cartographer, and a manipulator arm.
- Facilitated the user to specify the start location and drop location of the robot and the package location, and applied computer vision and SVM techniques to identify and locate the package in the map, and utilized ROS topics and services to coordinate the picking and dropping actions of the manipulator arm

Autonomous Robot Navigation and Mapping

- Designed and developed an autonomous robot system using ROS that can communicate, explore, and map an unknown environment using explorer and follower robots.
- Achieved accurate and robust robot navigation and mapping using Procedural Programming Paradigms, image processing, laser scanning, path planning, ArUco markers, and SLAM techniques, and used various ROS tools such as RViz, Gazebo, and rosbag for optimal performance.

Deep Reinforcement Learning for sparse reward feedback

- Implemented the Learning Online with Guidance Offline (LOGO) algorithm for reinforcement learning in environments with sparse reward feedback using Python, TensorFlow, and OpenAI Gym.
- Improved the algorithm's performance using Clipped Double Q-Learning and Proximal Policy Optimization Algorithm, achieving better performance in commonly used benchmarks adjusted to sparse settings.

Image Captioning using Deep Learning

- Developed and implemented an image captioning system using deep learning techniques, such as CNN, classical transformer, and vision transformer, on the MSCOCO dataset using PyTorch and Python.
- Achieved better performance and accuracy in generating captions for a given image using the vision transformer model, which captures global dependencies among image features, and conducted exploratory data analysis and hyperparameter tuning to improve visualization and results.

Stereo Vision System

- Developed stereo vision pipelines to extract 3D information from a pair of images using feature matching, fundamental matrix estimation, and calibration parameters, using Python and OpenCV.
- Implemented calibration, rectification, and depth computation using SIFT, corner detection, RANSAC, and least square method, and generated disparity and depth images with map conversion, achieving 5% disparity error, 10% depth error, and 15 seconds runtime per pair of images.

Sensor Fusion

- Developed an extended Kalman filter for tracking multiple objects in real-world scenarios using data from the Waymo Open Dataset and LiDAR and camera sensors.
- Improved the object detection and tracking performance using sensor fusion techniques to combine data from LiDAR and camera sensors, and developed a camera measuring model to project 3D points into 2D points with transformations in the camera axis.

Remote Dressing Support System

- Developed and implemented **reinforcement learning** algorithms for **robot-assisted feeding** using **Assistive Gym** and **Stable Baselines3**.
- Evaluated the reinforcement learning algorithms for robot-assisted feeding, including **Proximal Policy Optimization** and **Soft Actor Critic**.

Wheelchair Path Planning Using A* and RRT*

- Developed path planning algorithms for **autonomous navigation** of a wheelchair for **A*** and **RRT*** algorithms in 2D and 3D environments.
- Evaluated against real-life constraints such as **static and dynamic obstacles** to test the algorithms to evaluate both the algorithms.
- Simulated RRT* algorithm for **wheelchair navigation** in an airport setting using **Gazabeo**.

Robot Manipulation using WAM Arm and Hand

- Engineered and executed various **controllers** for multi-link robotic arms using **Kinematics**, **Dynamics**, and **PID algorithms**.
- Contributed to the **design** and development of software components including **URDF** files, controllers, and **CAD models**.
- Tested and debugged software components to ensure optimal performance using **rqt_gui** for **PID tuning**.

IntelliDrive

- Designed an algorithm to **detect lanes** and **turns** using **Bird's-eye view** method to mimic lane departure warning for **self driving cars**.
- Integrated **YOLO v5** and evaluated the performance on **synthetic dataset** using traffic sign images, achieving an accuracy of 98% in **detecting** and **classifying** traffic signals.

WORK EXPERIENCES

Data Scientist: IndeBo July 2022 - April 2023

- Designed a recommendation system that used statistical modeling techniques such as K-Means clustering and matching algorithms to suggest tourist destinations based on client preferences.
- Extracted and processed data on the tourist destinations visited by the clients using Natural Language Processing and sentiment analysis techniques.
- Leveraged the recommendation system to facilitate itinerary planning for the customers, increasing their satisfaction and retention rate.

Robotics Controls Intern: Maruti Suzuki Ltd May 2018 - November 2018

- Implemented and maintained control systems for robots using various tools and methods, such as MATLAB, Simulink, PID, and feedback loops, and tested their performance and reliability.
- Conducted assembly line test for car axle production for various Maruti Suzuki cars, supervised the functioning of the production line, and communicated with the quality control team to ensure the compliance of the production standards.