iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** V **Month of publication:** May 2019

DOI: https://doi.org/10.22214/ijraset.2019.5532

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue V, May 2019- Available at www.ijraset.com

Plant Leaf Disease Detection on Android Phone

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Abstract: Agriculture is a most important and ancient occupation in India. As the financial system of India is relayed on farming production, the extreme concern of food production is essential. The taxonomy and identification of crop infection have the foremost technical and economic importance in the Agricultural Industry. However, disease detection needs incessant observing of specialists which might be prohibitively costly in big farms region. Automatic recognition of plant diseases is necessary to research themes as it may benefit in monitoring huge fields of crops and thus automatically detect the symptoms of diseases as soon as they appear on plant leaves.The goal of this application is to develop a system which recognizes crop diseases for that user have to take an image through an android phone, Image processing starts with the digitized colour image of the diseased leaf.

Keywords: Image Processing, Android, Texture, Plant Leaf Diseases

I. INTRODUCTION

The technology is growing and enhancing day by day. Same technology as we are observing today is not same as tomorrow. Today one of the most potential technique is internet of things is growing very vastly. Internet of things (IoT) has given new dimension to the world where everything is connected through the internet everywhere and at any time. It contains heterogonous environment and things like sensors, actuators, devices, vehicles, buildings and mobile phones and other items with embedded electronics and software, network connectivity which establishes smart environment. These things are designed for a purpose: a wall watch can alert with weather conditions. Internet of Things has great potential in agricultural field as it reduces the cost by saving on fertilizers, water supply and pesticides and manual work. The application of IoT in agricultural field is known as Precision Agriculture. Various applications of precision agriculture are: prediction of diseases, prediction of weather forecasting, classification of soil, monitoring crop, yield prediction, automatic irrigation system, etc. Disease detection at an early stage on crop is challenging task for farmers where physical presence is must. Disease detection and recognition on crop is very important. There are various algorithms in image processing for disease recognition by image classification like KNN, SVM, Random Forest, Artificial Neural Network and CNN. Lots of research is going in image classification field as CNN has given ground breaking results over past decades in various application fields like voice recognition, image recognition, pattern recognition, etc. Previously image classification algorithms like face recognition need to pay attention at where the face is located in an image this major problem is overcome by CNN as well as features of an image are deeply processed at each layer. Every disease on crop has different features which are extracted at each layer of convolution network. In our case, we worked on tomato plant, it is all season plant but during khariff season there are more chances of getting diseased as humidity of air increases in this season and due to rainfall disease spread easily. In west Maharashtra Septoria, Late Blight, Early Blight, Powdery Mildew are commonly found on tomato plant.

II. EXISTING SYSTEM

Due to globalization the climate is changing which directly affects crops health and crop productivity is reduced and these results into farmers strike and prices of vegetables are rapidly increases and many other problems. To increase yield and to maintain quality of food, therefore it is important to detect disease on crop at an early stage which is not possible in case of manual monitoring. In the rural area the farmer can detects the leaf disease only seeing the plant leaf. But the issue is that the plant leaf disease does not detect in early stage. There are many existing systems which used for leaf disease detection using different algorithm. The proposed sys- tem classifies the leaf image using image classification algorithm CNN. It can automatically detect and recognizes disease based on extracted features at each convolution layer.

III. PROPOSED SYSTEM

The Proposed System is able to detect and recognise disease on crop at an early stage using convolution neural network to increase yield. The proposed system can detect plant leaf diseases at an early stage and helps to classify diseased plant image. It will Help to analyze and detect plant disease and Provides Recommendation of pesticide to recover from disease if any.

A. Motivation

Every day we come across some news related to agricultural issues. Precision Agriculture is one of the best solutions for solving these issues with growing technology. It automates almost all the tasks of farmer by educating him about his field and about current status of market. It is economical solution as no labor is required for field monitoring. At home farmer can monitor his field. In developed country precision agriculture is used by farmer but in India farmers are not using it due to many reasons. Varying environmental changes affects crop yield. Precision agriculture can help Indian farmer to solve their problem.

