DIGITAL IMAGE PROCESSING PROJECT PROPOSAL

Title:

Apple Folia Disease Detector

Group Member:

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Abstract:

Apples are one of the most important temperate fruit crops in the world. Foliar diseases constitute a prominent threat to the overall productivity and quality of apple orchards. The current process for disease diagnosis in apple orchards is based on manual scouting by humans, which is time-consuming and expensive. Transforming this process to the digital image processing domain will make it much easier and more efficient. We just need images of the leaves that may be captured using a drone or satellite and then diagnose the diseases using images.

Motivation:

The motivation behind choosing this topic as a digital image processing semester project is multifaceted. Firstly, apples are a widely cultivated fruit crop globally, and the impact of the foliar disease on apple production is very prominent. Secondly, the current method of disease detection is labor-intensive, time-consuming, and costly.

Transforming traditional ways using digital image processing, we aim to revolutionize disease diagnosis in apple orchards, making it more efficient and cost-effective. Thirdly, utilizing technologies like drones and satellites for image capture offers scalability and the potential for early disease detection and helps farmers look after their orchards by detecting diseases early.

Related Work:

- **Apple Fruit Disease Detection Using Image Processing**

  In this project, they detected diseases of apple by the apple image using SVM and CNN models in digital image processing. Our main difference from their project is that we are using leaves to detect disease. This difference will make us able to detect disease earlier before it affects the fruit.

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  Project link
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- **Detection and Classification of Apple Fruit Diseases Using Complete Local Binary Patterns**

  They are also using apple images that have spots on the surface due to some diseases. Detecting diseased apples is good stuff but it is too late at this stage. So, the solution proposed by us is utilizing affected leaves in the early stages to prevent disease before it affects the apple.
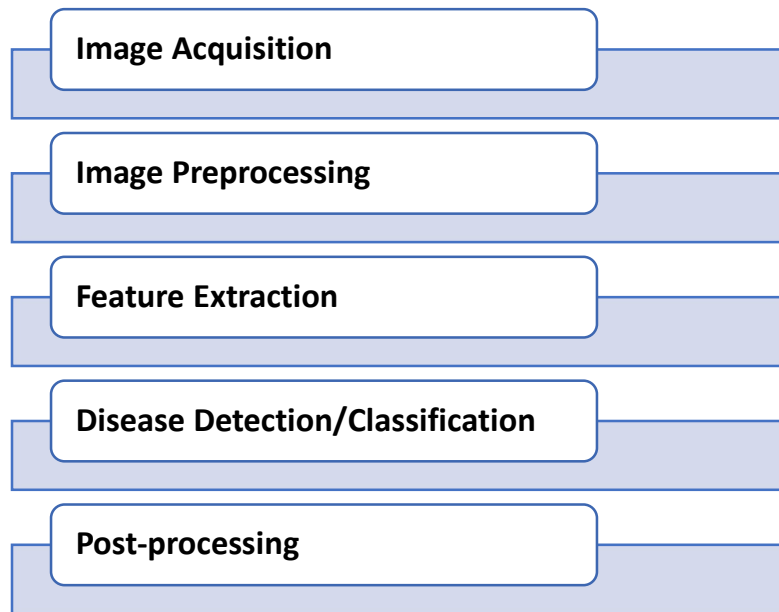
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  Project link
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- **An Apple Leaf Disease Identification Model for Safeguarding Apple Food Safety**

  In this project, they are using leaves, but they have a very small number of leaves per disease, and they are generating fake images that is why our project is different from theirs as we have eighteen thousand six hundred and thirty-six images and have an average fifteen hundred images per disease.

