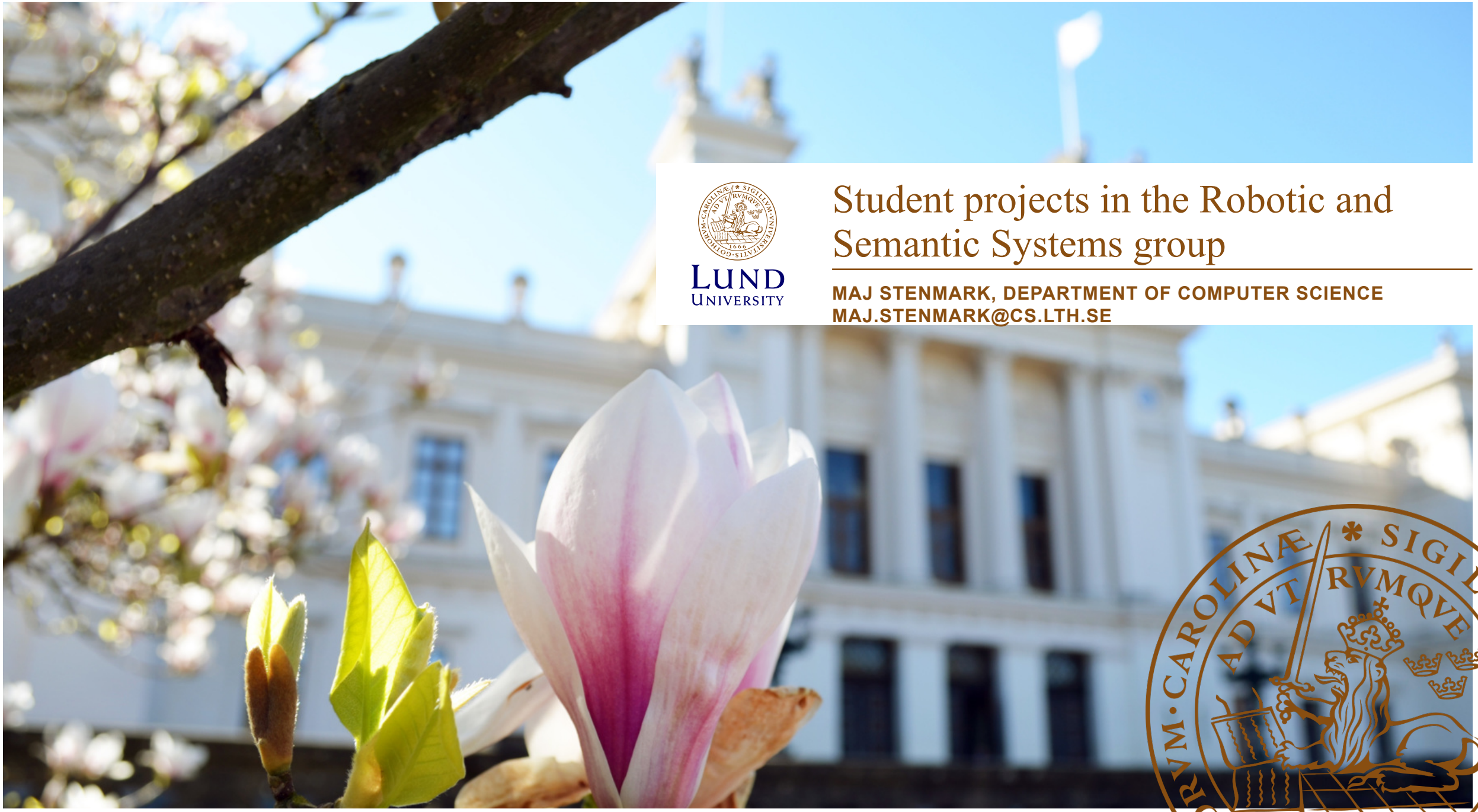

Student projects in the Robotic and Semantic Systems group

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Hand and object tracking for robot learning

Supervisor: Maj Stenmark, Jialong Li purple flag wed afternoon

This project focuses on developing a system for hand and object tracking to extract high-quality demonstrations for robot learning. Using computer vision techniques for hand tracking and segmentation, the system should capture human hand and object movements from video recordings from RGB-D cameras of task demonstrations. This data can be used to train robots in tasks such as object manipulation and assembly.

The project will explore different tracking methods, focusing on deep learning-based methods [1] [2] to achieve accurate and robust tracking.

