Automating Severity Assessment of Southern Leaf Blight in Corn Leaves Using Machine Learning

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Efficient identification of abiotic and biotic stress experienced in an uncontrolled environment by plants is a prominent issue in agriculture. The use of machine learning approaches with computer vision allows for the estimation of disease progression and the early detection of diseases so that mitigation techniques can be applied before crops become too infected for recovery or before the disease spreads to neighboring plants. This work aims to develop an efficient, objective computational pipeline capable of estimating the disease severity caused by Southern Leaf Blight in images of field-grown maize plants. We collected visible light (RGB) field images of maize leaves from lines susceptible and resistant to southern leaf blight and obtained field severity scores of the maize lines. We have shown a strong correlation, $r(262) = .935$, $p < .0001$, between the field severity scores and the severity score of an image with an individual leaf, indicating that images of a leaf provide consistent grading as would be done in the field for a plot of plants. We propose a multistage approach to quantify infected tissue based on a heatmap produced by a convolutional neural network trained to identify the lesions. This research could provide a road map to early stress detection in the field, which could be used as a decision support tool to identify cultivars that are more resistant to abiotic or biotic stress, monitor epidemics, and understand a plant's stress state such that resources are optimized.