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Detailed Description:

In this project, our basic objective is to help farmers and orchard managers by providing them with advanced digital tools in the form of a user-friendly website and mobile application which uses an image processing model at backend. Through these digital platforms, we seek to change orchard management and disease detection, thereby enhancing the overall health and productivity of apple orchards. We are going to develop a CNN and SVM image processing model that will work as backend of the website and mobile app. Here are the steps to achieve this:

Image Acquisition

Image Preprocessing

Feature Extraction

| Disease Detection/Classification |
|---|

Post-processing

- **Image Acquisition:**

We are using pre captured high-definition images data set available at Kaggle under plant pathology 2021 competition. There are a total of eighteen thousand six hundred and thirty-six images and have an average fifteen hundred images per disease. We will use these images to train our CNN and SVM model which will classify our leaf images and help in detecting diseases. As far as the usage of the model is concerned the farmer will capture images through drone or any camera device and use our model through website or mobile app and get information about the leaf.
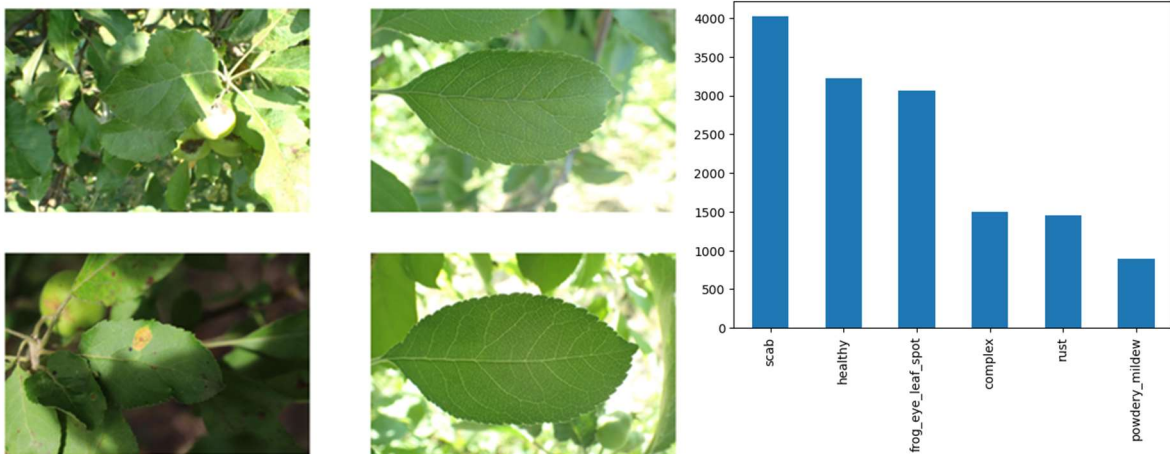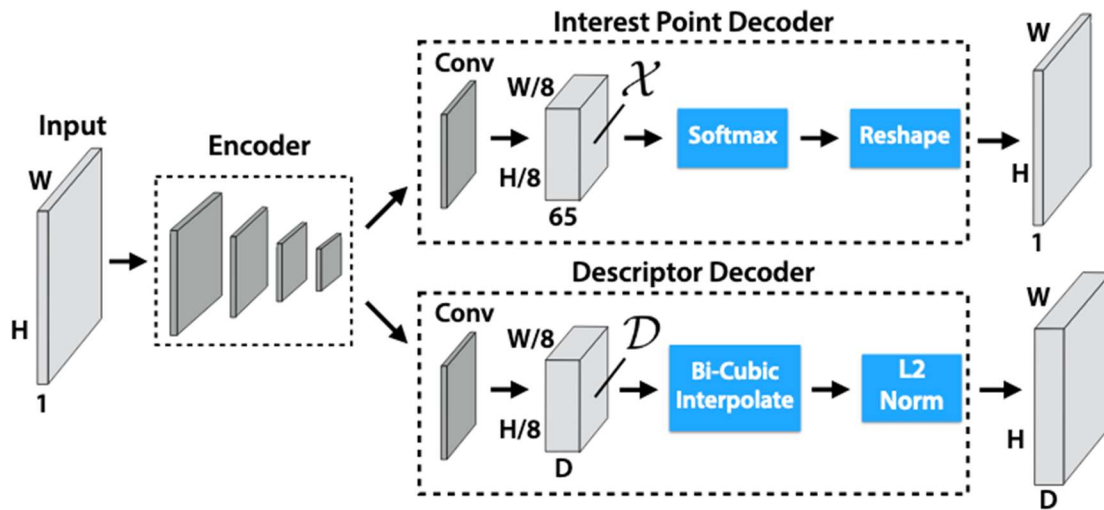
- **Image Preprocessing:**

