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Shashank Sharma

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Experience

Dematic, Kion Mobile Automation — Holland, MI
Machine Learning Engineer (Perception, Localization, and Mapping) — *Sept 2020 – Present*

- Developing autonomous vehicles for warehouse environments as part of the on-board software team.
- Improved accuracy and robustness of the reflector extraction algorithm leading to sub-centimeter accuracy.
- Developed a Gazebo-based virtual testing pipeline to improve line extraction algorithm using hyperparameter tuning.
- Improved speed of feature-based association algorithm by 50%, leading to a 30% faster localization pipeline. Analyzed real-time CPU utilization of SLAM processes and threads using Valgrind, LTTng, and perf.
- Standardized the pallet pick/drop testing at physical warehouses. The accuracy-repeatability analysis was done using an external laser tracking system by Faro. Also, a procedure to calibrate lidar, steering encoder, and traction encoder was created.
- Developed a python-based tool to visualize recorded SLAM logs, and automated their offline performance analysis.
- Certified SAFe (Scaled Agile Framework) Practitioner and trained to use Scrum, Kanban, and XP in a SAFe environment.

Stony Brook University — Stony Brook, NY
Research Assistant — *May 2017 – Aug 2020*

- Proposed machine learning and algebraic algorithms for simulation and synthesis of complex single-degree-of-freedom robotic systems, and published multiple articles in journals by the American Society of Mechanical Engineers.
- Created MotionGen, a web-based mechanism design framework. Uses MEAN (MongoDB, Express.js, Angular.js, Node.js) stack to create a RESTful web service based on MVC architecture. iOS and Android apps created using Apache Cordova framework.

Education

Stony Brook University — Stony Brook, NY
Ph.D., Mechanical (Concentration: Design and Robotics, Minor: Applied Mathematics), GPA 3.95 — *Aug 2015 – Aug 2020*

- **Relevant Courses:** Robotics, Advanced Dynamics, Vibration and Control, Kinematic Analysis and Synthesis, Applied Stress Analysis, Product Design Optimization, Geometric Modeling, Analysis of Algorithms

Relevant Projects

Robotics Software Engineer Nanodegree Program — Udacity
C++, Python, ROS, Gazebo, AMCL, gmapping, RTABMap — *Apr 2021 – Apr 2022*

- Simulated Automated Guided vehicles (AGVs) and Autonomous Mobile Robots (AMRs) in a warehouse environment.
- Mapped a virtual environment, by manually moving an AGV and creating an occupancy grid map. The AGV only had a 2D lidar sensor on it. Localized an AMR using the same map while controlling it manually or autonomously using path planning. Simulated a complete pick and drop operation. ROS packages like gmapping, AMCL, and move_base were used.
- Used SLAM to manually move an AMR through a virtual environment and create a loop-closed 3D graph map using RTAB-Map. The AMR used a 3D camera and a 2D lidar sensor to create the map for localization.

Self Driving Car Engineer Nanodegree Program — Udacity
Python, Jupyter, OpenCV, TensorFlow, Keras, C++, ROS — *Mar 2019 – Mar 2020*

- Detection: A robust image processing pipeline is created to detect highway lanes in dashcam live-feed.
- Perception: Car's position within lane and lane curvature is calculated using bird's eye view (BEV) and polynomial fitting.
- Classification: LeNet inspired convolution neural network is developed to detect and classify 40+ kinds of traffic signs.
- Deep Learning: Cloned human behavior using an end-to-end neural network to autonomously steer a car using camera input.
- Sensor Fusion: Car location is estimated using an extended Kalman filter which acts on LIDAR and RADAR sensor data.
- Localization: A 2D particle filter for sparse localization is designed and uses GPS and sensor data with a landmark map.
- Trajectory Planning: A Finite State Machine based planner is created to achieve autonomous highway driving with other cars.
- Control: A PID controller is implemented to maneuver a vehicle around a virtual track using steering, throttle, and brake.
- System Integration: Robot Operation System (ROS) is used to robustly combine Perception, Planning, and Control.

Technical Proficiency

- **Robotics hardware :** Nvidia Jetson (Nano and Xavier NX), 2D and 3D Lidar (Sick, Ouster, and Velodyne), RGBD camera (Intel Realsense D455), steering and traction encoder, IMU, Raspberry Pi, Arduino
- **Robotics software :** Keras, Tensorflow, PyTorch, ROS, Gazebo, Rviz, Anaconda, Jupyter, OpenCV, Scikit, Pandas
- **Programming Languages :** C++, Python, Javascript, Matlab, Mathematica, Delphi
- **Tools :** Git, Virtual box, Jenkins (Unit and Integration testing), Msgpack, Valgrind, LTTng

Selected Publications

- Sharma S., Purwar A.; **A Machine Learning Approach to Solve the Alt–Burmester Problem for Synthesis of Defect-Free Spatial Mechanisms.** ASME J. Computing and Information Science in Engineering; doi:10.1115/1.4051913
- Sharma S., Purwar A.; **Path Synthesis of Defect-Free Spatial 5-SS Mechanisms Using Machine Learning.**, ASME IDETC-CIE2020; doi:10.1115/DETC2020-22731
- Sharma S., Purwar A.; **Unified Motion Synthesis of Spatial Seven-Bar Platform Mechanisms and Planar-Four Bar Mechanisms.**, ASME IDETC-CIE2020; doi:10.1115/DETC2020-22718
- Sharma S., Purwar A., Ge Q.J.; **A Motion Synthesis Approach to Solving Alt-Burmester Problem by Exploiting Fourier Descriptor Relationship Between Path and Orientation.**, ASME J. Mechanisms Robotics; doi:10.1115/1.4042054
- Sharma S., Purwar A., Ge Q.J.; **An Optimal Parametrization Scheme for Path Generation Using Fourier Descriptors for Four-Bar Mechanism Synthesis.**, ASME J. Computing and Information Science in Engineering; doi:10.1115/1.4041566