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Implementation of Disease Detection in Fruits using Neural Networks

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Abstract

Commercialized agricultural operations are always looking for ways to reduce labour requirements without compromising output. Images of a few different fruit diseases, including Bitter Rot, and Sooty Blotch are employed in this method. Fruit infections' ability to lower productivity and the global economy in the agricultural sector is a frustrating situation. In actuality, a healthy diet should be built around fruits. India has a population that is approximately 68 per cent dependent on agriculture. A significant percentage of the Indian economy is based on agriculture. Fruit cultivation has been a vital part of agriculture all over the world and has been the foundation of rural economies. Monitoring a plant's health and spotting illness manually is challenging. Agribusiness is a major contributor to the global economy, but its growth is slowing when compared to the rise in interest, and this ratio of interest to creation is expected to maintain high in the next few generations.

1. Introduction :

Farmers today deal with numerous issues when growing fruits, particularly in the beginning phases. Fruits have extremely little immunity against infection in their early stages. Due to the bacteria that cause infections, these fruits are therefore particularly susceptible to disease.

Large portions of India's population rely mainly on farming for their living, however, this sector makes up only a small portion of the country's overall economy. It's an outcome of low agricultural productivity. Plant diseases cause a drop in productivity. Diseases are a significant risk and problem for the agriculture industry. Fruits are essential agricultural components that are usually eaten by everyone.

Determining the condition is therefore critical, and finding a cure is crucial. Pesticides, weedkillers, and fertilizers are the major components of the solution to effectively fight the disease.

In the modern world, it is past time to take care of the farming fields. However, due to ongoing climatic and other changes, crop yields and farming productivity have shifted to some serious problems that are a source of the legitimate issue (Tran et al.).

In agricultural sectors, higher yields of better-quality fruit are necessary. To do this, an automated technique that can detect disease in fruits is required. Given the deplorable fruit improvement, lack of maintenance, and physical inspection, the production of fruits with high value has decreased. The illness of fruits reduces the quantity and kind of cultivating things (Yin et al.).

Contaminations and tiny microbes are the root causes of fruit illnesses (Koushik et al.). There is a

chance of inaccurate sorting and packing of fruits as a result of manual testing and a lack of understanding of product evaluation. Producers are under pressure to satisfy the demand for quick output because of the shortage of competent workers and growing labour expenses.

Convolutional Neural Networks (CNN), more advanced than Artificial Neural Networks (ANN), replace generic matrix multiplication in at least one of their layers with the mathematical process of convolution. They are utilized in image processing and recognition because They were designed primarily to deal with pixel data. Because it employs machine learning to identify important components without personal communication, CNN has a major advantage over its early pioneers. Its incorporated convolutional layer reduces the vast dimensionality of images without losing any information. As a result, CNNs are particularly suitable for this picture classification case.

2. Literature survey:

To identify diseases in fruits and vegetables, Bhange, M. & et al. (Akhilesh et al.) suggested approaches to deep learning and image processing. In early projects, a Deep Convolutional neural network (DCNN), a supervised learning technique, is used to detect objects (Kaseb, Khaled, and Galal). Using image processing, Dubey, S. R. & coworkers (S et al.) devised a method for diagnosing fruit diseases. Using plant leaf pictures, Sachin D. Khirade and A. B. Patil (Khirade and Patil) suggested a method for identifying plant diseases. They also talk about how to identify diseases using feature extraction and segmentation.

An OpenCV algorithm for Canny Edge Identification that depends on various thresholds and is practical for edge detection in images was proposed by Zhao Xu, Wu Guoxin, and Xu Baojie (Xu, Baojie, and Guoxin). The authors conducted a review of various segmentation methods in (Sravan et al. Kukreja and Dhiman Gargade and Khandekar). The noise impact and data dissertations were hampered during the picture segmentation procedure (Li et al.). The methods were separated into edge-based, region-based, and graph-based categories. Segmentation's main objective is to enhance the quality of the image to make it sufficient for display.

