Dr. Babasaheb Ambedkar Technological University, Lonere

A

Project Report

on

"Identification and Solutions for Grape Leaf Disease Using Deep Learning"

Submitted in partial fulfillment of the requirement for the degree of

Bachelor of Technology

in

COMPUTER SCIENCE AND ENGINEERING

by

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under the guidance of

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Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

Padmabhooshan Vasantraodada Patil Institute of Technology, Budhgaon

(Approved by AICTE, New Delhi, Recognized by Government of Maharashtra & Affiliated to DBATU)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CERTIFICATE

This is to certify that,

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Studying in B.Tech. Computer Science and Engineering have successfully completed the project entitled

"Identification And Solution Of Grape Leaf Disease Using Deep Learning"

under the guidance and supervision of Prof. D.D.Dhokte**.** during the academic year 2021-2022 towards the partial fulfillment of curriculum prescribed by Dr. Babasaheb Ambedkar Technological University, Lonere for the award of degree of Bachelor of Technology in Computer Science & Engineering.

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We express our deep gratitude to **Mr. B. S. Patil**, Head of Computer Science & Engineering Department, for his valuable guidance and constant encouragement. We are very much thankful to **Dr. D.V.Ghewade**, Principal, Padmabhooshan Vasantraodada Patil Institute of Technology, Budhgaon (Sangli) for providing all the necessary facilities to carry out project work.

Last but not least we are thankful to our parents for their moral as well as financial support.

ABSTRACT

Crops are facing many diseases nowadays. These diseases lead to major damage and economic loss and hence early detection of disease is necessary to prevent the damage acquired by the crops. Fallacious diagnosis and severity of diseases leads to improper use of pesticides. Expert naked eye observation is the primary method used by plant disease detection and identification. Yet examination of the naked eye is time-consuming, costly and takes a lot of effort.

A classification is a system by which the leaf is classified according to its unique morphological characteristics. There are so many methods of classification, choosing a classification system is always a daunting task, because the consistency of the result differs according to different input data. Image processing is one of the commonly used methods for the identification and diagnosis of plant-leaf diseases. More effective methods are developed and proposed for the early detection of plant disease with lowest processing period due to technological and scientific advances.

The main aim of the proposed system is to detect the disease of grape leaf using neural network algorithm and to provide preventive or solutions to the user. Earlier one had to manually extract the features from images and pass it to different classification algorithm but CNN performs both image recognition and feature extraction. Compared to other algorithms the accuracy for image classification by CNN is more.

DECLARATION

We are hereby declaring that the work presented in this project report entitled **"Identification and Solutions for Grape Leaf Disease Using Deep Learning"**

Being submitted by us to the PVPIT collage , Budhgaon in partial fulfillment of the requirements for the awarded of the degree in Computer Science engineering during the academic year 2021-2022 under the guidance of **Prof. D.D. Dhokate.**

We also declare that the work carried out by various workers referred in this project has been listed in the list of reference. I also declare that the work claimed that as own contribution in this project is not duplicated from any other published works.

I also declare that to the best of my knowledge this project or any part thereof has not been submitted by me or any other university or institutions for award of any degree.

Date-

Place-Budhgaon

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1. INTRODUTION

India record of progress in agriculture throughout the course of recent many years has been very noteworthy. The farming area has been effective in staying up with rising interest for food. The commitment of expanded land region under farming creation has declined over the long run and expansions underway in the beyond twenty years have been as a rule because of expanded efficiency. Indian Economy is highly dependent on agricultural pro ductivity of the country. Grape is very commercial fruit of India. It can easily be grown in all tropical, sub-tropical and temperate climatic regions. India has got different types of climate and soil in different parts of the country. This makes grapevines a major vegetative propagated crop with high social economic importance. The grape plant will cause poor yield and growth when affected by diseases. The diseases are due to the viral, bacteria and fungi infections which are caused by insects, Rust and nematodes etc., These diseases are judged by the farmers through their experience or with the help of experts through naked eye observation which is not accurate and time consuming process. Early detection of disease is then very much needed in the agriculture and horticulture field to increase the yield of the crops. We have proposed a system that can detect and identify diseases in the leaves of the grape plants.

1.1 BACKGROUND

India is agricultural country and our sangli region is basically surrounded by various farming. Also we are from farmers family. Tasgaon is highest in grape cultivation in Sangli District. In total area approximately 21% grapes are cultivated in Tasgaon. In the farmers view it is a cash crop which give economic benefits as compare to other crops .Crops are facing many diseases nowadays. These diseases lead to major damage and economic loss and hence early detection of disease is necessary to prevent the damage acquired by the crops.

