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RESEARCH ON RECOGNITION MODEL OF CROP DISEASES AND INSECT PESTS BASED ON DEEP LEARNING IN HARSH ENVIRONMENTS

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ABSTRACT

Rural illnesses and bug vermin are quite possibly the main factors that genuinely compromise rural creation. Early discovery and ID of vermin can adequately lessen the monetary misfortunes brought about by bugs. In this paper, convolution neural organization is utilized to consequently recognize crop infections. The informational index comes from the public informational collection of the AI Challenger Competition in 2018, with 27 illness pictures of 10 yields. In this paper, the Inception-ResNet-v2 model is utilized for preparing. The cross-layer direct edge and multi-facet convolution in the leftover organization unit to the model. After the joined convolution activity is finished, it is actuated by the association into the ReLu work. The test results show that the general acknowledgment precision is 86.1% in this model, which confirms the viability. After the preparation of this model, we planned and executed the We chat applet of harvest sicknesses and bug bugs acknowledgment. At that point we completed the genuine test. The outcomes show that the framework can precisely distinguish crop infections, and give the relating direction.

INDEX TERMS

Recognition of Pests and Diseases, Deep Learning, Convolutional Neural Network, Harsh Environment.

1. INTRODUCTION

As a superpower with more than 20% of the world's finished people, China has been managing the issue of insufficient arable land resources. As demonstrated by the audit data of the Ministry of Agriculture, the degree of created land in China is much under 10% of China's property area. As shown by estimations data, the lopsided district addresses around 66% of the total land area in China, while the plain locale addresses just 33%. Around 33% of the country's agrarian people and arable land are in slanting areas. The current situation has achieved the respectably defenseless creation conditions of agribusiness, officer administration and animal development in China. As shown by the experiences of the Food and Agriculture Organization of the United Nations, the per capita created land district in China isn't by and large half of the world ordinary level, and shows a lessening design bit by bit. At the point when the calamitous occasions cause green creation decline, it will really impact the yield of agrarian things and cultivating new development. So how to encourage agriculture consistently, especially in the incredible environment, is basic for China

Not withstanding the way that with the progression of science and advancement, green creation is progressing. However, in view of various basic parts and non-ordinary factors, the yield of harvests has not been unbelievably improved. Among the various segments, the greatest degree is the issue of reap diseases and unpleasant little animal annoys. As shown by bits of knowledge, the space of harvests impacted by vermin and diseases in China is just probably as high as 280 million km² reliably, and the prompt yield adversity is at any rate 25 billion kg [1]. Lately, this issue is on the climb and genuinely sabotages the progression of planting industry. Ideal assurance and countering of yield afflictions has gotten particularly huge. As of now, country experts oftentimes use books and association, contact close by trained professionals and use various methods to guarantee and supervise crop contaminations. In any case, for various reasons, misinterpretations and various issues often occur, achieving provincial creation is significantly affected. As of now, the investigation on crop sicknesses is prevalently isolated into two headings. The first is the standard genuine strategy, which is principally established on extraordinary revelation to recognize different afflictions. Different kinds of diseases and frightening little animal troubles cause assorted leaf hurt, which prompts unmistakable horrendous maintenance and impact of has deteriorated by infections and strong harvests. The other one is to use PC vision advancement to recognize pictures. As such, the properties of ailment pictures are eliminated by using PC related advancement, and the affirmation is assisted through the different characteristics of sickly plants and sound plant

Lately, the quick improvement of electronic thinking has made life more favorable, and AI has become an eminent development. For example, AlphaGo squashed the best on earth of Go. Siri and Alexa as voice partners of Apple and Amazon are generally employments of mechanized thinking advancement tended to by significant learning in various fields. As the key investigation object of PC vision and man-made awareness, picture affirmation has been massively advanced recently. In agrarian applications, the target of picture

affirmation is to recognize and mastermind different sorts of pictures, and look at such yields, sickness types, earnestness, and so on By then we can design relating countermeasures to deal with various issues in green creation in an ideal and compelling way. To moreover ensure and improve the yield of harvests and help the better headway of agriculture

With the speedy progression of significant learning [2], especially in picture affirmation [3], talk assessment, typical language planning and various fields, it shows the uniqueness and efficiency of significant learning. Differentiated and the regular strategies, significant learning is more capable in the finish of gather afflictions in the field of cultivating creation. The significant learning model can screen, investigate and thwart the advancement of yields on time. Picture affirmation of yield contaminations and dreadful little creature disturbances can lessen the dependence on plant security specialists in provincial creation, with the objective that farmers can deal with the issue on time. Differentiated and counterfeit unmistakable confirmation, the speed of smart association ID is much faster than that of manual area. In addition, the affirmation precision is getting progressively raised in the relentless new development. The establishment of a sound cultivating association and the mix of Internet and plant industry cannot simply tackle the issues related to edit yield affected by disorders and dreadful little animal bugs, yet furthermore be useful for the improvement of provincial information [4].

Regardless, as a result of the harsh domain of the mountain environment, the including impedance factors are more important. Accordingly, the image getting is more problematic than the general environment. Besides, the camera and association transmission needed for picture affirmation and getting ready will similarly have a particular impact. Thusly, it is all the more difficult to do insightful affirmation in sharp districts. This paper endeavors to manufacture the Internet of Things stage in the confusing environment of rough districts, and do the investigation on the unmistakable verification model of yield diseases and bug annoys. The inspiration driving this model is to improve rustic information, deal with the harm of aggravations and ailments to crops, and improve crop yield.

2. LITERATURE SURVEY

The distinguishing proof and avoidance of yield illnesses and bug nuisances is a consistent exploration subject. With the improvement of innovation, numerous sensor organizations and programmed observing frameworks have been proposed.

A strategy for identification of explicit infection in grapes is proposed in [5]. Fleece mold bother/illness can be distinguished by the continuous framework with climate information. The focal cut off give gauge administration of climate condition and infection. Another sort of arrangement related of observing snares which are utilized to catch bug is with the assistance of picture sensors [6]. In [6], he creators planned and carried out a low force burned-through framework which depends on remote picture sensors and fueled by

battery. The recurrence of catching and moving snare pictures of sensors can be set and distant changed by catching application

Acoustic sensors are likewise utilized in checking framework. In [7], the creators give an answer for distinguish red palm weevil (abbr. RPW) with them. With the assistance of acoustic gadget sensor, the bug's clamor can be caught consequently. At the point when the commotion level of bug increments to some edge, the framework will inform the customer that the invasion is happening in the particular region. It assisted ranchers with being practical of time and energy to check all aspects of cropland without anyone else and increment the work effectiveness. All acoustic sensors will be associated with base stations and every one will report the commotion level if the predefined limit esteem is outperformed [7]

AI likewise had been applied in the horticultural field, like examination of plant infection and bugs, etc. A lot of methods of AI had been generally used to tackle the issue of plant illness finding. In [8], a Neural Network based technique for assessing the strength of potato with leaf picture datasets is proposed.

Also, the test research in [9] was completed, which meant to carry out an arrangement of perceiving plant illness with pictures. To recognize wheat stripe rust from wheat leaf rust and grape fleece mold from fine buildup, four unique kinds of neural organizations were prepared dependent on shading, shape and surface highlights extricated from infection picture dataset. The work showed that neural organization dependent on picture preparing can expand the effectivity of diagnosing plant infection [9]

Additionally, scab infection of potato could be likewise distinguished by the picture preparing techniques [10]. Initially, the pictures from different potato fields were gathered in [10]. After picture upgrade, picture division was completed to procure target locale. Finally, a histogram-based way to deal with examinations the objective area was applied, so the period of the illness could be found [10].

