



# ***DETECTION AND CLASSIFICATION OF FRUIT DISEASE USING MACHINE LEARNING***

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**ABSTRACT:** In the country like India, agriculture is the backbone of the overall GDP.

This Horticulture has become one of the important source of economy for the country and even the farmers. Farmers will see much losses because of not identifying the diseases at early stage. Relying on pure naked-eye observation to detect and classifying diseases can be expensive for various Fruit diseases. It poses a great threat to the agricultural sector by reducing the life of the plants. In Agriculture field also image processing plays a very important role in identifying any disease of the Fruit and grading the quality of the fruit. Identification of the Fruit diseases will help in preventing the losses in the yield and quantity of the agricultural product. The studies of the Fruit diseases mean the studies of visually observable patterns seen on the Fruit. Health monitoring and disease detection on Fruit is very critical for sustainable agriculture. It is not easy to monitor the fruit diseases manually. In this project, we have implemented the methods for the detection of Fruit diseases using the images of the fruit.

**KEYWORDS:** Preprocessing, Feature extraction, CNN

## **1. INTRODUCTION**

Some of the fruits that grows with an awfully high yield in many nations of Asian countries and one in every one of the foremost profits gaining fruit within the market. However, because of numerous conditions, the plants are infected by numerous diseases that destroy the complete crop departure terribly less product yield. So, the work proposes a picture process and neural network strategies to agitate the most problems with Phytopathology, i.e. detection and classification of wellness. Pomegranate and Apple (*Punica granatum*) is a deciduous tree grown in arid and semiarid regions. It grows well in areas with temperatures ranging from 25-35 degrees and an annual rainfall of 500-800 mm. In recent years, diseases have resulted in huge losses in Fruits produced. These diseases are usually caused by micro-organisms like fungi, bacteria, and viruses. The major diseases are Bacterial Blight, Fruit Spot, Fruit Rot, and Leaf Spot. These diseases are very severe and destroy orchards.

The project design implemented by this paper focuses on various diseases category affecting on Fruits these are Alternaria fruit spot, cercospora fruit spot, bacterial blight, fruit rot. There is no other fruit crop that has high medicinal value compared to that in Pomegranate and Apple. This nutrient dense, antioxidant rich fruit has been revered as a symbol of health, fertility and eternal life. This Fruits gets some of the major diseases, which destroys the fruits and trees resulting in less yield and loss to farmers.

In India, at present the Fruit disease detection is done by some domain expert and this disease detection is done manually. So it may be time consuming to detect disease of fruit and provide proper treatment to prevent economical loss. In this project, we proposed automatic fruit disease detection system using image processing. The fruit is taken in the low rain region and which gives the more profit to the farmers. The disease mainly spread in rainy and winter season. These diseases affect stem, leaf and fruits. The fruit disease in the form of dark brown surrounded by dark yellow, infected leaves turn in yellow color. There is need to identify these diseases at the primary stage to prevent loss to the farmers.

## LITERATURE SURVEY

- [1] H. Al-Hiary, S. Bani-Ahmad, M. Reyalat, M. Braik and A. Rahamneh have proposed Fast and Accurate Detection and Classification of Plant diseases. They proposed and experimentally evaluated a software solution for automatic detection and classification of plant leaf diseases. The proposed solution is an improvement to the solution proposed as it provides faster and more accurate solution. The developed processing scheme consists of four main phases. The following two steps are added successively after the segmentation phase. In the first step we identify the mostly green colored pixels. Next, these pixels are masked based on specific threshold values that are computed using Otsu's method, then those mostly green pixels are masked. The other additional step is that the pixels with zeros, red, green and blue values and the pixels on the boundaries of the infected cluster (object) were completely removed. The experimental results demonstrate that the proposed technique is a robust technique for the detection of plant leaves diseases.
- [2] Z. May and M. H. Amaran has proposed Automated Oil Palm Fruit Grading System using Artificial Intelligence, This project deals with the ripeness of oil palm fruit. The current procedure in the palm oil mills is grading the oil palm fruit manually using human graders. This method is subjective and inconsistent because each grader has its own techniques and may vary from each other's. Hence, it affects the quality and quantity of the oil that can be extracted. In this project, a new model of automated grading system for oil palm fruit is developed using the RGB color model and artificial fuzzy logic. The vegetation indices from hyper spectral data have been shown for indirect monitoring of plant diseases. But they cannot distinguish different diseases on crop.
- [3] Wenjiang Huang et al developed the new spectral indices for identifying the winter wheat disease. They consider three different pests (Powdery mildew, yellow rust and aphids) in winter wheat for their study. The most and the least relevant wavelengths for different diseases were extracted using RELIEF-F algorithm. The classification accuracies of these new indices for healthy and infected leaves with powdery mildew, yellow rust and aphids were 86.5%, 85.2%, 91.6% and 93.5% respectively. Enhanced images have high quality and clarity than the original image. Color images have primary colors red, green and blue. It is difficult to