Agriculture accounts for 70% of the population. Farmer has a wide range of options to choose the variety for fruits . Farmers spray large quantities of pesticides to combat pests, which contribute to higher production costs. Only after the infection the diseases are known, this leads to wastage of time and money that is invested on the vineyard. A product quality control is basically necessary in order to manufacture more value-added goods. The plant diseases are one of the most significant causes for this nature . Fast revelation and proper knowledge of their extent will help to make judgments about the proper use of pesticides in terms of their presence and quantity and thus help conserve crops. Data mining is about using data processing to clarify the past and forecast the future. Classification is a data mining activity, based on numerical or categorical variables, which categories data . Research on plant disease detection is now increasing for days, which can be useful in monitoring large fields and thus automatically detecting symptoms as they occur on plants. Grapes can also be processed into comfitures and preserves, juices, grape seed oil, extract of grapes, raisins and vinegar. First consideration when trying to grow grapes is the selection of a variety based on the prevailing local climate, with the best production in hot, dry regions.

Farmers need consent expert supervision which could be mostly expensive and it may take a lot of time and hence it is of great realistic significance to look for fast and more reliable method to automatically identify the diseases. In cases of grapes, most of the signs of disease are found on the vines and berries. The leaf considered for detection shows the symptoms of the disease . The image should go through some processes such as pre-processing, extraction of features and classification processes to detect plant diseases. Pre-processing is an enhancement of the image features that are necessary for further processing. In this paper we are focusing on three types of grape leaf diseases black rot, powdery mildew, and downy mildew.

Classify the image using CNN algorithm and will give the output whether the leaf is healthy or name of the disease and will also suggest solutions to protect the grape vines. Only the continuous attribute values can be added to the simple fuzzy min-max neural network (FMMN) and cannot manage the discrete values. Also explaining the results of the classification provided by FMMN needs to be obtained to make it more applicable to applications in the real world .In FHLSN, membership function calculates the input pattern's membership value based on its distance from both endpoints of the hyper line segment. But input pattern is often similar to the hyper line segment but far from its endpoints. To solve this problem MHLSNN was introduced. In MHLSNN membership function the minimum distance of the input pattern from the hyper line segment midpoint and its distance from both the points is centered .

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1.2 Application in General form in different areas : -

Applications that we used in farming or agriculture sector. Farmers need consent expert supervision which could be mostly expensive and it may take a lot of time.

1.3 Challenges in existing system

There are a lot of challenges that machine learning professionals face to inculcate ML skills and create an application from scratch.

1. Poor Quality of Data

Data plays a significant role in the machine learning process. One of the significant issues that machine l earning professionals face is the absence of good quality data. Unclean and noisy data can make the whole process extremely exhausting. We don't want our algorithm to make inaccurate or faulty predictions. Hence the quality of data is essential to enhance the output.

2. Underfitting of Training Data

This process occurs when data is unable to establish an accurate relationship

between input and output variables. It simply means trying to fit in undersized jeans. It signifies the data is too simple to establish a precise relationship.

3. Overfitting of Training Data

Overfitting refers to a machine learning model trained with a massive amount of data that negatively affect its performance. It is like trying to fit in Oversized jeans. Unfortunately, this is one of the significant issues faced by machine learning professionals.

4.

4. Machine Learning is a Complex Process

The machine learning industry is young and is continuously changing. Rapid hit and trial experiments are being carried on. The process is transforming, and hence there are high chances of error which makes the learning complex.

5. Slow Implementation

This is one of the common issues faced by machine learning professionals. The machine learning models are highly efficient in providing accurate results, but it takes a tremendous amount of time.

2. LITERATURE SURVEY:

2.1 THEORY WORK

Artificial Intelligence:

[1] Artificial intelligence (AI) is the simulation of human intelligence processes by machines, especially computer systems enabling it to even mimic human behavior. Its applications lie in fields of Computer Vision, Natural Language Processing, Robotics, Speech Recognition, etc. Advantages of using AI are improved customer experience, accelerate speed to market, develop sophisticated products, enable cost optimization, enhance employee productivity and improve operational efficiency. [5]Machine Learning (ML) is a subset of AI which is programmed to think on its own, perform social interaction, learn new information from the provided data and adapt as well as improve with experience. Although training time via Deep Learning (DL) methods is more than Machine Learning methods, i is compensated by higher accuracy in the former case. Also, DL being automatic, large domain knowledge is not required for obtaining desired results unlike in ML

