SONY COMPUTER SCIENCE LABORATORIES, PARIS - SUSTAINABILITY TEAM

Modeling and predicting the 3d growth of saffron plants

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keywords: 3d vision, computer graphics, deep learning

The Sony CSL sustainability team is developing an phenotyping platform that is light weight, low-cost, open source and targeted at laboratories in plant science. The objective is to capture the 3d structure of a plant using a camera attached to a robotic arm and to characterize its traits (architecture, growth, ...) using 3d vision techniques. The current application of the robot is dedicated to the measure of angles between organs of a commonly studied plant, Arabidopsis thaliana. This research, in collaboration with a plant science laboratory, has led to the development of a 3d segmentation algorithm that labels each 3d point of the plant corresponding to the type of organ it belongs to. Also, geometrical algorithms have been developed to measure the angles between successive fruits and extracted the skeleton of the plant and track the growth of individual organs.

The objective of the internship is to model and predict 3d the growth of a safran plant. For modeling, a L-system based software (Lpy [1]) will be used, producing 3d point clouds of a saffron plant at given times along its growth. An exploration of deep neural network for point clouds wll then be done to select an architecture suitable for the prediction of the growth of the plant. Similar ideas have been proposed in the litterature for 2d images [2] and architectures for 3d point clouds have been proposed [3] from which the student can take inspiration. Ultimately, the student will test his algorithms on real data.

The student should have knowledge about 3d vision and/or neural networks. The internship will be in collaboration with the team "Mosaic" from the RDP in ENS Lyon and "Informatique Géométrique et Graphique" of the iCube laboratory in Strasbourg.

[1] Boudon, F. et al. (2012). L-Py: an L-system simulation framework for modeling plant architecture development based on a dynamic language. Frontiers in plant science, 3, 76..

[2] Drees, L.et al. (2021). Temporal Prediction and Evaluation of Brassica Growth in the Field using Conditional Generative Adversarial Networks. arXiv preprint arXiv:2105.07789.

[3] Deep Learning for 3D Point Clouds Analysis - Loic Landrieu
https://www.youtube.com/watch?v=BUvyKrl7-Bk

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