B. Scope

To increase yield and to maintain quality of food, therefore it is important to detect disease on crop at an early stage which is not possible in case of manual monitoring. In the rural area the farmer can detects the leaf disease only seeing the plant leaf. But the issue is that the plant leaf disease does not detect in early stage. There are many existing systems which used for leaf disease detection using different algorithm. The proposed system classifies the leaf image using image classification algorithm CNN. It can automatically detect and recognizes disease based on extracted features at each convolution layer.

C. Architecture Diagram

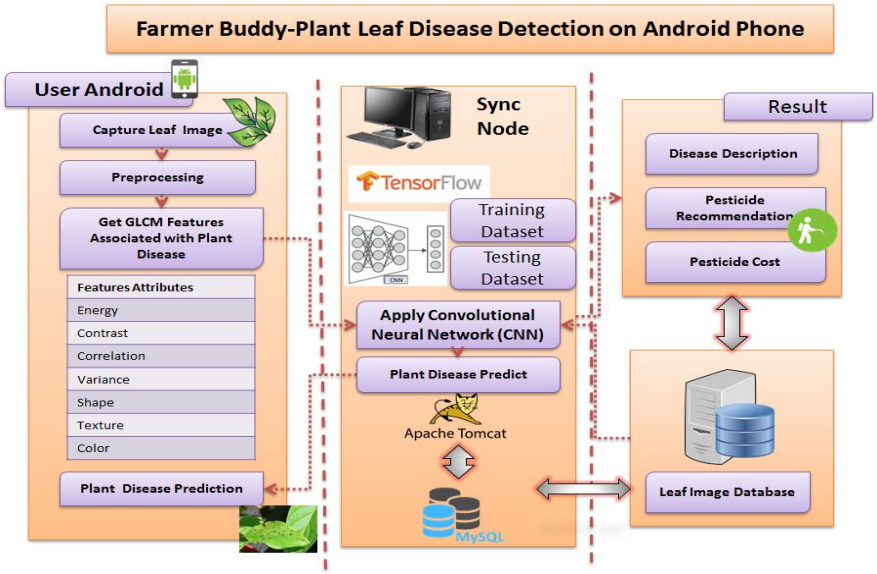

Fig.1: System architecture

Above fig shows system architecture. The techniques of machine vision are extensively applied to agricultural science, and it has great perspective especially in the plant protection field, which ultimately leads to crops management. The proposed system for plant leaf disease detection based on the infected images of various plants. Image of the infected plants are captured by digital camera and processed using image growing, image segmentation techniques to detect infected parts of the plants.

Image Acquisition and Enhancement: This is phase where we are getting input images and applying image enhancement techniques which is called as pre-processing phase of input image. In Image enhancement noise reduction and contrast adjustment will be performed, following is the formula for the RGB Normalization:

Image Segmentation: After the alteration of captured image, the processed image is converted to binary level image (black and white image) using the thresholding.

Feature Extraction: The Gray Level Co-occurrence Matrix1 (GLCM) features are extracted to analyze the plant disease, which includes: Contrast, shape, texture, correlation, etc.

Disease prediction: We can apply Machine learning algorithm on the trained dataset to detect that whether the plant is having some disease or not and what pesticides are needed for recovery from that disease. By using an image processing we can easily recognize the plant disease.

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IV. METHODS AND MATERIAL

We are using CNN algorithm for extracting the features of given input image of plant and detect the disease.

A. Algorithm used

1) Convolution Neural Network (CNN): Convolution neural network is one of the main category for image classification. It takes an input image, process it and classify it under certain categories.

There are three main layers in CNN:

a) Convolution Layer: This is the first layer that extract feature from input image. Convolution is a process where the network tries to label the input signal. It takes two inputs such as image matrix and a filter. The layer computes the output by performing the dot product between the filter and image patch. layer holds the raw input of image with width 32, height 32 and depth 3.

i) Image matrix dimension(h*w*d)

ii) A filter Matrix dimension(f_h*f_w*d)

iii) Output dimension(h-f_h+1)*(w-f_w_1)*1

1. *Activation Function:* Here we are using ReLu activation function. ReLU stands for Rectified Linear Unit for a non-linear operation. The output is $f(x) = max(0,x)$. ReLu is important because it introduce non-linearity in our system.

b) Pooling Layer: The main function of this layer is to reduce the number of parameters when the image is too large and makes the computation faster and also prevent the overfitting. Two common types of pooling layers are max pooling and average pooling. If we use a max pool with 2 x 2 filters and stride 2, the resultant volume will be of dimension 16x16x12.

$$r = \frac{R}{R+G+B}; \; g = \frac{G}{R+G+B}; \; b = \frac{B}{R+G+B}$$

c) Fully-Connected Layer: This layer is regular neural network layer which takes input from the previous layer and computes the class scores and outputs the 1-D array of size equal to the number of classes. we flattened our matrix into vector and feed it into a fully connected layer like neural network. Finally, we have an activation function such as softmax or sigmoid to classify the outputs. Softmax function is use to classify an object with probabilistic values between 0 and 1.