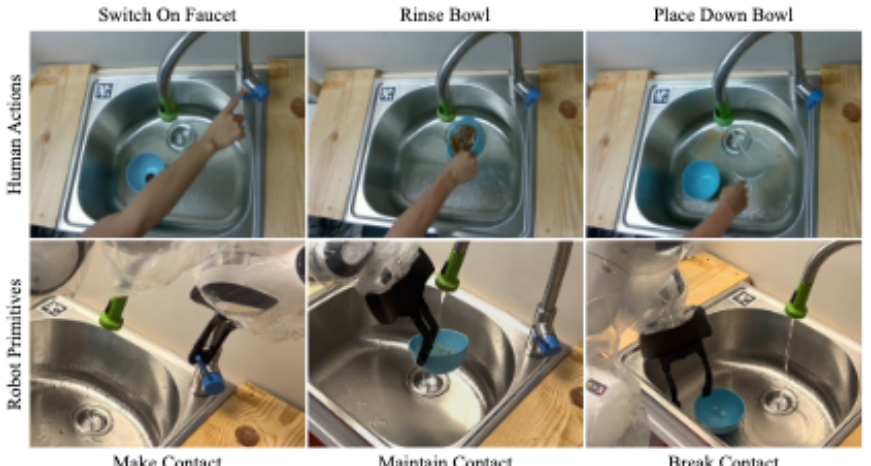
Key objectives:

- Implement a hand and object tracking system using computer vision techniques.
- Extract and process demonstration data for robot learning.
- Evaluate the tracking method by on a simulated or physical robot system.

This project is one step in the direction of intuitive human-to-robot skill transfer.

[1] Dingkun Guo *Learning Multi-Step Manipulation Tasks from A Single Human Demonstration* https://arxiv.org/abs/2312.15346

[2] You Only Teach Once: Learn One-Shot Bimanual Robotic Manipulation from Video Demonstrations https://arxiv.org/abs/2501.14208



Implement Quest2Ros for dual-arm KUKA robots

Supervisor: Volker Krueger, Jialong Li yellow flag thursday

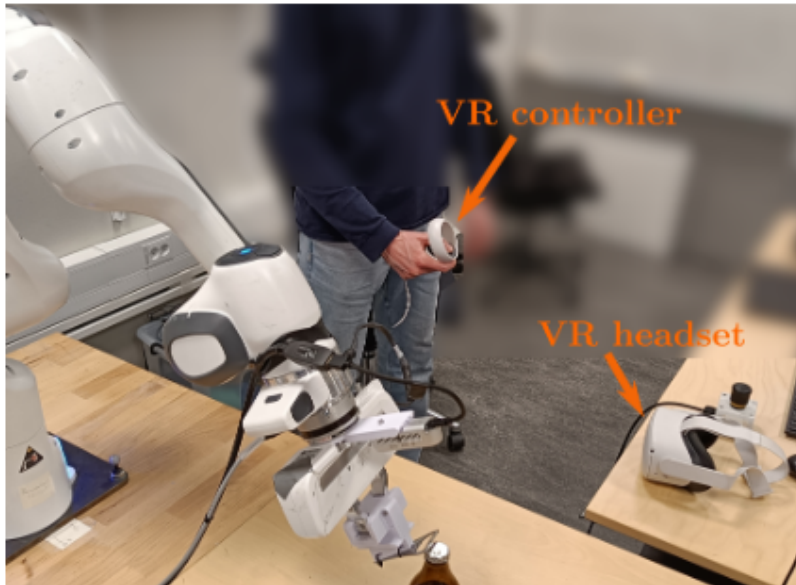
This project aims to integrate the Quest2Ros [1] module to enable teleoperating of KUKA robots using Meta Quest hand controllers. The goal is to create an intuitive system where users can remotely control a dual-arm robotics system in real time, providing demonstrations of better quality for robot learning [2].

By using ROS 2 (Robot Operating System) and the Quest2Ros interface, the system will be used to collect demonstrations for imitation learning.

Key objectives:

- Set up and integrate the Quest2Ros module for real-time KUKA robot teleoperation.
- Develop a control pipeline for smooth and responsive movement and haptic feedback (vibration) from the robot force sensors.
- Evaluate the system's usability and effectiveness in capturing demonstration data.

This project contributes to advancements in human-robot interaction, making human-to-robot skill transfer more natural.



[1] Quest2ROS: An App to Facilitate Teleoperating Robots
https://quest2ros.github.io/

[2] DexMimicGen: Automated Data Generation for Bimanual Dexterous Manipulation via Imitation Learning https://arxiv.org/abs/2410.24185

Integrate and evaluate Magma

Supervisor: Maj Stenmark

This project explores the foundation model Magma (https://microsoft.github.io/Magma/), a newly released multimodal model for AI agents, including for robot manipulation. The goal is to assess whether Magma can be effectively integrated into the robots in our lab to improve interaction capabilities. Magma combines visual and textual information, making it a promising candidate for tasks such as object recognition and instruction following. This project will involve testing the model's performance on real-world robotics tasks, evaluating its accuracy, latency and adaptability to a few different scenarios.

- Key objectives:
- Set up and integrate the Magma model with our robotics platform.
- Test its capabilities in perception, reasoning, and task execution.
- Analyze the feasibility for robotics applications.

This project contributes to the understanding of the performance limitations of state-of-the-art foundation models in robotics.