3. EXISTING SYSTEM

As indicated by insights, the space of harvests influenced by vermin and illnesses in China is pretty much as high as 280 million km² consistently, and the immediate yield misfortune is at any rate 25 billion kg [1]. As of late, this issue is on the ascent and genuinely undermines the improvement of planting industry. Opportune conclusion and avoidance of yield illnesses has gotten especially significant. As of now, farming laborers frequently use books and organization, contact neighborhood specialists and utilize different techniques to ensure and oversee crop infections. However, for different reasons, misinterpretations and different issues regularly happen, bringing about horticultural creation is profoundly influenced. As of now, the examination on crop sicknesses is essentially partitioned into two headings. The first is the customary actual strategy, which is predominantly founded on ghastrly identification to recognize various illnesses. Various kinds of illnesses and creepy crawly bugs cause distinctive leaf harm, which prompts diverse ghostly retention and effect of has disintegrated by infections and sound harvests.

4. PROPOSED SYSTEM

The focal cut off give gauge administration of climate condition and sickness. Another sort of arrangement related of checking traps which are utilized to catch vermin is with the assistance of picture sensors [6]. In [6], the creators planned and carried out a low force burned-through framework which depends on remote picture sensors and fueled by battery. The recurrence of catching and moving snare pictures of sensors can be set and distant changed by catching application. Acoustic sensors are additionally utilized in checking framework. In [7], the creators give an answer for identify red palm weevil (abbr. RPW) with them. With the assistance of acoustic gadget sensor, the bug's clamor can be caught naturally. At the point when the commotion level of vermin increments to some limit, the framework will tell the customer that the pervasion is happening in the particular region. It assisted ranchers with being practical of time and energy to check all aspects of cropland without anyone else and increment the work productivity. All acoustic sensors will be associated with base stations and everyone will report the commotion level if the predefined limit esteem is outperformed [7]. AI additionally had been applied in the horticultural field, like examination of plant sickness and bothers, etc. A lot of procedures of AI had been generally used to tackle the issue of plant infection finding. In [8], a Neural Network based strategy for assessing the wellbeing of potato with leaf picture datasets is proposed. Also, the trial research in [9] was done, which expected to execute an arrangement of perceiving plant infection with pictures.

5. IMPLEMENTATION

In this paper, an intricate Internet of Things climate of harvest illnesses and creepy crawly bugs ID model is set up. Through the arrangement of sensors and cameras in complex hilly climate, the natural data and picture data of the scene are gathered, and the essential data set of harvest bug recognizable proof is set up. Through the profound learning network model, the picture data is learned and perceived, which is utilized to recognize and gather leaf pictures, and afterward distinguish vermin and sicknesses.

A. THE STRUCTURE OF CROP DISEASE RECOGNITION MODEL

In this paper, Inception-ResNet-v2 network is utilized as the essential model of yield infection acknowledgment. This cross breed network not just has the profundity benefit of remaining organization, yet in addition holds the interesting qualities of multi-convolution center of commencement organization. In the wake of adding the remaining unit in the beginning organization, despite the fact that there is no huge improvement in exactness, yet it successfully takes care of the issues of slope vanishing and inclination blast. Furthermore, the assembly speed of the model is sped up. Additionally, the preparation effectiveness and the little reach advancement execution are improved. [24]. The design of this model is appeared in Fig. 2

As demonstrated in Fig. 3, the first commencement module takes equal construction for include extraction, and afterward stack. In this paper, we add the cross-layer direct edge and multi-way convolution layer in the lingering network unit to the model. After the joined convolution activity is finished, it is actuated by the association into the ReLu work. As demonstrated in Fig. 4, the 7×7 convolution structure in the first beginning construction is supplanted by 1×7 and 7×1 convolution in the commencement layer B. Also, the 3×3 design in the remaining layer C is supplanted by progressive 3×1 and 1×3 in Fig. 5. This model can adequately diminish the computational intricacy of a solitary convolution layer by supplanting the first huge convolution piece with multi-facet little convolution bit. What's more, it doesn't change the presentation of the framework. In view of the

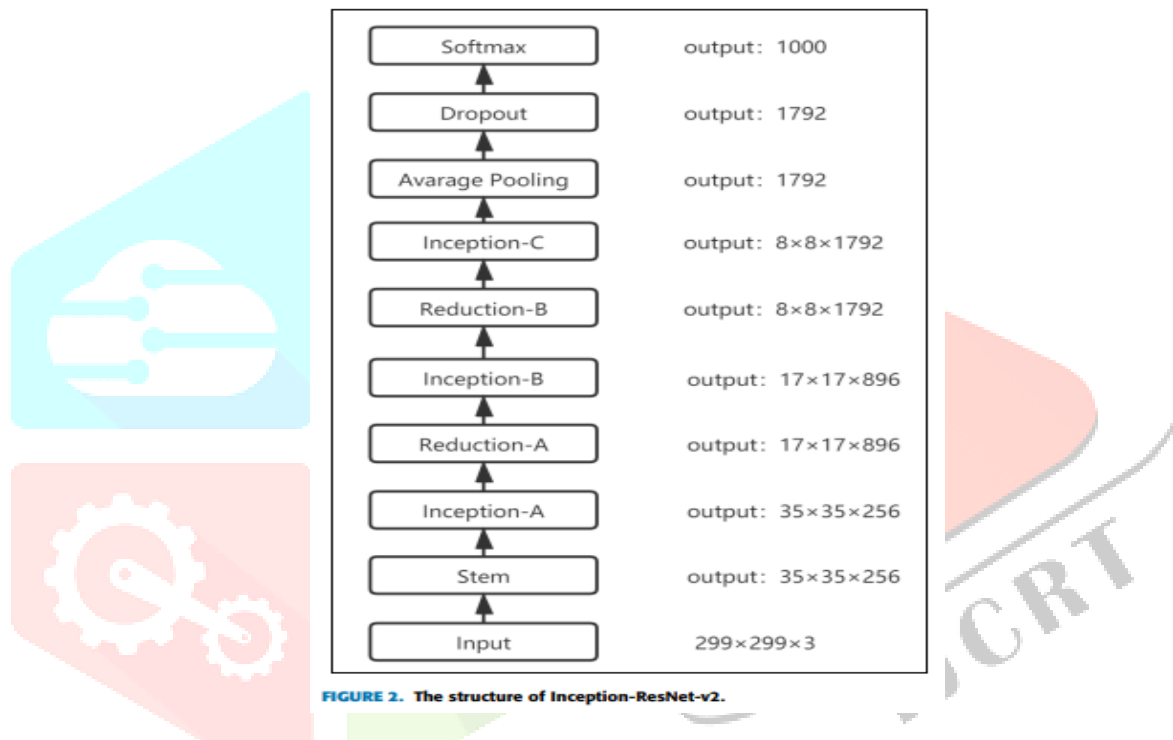


FIGURE 2. The structure of Inception-ResNet-v2.

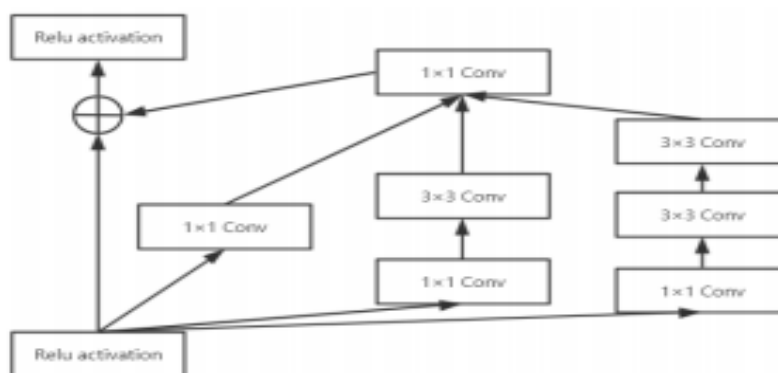


FIGURE 3. The structures of Inception-A in Inception-ResNet-v2.

increase of convolution layer and the deepening of network depth, the performance of this network is more excellent than before.

