Niraj Basnet

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Technical Skills

Robotics: Motion planning, Trajectory Optimization, Controls, Data structures and algorithms, AI, Optimization, Mapping, Localization, Sensor Fusion, Machine learning, Deep learning, Reinforcement Learning
Programming Languages: C/C++, Python, MATLAB, Latex
Software Tools: ROS, Rviz, Gazebo, CARLA, OMPL, Tensorflow, Pytorch, OpenCV, Git, Linux, Jenkins, Docker

Experience

Graduate Research Assistant, *Oregon State University* Jun 2019 – Dec 2020

- Developed motion planning and controls stack of OSU team for autonomous F1/10 cars racing competition.
- Engineered a real-time(30Hz) model predictive contouring controller for generating and tracking dynamically feasible high speed(upto 8m/s) racing trajectories while avoiding obstacles and opponents in the race track.
- Developed a real-time(40Hz) hierarchical planner comprising state lattice planner and Nonlinear MPC(for tracking).
- Automated racetrack mapping and its relevant data extraction and pre-processing for autonomous cars racing, thereby slashing preparation time before the race, by almost half.
- Adapted an evolutionary algorithm(CMA-ES) for raceline-optimization of a given racetrack.
- Evaluated trajectory tracking performance of various control strategies like PID, LQR, MPC and Pure Pursuit.

Graduate Teaching Assistant, *Oregon State University* Sep 2018 – May 2019

- Conducted various workshops on version control, interfacing sensors, ROS, etc. as an IOT community coordinator to garner students' interest and achieved membership boost of almost 20%.
- Provided course support and assisted in development of new course material for Autonomous car racing course.

Robotics Software Engineer, Co-founder, *Paaila Technology, Nepal* Dec 2016 – Sep 2018

- Led a team of 4 engineers for development of motion planning and control stack, collaborated with mechanical and electrical hardware teams, to create initial prototypes for waiter and service robots within 9 months.
- Deployed a multi-robot global path planner to plan collision-free paths within 1 second for waiter robots.
- Evaluated EKF and UKF, and found UKF more precise for indoor pedestrian tracking with lidar and radar sensor.
- Improved integration testing of various components of navigation stack by running simulation tests on dockerized Gazebo, thereby reducing the code deployment time by over 30%.

Projects

Motion planning for Self-driving cars in city traffic using CARLA simulator | *Python, CARLA* Oct 2020

- Integrated finite state machine(FSM) based behaviour planner and conformal lattice planner to plan collision-free trajectories for self-driving car in city traffic. Learnt CARLA to simulate planning in realistic driving scenarios.

Mapping, Localization and Motion planning algorithms | *C++, Python, ROS* Feb 2019 – Jun 2020

- Coded planning algorithms like Hybrid A*, PRM, RRT, RRT*, BIT*, and potential fields for learning.
- Implemented occupancy grid mapping and particle filter(Monte Carlo Localization(MCL)) on simulated vehicles.

Investigation of sampling techniques for RRT* motion planning of quadrotor | *C++, OMPL* Mar 2019

- Benchmarked sampling methods like uniform, obstacle-based, gaussian, and max-clearance in maps of varying obstacles density to find the dominant method in each type of map, in order to reduce planning time.
- Found thresholds for using various methods based on occupancy ratio of obstacles to free-space in a map.

Multi-robot task allocation for warehouse environment | *Python, Pytorch* Dec 2018

- Explored cooperative co-evolutionary algorithms for distributed task-allocation in a warehouse environment.
- Attained a 7% improvement over the centralized sequential task allocation approach.

Autonomous badminton playing robots | *C++, Python, Arduino, ROS* Jul 2015

- Tuned PID controller for holonomic control of robot and also coded shuttlecock trajectory predictor.
- Achieved Best Idea and Mabuchi Motor awards in ABU-Robocon, an International robotics competition.

Publication

- **N. Basnet** and H. Abbas, "Logical signal processing: A fourier analysis of temporal logic," in *Runtime Verification*, (Cham),pp. 359–382, Springer International Publishing, 2020. **(Best paper nominee)**

Education

Oregon State University(OSU) Corvallis, OR
Masters of Science in Computer Science, GPA: 3.71/4.0 *Sep 2018 – Dec 2020*

Institute of Engineering(IOE), Pulchowk Campus Lalitpur, Nepal
Bachelors in Electronics and Communication Engineering, GPA: 3.8/4.0 *Sep 2012 – Sep 2016*