

Exploring the Potential of Deep Learning Architectures for Plant Trait Prediction

It has been said that plants are the superheroes of ecosystems, and that knowledge of their characteristics is essential to comprehending the diversity, productivity, and adaptability of ecosystems to climate change. Loss of biodiversity and climate change are two of the most urgent issues of our day. Plant traits refer to characteristics inherent to plants that explains their functionality and their relationship with the environment. Various aspects like plant canopy height, which denotes a plant's ability to outcompete neighboring plants for sunlight make up the traits and leaf area. The aim behind this project is to harness the power of artificial intelligence to delve into the world of plant biodiversity, addressing the urgent need to understand how ecosystems adapt to climate change. Through this research, we will get insights into plant qualities and their responses to changing environmental conditions.

The proposed project aims to utilize deep learning models for predicting plant traits from images. Leveraging a dataset of over 30,000 labeled plant images along with ancillary data including climate information and soil characteristics, the project will employ convolutional neural network (CNN) architectures such as ResNet18. Through transfer learning, the pre-trained CNN models will be adapted to the task of plant trait prediction. Data augmentation techniques will be employed to enhance model generalization and robustness. The project seeks to optimize model performance by integrating image data with ancillary data and fine-tuning the CNN models to accurately predict plant traits based on visual information and environmental context.

Literature Survey

This paper uses the image data from citizen science platforms like iNaturalist and combines it with the trait observations from the TRY database and explores the potential of leveraging Convolution Neural Networks (CNNs) to predict plant functional traits using visible morphological features extracted from photos. Plant functional traits play an important role in determining the biodiversity and ecosystem processes, traditional measurement methods are often labor-intensive and inefficient which makes way for the need for better innovative approaches. CNNs, known for their proficiency in extracting intricate features from raw image data, shows promise in ecological research. The paper also accounted for intraspecific trait variability along environmental gradients. The results show how well CNNs can predict a range of plant qualities, bridging taxonomic and geographic divides and facilitating the creation of global trait maps that mirror macroecological patterns. (Schiller et al., 2021)

References

- Schiller, C., Schmidtlein, S., Boonman, C., Moreno-Martínez, A., & Kattenborn, T. (2021). Deep learning and citizen science enable automated plant trait predictions from photographs. *Scientific Reports*, *11*(1). doi:10.1038/s41598-021-95616-0
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