B. DATASET

The data set used in this paper is from the data set used in the Crop Disease Recognition Competition of the 2018 Artificial Intelligence Challenger Competition. The dataset includes 47363 images of 27 diseases related to 10 crops (mainly tomatoes, potatoes, corn, etc.). The data set is divided into three parts: 70% for training set, 10% for validation set and 20% for test set. Each picture contains only the leaves of a single crop. Some sample pictures are shown in Fig. 6

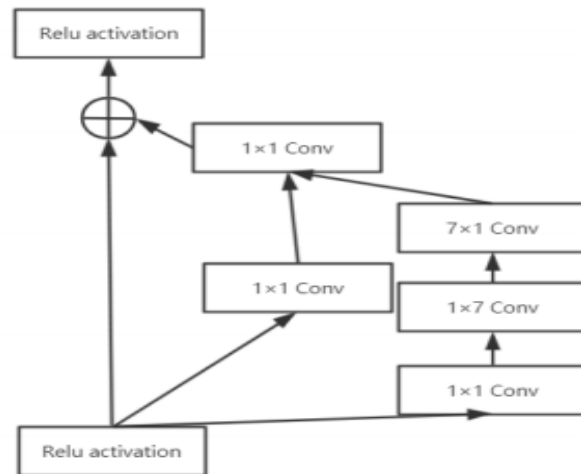


FIGURE 4. The structures of Inception-B in Inception-ResNet-v2.

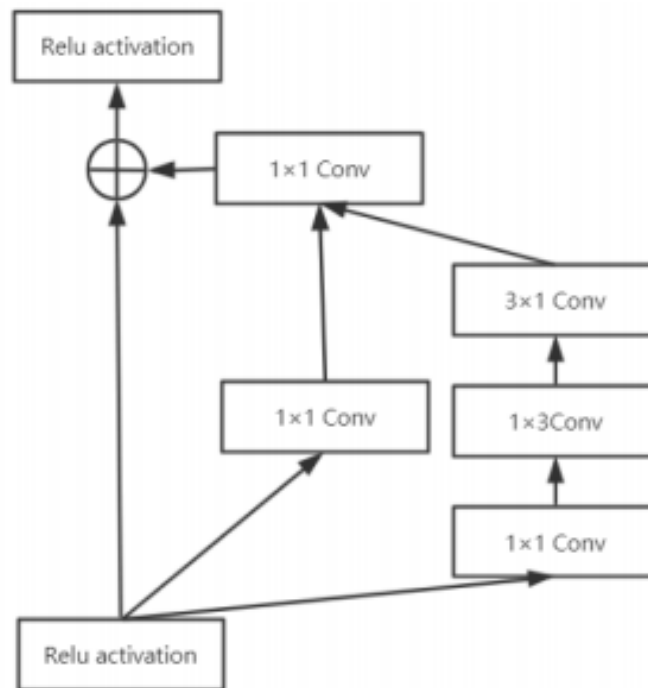
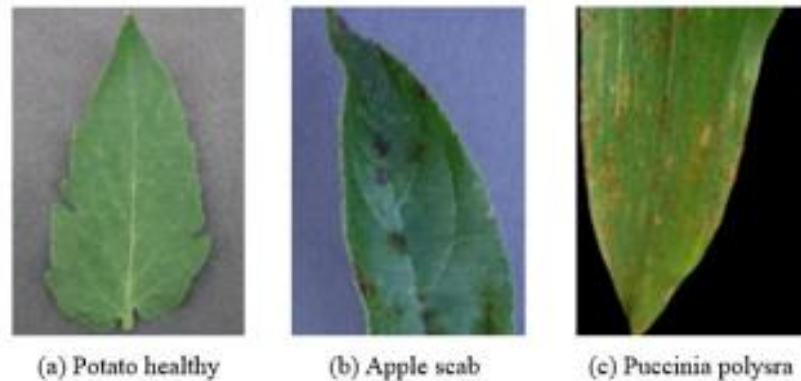


FIGURE 5. The structures of Inception-C in Inception-ResNet-v2.

C. IMAGE PREPROCESSING

The reason for picture preprocessing is to dispense with the impedance of futile data in informational collection to show acknowledgment, and to extend the informational collection partially. The neural organization can accomplish better preparing impact. Thusly, the obviousness of the picture can be viably improved, with the goal that the acknowledgment precision of the model can be improved. As of now, the normally utilized preprocessing strategies incorporate mathematical space change and pixel shading change. The previous incorporates flip, crop, pivot, zoom, etc. The last incorporates evolving contrast, adding



Gaussian clamor, shading vacillating, etc. In view of the lopsided dispersion of informational collections, so in this paper, we primarily take the technique for light change and arbitrary cut-out. Upgrade the element data of the image and the size of the informational collection itself. The impact of the foundation factor and the information amount issue on the model is debilitated. It can improve the model produce learning impact and increment the steadiness of the model. At first; this paper doesn't prepare the neural organization by move learning technique. Eventually, albeit the preparation set has arrived at 90% precision. Nonetheless, as per the misfortune pattern and the last test set outcomes, it very well may be plainly seen that there is an over-fitting marvel. After examination, the most probable explanation is that the informational collection is generally little. In spite of the fact that information improvement reduces the issue of lopsided conveyance somewhat, it doesn't totally tackle the issue of over-fitting. From that point, this paper utilizes move learning on this informational index. It is to utilize the standard organization for preparing, just need to alter the model somewhat and train here can get excellent preparing impact. To summarize, move learning can bring higher beginning exactness, quicker intermingling pace and more precise estimate precision for the model.

D. NORMALIZED PROCESSING

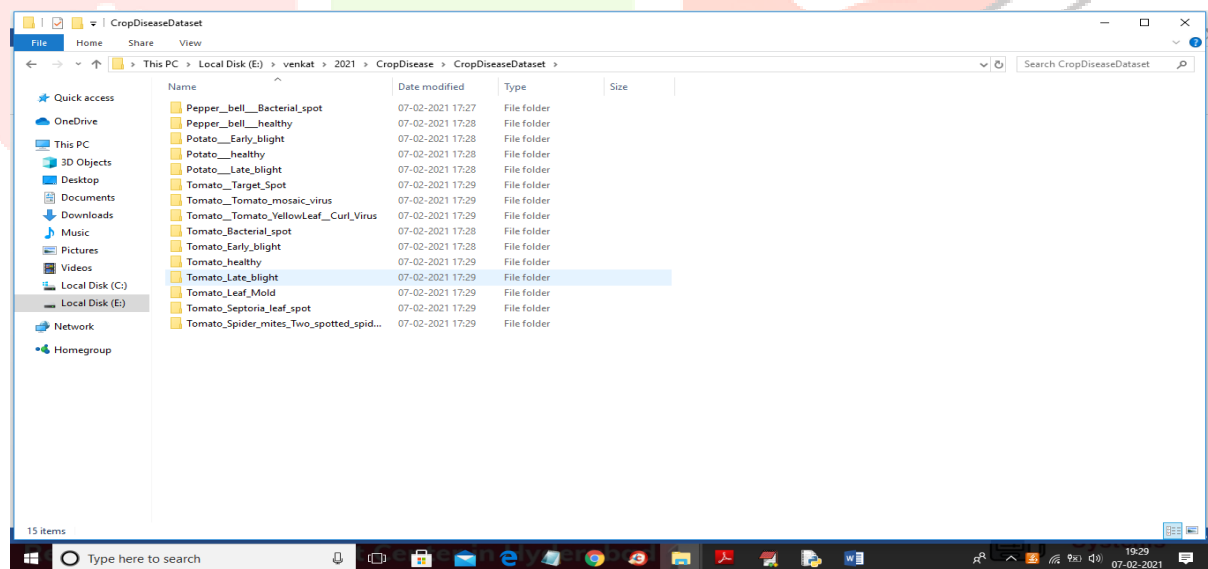
After that above steps are complete, the picture of the data set will be normalized. Normalization can be considered to be an indispensable and important part of the convolutional neural network. It scales the characteristics of each dimension to the same range. On the one hand, it is convenient to calculate data and improve the efficiency of operation. On the other hand, the association between different features is eliminated. Therefore, the ideal model training result can be obtained.

