Navneet Paul

Weverskade 58 – 3147 PA Maassluis, Netherlands

☐ +31 649154399 • ✉ nav74neet.paul@gmail.com
🌐 nav74neet.github.io

Masters student(MSc) in Electrical Engineering with specilization in Robotics and Mechatronics, at **Universiteit Twente**. Research interest relate to **computer vision**, fusion of machine learning techniques (**deep reinforcement learning** and **inverse reinforcement learning**) & control theory in the domain of **robot manipulations, legged-robot locomotion strategies, robot teleoperation**, etc.

Professional Experience

Lely Industries N.V.   **Maassluis, South Holland, Netherlands**
Computer Vision & Machine Learning Intern   *September 2020 – Present*

Currently working on generation of photorealistic simulated scenes from the video/images for training autonomous agricultural robots at Lely. We use a generative adversarial learning framework while synthesizing the simulated scenes from semantic maps.

ABB Robotics Motion Division   **Bangalore, Karnataka**
Graduate Engineering Trainee   *April 2017–August 2017*

The aim of the project was to develop a human collaborative robot for an industrial environment. I was part of the mechanical design & simulation team. Key functions: fabrication of auxiliary units of an industrial robot, viz; grippers, actuators, etc., depending on various customer specifications requirements. Involved in the Anthropomorphic Robotic Arm(A.R.A.) project wherein our team fabricated a 3D printed humanoid robotic arm & interfaced it with an IRB1600 robot, actuated by servo motors & controlled by Arduino Uno micro-controller board (with ATmega328P microcontroller chip) connected to the ABB IRC5 industrial robot controller.

Research Experience

Robert Bosch Center for Cyber Physical Systems   **Bangalore, Karnataka**
Project Associate   *August 2018–July 2019*

Worked as a Robotics and Machine Learning Researcher. Research focused on robot learning from human demonstrations & teleoperation of an industrial robotic arm using haptics 3D navigator (Novint Falcon) and implementing machine learning techniques (such as reinforcement learning, imitation learning, generative adversarial networks, etc) for robot manipulation tasks in industrial automation environment. The research project is funded and in collaboration with Yaskawa Electric Corporation, Japan.

Aerospace Engineering Division, IISc   **Bangalore, Karnataka**
Project Associate   *August 2017–July 2018*

I worked for almost an year at the Computational Intelligence Laboratory & Advanced Flight Simulation Laboratory, Dept. of Aerospace Engineering, IISc, under the guidance of Dr. S N Omkar (Chief Research Scientist). My research focused on developing simulation frameworks for implementing several reinforcement learning algorithms such as Q-Learning and DDPG for autonomous navigation of UAVs and bipedal walking robots. I also worked on human motion analysis for rehabilitation purposes using optical motion capture systems and surface electromyographic (sEMG) sensors.

Mechanical Engineering Division, IISc   **Bangalore, Karnataka**
Summer Research Intern   *May 2016–July 2016*

I interned at the Surface Interaction and Manufacturing (SIAM) Laboratory at the Dept. of Mechanical Engineering, IISc under the guidance of Dr. Satish V Kailash. I worked in the domain of friction stir welding(FSW) for butt-joint of pure aluminium with pure copper using a 3-axis horizontal FSW machine and analyzing several welding parameters associated (like feed-rate, tool configuration, etc.

Education

Universiteit Twente   **Enschede, Netherlands**
MSc Electrical Engineering (Specialization: Robotics and Mechatronics)   *2019–2021*

VIT University   **Vellore, Tamil Nadu, India**
B.Tech Mechanical Engineering , GPA: 8.30/10.0   *2013–2017*
Bachelor's Thesis: **Anthropomorphic Robotic Arm (ARA)**

Projects

- **Face morphing detection:** Used methods such as (i) Histogram of Gradients(HoG) with Support Vector Machines(SVM), (ii) Linear Binary Pattern(LBP) & (iii) Binarized Statistical Image Feature(BSIF) for detection of morphed face photographs and setup a comparative study of their performances.