Basic Operation of Neural Network:

[2]Neural Networks (NN) form the base of deep learning, a subfield of machine learning where the algorithms are inspired by the structure of the human brain. NN take in data, train themselves to recognize the patterns in this data and then predict the outputs for a new set of similar data. NN are made up of layers of neurons. These neurons are the core processing units of the network. First, we have the input layer which receives the input; the output layer predicts our final output. In between, exist the hidden layers which perform most of the computations required by our network. Our grape leaf images are composed of 128 by 128 pixels which make up for 16,384 pixels. Each pixel is fed as input to each neuron of the first layer. Neurons of one layer are connected to neurons of the next layer through channels. Each of these channels is assigned a numerical value known as weight. [6]The inputs are multiplied to the corresponding weight and their sum is sent as input to the neurons in the hidden layer. Each of these neurons is associated with a numerical value called the bias which is then added to the input sum. This value is then passed through a threshold function called the activation function. The result of the activation function determines if the particular neuron will get activated or not. An activated neuron transmits data to the neurons of the next layer over the channels. In this manner the data is propagated through the network this is called forward propagation. In the output layer the neuron with the highest value fires and determines the output.[8] The values are basically a probable. The predicted output is compared against the actual output to realize the error in prediction. The magnitude of the error gives an indication of the direction and magnitude of change to reduce the error. This information is then transferred backward through our network. This is known as back propagation. This cycle of forward propagation and back propagation is iteratively performed with multiple inputs. This process continues until our weights are assigned such that the network can predict the type of tumor correctly in most of the cases. This brings our training process to an end. NN may take hours or even months to train but time is a reasonable trade-off when compared to its scope.[11] Several experiments show that after pre-processing MRI images, neural network classification algorithm was the best more specifically CNN (Convolutional Neural Network) as compared to Support Vector Machine (SVM), Random Forest.