6. EXPERIMENTAL RESULTS

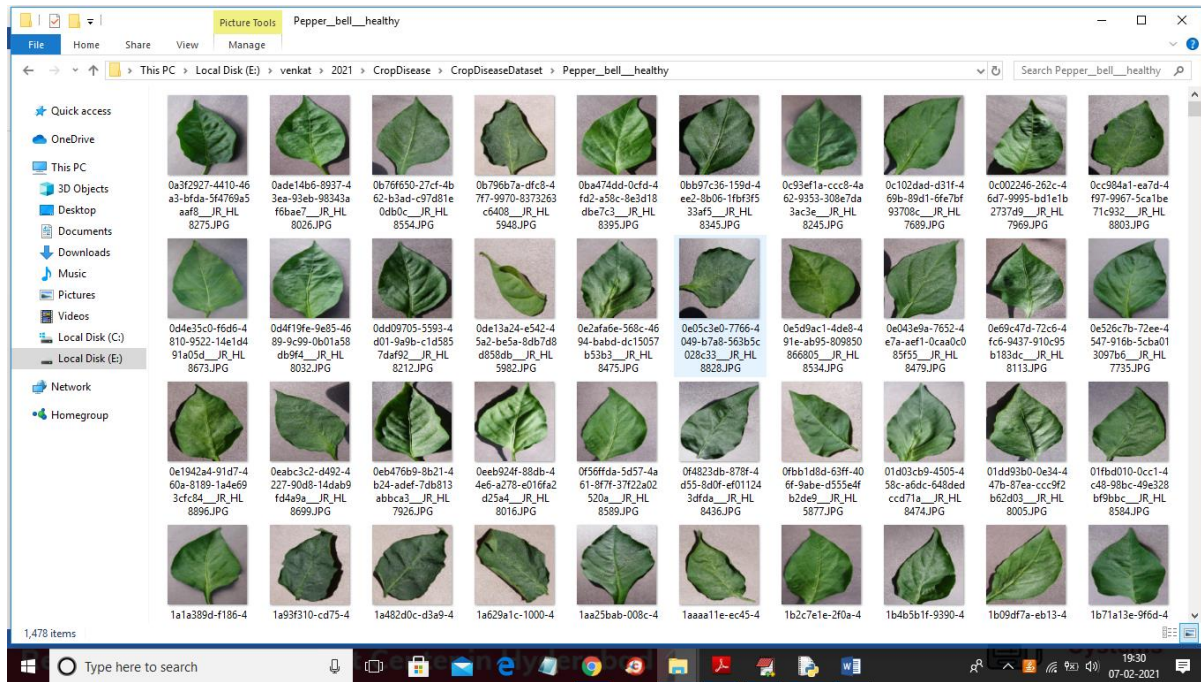
In this paper author is applying deep learning convolution neural network (CNN) to predict crop disease and its pests to reduce economical loss in crop business. To build disease recognition model author is applying RESNET CNN model which consists of 3 parts

- 1) Feature Extraction: CNN compose of multiple layers and first layer define for feature extraction and this features will be extracted from given input image dataset or any other multidimensional dataset.
- 2) Feature Selection: Using this layer features will be selected by applying a layer called pooling or max polling.
- 3) Activation module: using this module RELU will be applied on input features to remove out unimportant features and hold only relevant important features
- 4) Flatten: This layer will be define to convert multidimensional input features into single dimensional input array
- 5) Dense: This layer can be used to connect one layer to other layer to receive input features from previous layer to new layer to further filter input features in next layer to get most important features from dataset to have best prediction result.

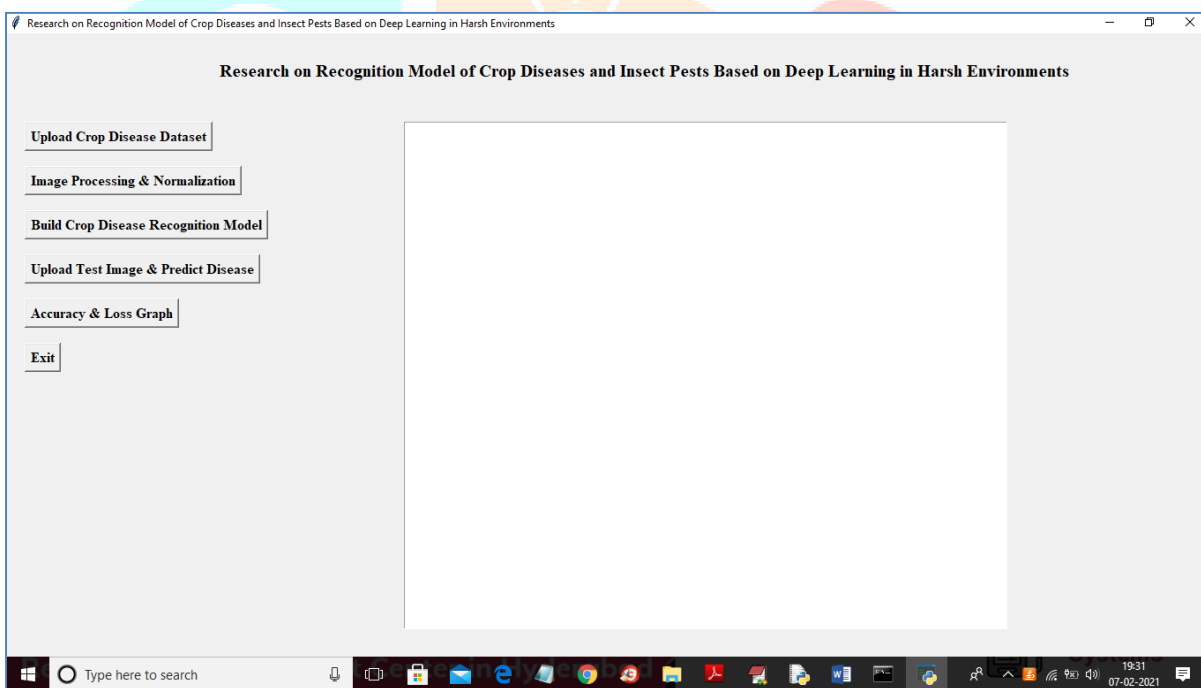
To implement this project we have used crop disease recognition dataset and this dataset saved inside 'CropDiseaseDataset' folder and below screen shots showing various type of crop disease images