implement the applications using RGB because of their range i.e. 0 to 255. Hence they convert the RGB images into the grey images. Then the histogram equalization which distributes the intensities of the images is applied on the image to enhance the plant disease images.

[4] Mrunalini R. Badnakhe, Prashant R. Deshmukh compare the Otsu threshold and the k-means clustering algorithm used for infected leaf analysis in [5]. They have concluded that the extracted values of the features are less for k-means clustering. The clarity of k-means clustering is more accurate than other method. The RGB image is used for the identification of disease. After applying k-means clustering techniques, the green pixels are identified and then using otsu's method, varying threshold value is obtained. For the feature extraction, color cooccurrence method is used. RGB image is converted into the HSI translation. For the texture statistics computation the SGDM matrix is generated and using GLCM function the feature is calculated.

[5] The FPGA and DSP based system is developed by Chunxia Zhang, Xiuqing Wang and Xudong Li, for monitoring and control of plant diseases. The FPGA is used to get the field plant image or video data for monitoring and diagnosis. The DSP TMS320DM642 is used to process and encode the video or image data. The nRF24L01 single chip 2.4 GHz radio transmitter is used for data transfer. It has two data compress and transmission method to meet user's different need and uses multi-channel wireless communication to lower the whole system cost.

[6] Monica Jhuria et al used image processing for detection of disease and the fruit grading in. They have used artificial neural network for detection of disease. They have created two separate databases, one for the training of already stored disease images and other for the implementation of the query images. Back propagation is used for the weight adjustment of training databases. They consider three feature vectors, namely, color, textures and morphology. They have found that the morphological feature gives better result than the other two features.

## Existing system

Detection and classification of Pomegranate and Apple fruit diseases pose significant challenges in the agricultural industry. Rotten fruits can lead to diseases, causing damage to other fresh fruits and reducing overall productivity. Traditionally, this classification process was labor-intensive, time-consuming, and inefficient, relying mainly on color as the primary categorization feature. To address these limitations, machine learning algorithms such as Support Vector Machine (SVM) have been employed for disease classification.

## DISADVANTAGES:

- 1) It increases the cost of production also.
- 2) Support Vector Machine (SVM) produces adequate results on a small number of datasets & Lesser in accuracy

## PROPOSED SYSTEM

The proposed model classifies the Pomegranate and Apple diseases from the input images. In this work, we have used three types of diseases such borer, cercospora, bacterial blight and final one healthy fruit. A

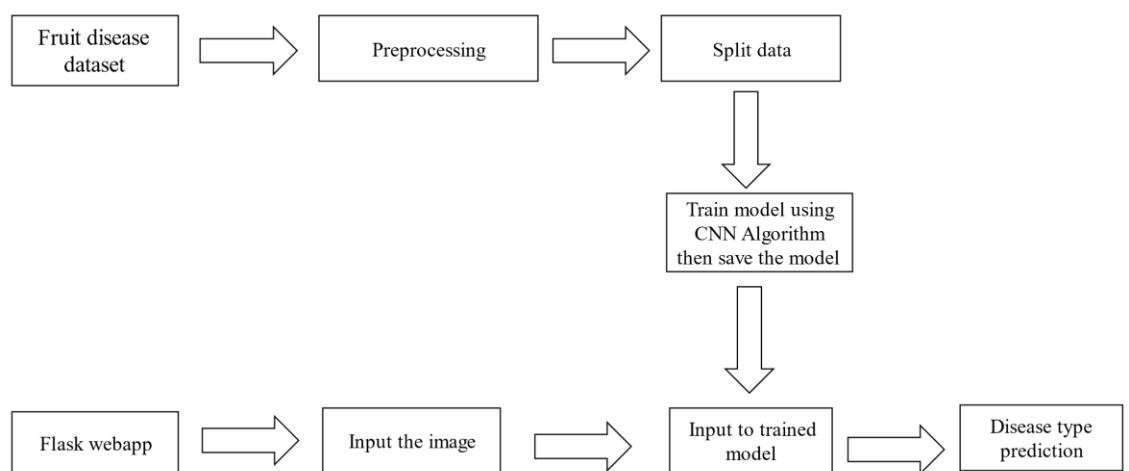
Convolutional Neural Network (CNN) is used for extracting the features from input images of disease and healthy, and Softmax is used for multiclass classification. The performance of the proposed model is evaluated on a dataset that is downloaded from Kaggle and produces an accuracy of 90% and above. The results showed that the proposed CNN model can effectively classify the diseases with their respective category and healthy fruit.