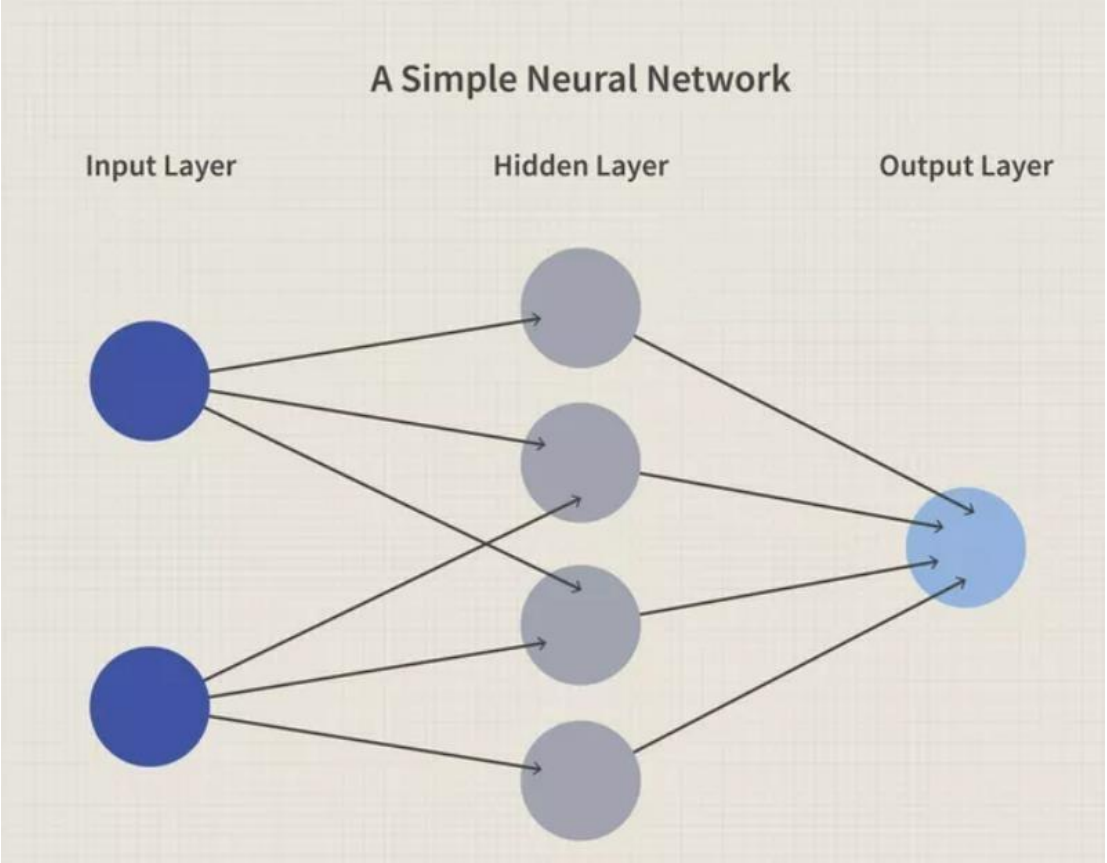

Fig: How neural network work

Activation Function:

[6]Sigmoid function ranges from 0 to 1 and is used to predict probability as an output in case of binary classification while SoftMax function is used for multi-class classification. tanh function ranges from -1 to 1 and is considered better than sigmoid in binary classification using feed forward algorithm. RELU (Rectified Linear Unit) ranges from 0 to infinity and Leaky ReLU (better version of ReLU) ranges- from -infinity to +infinity. ReLU stands for Rectified Linear Unit for a non-linear operation. The output is $f(x) = \max(0, x)$. ReLU 's purpose is to introduce non-linearity in our ConvNet. Since, the real-world data would want our ConvNet to learn would be non-negative linear values. [18]There are other nonlinear functions such as tanh or sigmoid that can also be used instead of ReLU. Most of the data scientists use ReLU since performance wise ReLU is better than the other two. Stride is the number of pixels that would move over the input matrix one at a time. Sometimes filter does not fit perfectly fit the input image. We have two options: either pad the picture with zeros (zero-padding) so that it fits or drop the part of the image where the filter did not fit. This is called valid padding which keeps only valid part of the image.

Convolutional Neural Network:

[3] Classifier models can be basically divided into two categories respectively which are generative models based on hand- crafted features and discriminative models based on traditional learning such as support vector machine (SVM), Random Forest (RF) and Convolutional Neural Network (CNN). One difficulty with methods based on hand-crafted features is that they often require the computation of a large number of features in order to be accurate when used with many traditional machine learning techniques. This can make them slow to compute and expensive memory-wise. More efficient techniques employ lower numbers of features, using dimensionality reduction like PCA (Principal Component Analysis) or feature selection methods, but the reduction in the number of features is often at the cost of reduced accuracy. [16]Grape leaf segmentation employ discriminative models because unlike generative modelling approaches, these approaches exploit little prior knowledge on the leaves 's anatomy and instead rely mostly on the extraction of [a large number of] low level image features, directly modelling the relationship between these features and the label of a given voxel.

In our project, we have used the Convolutional Neural Network architecture for Grape Leaf Disease Detection and Classification. Convolutional neural network processes closely knitted data used for image classification, image processing, face detection etc. It is a specialized 3D structure with specialized NN analyzing RGB layers of an image. Unlike others, it analyses one image at a time, identifies and extracts important features and uses them to classify the image. Convolutional Neural Networks (ConvNets) automatically learns mid-level and high-level representations or abstractions from the input training data. The main building block used to construct a CNN architecture is the convolutional layer. It also consists of several other layers,

Some Of Which Are Described As Bellow:

- Input Layer-It takes in the raw pixel value of input image.
- Convolutional Layer- It is the first layer to extract features from an input image. Convolution preserves the relationship between pixels by learning image features using small squares of input data. It is a mathematical operation that takes two inputs such as image matrix and a filter or kernel to generate a feature map Convolution of an image with different filters can perform operations such as edge detection, blur and sharpen by applying filters.
- Activation Layer-It produces a single output based on the weighted sum of inputs.
- Pooling Layer-Pooling layers section would reduce the number of parameters when the images are too large. Spatial pooling (also called sub-sampling or down sampling) reduces the dimensionality of each map but retains important information.

Spatial Pooling Can Be Of Different Types:

  - Max Pooling – taking the largest element in the feature map
  - Average Pooling - taking the average of elements in the feature map
  - Sum Pooling – taking the sum of all elements in the feature map

- Fully Connected Layer-The layer we call as FC layer, we flattened our matrix into vector and feed it into a fully connected layer like a neural network. the feature map matrix will be converted as column vector (x1, x2, x3, …). With the fully connected layers, we combined these features together to create a model. For classifying input image into various classes based on training set.
- Dropout Layer-It prevents nodes in a network from co-adapting to each other.