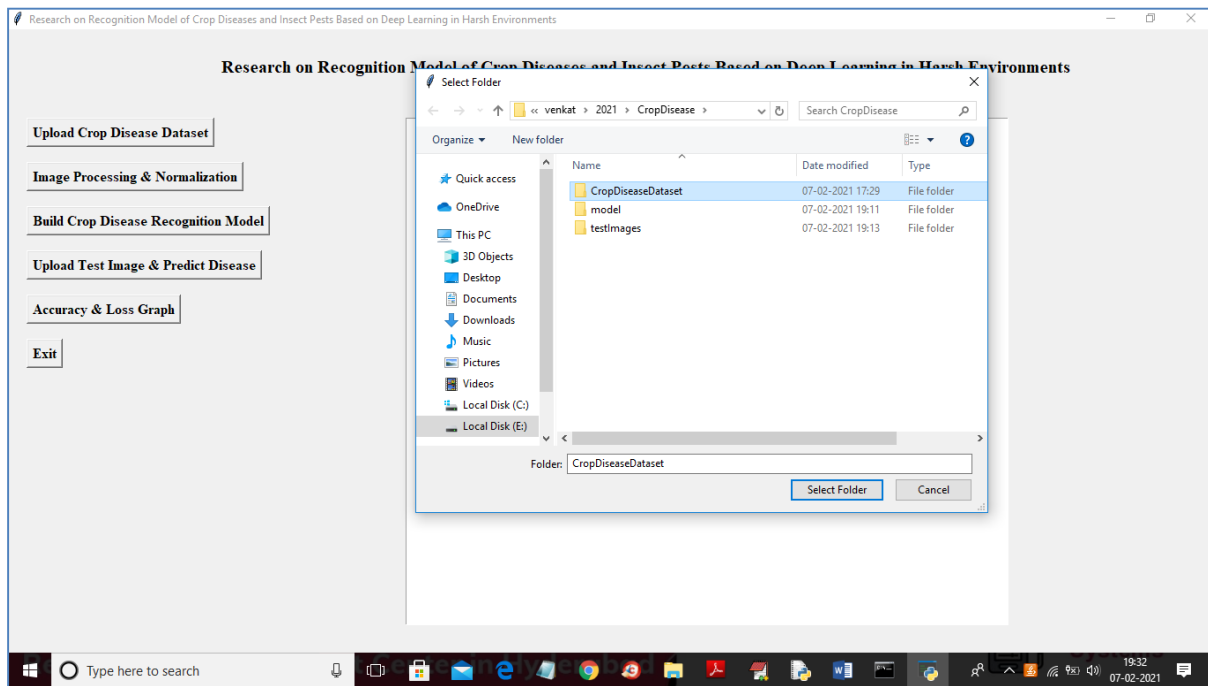
In above screen we are using 15 different type of crop images and each folder contains images of own leaf and in below screen you can see those image. You too just go inside any above folder to see images



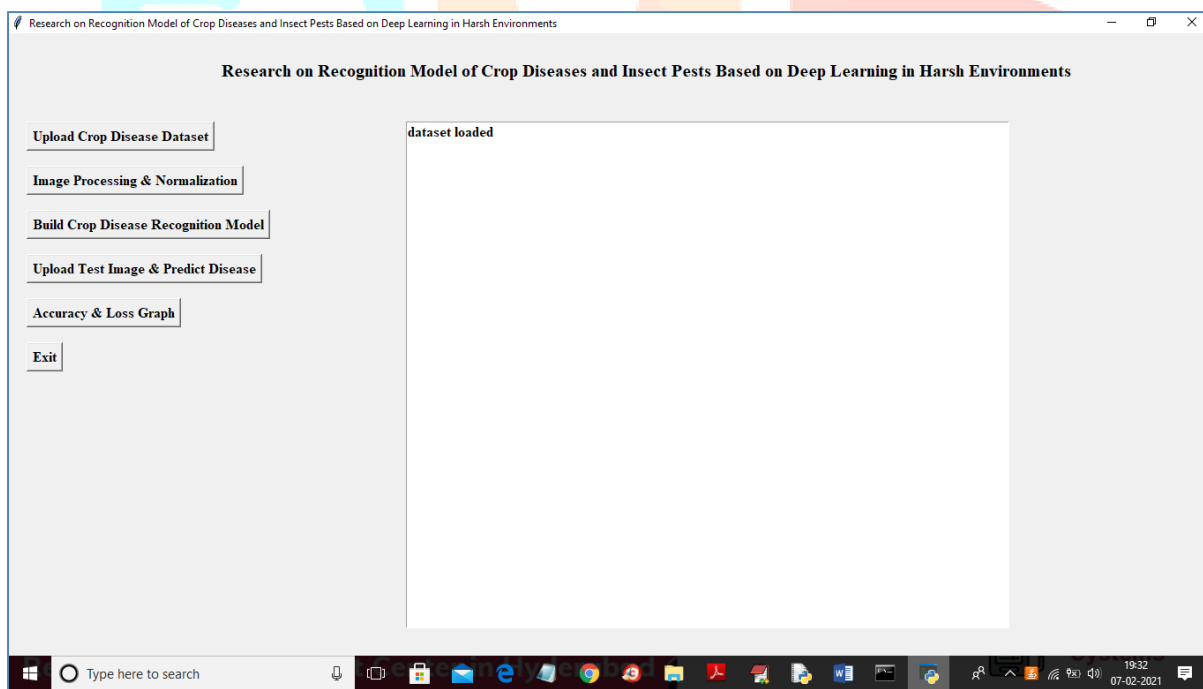
To run project double click on 'run.bat' file to get below screen



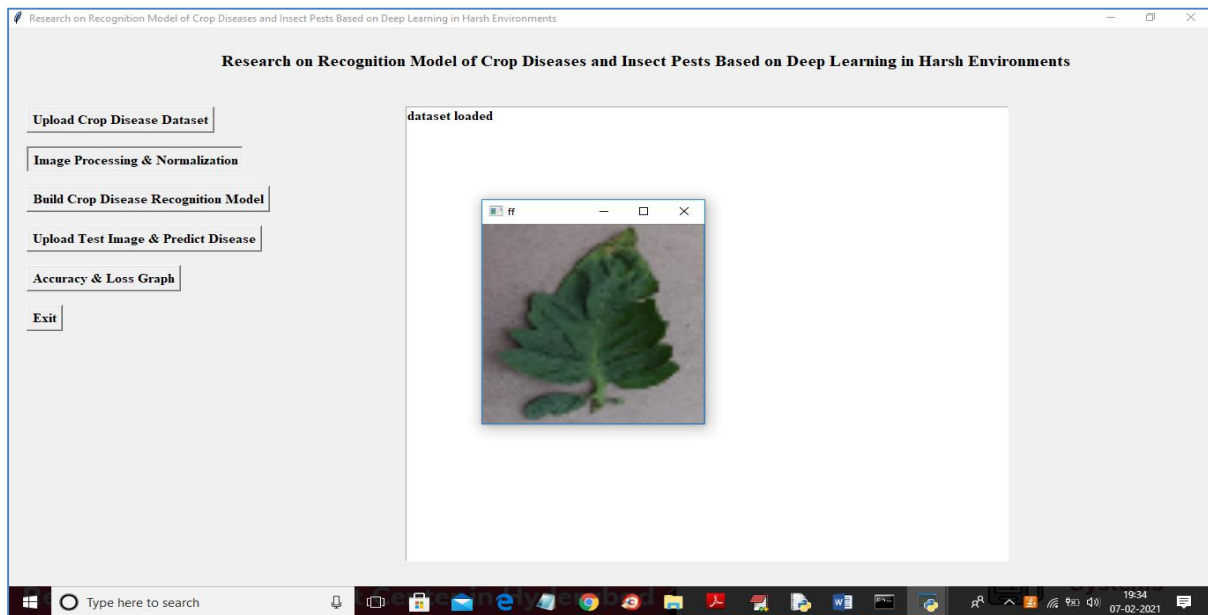
In above screen click on 'Upload Crop Disease Dataset' button to upload dataset images



