

Pravin Dangol

RESEARCH ASSISTANT · SILICONSYNAPSE LAB

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☎ (617)620-5992 | ✉ dangol.p@northeastern.edu | 💻 pravindngl | 🎓 Pravin Dangol

Research assistant working on control and motion planning of legged robots. Passionate about robotics, with a background in classical controls and robot dynamics. Currently interested in utilizing reinforcement learning as a hierarchical higher level controller.

Education

Northeastern University

PH.D. ELECTRICAL ENGINEERING

Boston, MA

Sep. 2017 - Present

St. Cloud State University

B.S. IN MECHANICAL ENGINEERING

St. Cloud, MN

Aug. 2012 - Dec. 2016

- Graduated Summa Cum Laude in the honors program.

Work Experience

The Mathworks Inc.

Natick, MA

SOFTWARE ENGINEER INTERN

May 2021 - Present

- Involved in development of DDS/ROS2 middleware toolbox for the simulink product line.
- Projects involve updating existing C++ APIs as well as creating new APIs for multiple vendors.

SiliconSynapse Lab, Northeastern University

Boston, MA

RESEARCH ASSISTANT

Sept. 2018 - Present

- Led projects that deal with the design and control of bio-inspired legged robots.
- Designed and assembled a lightweight quadrupedal robot. Implemented agile walking gaits through state estimation, motion planning and hierarchical control strategies; deployed on the hardware through a real-time OS.
- Implemented a robust closed-loop controller with optimized dynamic gaits for a thruster assisted bipedal robot. Designed running and walking gaits based on the Hybrid Zero Dynamics framework.

Electrolux

St Cloud, MN

PRODUCT DEVELOPMENT ENGINEER

Jan. 2017 - Jul. 2017

- Managed and led projects aimed at increasing reliability, quality, and reducing the manufacturing costs of commercial kitchen appliances.
- Designed mass-produced components to extend the product life cycle of the existing appliance line.
- Gained hands-on experience with sheet metal fabrication, injection molding, extrusion, thermoforming, and tooling required for large volume production.

TLC Electronics Inc.

St Paul, MN

AUTOMATION INTERN

May 2016 - Aug. 2016

- Automated assembly lines to improve build times for parts used in the electronics and medical device industry.
- Prototyped and designed test fixtures to increase efficiency in the assembly process and electrical testing.

Hutchinson Technology Inc.

Hutchinson, MN

R&D ENGINEER CO-OP

Jan. 2015 - Aug. 2015

- Involved with design, process development, and research for shape-metal alloy based optical image stabilizers used in smart-phones.
- Worked on design for manufacturability of electro-mechanical assemblies, designed fixtures, tested and analyzed parts to optimize performance and power consumption.

Projects

Online quadruped trajectory update through model free RL

SILICONSYNAPSE LAB

April 2020 - September 2020

- Utilized SOTA TD3 algorithm to control body posture, regulate walking speed and ground contact on a quadruped with limited observations.
- Timing based gaits with feet end position control, state and touchdown estimates were first used to create baseline dynamics gaits at a high bandwidth. The RL scheme was then used as a trajectory update law at a lower bandwidth to maximize training efficiency.
- This combined hierarchical structure resulted in more stable and robust gaits without needing to use complex model based controller or any costly online optimization methods.

ML based ground dynamics estimation for bipeds

ADVANCED MACHINE LEARNING COURSE

November 2019 - December 2019

- The purpose of this project was to demonstrate techniques learned in an advanced machine learning course. A paper was recreated to estimate ground dynamics for bipeds traversing unknown terrains.
- The unknown dynamics of the ground reaction forces were modeled as Gaussian Process, the intractable posterior distribution was estimated through forward-backward pass variational inference method to account for inherent instability of dynamics systems.

Image guided micro manipulation

PIEZO-ACTIVE SYSTEMS LAB

January 2018 - August 2018

- The project involved vision based feedback on a 3 axis (RRP) micro-manipulator to characterize carbon nanotubes and tissue samples.
- Utilized computer vision tool to obtain relative position information to guide the manipulators' end effector.
- Explored region based convolution neural network to locate objects of interest.

Project development for undergraduate dynamics and control courses

MECHANICAL ENGINEERING DEPARTMENT, NEU

September 2017 - August 2018

- Designed coursework related projects to help student analyze, simulate and control physical electro-mechanical systems.
- Projects were focused on constrained single wheel active suspension system, multi cart gantry system, gyro-stable platform, and rotary/linear inverted pendulum.
- Established real-time communication with sensor and actuator to realize baseline control architecture for students to test their controllers.

Skills

Technical Experience Robotics: Kinematics/Dynamics modeling, Motion Planning, DDS, ROS, AWS RoboMaker;
Machine learning: Reinforcement learning; object detection, dynamics estimation;
Controls Theory and State Estimation: linear, robust, adaptive, and non-linear methods;
CAD: CATIA, SolidWorks, Ansys

Programming C, C++, Python, MATLAB

Toolboxes Trajectory optimization and control: CasADi, FROST, TOWR, DRAKE
Deep Learning: PyTorch, Tensorflow

Publications and presentations

- P. Dangol, A. Lessieur, E. Sihite, and A. Ramezani, "A HZD-based Framework for the Real-time, Optimization-free Enforcement of Gait Feasibility Constraints," *Humanoids*, Munich, Germany, 2021
- A. Ramezani, P. Dangol, E. Sihite, A. Lessieur, and P. Kelly, "Generative Design of NU's Husky Carbon: A Morpho-Functional, Legged-Aerial Robot," *International Conference on Robotics and Automation (ICRA)*, Xi'an, China, 2021
- P. Dangol and A. Ramezani, "Performance and Robustness Satisfaction in a Thruster-assisted Legged Robot," *International Federation of Automatic Control (IFAC)*, Berlin, Germany, 2020
- P. Dangol, A. Ramezani and N. Jalili, "Performance satisfaction in Midget, a thruster-assisted bipedal robot," *American Control Conference (ACC)*, Denver, CO, 2020
- P. Dangol and A. Ramezani, "Hybrid Invariance Achieved Through Leg and Thruster Actions," *EEE-RAS 19th International Conference on Humanoid Robots (Humanoids)*, Toronto, Canada, 2019