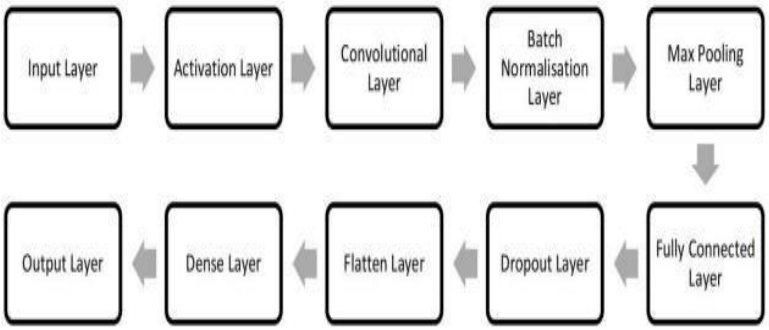

Fig : Layers of CNN & its working

2.2 PROPOSED WORK TO BE CONVERTED

Stages of Detection

- **Image Preprocessing:** As input for this system is MRI, scanned image and it contain noise. Therefore, our first aim is to remove noise from input image. As explained in system flow, we are using high pass filter for noise removal and preprocessing.
- **Segmentation:** Region growing is the simple region-based image segmentation technique. It is also classified as a pixel-based image segmentation technique since it is involving the selection of initial seed points.
- **Morphological operation:** The morphological operation is used for the extraction of boundary areas of the leaf images. This operation is only rearranging the relative order of pixel value, not mathematical value, so it is suitable for only binary images. Dilation and erosion are basic operation of morphology. Dilation is added pixels to the boundary region of the object, while erosion is removing the pixels from the boundary region of the objects.
- **Feature Extraction:** The feature extraction is used for edge detection of the images. It is the process of collecting higher level information of image such as shape, texture, color, and contrast.
- **Connected component labeling:** After recognizing connected components of an image, every set of connected pixels having same gray-level values are assigned the same

Grape Leaf Disease Identification Using Machine Learning Techniques:

1] Global Thresholding:

In this method the image is converted to grayscale image. Connected feature labelling is added to the threshold picture to identify the contours. With the wide-reaching area the contour is then established. Then binary AND operator is applied to the detected image contour and the HSV reference. The resulting picture was threshold once again using invert thresholds.

2] Supervised Learning:

In BGR image the diseased part of the leaves usually appears in blue color. The RGB image is converted into BGR image to filter out the diseased part blue color pixels for segmentation. Training image is used to assess the bottom and top limits of the blue pixels to filter out the grey pixels. The pixels inside the lower and upper boundaries are then filtered from the input as blue pixels.

3] Feature Extraction:

Photo features provide a wealth of information about the photo content. These features represent certain distinguishing features that can be used to differentiate input patterns among categories. We used texture and color features of the image for classification in this study.

4] Classification Using Different Classifier:

The derived characteristic vectors are then used to train and evaluate the output of the different classifier.

5] Support Vector Machine:

SVM outputs an optimal separating hyperplane due to a labelled training data. This hyperplane classifier new data point by class. Some parameters of the SVM classifier need to be tuned to improve SVM accuracy. One of the parameters is the kernel that defines whether the separation is linear or not.

6] Random Forest:

Random Forest is a method of learning the ensemble and also a supervised algorithm for learning. It constructs a forest of trees for decision.

2.3. EXISTING WORK

1. Grape Leaf Disease Detection Using K-Means Clustering Algorithm:

There are some methods that use automatic disease detection and classification to describe the plant leaves diseases. K-means and fuzzy algorithm are the most prominent classification strategies, based on their efficiency in clustering. Fuzzy clustering algorithm is a clustering algorithm that uses a wide range of problem related to the analysis of features, clustering and classifying design. Another popular method is K-Means which basically applied partitioning of the object into a manual cluster(K) is done in such a way that the object that the object in each cluster stays as similar to each other but far from the object in another cluster.

2. Grape Leaf Disease Identification Using Machine Learning Techniques:

In this paper the proposed method uses a grab cut algorithm to categorize the segmented leaves as fine, black rot, esca, and leaf blight in the first segment of the ROI from the background.