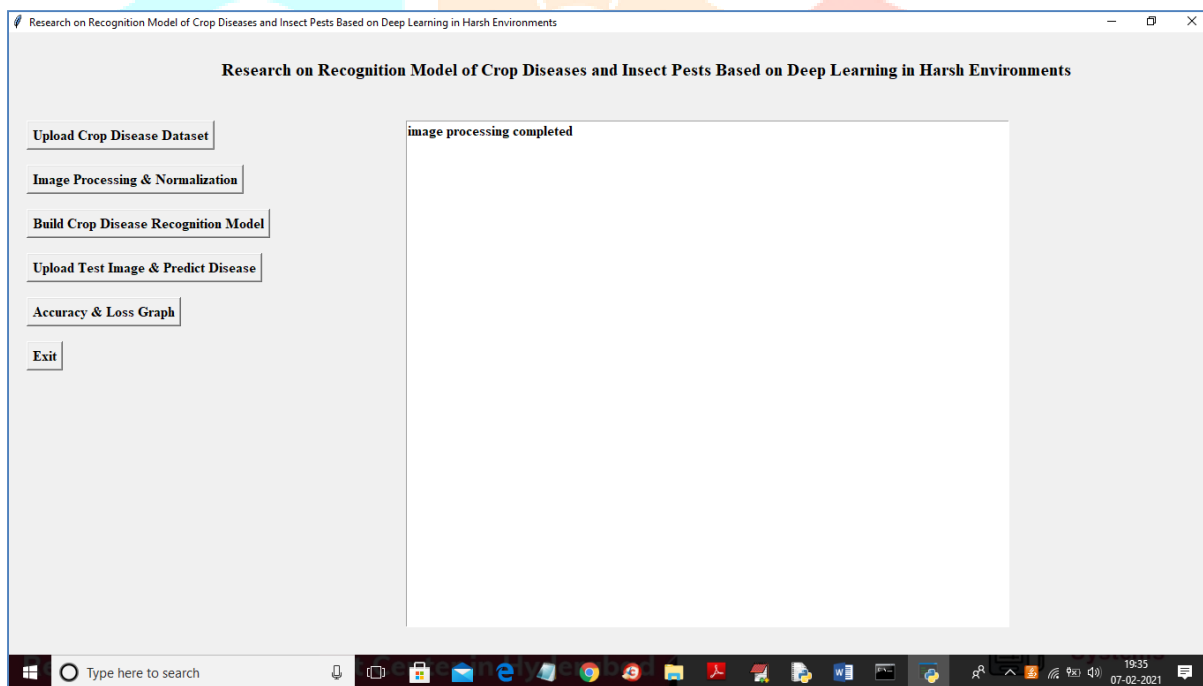
In above screen selecting and uploading 'CropDiseaseDataset' folder and then click on 'Select Folder' button to load dataset and to get below screen.



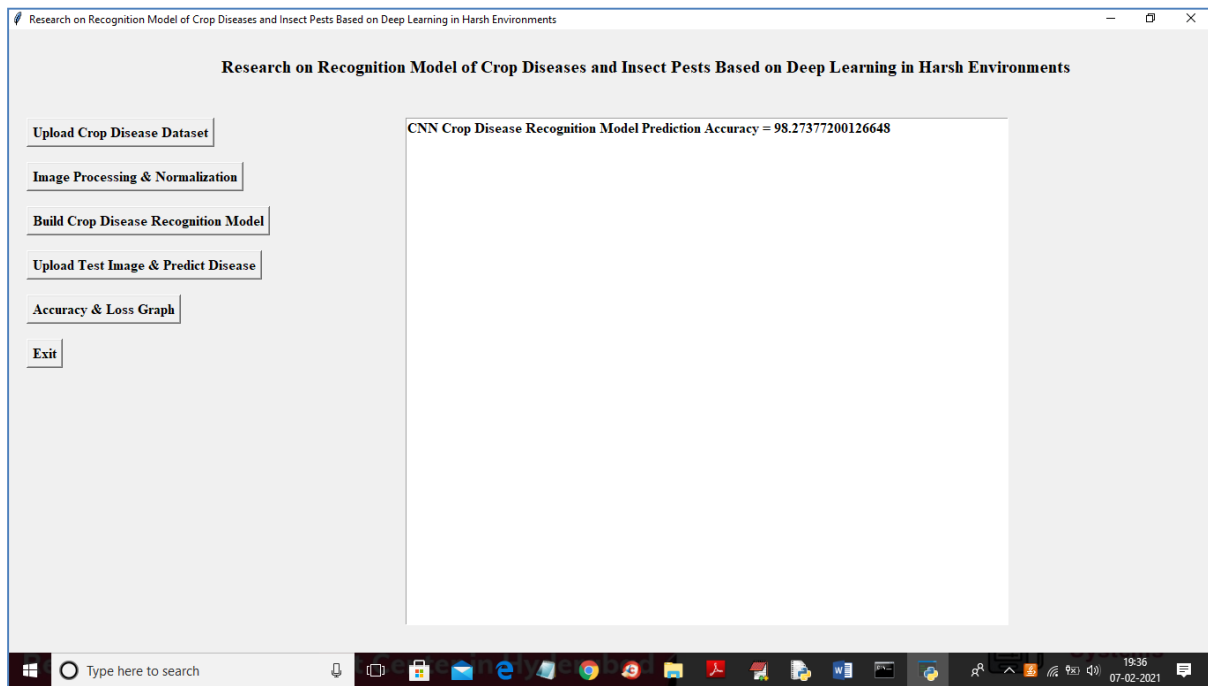
In above screen dataset loaded and now click on 'Image Processing & Normalization' button to read all images and then process images to normalize by converting each image pixel value between 0 and 1 and for that normalization we will divide image pixels with 255 and then get value as 0 or 1 as all images pixel value will be between 0 to 255.



In above screen after applying normalization we are just displaying one random image from dataset to check whether images loaded and process properly or not and now you close above image to get below screen.



In above screen all images process successfully and now dataset images are ready and now click on 'Build Crop Disease Recognition Model' button to build CNN model.