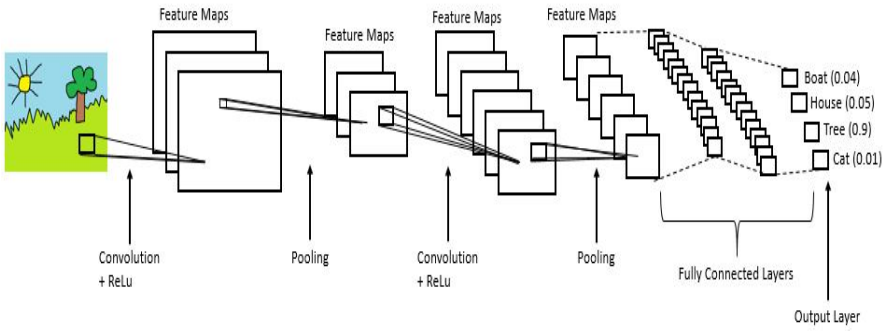

Fig 2: Convolution Neural network

V. RESULT

We have taken tomato plant for disease detection .In training dataset 4 classes of disease are added they are

A. Tomato bacterial spot
B. Tomato late blind
C. Tomato sartorial leaf spot
D. Tomato yellow leaf

And one class is for Healthy leaf.

2200 images are taken to train the dataset.

We can capture image or browse image from phone in the application.

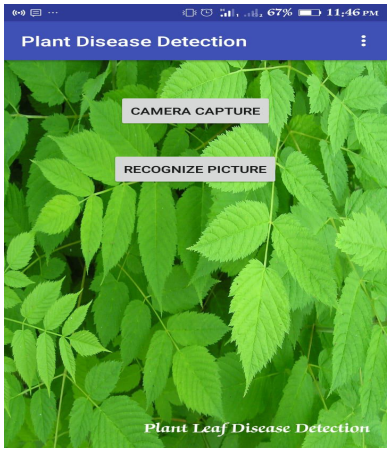

Fig.3 Screenshot

Disease prediction and pesticide recommendation is given.

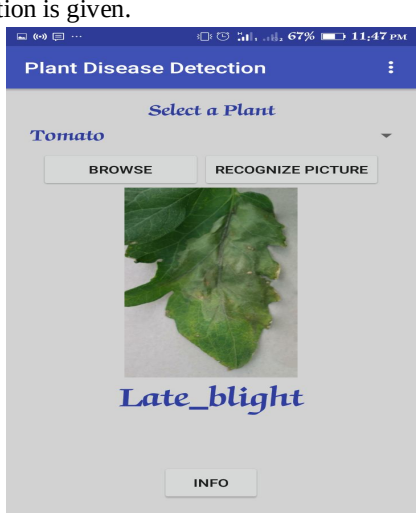

Fig.4 Sreenshot2

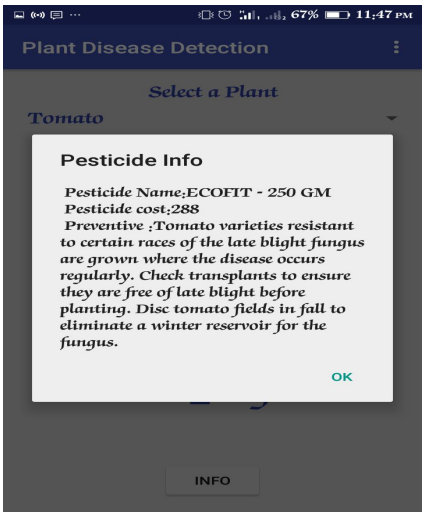

Fig.5 Scrrenshot3

VI. CONCLUSIONS

The recognition of crop diseases is of the main technical and economic aspect in the agricultural Industry. The naked eye observation of experts is the main traditional approach is practice for detection of plant diseases. The plants need close and clear monitoring especially for the detection and management of a disease that can affect production and subsequently the postharvest life. The system pre-processes and analyses results and provides feedbacks liked disease prediction, pesticide recommendation, and etc to the famers. The goal of this application is to develop a system that can recognize crop diseases.