3. Global Thresholding:

In this method the image is converted to grayscale image. Connected feature labelling is added to the threshold picture to identify the contours. With the wide-reaching area the contour is then established. Then binary AND operator is applied to the detected image contour and the HSV

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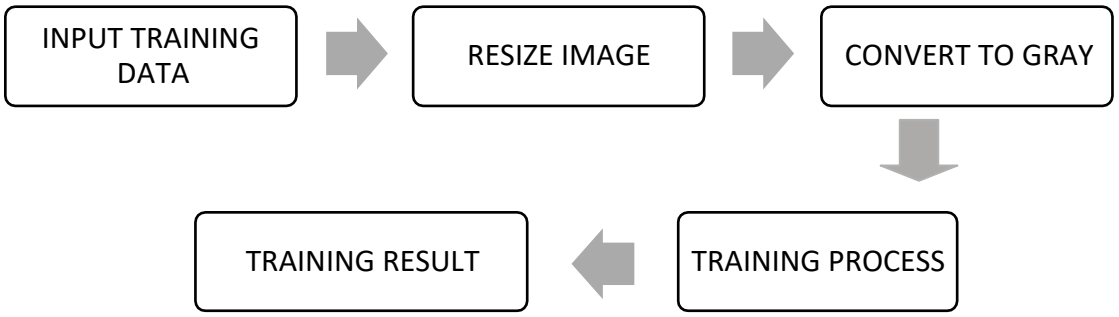


Fig : Training Process Flow

It constructs a forest of trees for decision. Many trees fit into a random classification of forests. The extracted characteristics vector is passed to each forest trees as an input vector and a decision rule is obtained to put it another way trees vote for a class.Many trees fit into a random classification of forests. The extracted characteristics vector is passed to each forest trees as an input vector and a decision rule is obtained to put it another way trees vote for a class.

3. REQUIREMENT ANALYSIS

3.1 INTRODUCTION :-

Grapes are fruits originating from Europe and Western Asia. This fruit can be made into juice, dried into raisins or fermented into grapes and brandy. Besides grapes can also cure many diseases because it has medicinal properties. Grapes are an important fruit crop. The presence of diseases in grapes can result in losses for farmers. Identification of grape leaf disease is needed by farmers so that solutions can be found to avoid greater losses during harvest. Diseases of grape leaves such as powdery mildew and downy mildew can cause great losses. Diseases in plants are found in the leaves, fruits and on the stems of plants. Early detection of leaf diseases is a major challenge in agriculture [2]. SVM classifier to detect grape leaf disease [2], and using machine learning techniques to identify grape leaf diseases [9]. By using CNN it is expected to know the level of accuracy that results from.

3.1.1 Purpose : -

India is well known for its agriculture production. Farmers have variety of options to cultivate crops in the field. Still, the cultivating these crops for best harvest and top quality of production is done in a technical way. So, the yield can be increased and quality can be improved by the use of technology. Generally, whenever there is disease to a plant, we can say that leaves are the main indicator of the disease caused to the plant.

The most important visual property is leaf's texture and color. Hence, classification of leaf disease is necessary in evaluating agricultural produce, increasing market value and meeting quality standards. The process will be too slow, If the identification and categorization is done through physical techniques, we need the experts help sometimes it will be error prone and who are less available.

The labors classify based on color, size etc. if these quality methods are recorded into automatic system by using appropriate program design language, then the effort will be error free and faster. There is need for developing technique such as automatic plant disease detection and classification using leaf image processing techniques. This will prove useful technique for farmers and will alert them at the right time before spreading of the disease over large area.

3.1.2 Scope : -

We have mainly focused on four diseases in grapes causing devastating yield losses in most of the years. These are Bacterial Spots, Powdery Mildew, Downy Mildew and Rust. The system will give more accurate results for the detection of these diseases using the CNN. An improved CNN model is proposed for diagnosing grape leaf diseases. By analyzing the features of grape leaf diseased images To reduce the damage of diseases, many researchers have made tremendous efforts to identify plant diseases. With the continuous development of machine learning algorithms, they have been widely utilized to identify plant pests and diseases. The purpose of an automatic identification system of grape diseases for the recognition of five diseases including black rot , esca , leaf blight and healthy leaf. Feature extraction and model training of the leaf images were performed using pre-defined CNN architecture. And experimental results showed that the model was able to accurately classify grape diseases. The labors classify based on color, size etc. if these quality methods are recorded into automatic system by using appropriate program design language, then the effort will be error free and faster. This project is very useful farmers . This will prove useful technique for farmers and will alert them at the right time before spreading of the disease over large area.

