Open topics for master theses

1. Energy fluxes in a combined production of glass, biogas and mescal spirits in Mexico. A glass recycling facility in Mexico is improving their energy footprint by different technological means. At the same time, they produce mezcal,a local alcoholic beverage, and treat organic waste to produce biogas.The objective is to perform an energy balance to identify the possibilities of an integrated energy management.

2. Reuse of exhaustion carbon dioxide from a biogas reactor as greenhouse fertilizer. Biorreactors produce CO2 that could be used as a fertilizer for plant production. The objective is to evaluate the feasibility of such coupling and present alternatives for implementation.

3. Yield prediction of greenhouse tomato using deep neural models. Harvesting tomatos in greenhouses is a regular task that depends highly on the microclimate. For the producers, it is useful to estimate the expected amount of kilograms to be harvested for economical and logistic reasons. The objective is to develop a model (e.g. LSTM) to estimate the yield using climatic values as inputs.

4. Deep resolution mapping of satellite and remote sensing images. Images of satellites and UAV can represent the same geographical area with different spatial and spectral resolution. Mapping between images of the same area could improve the resolution and allow to detect objects by fusing information from different sources. A first approach could use convolutional deep neural networks.

5. Transferability of greenhouse climate models. All empiric climatic models are tied to the dataset used to create them,making it difficult to use them under different conditions. In the case of greenhouses, the microclimate is defined not only by the physical structure, but also the geographical location, the agronomic management and the crop itself. The ability to transfer models between facilities can foster the technology transfer in the sector.

6. Evaluation and improvement capacities of irrigation in an organic greenhouse farm. A particular organic farm in northern Germany produces vegetables under organic certifications. Preliminary data suggest that the irrigation (microirrigation on soil) shows room for improvement. A thorough water balance could help to make suggestions on the irrigation management.

7. Deep generative models to predict image time series. Time series of geographical images are often used to show the evolution of land-use in a given area. Goal of this research topic is to explore the use of generative models to predict such developments by creating images of the area, using previous instances as inputs.

8. Hydraulic design of a biorreactor for biogas production. An hydraulic model (CFD) of a particular biorreactor is needed to improve its design, with a particular focus on minimizing its dimensions.

9. Segmentation of maize and weed for autonomous navigation. An autonomous robot needs to be able to differentiate maize and weed in real time to be able to accurately navigate between lines in a field. For this, a segmentation and classification model of the images from the video camera is needed.