## Advantages

- The main advantage of CNN compared to its predecessors is that it automatically detects the important features without any human supervision.
- Higher Accuracy
- For example, given many pictures of disease and healthy it learns distinctive features for each class by itself. CNN is also computationally efficient.

**Fig : System**

### Architecture



**Fig:FLOWCHART**

**Image Acquisition:** This is the first step where you collect images of the fruits. These images can be collected in different environments and various stages of the disease.

**Image Preprocessing:** The collected images are preprocessed to remove noise and enhance the features of interest. This may involve resizing, cropping, color space transformations, and other techniques.

**Segmentation:** This step involves dividing the image into multiple segments (or pixels) that have similar characteristics.

**Feature Extraction:** Here, we extract features from the segmented images that will help in the classification of the fruit diseases. Commonly used features include color, texture, and shape. Techniques such as color histogram can be used for feature extraction.

**Training the Classifier:** Once we have our features, we can feed them into a machine learning algorithm which will learn to classify the fruit based on these features. we could use algorithms like K-Nearest Neighbors (KNN), Decision Trees, Random Forests, or Support Vector Machines (SVM). In some cases, Convolutional Neural Networks (CNN), a class of deep learning algorithms, are used for this purpose.

**Testing and Validation:** Finally, we test our trained model on a set of images. we then measure the performance of the model using metrics such as accuracy.

### Convolutional Neural Networks (CNNs):

- CNNs are widely used for image classification tasks and are particularly effective for detecting patterns and features in images.
- Train the CNN model on a dataset of diseased and healthy fruit images, enabling it to learn discriminative features for disease detection and classification.

### Softmax Layer:

- The softmax layer is commonly used in the final stage of a neural network model for classification tasks, including the detection and classification of fruit diseases using machine learning.
- Before reaching the softmax layer, the neural network processes the input data (e.g., images of diseased fruits) through various layers, extracting meaningful features that are relevant for classification.
- The softmax function is applied to each output neuron's raw score to transform it into a probability distribution over multiple classes. The softmax function is defined as:

$$\text{softmax}(z)_i = \frac{e^{z_i}}{\sum_{j=1}^K e^{z_j}}$$

Where:

$z_i$  is the raw score (logit) for class  $i$ .

$K$  is the total number of classes.

$e$  is Euler's number (approximately equal to 2.71828).

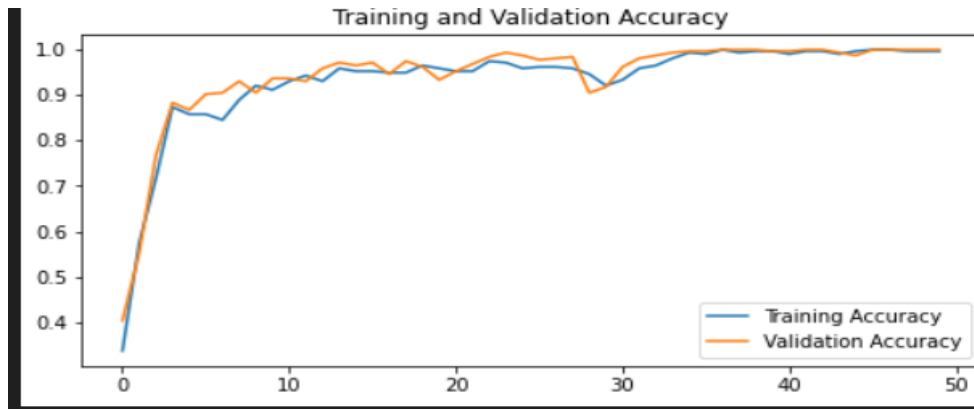
### Supervised Learning Algorithms:

