

Title: Simulation of Environment Sensors – towards digital twins of autonomous agricultural machines

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Abstract:

Perception of the environment is a basic requirement for all cognitive robotic tasks. In agriculture the unstructured and living – thus evolving and developing – environment is a constant challenge. A Digital Twin of environment sensors (Lidar, camera) shall be developed, including the sensor hardware-in-the-loop, to automatically collect feedback on the model quality. Critical features are the realtime capability of the simulation and the very small Sim-to-Real-gap in order to synthesise data with integrated ground truth annotations. The feedback data will be used to re-train and improve the models accordingly. Digital Twins are a highly researched field. The goal is to develop Digital Twin simulations of sensor outputs, in unstructured environments, with changing and challenging ambient conditions, in order to synthesise training data for control algorithms. Thus by simulating environments and environmental sensors, to create enough data for the development of control applications.

This scientific work is to be realized in an agricultural use case. The work is carried out in cooperation with agricultural technology companies.

Desired skills of the applicant:

- Scientific Background in Robotics, AI and Digital Twins
- Strong programming skills in python
- Experiences in the application field agriculture is also a strong plus

References:

J. Thieling, S. Frese and J. Roßmann, "Scalable and Physical Radar Sensor Simulation for Interacting Digital Twins," in IEEE Sensors Journal, vol. 21, no. 3, pp. 3184-3192, 1 Feb.1, 2021, doi: 10.1109/JSEN.2020.3026416.