In preprocessing we will downgrade our image resolution as each image is of one megabit size that is too expense for eighteen thousand plus images in terms of processors and memory. In addition, we will shift our images to representation other than RGB if spots are more visible in that domain. Also, we will preprocess images in such a way that our leaf's detected part becomes clear and helps our model to get trained efficiently.
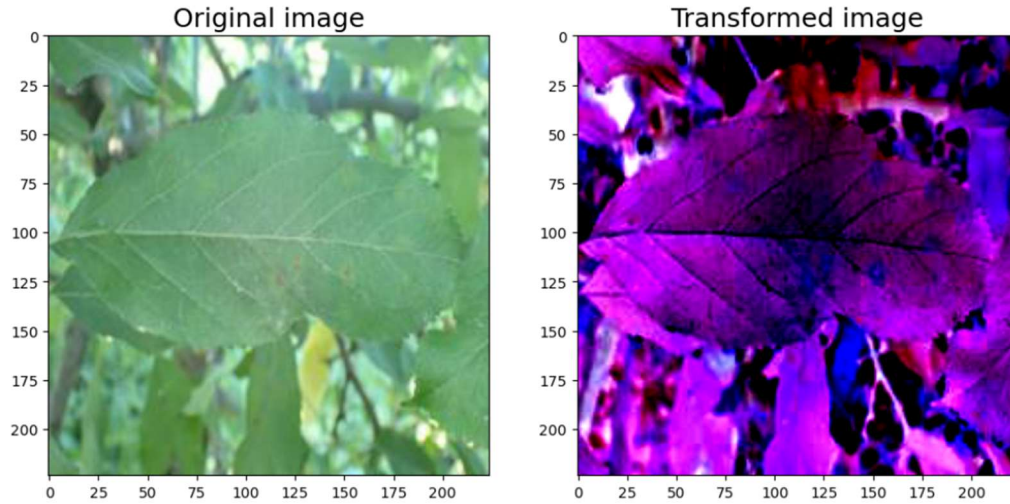

- **Feature Extraction:**

Feature extraction is like mining the essence of segmented leaf images. We analyze texture, color, shape, and unique disease indicators. These quantified attributes become the building blocks for precise machine learning, aiding disease diagnosis in apple trees.

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- **Disease Detection/Classification:**

  We will train a CNN model on preprocessed images that will classify our leaves into five disease categories: scab, frog eye leaf spot, rust, powdery mildew and complex. Complex is a mixed category, complex labeled leaf has more than one disease.

  A Convolutional Neural Network is a specialized type of artificial neural network primarily used for processing visual data, such as images and videos. CNNs are designed to automatically extract meaningful features from input images through convolutional layers, enabling them to identify patterns, shapes, and textures.

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( CCN Training ) → ( CNN Classification ) → ( Performance Evaluation ) → ( Model Testing )
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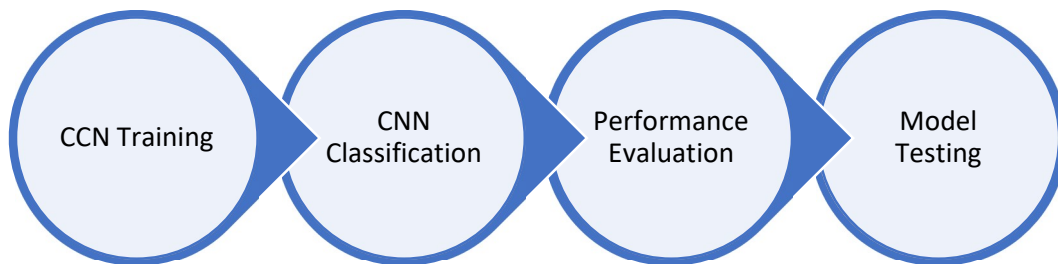
- **Post-processing:**

  To make our model useable we will develop the model and deploy it on server from where it will be accessed through website and mobile app. Any farmer having apple orchard can use our website or mobile app to get pictures of leaf and send to our server and get results back. In future they can use drone technology to capture images and send them to get predictions about diseases and even drone itself can act if the disease is detected like spraying pesticides relevant to that disease. In this way orchard management will become more efficient and cost effective and that is how our goal will be achieved.