Tomato And Chilli Plant Disease Detection using CNN

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Abstract — **Agriculture is one of the important sources of national income. Agriculture crops are subjected to diseases that occur due to bacteria, virus and pest. The disease most occurs in leaf due to which the production of plant decreases which in turn reduces the income for farmer. Plant leaf disease detection requires an expert to identify the accurate disease manually. This procedure is time required and is expensive. Hence we propose a machine learning algorithm to identify and categories the disease that occurs in plants. In our work we consider four diseases that mainly occurring in tomato and chilly plant for example early blight, septoria leaf spot, curl leaf and late blight. Hence we propose machine learning and image identification technique to recognize and classify the disease. In our work we have considered total 450 images involving the image of disease like septoria leaf spot, curl leaf early blight and late blight. Image preprocessing was done using Gaussian filter to remove noise. Feature segmentation was done by K-means clustering. Feature extraction was completed by converting color RGB to HIS. CNN classifier was used to classify and identify the disease. The proposed work provided an overall efficiency of 85.03%.**

Keywords— (CNN) Convolutional neural network.

I. INTRODUCTION

The agricultural land accumulation in today's world is more than just a source of food. The backbone of the Indian economy is agricultural productivity[7-8]. According to global studies, India leads the globe in tomato and chilli output. India is both the world's top producer and consumer of tomato and chilli. Tomatoes are the most widely consumed vegetable in India, and they are high in vitamin C and beta-carotene. Chilli is also a crucial and necessary component of many cooking tasks. However, the presence of numerous microorganisms such as bacteria, fungi, and pathogens, as well as poor cultivation habits, induce diseases in tomato and chilli production[7]. Chilli crop damage by disease and viruses accounts for around 38% of global agricultural production. Many farmers keep away from developing chillies at some point of the wet season because of infections that lower yield and quality. As a result, disease detection in plants has become increasingly important. In naked eye observation, a simple approach for examining and grading unhealthy parts of tomato and chilli plantations. However, hand grading of tomatoes and chillies is a time-consuming process[3]. To circumvent this manual procedure, we employ machine learning and image processing methods to create automated software for analysing and grading diseased parts of tomato and chilli plantations. Plant illness manifests itself in a variety of shapes, patterns, colours, and other characteristics. It is vital to comprehend this relationship in order to reduce crop damage. We introduce the use of feature extractors to address disease identification in this paper. Instead of utilizing the standard approach. Image processing is one of the most important technological applications in the agriculture area. Visual processing techniques are used to extract key elements from image data. Image processing is used in the proposed methodology for analysis and grading, which improves accuracy[11]. Traditional function extraction processes have much less ability than CNN. When in comparison to traditional classifiers, the upgraded CNN community become used to educate the ailment identity version for an open supply ailment dataset. Crop losses can, however, be reduced if specific plant infections are accurately detected and recognized early. These need-based treatments result in both financial and environmental benefits. After examining leaf photos, we suggested a method for identifying illnesses in the crop. This project will help farmers identify plant illnesses without having to rely on plant specialists. It will aid in the timely remedy of plant illness, So improving each the pleasant and amount of meals plants produced, and as a result helping with inside the boom of farmer profit. For experimental purposes, we have downloaded the tomato leaves data set. We constructed a CNN model to classify the image after downloading the dataset, and the performance of the model had to be examined based on various parameters with regard to the pre-trained model, and the results were provided in the paper.

II. LITERATURE REVIEW

Plant leaf disease detection is a important subject matter of research, and photograph processing and system getting to

know strategies had been extensively hired to acquire correct categorization. We describe a number of the most usually used strategies in literature surveys on this study.

[1] suggested a simple method for classifying infected tomato leaves into different categories, such as tomato late blight, bacterial spot, early blight, tomato leaf curl, and healthy. The dataset for the proposed work comprised of 383 photos that were captured with a camera. On the input data set, Otsu's me method was used to segment images. Here, supervised learning approaches were employed to train the decision tree classifier using RGB colour components and colour data. The propped work provided a high efficiency in classifying the diseases but the amount of control that the user and over fitting in terms of noisy data has over the model is relatively less.

[2], proposed an set of rules to hit upon whether or not tomato leaf is inflamed or not. The picture given as enter turned into pre-processed with the aid of using getting rid of the historical past and the noise gift with the use of abrasion technique. For texture characteristic extraction from the improved picture turned into used however the Gray degree Co-incidence Matrix (GLCM) method. They used assist vector machine (SVM) classifier the usage of distinctive kernel function. The proposed device has done 99.83% accuracy the usage of SVM classifier with linear kernel function. The proposed paintings turned into constrained to categorise whether or not leaf turned into inflamed or not, lesser range of enter pix had been taken to shape the facts base.

