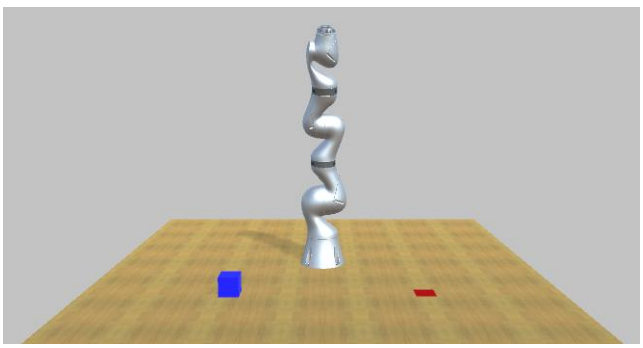
Robotics, Artificial Intelligence
and Real-Time Systems

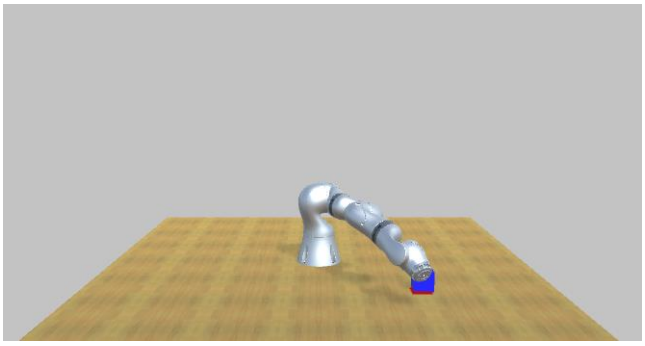
Master thesis / Guided Research

Vision-Based Continual Reinforcement Learning for Robotic Manipulation Tasks

BACKGROUND

The concepts of both reinforcement learning (RL) and continual learning (CL) borrow their basic principles from how learning works in animals and humans. While reinforcement learning usually has its focus on learning a specific task based on a reward signal, continual learning focuses on consolidating the knowledge and acquiring new knowledge in a manner that new tasks should be learned without forgetting the previous ones. This is an active field of research in Artificial Intelligence, where neural-network-based approaches have to make tradeoffs related to the *stability-plasticity dilemma* and prevent *catastrophic forgetting* in artificial agents.





TASK

In this thesis you will apply concepts and algorithms from continual and reinforcement learning to train neural-network-based model that controls a robotic manipulator in simulation, such that it can solve 2 distinct tasks (e.g., reaching an object and pushing an object), by learning the tasks sequentially. Based on the results, the models trained in simulation can be evaluated on a real robotic manipulator at the end.

Through the work you will:

- gain hands-on experience with state-of-the-art algorithms in RL and CL and a good overview of the current state in this research area
- design experiments and evaluate different properties of the models

REQUIREMENTS

- Previous practical experience with popular AI frameworks (TensorFlow/PyTorch)
- Good knowledge of Python
- High motivation to address research-relevant questions

FURTHER READING

[1] Embracing Change: Continual Learning in Deep Neural Networks (link)
[2] Continual Learning on Incremental Simulations for Real-World Robotic Manipulation Tasks (link)

DETAILS AND CONTACT

Supervisor: Prof. Dr.-Ing. habil. Alois Christian Knoll
Advisors: Josip Josifovski (co-advising with Zhenshan Bing and Mohammadhossein Malmir)
If you are interested in the topic, please send an email to Josip Josifovski stating your previous relevant experience and include supporting documents like grade report.