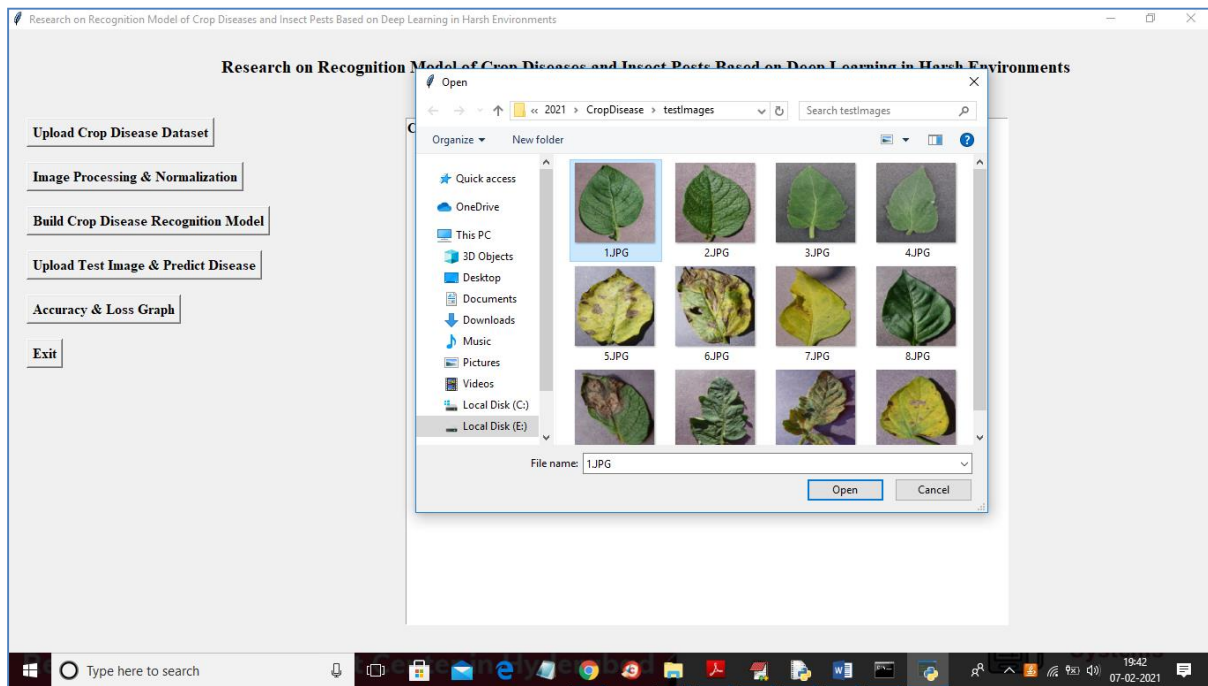
In above screen CNN model generated and its prediction accuracy is 98% and in below console screen we can see all CNN layers details.

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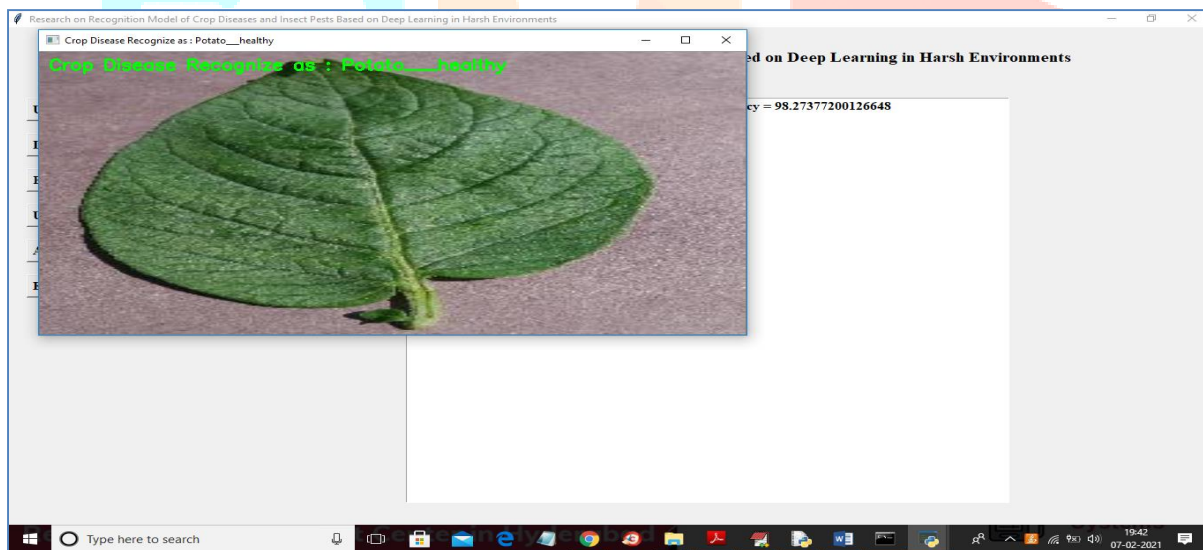
C:\Windows\system32\cmd.exe
WARNING:tensorflow:From C:\Users\Admin\AppData\Local\Programs\Python\Python37\lib\site-packages\keras\backend\tensorflow_backend.py:4070: The name tf.nn.max_pool is deprecated. Please use tf.nn.max_pool2d instead.
WARNING:tensorflow:From C:\Users\Admin\AppData\Local\Programs\Python\Python37\lib\site-packages\keras\backend\tensorflow_backend.py:422: The name tf.global_variables is deprecated. Please use tf.compat.v1.global_variables instead.
Model: "sequential_1"
Layer (type)                Output Shape                Param #
-----
conv2d_1 (Conv2D)           (None, 62, 62, 32)         896
max_pooling2d_1 (MaxPooling2 (None, 31, 31, 32)         0
conv2d_2 (Conv2D)           (None, 29, 29, 32)         9248
max_pooling2d_2 (MaxPooling2 (None, 14, 14, 32)         0
Flatten_1 (Flatten)         (None, 6272)               0
dense_1 (Dense)             (None, 256)                1605888
dense_2 (Dense)             (None, 15)                 3855
-----
Total params: 1,619,887
Trainable params: 1,619,887
Non-trainable params: 0
None

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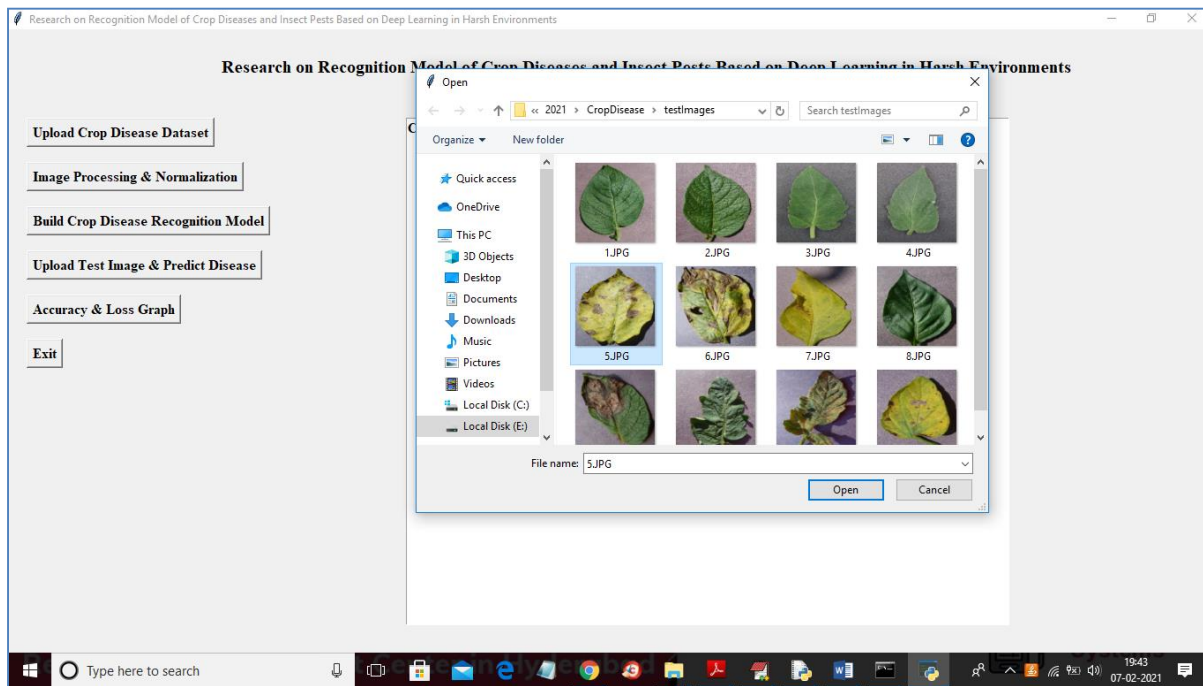
In above screen we can see we have used CONV2D, MAXPOOLING, FLATTEN and DENSE layer to build crop disease recognition model and RELU details you can see in code. Now model is ready and now click on 'Upload Test Image & Predict Disease' button to upload any test image and then application will predict disease or healthy from that image