Rangarajan et al [3], rent the authentic AloxNet, VFF16 community structure, mixed with getting to know of migration to get an accuracy of approximately 97% at the seven segmented tomato inflamed leaves. The final results of weight, deviation and charge pf getting to know on the velocity of ailment detection and accuracy are examined.

Razavi et al [4], evolved the progressed CNN community to educate the ailment detection version for the open supply ailment dataset and differentiate them with hooked up classifiers consisting of GIST, SVM and LBP which verified that the version is better than different classifications in phrases of accuracy of classification.

In [5], the authors of the paper advanced a neural-community primarily based totally machine to locate plant sickness like mosaic virus, goal spot, bacterial seek, septoria leaf spot, overdue blight and early blight. The proposed version used a three channel convolution neural community as well as received a complete accurateness of 89.29%.

The authors of the paper [6] used an automated machine to are expecting illnesses in cucumber leaves. The proposed version makes use of K-approach clustering primarily based totally segmentation and 85.70% of accuracy received.

In [7-8] authors have supplied mind regarding early detection of chilli illness through leaf capabilities inspection. Leaf image is captured and processed to determine the health reputation of each plant. Finally end that the chemicals handiest applied even as the flora are detected to be effected with the diseases. The image processing techniques are used to perform masses of chilli illness images. The plant chilli illness detection thru leaf image and records processing techniques might be very useful and inexpensive tool especially for supporting farmers in mounting the huge plantation area.

Sachin D. Khirade et al [9] used picture processing to stumble on the plant sicknesses. It entails diverse degrees like picture acquisition, picture preprocessing, picture segmentation, characteristic extraction and type etc. They had mentioned the strategies for ailment detection the use of leaf picture. Anand R et al [10] brought the approach for figuring out brinjal plant leaf sicknesses like Bacterial wilt, Cercospora leaf spot, Tobacco mosaic virus, Collar rot and approach for cautious detection of sicknesses. For type that they'd used synthetic neural network. For segmentation motive k-suggest clustering set of rules is used and for characteristic identity texture is used.

In [11] Sushil R. Kamalapurkar cautioned a machine which could offer greater correct effects associated with the identity and category of sicknesses from the photograph of leaf. They had making use of one-of-a-kind technique like preprocessing schooling and identity. They needed to do characteristic extraction after which classify that photograph, after that they needed to diagnosis. In this manner they discover sicknesses.

III. PROPOSED METHODOLOGY

To exhibit and classify the plant sicknesses and to achieve answers for it with the aid of using constructing a version that may be hired with the aid of using developer to create a dataset pictures captured with the aid of using clever telephones or net applications,to pick out the sicknesses found in Tomato and Chilli leaves the usage of Convolutional Neural Network (CNN)[5]. This consists of a few fundamental steps of photo processing to come across plant leaf sicknesses and additionally category of plant leaf sicknesses. The steps consists of photo acquisition, photo pre-processing, photo segmentation, functions extractions, classifications and leaf ailment detection. These steps are defined as below.

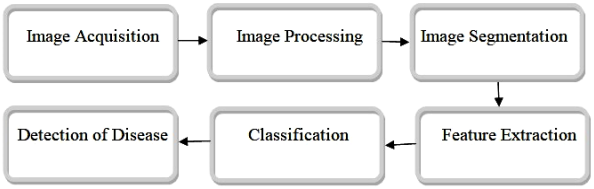

Fig. 1. Block diagram of proposed work .

A. *Image Acquisition*

The first degree of our paintings includes acquisition of pics. Image acquisition changed into completed via way of means of gathering the pics from village facts set. Nearly 450 pics belonging to 4 not unusualplace sicknesses early blight, septoria leaf spot, curl leaf and past due blight have been amassed to shape the database.

B. *Image Pre-Processing*

Image pre-processing consist of the stairs of photograph enhancement, RGB to lab conversion, Filtering etc,.. Image smoothing is carried out the usage of the filtering strategies to be had in photograph processing like medium filter, this facilitates to do away with the noise from the pix if any [1-3].

$$f(i,j)=median\{g(m,n)\} \longrightarrow \quad (1)$$

C. *Image Segmentation*

Image segmentation approach partitioning of photograph into diverse elements identical capabilities are having identical

comparison the segmentation may be achieved the use of one-of-a-kind strategies like otsu method, k-approach clustering, changing RGB photograph into HIS version etc[10]. The k-approach clustering is used for class of item primarily based totally on a hard and fast of capabilities into K range of classes. The organization of item is achieved with the aid of using minimizing the sum of the squares of the space among the item and the corresponding cluster.