3. METHODOLOGY:

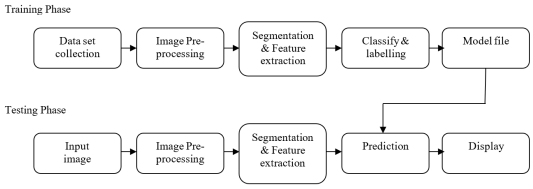

FIGURE 1. Block diagram of an implementation of disease detection in fruits using neural networks

3.1. Data set Collection:

If the image has already been taken, in addition to using the camera and program to capture the contaminated area, it is also possible to choose the image from the gallery. The acquired image will typically be in RGB format. The farmers were given instructions while the picture was being taken (Schor et al.). It should concentrate on the fruit's diseased area and a specific distance. The image is scaled and given a colour transformation during pre-processing.

3.2. Image Pre-processing:

Pre-processing a picture has the goal of enhancing the quality of the image such that we can more effectively analyse it. Pre-processing allows us to remove unwanted distortions and improve some qualities that are essential for the application we are building. Those characteristics could change depending on the application.

3.3. Image Segmentation:

The split of an image into groups of pixels is known as the segmentation of an image that is homogeneous in terms of a particular criterion. Adjacent groups must not cross over into other groups, and different groups must not become diverse. Instead of being pixel-oriented, segmentation algorithms are area-oriented. The division of the image into related regions is the outcome of segmentation. Image segmentation's primary goal is to extract different features from the image that may be combined or separated to create objects of interest on which analysis and interpretation can be done.

3.4. Feature Extraction:

The process of improving photographs to better show visually appealing elements is known as feature extraction. The input photos are examined for

properties like spots, colour, form, and area, among others. Colour can distinguish one sickness from another. Additionally, the morphology of each disease may vary. Kurtosis, skewness, cluster prominence, and cluster shadow are examples of texture characteristics. It is mostly carried out to reduce the complexity of picture processing. Depending on the threshold setting, the disease is recognised based on alterations in the traits that point to an infection in the fruit photos.

3.5. Classifiers:

The pictures are categorised, and CNN is used to examine and classify the numerical qualities of different features. The CNN (Convolution Neural Network) is employed in the suggested method.

Steps Involved in CNN algorithm:

1. A substantial amount of training data is provided as input.
2. To check the training model's accuracy, a set of Test datasets is provided.
3. Utilize colour characteristics to do feature extraction.
4. Utilize texture and colour attributes to perform the feature-level fusion.
5. On the segmented picture, use a Convolution neural network classifier.
6. Step 7 is to be followed if the fruit is ill; otherwise, step 8 is to be followed.
7. Follow step 9 after applying Thresholding for picture segmentation.
8. Print "Given fruit is Healthy".
9. Print the result with the fruit disease classification.

3.6. Prediction:

The final stage of disease detection. The disease that the fruit is infected with is identified. Some of the diseases include sooty blotch, powdery mildew, and others. Here, the algorithm's accuracy is also noticed.

3.7. Data set:

A dataset is a set of data that is utilised to train the model. It serves as a model for the CNN algorithm to learn how to generate predictions.

The neural network is first trained on the photos. A classifier is used to extract the features and train them. The database is used to store the images after training. The classifier receives the test images,

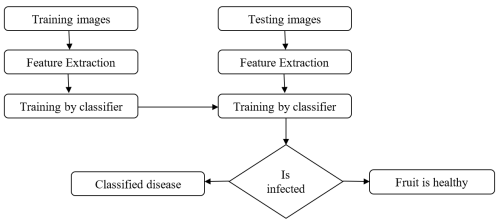

FIGURE 2. Flow chart of an implementation of disease detection in fruits using neural networks

which are then examined and contrasted with the trained images. If the fruit is affected by any disease the disease name is displayed otherwise it is displayed as the fruit is healthy.