3.1.3 Overview : -

Farming assumes essential part in Indian economy. In India, almost around 70% of individuals are reliant straightforwardly or by implication upon farming. In farming we perform tasks like seed planting, digging, pesticide splashing and so on. So it requires a great deal of energy of person and it is tedious activity. Because of the heavyweight of the farm haulers the dirt will be compacted, the compacted soil will lose porosity and it becomes hard for the seeds to develop. So now is the ideal time to mechanize the area to conquer this issue. To defeat this issue we foster this framework. The

Overview of these project is given below:

- To enable the farmer to seed the large area of lands in minimum amount of time.

- To spray accurate peptides on their plant.

- To develop machine learning -based system which helps to farmer to grow their plants.

2.2External Interface Requirements

3.2.14 User Interfaces:

Bootstrap for user interface.

3.2.15 Hardware Interfaces :

Processer: Intel(R) core i3 CPU and above.

RAM: 512 MB and Above.

Hard Disk: 80 GB and Above

3.2.16 Software Interfaces :

a. Operating System: Windows10

b. Software: Python

3.2.17 Communications Interfaces :

Website only

3.3 NON-FUNCTIONAL REQUIREMENTS

3.3.1 Performance :

The application is very fast .It response time of the application should be quick. The performance of web server is as high as possible. The application can also support many users.

3.3.2 Reliability :

The application i.e. Technology that we are used in application is highly reliable with the same or similar efficiency after extensive use.

3.3.3 Availability : This website is available 24/7 every day

3.3.4 Security :

Security comes with most importance thing for application Our website is fully secured . Using an SSL certificate and data privacy policy will create trust among the users for our website It is also considered for the different admin roles by which you can control who can create, see, copy, change or delete information

3.3.5 Maintainability:

Maintainability of our website or application is fully capable for being maintained cost effectively over its life time and we can also add other requirements such as configurability, extensibility, modifiability , and modifiability,

3.3.6 Portability :

Portability is the ease with which a software system can be transferred from its current hardware or software environment to another environment.

4. DESIGN METHODOLOGY

4.1 MODEL APPROACH

In the following stage, the input data image is obtained and pre - processed until being conversion into module form for comparative analysis. The chosen dataset is efficiently separated and formatted before being renamed and placed in the appropriate folders. The model trained using CNN (using VGG19, Inception V3, and Inception resnetV2 architectures) and then the CNN based classification takes place then it compares whether the leaf is in healthy state or unhealthy state and display the result with remedies and treatment of the related plant leaf disease.

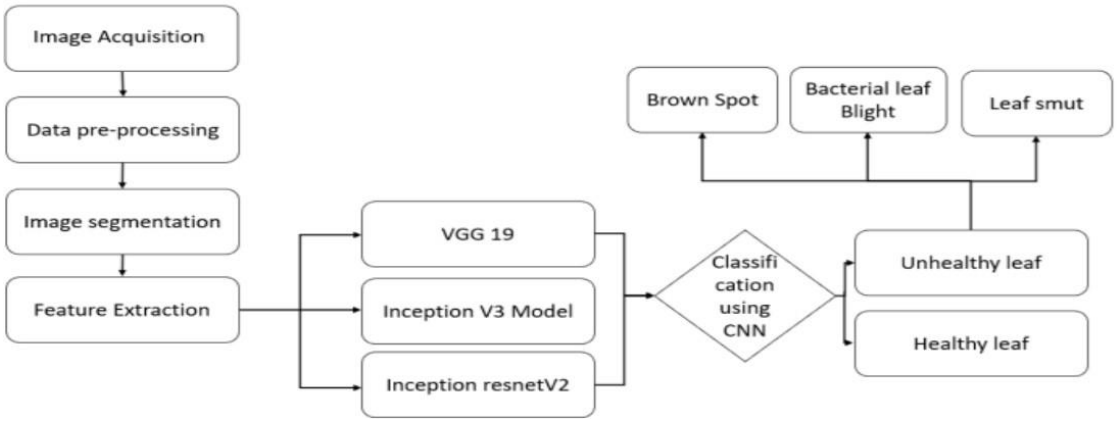


Fig: Model Approach

4.2 INTRODUCTION TO DESIGN METHODOLOGY

The state-of-the-art approach for determining a plant's health based on pictures is a type of deep learning called Convolutional Neural Network. Convolutional neural networks are image processing techniques used in this project to detect plant leaf diseases in graphs plants the overall modelling process required several steps for effectively preparing the data for the CNN model to yield a good result. Figure below illustrates the detailed set of steps involved.