- **3D object tracking:** Used optical flow and Conditional Neural Local Fields (CNLF) approaches for tracking the 3-dimensional tongue-tip motion.

- **Learning Peg-in-hole insertions from human demonstrations - an inverse reinforcement learning approach:** Using Generative Adversarial Imitation Learning (GAIL) and deep reinforcement learning algorithms for training an industrial robot to learn complex manipulation tasks such peg in hole insertions from prior human demonstrations. The key goal is to map the human actions for the task(like applied force, torque, orientation of end effector, etc) to the actual robot. The initial phase is development of simulation framework using ROS and Gazebo and haptics interface control in simulated environment using Novint Falcon and ultimately aiming for sim-to-real transfer of imitation learning to actual robot. The project is funded by & in collaboration with Yaskawa Electric Corp.

- **Deep Deterministic Policy Gradient for Bipedal walking robot:** A bipedal walking robot was developed in **Gazebo** simulation environment and Reinforcement learning algorithm, Deep Deterministic Policy Gradient based on actor-critic learning framework was implemented for generating a stable planar bipedal walking patter [Paper][Code][Video].

- **Q-Learning for autonomous navigation of UAVs in indoor environments:** Q-Learning with a simple PID tuned control was adopted for the autonomous navigation of an ArDrone in a 5x5 grid space (simulation environment: **Gazebo**). [Code][Video]

- **Anthropomorphic Robot Arm:** A 3D printed humanoid arm(with 5 DOF) is attached to the ABB IRB 1600 ID industrial robot, actuated using servomotors controlled using an Arduino Uno microcontroller which is interfaced to the ABB IRC5 controller via a custom build step-down voltage regulator circuit board. Project carried out at the **ABB Robotics Motion Division**, Bangalore as part of my bachelor's degree thesis. [Project Details][Video]

Publication(s):

- Kumar, Arun, **Navneet Paul**, and S. N. Omkar. **"Bipedal Walking Robot using Deep Deterministic Policy Gradient."** arXiv preprint arXiv:1807.05924 (2018).[Paper]

- Kumar A, Kapse RC, **Paul N**, Vanjare AM, Omkar S N. **Musculoskeletal modeling and analysis of trikonasana**. Int J Yoga (2018).[Paper]

- Bragadeshwaran, A., Kasianantham, N., Kaisan, M. U., Reddy, D. M. S., Aravind, K. M., **Paul, N.**,Chungath, T. **Influence of injection timing and exhaust gas recirculation (EGR) rate on lemon peel oil–fuelled CI engine.** Environmental Science and Pollution Research, 1-15.(2019) [Paper]
- Ramkumar, K.D., **Paul, N.**, Chungath, T. et al. **Characterization of Microstructure, Tensile Strength and Corrosion Behavior of Autogenous GTA Welds of Inconel X750 With and Without Activated Compound Flux**. Metallogr. Microstruct. Anal. (2017) [Paper]

Technical skills

- **Programming Languages:** C, Python, Matlab,TeX.
- **Framework(s):** Robot Operating System(ROS), OpenAI Gym.
- **Libraries:** TensorFlow, Pytorch
- **SDK Libraries:** CHAI3D Libnifalcon (Haptics libraries)
- **Simulation:** Gazebo, Moveit, Mujoco (basics), ABB RobotStudio, Ansys Workbench.
- **Microcontroller:** Arduino.
- **Designing & other** SolidWorks, Catia, Blender, MS-Office.

References

Dr. Yan Li, Expert Product Developer, Lely Technologies NV. [yli@lely.com]

Dr. Michael Yang, Assistant Professor, Department of Earth Observation Science, University of Twente. [michael.yang@utwente.nl]

Dr. Bharadwaj Amrutur, Chairman, RBCCPS, IISc. [amrutur@iisc.ac.in]

Dr. Shishir N Y Kolathaya, INSPIRE Faculty, RBCCPS, IISc. [shishirk@iisc.ac.in]