4. RESULTS AND DISCUSSION:

As a sample for processing, photos of infected and healthy fruits are given. The system is initially given a natural image of fruit as input. The image is subjected to pre-processing, segmentation, and feature identification. If the feature values are matched with any of the fruit in the training data set. Then if it is healthy fruit the result is displayed as the fruit is healthy otherwise the name of the disease is displayed. After running the code the following steps appears.

A. Citrus canker: Citrus canker is a disease mostly observed in citrus fruits like oranges. It is caused by various types of fungi.

Step 1: A template is displayed indicating the need to choose the input image.

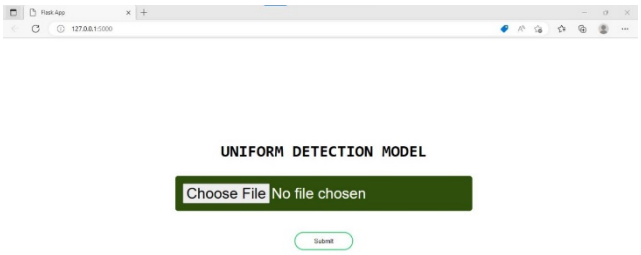

FIGURE 3. Window showing to choose the file.

Step 2: Input image is chosen from the data set.
Step 3: Below shown is the selected input image.
Step 4:Result will be displayed as follows.

B. Blotch apple: Throughout the fruiting season, many fungi can cause blotch fungus on apples, a frequent disease. This issue just affects the apple's skin.

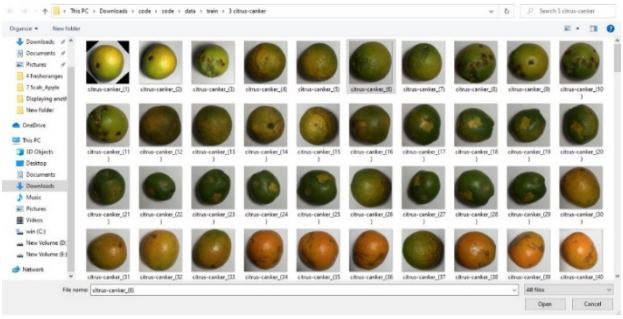

FIGURE 4. Window representing the collection of diseased fruit images.

FIGURE 5. Image showing the fruit to be tested.

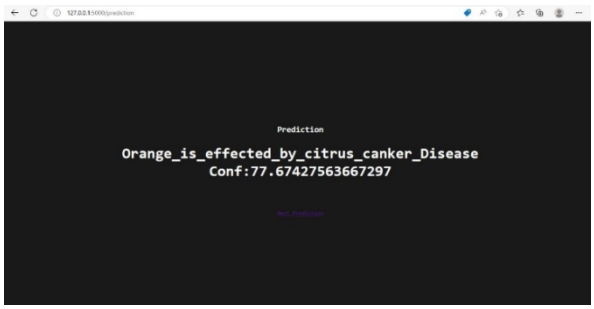

FIGURE 6. Image representing the name of the disease in orange.

These are the following steps used to detect blotch disease in apples.

Step 1: A template is displayed indicating the need to choose the input image.

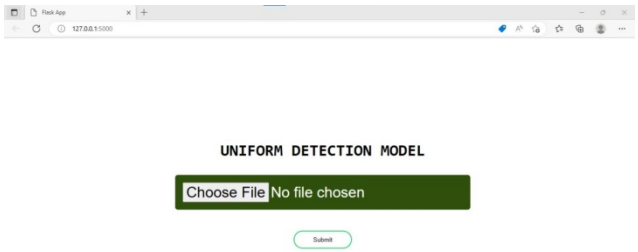

FIGURE 7. Window showing to choose the file.

Step 2: Input image is chosen from the data set.