D. Feature Extraction

In this step picture is determined in severa pixel value. According to pixel value, variety of spot and. Area of each spot or blobs determined. We extract the favored features from the sample picture for the assessment of pathogenic affected vicinity of the plant leaf. Size, shape, volume, color and texture are the precept features that separate diseased part of the plant from the wholesome plant. Color is one of the most vital parameter in function extraction process. Depending upon this parameter of function extraction we defined or select out out the high-quality of an picture. Other vital parameters are period, shape and volume. The rate is indirectly is based upon the period. But it is extra complex if shape and period of the chilli is irregular. The shape is subjective type parameter this is based totally mostly on human view. It is also indirectly affected to the rate. The most vital parameter is texture can play an vital function in color picture segmentation process[8]. Color function extraction is finished with the useful resource of the usage of RGB, HIS, CMY, YIQ.

E. Classification And Detection Of Diseases

CNN set of rules turned into used to become aware of and classify the sicknesses that arise with inside the tomato and cold plant. In our work, Convolutional-neural-network(CNN) method is carried out to become aware of and diagnose sicknesses in plant life from their leaves, consequently it executed wonderful consequences with inside the subject of device vision. CNN classifiers are educated to become aware of sicknesses in every plant class. If now no longer present, the leaves are labeled as “healthy”. CNN used for video popularity and photograph processing.

IV. ALGORITHM OF PROPOSED SYSTEM

In our model, we takes pattern pictures of chilli and tomato leaf plant as an input, so we used Convolutional Neural Network (CNN) to extract features. CNNs have huge programs in picture and video recognition, recommender structures and natural language processing. CNNs like neural networks, are made of neurons with learnable weights and biases[4]. Each neuron gets diverse inputs, takes a weighted sum over them, by skip it via an activation feature and responds with an output.

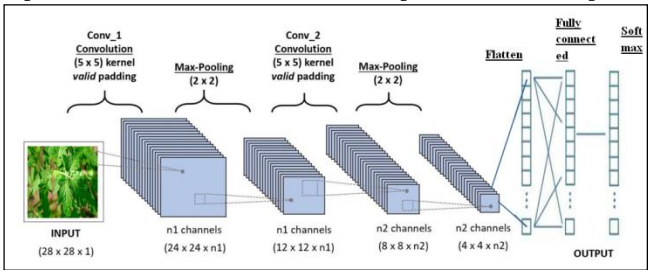

Fig 2. Block diagram of CNN.

In this paper, we're the use of CNN 2D. Generally, 2D convolutinal layers take a third-dimensional input, commonly an photo with three dimensional channels. They by pass a filter, additionally known as a convolutional kernel, over the photo, examining a small window of pixels at a time and transferring the window till they've scanned the complete photo.

CNN version includes seven convolutional layers with Relu activation characteristic .i.e. The Rectified Linear Unit (ReLU) is an activation characteristic followed with inside the layout of maximum neural networks, in particular CNN’s. it's miles the discover characteristic, f(i) = i, for all fine values and zeros out for terrible values of inputs ‘i’. so we've got used ReLU for hidden layers every accompanied with the aid of using MAX-pooling layer wherein it maximally turns on best a gaggle of neurons from the function and this efficaciously and decreases the width and top of the functions maps at the same time as maintaining the wide variety of channels and we've got additionally described the soft-max activation characteristic for class purpose.

V. Result

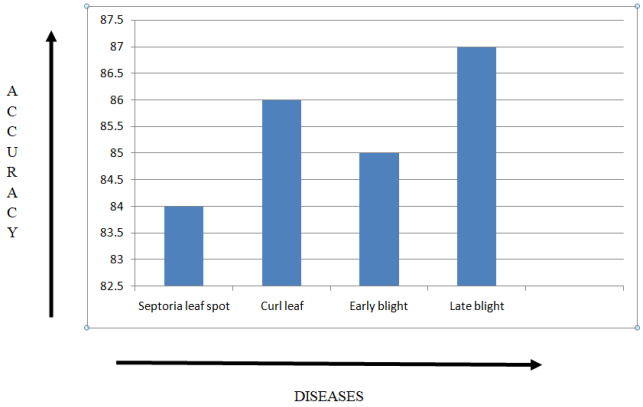

Fig 3: Graph between Accuracy and Diseases

For the accomplishment and conducting tests, we've got taken 50 pattern snap shots from the 450 photograph dataset to stumble on whether or not the leaf is inflamed with the aid of using the illnesses or not. The photograph dataset concerning the photograph of tomato and chilli plant leaf illnesses like septoria leaf spot, curl leaf early blight and overdue blight. In our paintings we used CNN approach to get a preferred photograph as output. Implemented approach on this paper is powerful and quickest approach in prediction of tomato and chilli plant disease. The typical performance changed into approximately 85.03% that is taken into consideration as pleasing and a success project.

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