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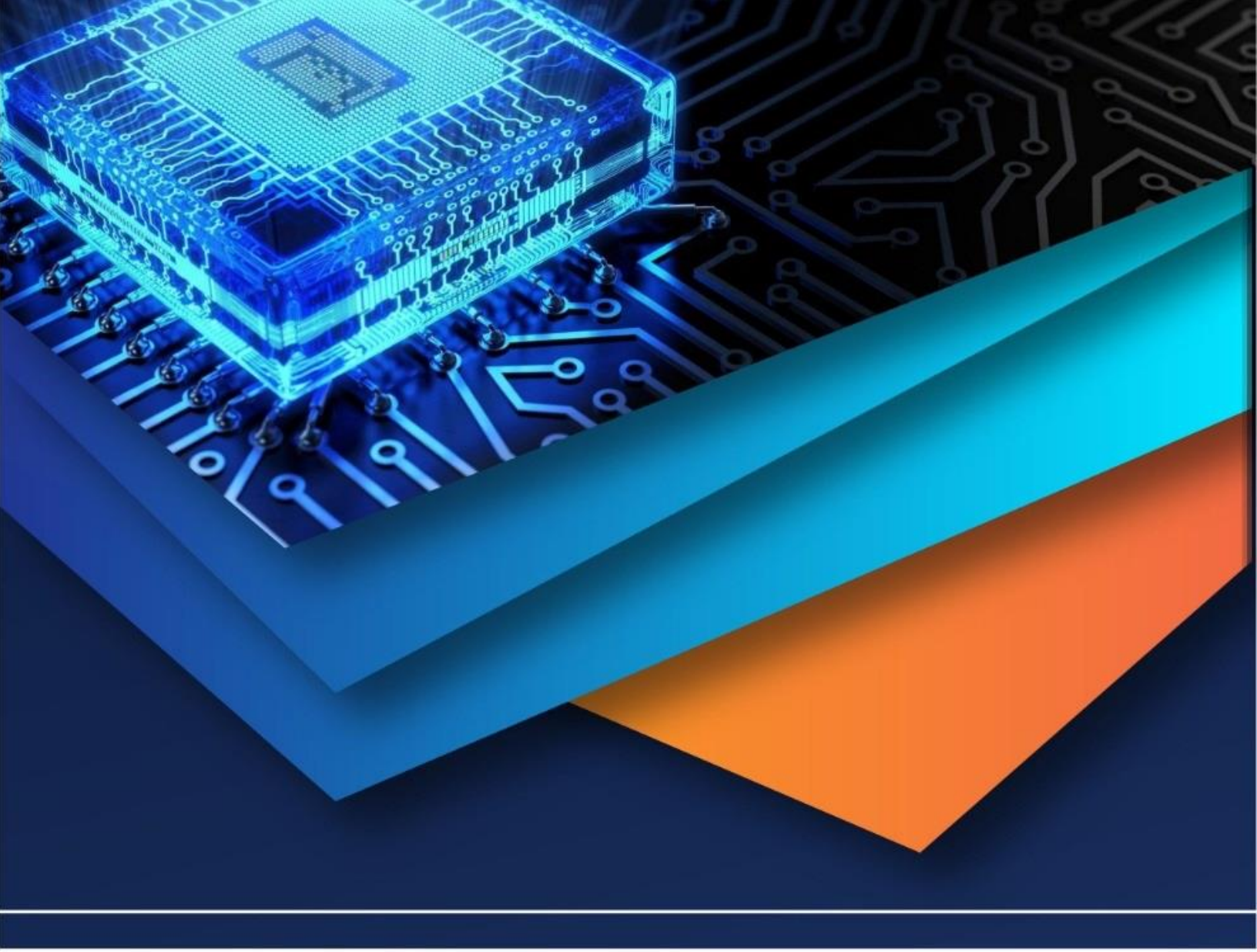

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