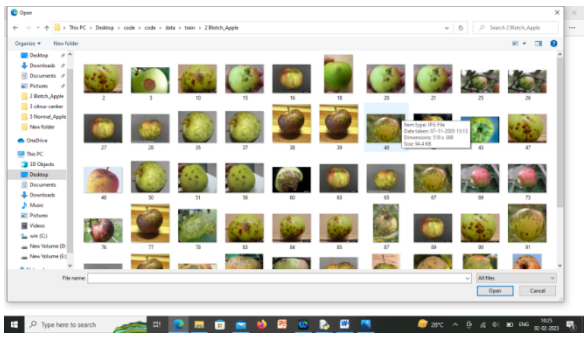

FIGURE 8. Window representing the collection of diseased fruit images.

FIGURE 9. Image showing the fruit to be tested.

Step 3: Below shown is the selected input image.

Step 4:Result will be displayed as follows.

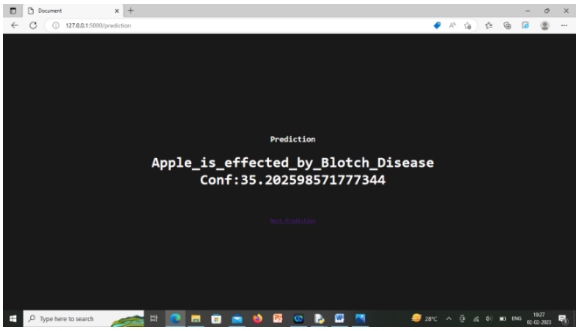

FIGURE 10. Image representing the name of the disease in the apple.

C. Rot apple: Rotting the apple is the most observed scenario. The Rotten apply are unfit to eat and may cause severe loss to farmers.

Step 1: A template is displayed indicating the need to choose the input image.

Step 2: Input image is chosen from the data set.

Step 3: Below shown is the selected input image.

Step 4:Result will be displayed as follows.

D. Scab: The most typical apple disease is apple scab. A fungus that affects both leaves and fruit is the source of scab. Fruit with scabs is frequently unsafe to eat.

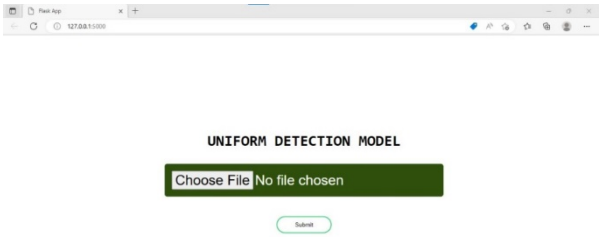

FIGURE 11. window showing to choose the file.

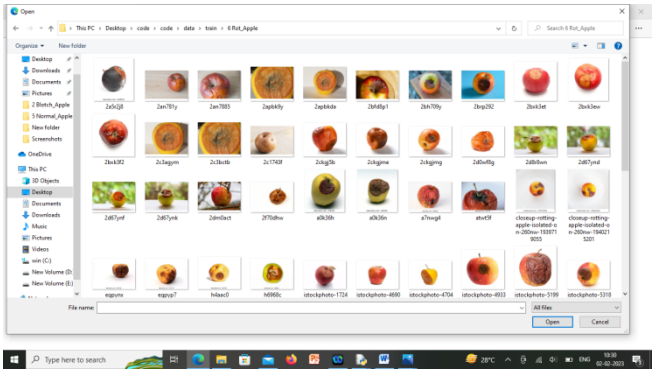

FIGURE 12. window representing a collection of diseased fruit images.

FIGURE 13. Image showing the fruit to be tested.

These are the following steps used to detect scab disease in apples.

Step 1: A template is displayed indicating the need to choose the input image.

Step 2: Input image is chosen from the data set.

Step 3: Below shown is the selected input image.

Step 4:Result will be displayed as follows.

E. Healthy Orange: Orange that is not affected by any disease is termed a healthy orange and these are the following steps followed to detect whether the orange is healthy or not.