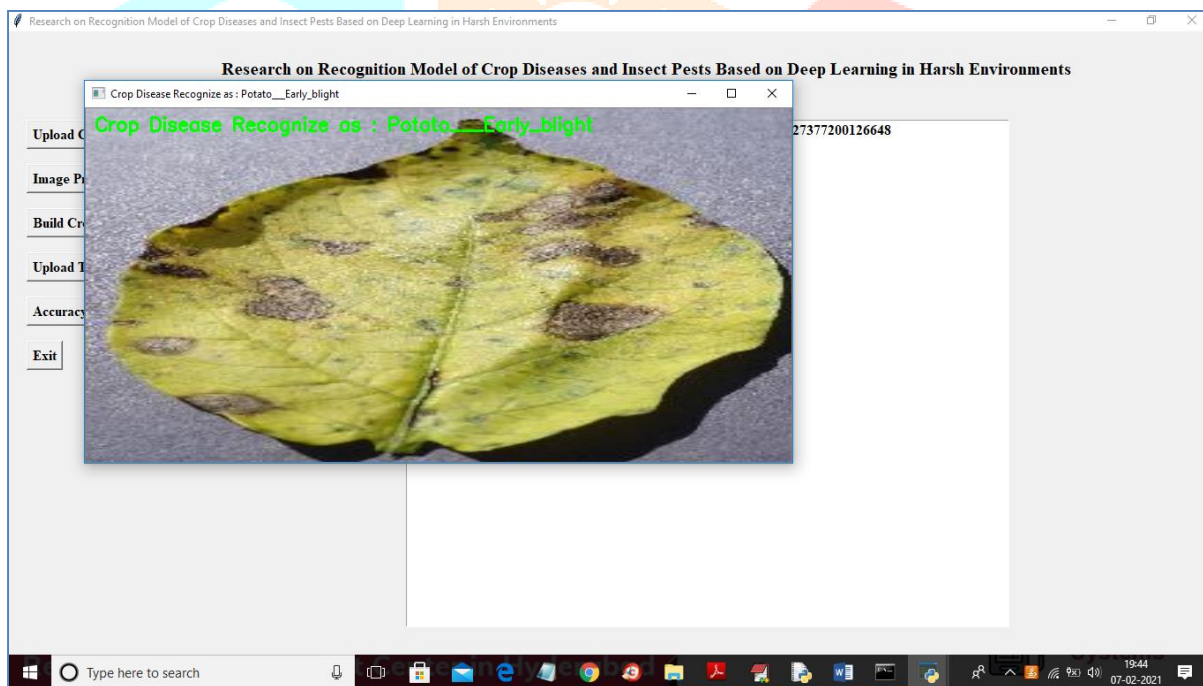
In above screen selecting and uploading '1.JPG' image file and then click on 'Open' button to get below prediction result.



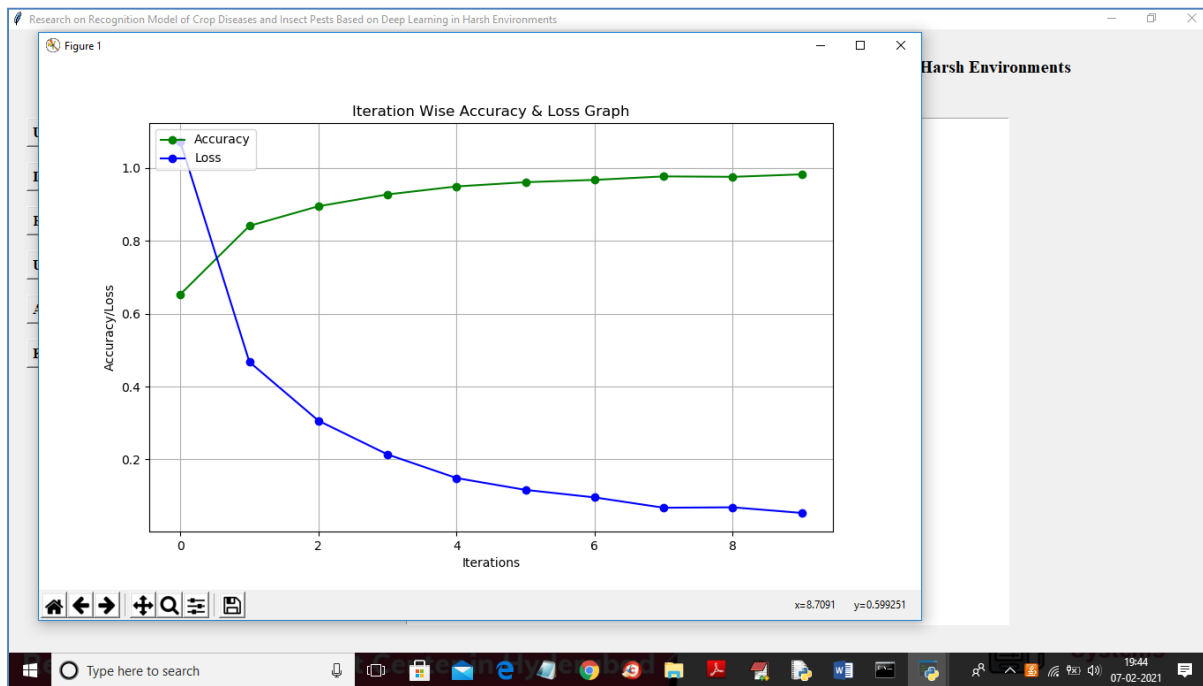
In above screen potato leaf predicted as healthy and now tries with other image



In above screen selecting and uploading '5.JPG' file and click 'Open' button to get below result



In above image potato EARLY BLIGHT disease is detected or recognize and similarly you can upload any other image and get result and now click on 'Accuracy & Loss Graph' button to get below graph.



In above graph x-axis represents epoch/iterations and y-axis represents accuracy/loss and green line represents accuracy and blue line represents loss and from above graph we can see with each increasing iteration accuracy is getting better and better and loss getting decrease.

7. CONCLUSION

In this paper, 27 sorts of sickness acknowledgment of 10 sorts of yields were contemplated. The Inception-ResNet-v2 model is developed by utilizing profound learning hypothesis and convolution neural organization innovation. Examinations show that the model can viably recognize the informational collection, and the general acknowledgment precision is pretty much as high as 86.1%. The outcomes show that the acknowledgment exactness of this cross breed network model is moderately higher than the customary model, and it very well may be viably applied to the ID and location of plant sicknesses and bug bothers. Later on work, there are two headings ought to be improved: 1) Extended informational collection. In this paper, just 27 infections of 10 yield species were contemplated, and different species and illnesses were not included, like rice and wheat, and their connected sicknesses. Hence, the subsequent stage is to get more yield species and sickness pictures for research. 2) Optimize the model. Through the trial of this paper, we can see that Inception-resnet-v2 this sort of blended organization enjoys assimilated the comparing benefit. This model has accomplished great acknowledgment exactness, and is deserving of additional investigation and improvement. Simultaneously, we should plan an organization model which can characterize crop pictures with higher precision.

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