



Student Thesis (Master)

In the area of: Intelligent Agricultural Robotics

„Analysis of the Sim-to-Real Gap in Agricultural Robotic Applications“

BACKGROUND:

In the field of artificial intelligence (AI), learning approaches are often used that are based on the interaction between robots and their complex real environments (e.g. reinforcement learning).

These approaches require the robot to continuously interact with its environment to find out how it can improve its performance. The repeated interaction often requires that the environment is regularly reset to an initial state. There is also the possibility that the robot may damage parts of the environment or itself through inappropriate behavior. For these reasons, simulation environments are often used during the learning phase. However, when transferring the skills learned in the simulation to the real world, there is often a performance gap (so-called sim-to-real gap), as the conditions in the simulation cannot exactly reproduce those of the real world.

TASK DESCRIPTION:

The following tasks are to be carried out as part of the final thesis with a robot available at the FG:

- Creating or adapting a simulation environment and a corresponding real-world environment.
- Training a robot controller in the simulation using AI (in particular reinforcement learning)
- Transfer of the robot controller from the simulation to the real-world environment
- Analysis of the differences in simulation and real world
- Testing methods to reduce the sim-to-real gap

METHODS:

- Literature reserach
- Python programming
- ROS2 and Gazebo (Ignition) or Nvidia Isaac Sim
- Pytorch or similar AI software libraries

Contact:

If you are interested, please write an email to **JProf. Dr. Anthony Stein**:

anthony.stein@uni-hohenheim.de