Step 1: A template is displayed indicating the

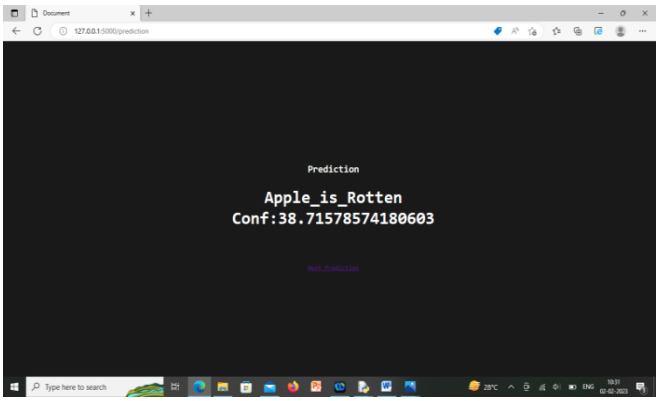

FIGURE 14. Image representing the name of the disease in the apple.

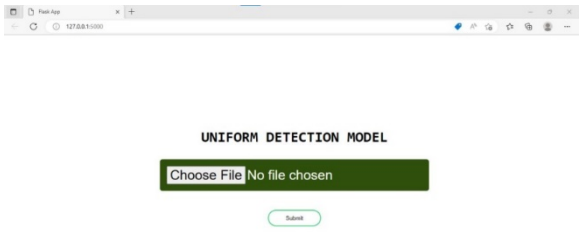

FIGURE 15. Window showing to choose the file.

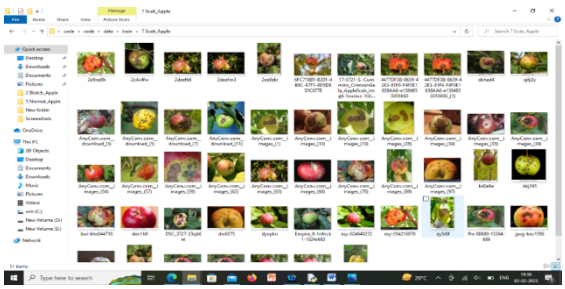

FIGURE 16. window representing the collection of diseased fruit images.

FIGURE 17. Image showing the fruit to be tested.

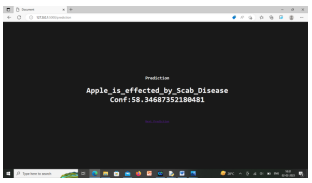

FIGURE 18. Image representing the name of the disease in the apple.

need to choose the input image.

FIGURE 19. Window showing to choose the file.

Step 2: Input image is chosen from the data set.

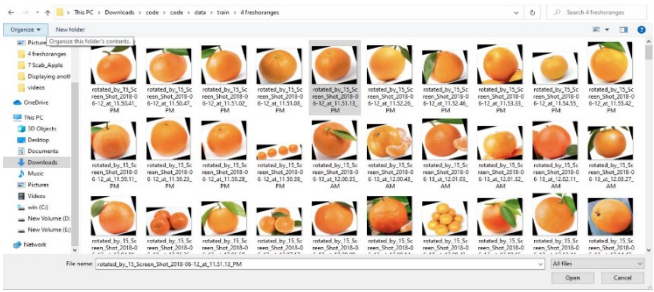

FIGURE 20. window representing the collection of diseased fruit images.

Step 3: Below shown is the selected input image.

FIGURE 21. Image showing the fruit to be tested.

Step 4:Result will be displayed as follows.

FIGURE 22. Image representing the name of the disease in orange.

5. CONCLUSION

The proposed system is capable of disease detection of the different fruits. It overcomes the different drawbacks of the existing systems and gives the better results. Convolutional Neural Network (CNN) a supervised learning technique is used in the proposed system. Using CNN, the diseases like Citrus Canker, Blotch Apple, Rot Apple and Scab in Oranges and Apple were detected. The images were collected from different disease affected fruits, healthy fruits and trained them using CNN. The use of CNN algorithms makes it simple to spot illness on fruits and assists in separating diseased fruit from good fruit. This strategy quickly detects and categorize the fruits using image processing techniques based on these approaches and algorithms. Additionally, this algorithm may be altered and used with various other commercial crops that are very susceptible to disease.

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