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# Shashank Sharma

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## Experience

**Dematic, Kion Mobile Automation** — Holland, MI
*Machine Learning Engineer* — *Sept 2020 – Present*

- Improved performance of our SLAM algorithm by up to 30% and Association algorithm by up to 50%.
- Led the standardization of the accuracy-repeatability testing process done on physical test tracks across global teams.
- Developed a Gazebo-based virtual testing pipeline to improve feature extraction algorithm using hyperparameter tuning.
- Developed a ROS and Rviz based playback tool to visualize onboard recorded data and analyze SLAM performance.
- Evaluated using Occupancy Grids for 2D and 3D Lidar sensors using Gmapping, Octomap, and Cartographer.
- Evaluated the use of Visual Inertial Odometry and GraphSLAM to improve AGV navigation in warehouse environments.
- 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*

- Developed a Computational Framework for Data-Driven Mechanism Design Innovation supported by a $450K NSF grant.
- Designed algorithms for simulation and synthesis of Planar, Spherical, and Spatial single-degree-of-freedom Robotic systems resulting in multiple publications 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.
- In-charge of Computer-Aided Design and Innovation Lab and collaborating with a research group of 10+ graduate students.

*Teaching Assistant* — *Aug 2016 – Apr 2017*

- Developed SnappyXO, a laser-cut design-driven robotics platform that enables designing mechanisms, structures, and robots. It has successfully raised $16K+ on Indiegogo for a crowdfunding campaign.
- Advised 250+ students in MEC101-Freshman Design Innovation, MEC 102-Engineering Computing, and Vertically Integrated Projects(VIP) Program. The Robot Design projects gained recognition from the Office of President at university.

## 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

**Udacity, School of Autonomous Systems** — Mountain View, CA
*Self Driving Car Engineer Nanodegree* — *Mar 2019 – Mar 2020*

- **Relevant Areas:** Computer Vision, Deep Learning, Sensor Fusion, Localization, Planning, Control, System Integration

## Relevant Projects

**Self Driving Car subsystem design and integration** — Udacity
*Python, Jupyter, OpenCV, TensorFlow, Keras, C++, ROS* — *May 2019 – Aug 2019*

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

## Selected Publications


- 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.; **Using a Point-Line-Plane Representation for Unified Simulation of Planar and Spherical Mechanisms**, ASME J. Computing and Information Science in Engineering; doi:10.1115/1.4046817
- 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