- *Regression:* Regression algorithms are more suitable for predicting continuous values, such as the severity of a disease or the quantity of a particular attribute, rather than classifying discrete categories like "healthy" or "diseased."
- *Classification:* Classification algorithms can categorize the input image into different classes based on color, texture or other features. This information can be used to classify the fruit disease

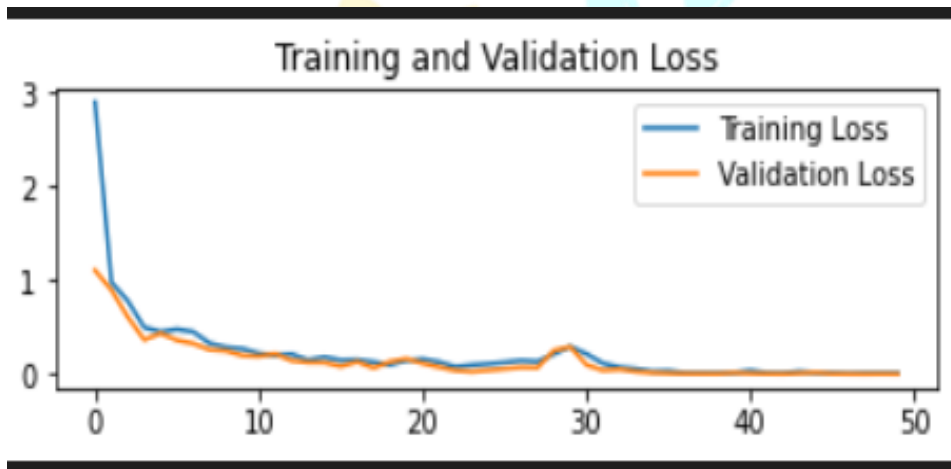
### Experimental Results

The use of CNNs is particularly effective in image classification tasks due to their ability to capture spatial dependencies and hierarchical patterns within the data. The Flask web application provides a user-friendly interface for accessing the disease detection system. Users can upload images of Pomegranate and Apple fruits and receive immediate results indicating whether the fruits are healthy or affected by any of the specified diseases. It reduces labor intensity, saves time, and improves overall efficiency. Additionally, by automating the process, it minimizes the risk of misclassification and helps prevent the spread of diseases to healthy fruits, thus preserving productivity. To further enhance the

system, continuous data collection and augmentation can be performed to increase the diversity and size of the dataset. This would improve the model's ability to generalize and classify fruits .



**Fig: Training and validation accuracy**



**Fig: Training and validation loss**

**Fig: Results**

**DETECTION AND CLASSIFICATION OF FRUIT DISEASES**

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Name	Description
bacterial blight	bacterial blight

**CONCLUSION:-**

The detection and classification of fruit diseases using machine learning techniques offer significant potential for improving agricultural practices, crop yield, and food security. By leveraging machine learning algorithms, researchers and agricultural practitioners can automate the process of identifying and categorizing fruit diseases, enabling early detection and targeted intervention. The implementation of fruit disease detection using machine learning, specifically the CNN algorithm, along with a Flask web application, has shown promising results. The system focuses on detecting three diseases: borer, cercospora, and bacterial blight, as well as classifying healthy fruits. This would improve the model's ability to generalize and classify fruits accurately. Additionally, regular updates and maintenance of the system can incorporate new disease patterns or add new diseases for detection as required. Overall, the integration of machine learning, specifically the CNN algorithm, and a Flask web application for Pomegranate and Apple fruit disease detection provides a valuable tool for farmers and agricultural stakeholders. It streamlines the classification process, aids in disease prevention, and ultimately contributes to improved crop yield and quality. The application of machine learning in the detection and classification of fruit diseases holds great promise for revolutionizing agricultural practices, promoting sustainable farming, and addressing global food security challenges. By harnessing the power of machine learning algorithms, we can develop more efficient, accurate, and scalable solutions for combating fruit diseases and ensuring a more resilient and productive agricultural sector.

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