A Minor Project Synopsis on

Plant Disease detection using Deep Learning and image processing

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INTRODUCTION

The latest generation of convolutional neural networks (CNNs) has achieved impressive results in the field of image classification. By the means of this minor project, we aim to classify the plant diseases by assessing the images of the leaves with the application of Deep learning and image processing and finding the most optimal machine learning algorithm to achieve the same, and create an interface to classify the provided image and generate the appropriate results using the model which may include various types of disease and their respective treatments.

We will identify the affected area of a leaf by visualization methods, we will be using the neural networks for capture the colors and textures of lesions specific to respective diseases upon diagnosis, which resembles human decision-making. A variety of neuron-wise and layer-wise visualization methods will be applied using a CNN, trained with a publicly available plant disease image dataset and the developed model will be able to recognize and classify several different types of plant diseases out of healthy leaves, with the ability to distinguish plant leaves from their surroundings.

MOTIVATION

The need for agricultural practice advancement is growing every day, and it's one of those fields that gets overlooked when it comes to the use of technology and artificial intelligence, which are ubiquitous in many aspects of our daily lives, but we're still using decades-old practices in agriculture, which has a significant impact on our agrarian economy. Machine learning can offer farmers with more detailed information on their crops, allowing them to make better agricultural decisions.

This applications could be used as a foundation for developing expert assistance or automated screening systems. Such tools may help to promote more sustainable agriculture practices and increase food security.

PROJECT OBJECTIVE

Using the plant village dataset as the train and test data, the goal of this project is to develop the best possible machine learning model to classify and identify the effective area of a diseased plant leaf plant disease by combining various image processing techniques with certain supervised or unsupervised machine learning algorithms, whichever produces the best accuracy and build a usable interface for providing disease related information and its treatments. This will be a critical step in recognizing the disease, its stage, the appropriate insecticide, pesticide, or fertilizer, and the appropriate dosage, as well as establishing a link between disease behavior and finding a solution for it and build a usable interface for providing disease related information and its treatments.

Current Practice	Pros	Cons
Manual selection of fertilizer/insecticide/pesticide and its amount without any automated recommendations or any other expertise.	Farmers determine the most appropriate amount based on the disease to the best of their knowledge.	Non-automated time-consuming process. Can lead to excessive usage, crops harmful for consumption, soil and water pollution.
Manual disease detection and diagnosis by farmer farmers or by agricultural scientists	A decision is made based on visuals and the spread to the best of farmer's knowledge.	Can be inaccurate and inefficient at times due to human error or lack of knowledge

		this is a very challenging and time-consuming task.
Automatic disease detection with the help of machine learning algorithm.	It is more accurate than the traditional practices	use a very high number of training parameters. Consequently, the training time and the prediction time of these systems are very high, or they require a machine with high computation powers and are not available to all farmers

Methodology

Datasets

The leaf images of peach plants have been extracted from the Plant Village dataset. The datasets image data for many plant leaves diseases and each of them has a healthy class contains many leaf images, and the diseased (Bacterial Spot) class comprise of diseased leaf images.

Image processing and labelling

Images intended to be used as datasets for deep neural network classifiers are to be preprocessed. Preprocessing involves cropping all the images, in order to highlight the region of interest, and using CV2, adjusting the size and colors of the image and making more changes according to the dataset.

Augmentation Process

The main purpose of applying augmentation is to increase the dataset and introduce slight distortion to the images which helps in reducing overfitting during the training stage. The image augmentation contained one of several transformation techniques including affine transformation, perspective transformation, and simple image rotations. Affine transformations were applied to express translations and rotations (linear transformations and vector addition, resp.) where all parallel lines in the original image are still parallel in the output image.

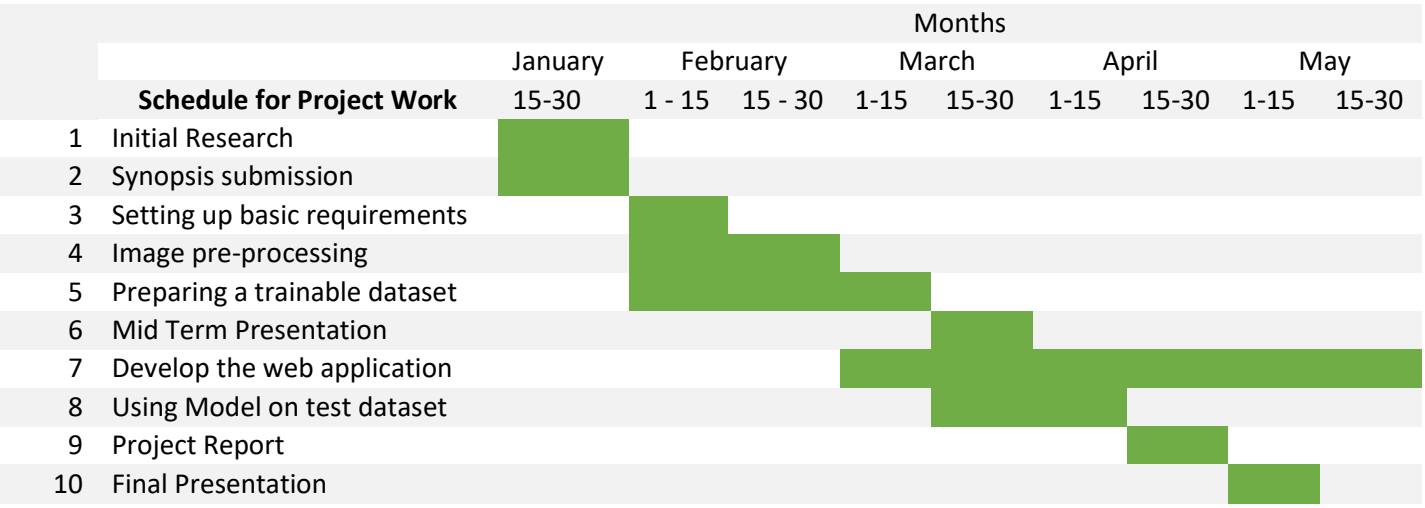
Neural Network Training

To train the model, the leaf images of plants will be randomly divided such that 70% of them form the training dataset, and 30% form the testing dataset.

In order to get better feature extraction, final images intended to be used as dataset for deep neural network classifier were preprocessed in order to gain consistency. Procedure of image preprocessing involved cropping of all the images manually, making the square around the region of interest (plant leaves). Images with smaller resolution and dimension less than 500 px were not considered as valid images for the dataset.

Web Application

Will be using react with redux to develop the front-end of the application where a user can upload the image of the plant (or use the camera), which is then processed by the developed model to find out any disease in the plant, and as a result, return the ailments and treatment of the unhealthy plant. We'll be using firebase as the backend service provider and use its hosting, cloud storage and firestore SDKs



FACILITIES REQUIRED

Hardware Requirements :

- CPU: Pentium 4 or Athlon XP
- CPU SPEED: 1.5 GHz
- RAM: 256 MB
- OS: Windows XP

Software Requirements :

- Windows XP or higher
- Python along with libraries like OpenCV, pandas NumPy
- Jupyter Notebook
- VS code
- Tensor flow and keras
- MERN stack

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