Spatio-Temporal Generation of Morphological Features for Plant Growth Prediction Using Progressively Growing GANs

Sheth, Dhruv (School: Pace Junior Science College)

Recent Innovations in Precision Agriculture (PA) are driven by Computer Vision and Data Processing systems to quantify plant parameters. Quantitative analysis of Plant Phenotyping in PA and monitoring morphological traits is a protracting process, hindering the objective and phenotyping pipeline. Generative Adversarial Networks (GAN)'s used for Generating features offer a catalytic approach to the time-consuming process to accelerate phenotyping and predict plant growth under different environmental factors before harvest. This research proposes a concept of using time-series plant growth datasets to understand Spatio-temporal features in plants and correlate the visual morphological features such as foliage or leaf density affected by external environmental variables and predict the growth and pattern specific to its environment. Environment-specific growth pattern prediction for each plant help in understanding the suitable environment for optimum growth of the plant and to maximize yield. This approach reduces the dependence over an experimental process to deduce the optimum growth environment through observational analysis and decreases cost over resources and labor. To achieve this process autonomously, an approach in Machine Learning, GANs are used. Spatio-Temporal 3D convolutions based Progressively Growing GANs are proposed to iteratively learn features in plants and generate future plant growth frames through image input frames of initial stages. After a thorough subjective and objective analysis of the generated frames, it can be understood that the results show high correspondence with Ground Truth frames and realistic generation of plant traits in images which make it visually interpretable and accessible.

Awards Won:
Third Award of $1,000