Chaitanya Chawla

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Education

Technical University of Munich — Munich, Germany
B.Sc. in Electrical and Computer Engineering — ***GPA 1.60*** † *(Rank 12 of 350)* — *Oct. 2020 – March 2024*
Minor in Robotics — ***GPA 1.20*** †
Coursework - Control Systems, Introduction to Robotic Control, Human Machine Communication, Numerical Analysis, Fundamentals of AI, Python for Machine Learning
Research Interests - Learning-based manipulation, imitation learning, human-robot interaction

Research Experience

Carnegie Mellon University — Jul 2023 – Present
Visiting Research Scholar, Bot Intelligence Group | ***Prof. Jean Oh*** — *Pittsburgh, Pennsylvania*
Learning Abstract Representations of Agent-Environment Interactions

- **Co-advisors:** **Prof. Sandra Hirche** & **Dr. Stefan Sosnowski** (TU Munich)
- Generated a comprehensive dataset with 50 demonstrations by orchestrating a puppet-master setup of 2 Lite6 Arms. Collected robot states and 6D object states
- Generated another dataset of human task demonstrations by estimating 6D hand poses. Converted 2D pose estimations from MMPose to 6D by aligning RGB predictions to depth data
- Enhanced a Temporal Variational Autoencoder policy by fine-tuning on combined agent- and objects states, achieving a notable 42.8% performance improvement
- Designed experiments such as KNN Classifier and latent space representation to study semantic label accuracy
- Manually combined latent variables of different skills representations to implement new, unseen tasks

Technical University of Munich — Mar 2023 – Present
Undergraduate Research Assistant, Vision and Perception Group | ***Prof. Darius Burschka*** — *Munich, Germany*
Robot-Agnostic Framework for Human-in-the-Loop Intrinsic Feature Extraction

- Developed an algorithmic framework within a collaborative project to extract task-specific constraints from human demonstrations. Incorporated user feedback to optimize trajectory representation
- Generated a knowledge base for task affordances, such as wiping/rubbing, by computing surface normals, surface limits, and object-surface proximity through point cloud data
- Proposed a method for segmentation of human demonstration trajectories based on waypoints that are detected by grouping point clouds into Octree voxels
- Extracted velocity-based constraints such as speed, orientation, and acceleration using object trajectory and modeled them into the trajectory representation
- Learnt a graph representation for the relevant action-state pairs for a task

Technical University of Munich — Jan 2022 – Oct 2022
Undergraduate Research Assistant, Human-Centred Robotics Lab | ***Prof. Dongheui Lee*** — *Munich, Germany*
Visual Teleoperation using Learning from Demonstration

- Built a pipeline for capturing 3D hand trajectories of a user through stereoscopic conversion of 2D Pose Detection
- Developed a Dynamic Motion Primitives (DMP) Framework for obtaining a regressed, learned trajectory
- Implemented control of Frank Panda on Gazebo as well sim-to-real using learned trajectory

Professional Experience

Roboverse Reply GmbH — Aug 2022 – Jul 2023
Research Internship (Part-time) — *Munich, Germany*

- Developed a Voice Control system for Boston Dynamics' Spot by and integrated it with the company's web framework
- Created a pipeline to transfer live point cloud data from Spot mounted BLKArc LIDAR sensor to Oculus VR Headset, so that a distant user could see Spot's immediate environment in real time
- Built a door-opening pipeline using Spot by deploying a CNN network to detect door knobs
- Presented the company's ongoing projects at TUM IKOM fair, showcasing the products and prospects

†NOTE — German GPA ranges from 1.00 to 5.00, where 1.00 is the highest

Projects

Face Recognition using Autoencoders and PCA June 2020 – Present

- Designed a CNN network for Face Recognition using a custom-processed Dataset
- Compared the impact of various preprocessing methods, such as Autoencoders and PCA

Miniature Factory Model May 2018 – May 2020

- As part of the practical course: Control and Automation (EI06631), came up with implementations of topics such as PID Controller (Balancing Cube), Petri Nets (Factory model), Neural Networks, PLC Controls and Path Planning
- Using a SCARA Robot, implemented various concepts including Transformation matrices, Forward Inverse Kinematics, Resolved Rate Control, Force- and Impedance-driven controllers

Main Controller Unit for Electric Car May 2018 – May 2020

- Designed and implemented the main controller unit for TU Fast Eco Team's vehicle in Shell Eco-Marathon 2021
- Implemented control of diverse subsystems, including the light controller, clutch controller, horn and wiper systems

Publications

T. Shankar, **C. Chaitanya**, J. Oh. **Learning Abstract Representations of Agent Environment Interactions** *In Submission to International Conference on Robotics and Automation 2024* (ICRA 2024)

Awards and Fellowships

2023	**Heinrich and Lotte Mühlfenzl Scholarship**: Awarded funding of €2,500 for undergraduate research	*Mühlfenzl Foundation*
2023	**TUM Promos**: Merit-based funding of €3,000 for research stay-abroad	*TU Munich*
2021/22/23	**German National Scholarship**: Awarded based on Merit and Extracurricular Activities	*German Federal Government*
2021	**Max Weber Program & TUM Junge Akademie**: Nominated by the University for excellence programs	*TU Munich*
2021/22/23	**Dean's List**	*TU Munich*

Teaching

Robotics Control Laboratory (EI06931) Nov 2023 – Present

- Conducted lab sessions for implementing different control methods on a KUKA KR 470 and a SCARA robot using MATLAB

Advanced Mathematics (MA9411) Apr 2022 - Sept 2022

- Was selected as a Tutor for one of the toughest undergrad courses, with over 40% students failing each year
- Led weekly recitation sections for a class of 40, discussing assignments designed by the Professor and me

Physics for Electrical Engineers (PH9009) Oct 2021 - Feb 2022

Bridge Course for Mathematics (MA9001) Sept 2021 - Oct 2021

Service and Leadership

SKY Campus Munich Nov 2021 - Present

- Started a student club, conducting weekly Yoga and Meditation to help students reduce stress and anxiety
- Organized workshops with professionals in meditation and breathing techniques to promote mental health and well-being

Electrical Engineering Students' Association (EESTEC) Nov 2021 - Oct 2022

- As Vice President: Invited researchers and leaders from the field of Robotics and AI for talks at the University
- Led a team of 15 to organize a university-wide Career Fair, with firms like BMW, Texas Instruments, & Infineon

Technical Skills

Programming Languages: Python, C/C++, MATLAB, HTML
Libraries: PyTorch, PCL, Scikit-Learn, Pandas, OpenAI Gym, RViz, Gazebo
Frameworks: ROS, Azure, AWS, WandB, Node.js, Flask, Docker