Evaluating plants as intelligent sensors for precision agriculture

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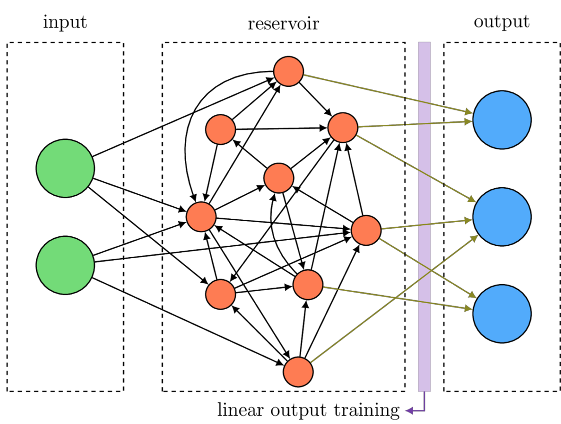
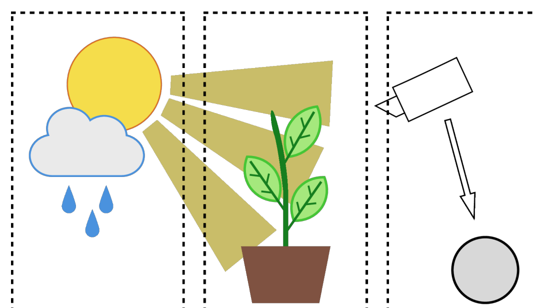
Setting

Plans continuously sense changes in their environment, and adapt their behaviour in function of these. Plants can store and use information of light sum, intensity and day length for several days or more to anticipate environmental changes that might appear in the near future. Consequently, plants can be seen as nonlinear dynamical systems with memory that are optimised for growth and survival in their local environment. Plants can thus also be abstracted as physical reservoirs. In physical reservoir computing, inputs excite a reservoir that can be partially observed using sensing theologies. This can be applied to plants since plants sense the environment (light, water, pests etc.) and respond to these. These responses can be captured using cameras, leaf thickness sensors, sap-flow sensors etc. We are investigating this intelligence and aim to leverage it to improve greenhouse setups for precision agriculture where precise crop information is essential.





Goal

During this thesis, we will evaluate this hypothesis (that plants are physical reservoirs) through a simulation based approach. To this end, and overview and evaluation of state-of-the-art crop models will be necessary, followed by the implementation of the most suitable candidate (based on existing resources). The responses measured from this simulated plant can readily be used to evaluate the performance and characteristics of the reservoir. Additionally, a physical experiment can be performed where the plant responses are monitored and a comparison is made between the results from the simulated and physical plant.