PhotoFolio: A Smartphone Application for the Efficient Detection of Various Plant Diseases Using Machine Learning

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Crop diseases are a major problem, causing between 20-40% of global crop yield to be lost on a yearly basis. These losses exacerbate existing food security problems and place a strain on global agriculture. Many farmers, especially in the developing world, lack the knowledge and skills to identify these detrimental plant diseases themselves and can often only rely on expensive expert consultants. However, detecting diseases early can help to minimize the impact of disease outbreaks and therefore increase crop yield. The purpose of this project was to create a smartphone application that could use an image of a plant leaf to accurately diagnose plant disease. Machine learning with the convolutional neural network (CNN) approach was used with a dataset of over 54,000 leaf images split into labeled classes encompassing 26 diseases in 14 crop species. For each image, the generated CNN model predicted a crop-disease pair, given 38 possible classes. The machine learning model was trained with transfer learning and achieved an accuracy of 99.51% classifying validation images of plant leaves that it was not trained on. The model was deployed onto a smartphone application that allowed the user to upload a picture of a plant leaf and then predict the crop species and the disease using the model. The application also included an information screen where a user could learn about management techniques for the disease. The application was verified to be functional in the real world through field testing at local garden centers and botanical gardens. This project allows for the democratization of access to accurate means for detecting crop diseases early, enabling better disease control by farmers.

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