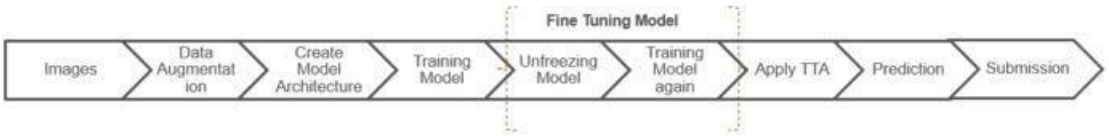


Fig: -Steps in modelling process

OVERALL SYSTEM DESIGN

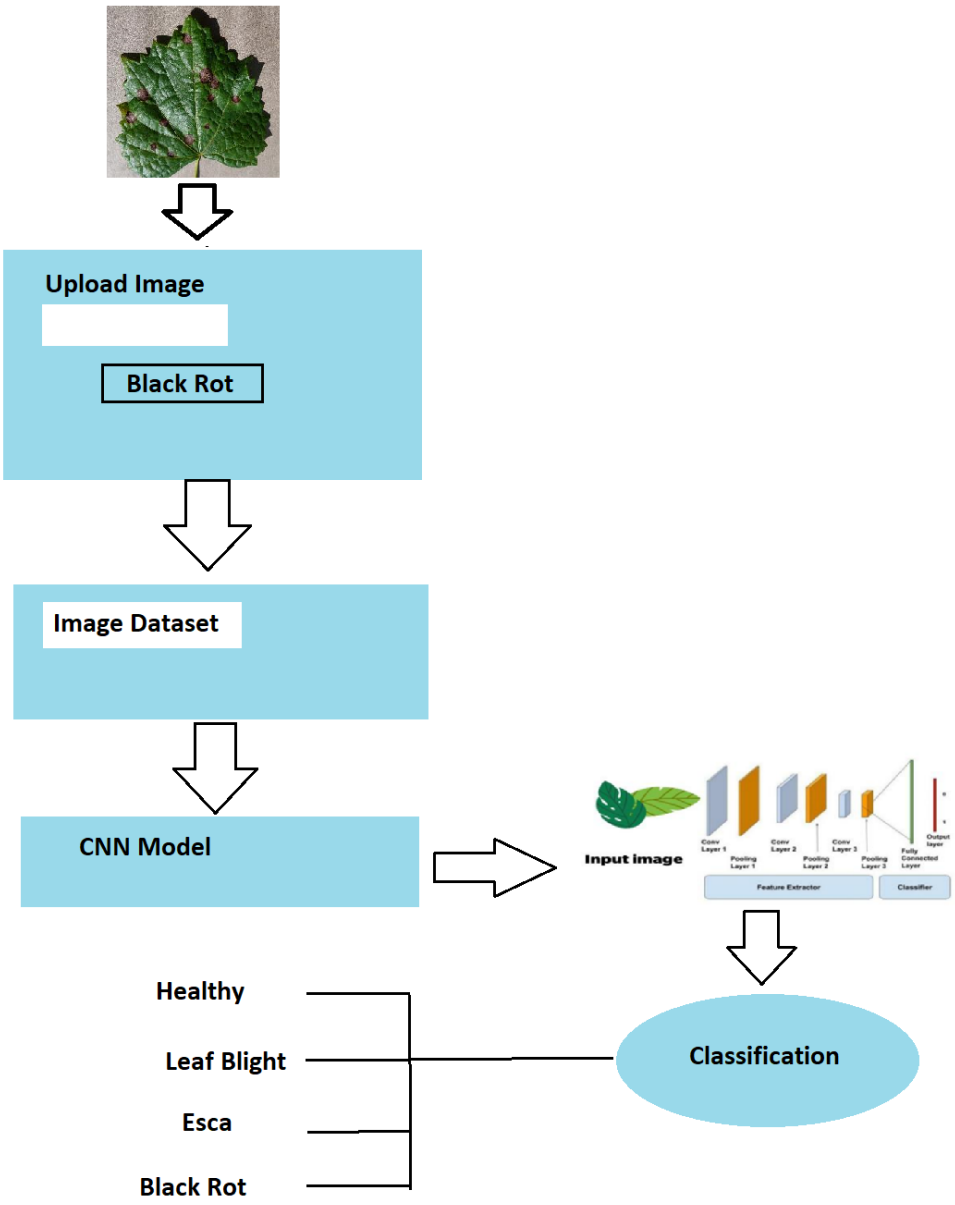


Fig- Working of the proposed system

4.4 CLASS DIAGRAM

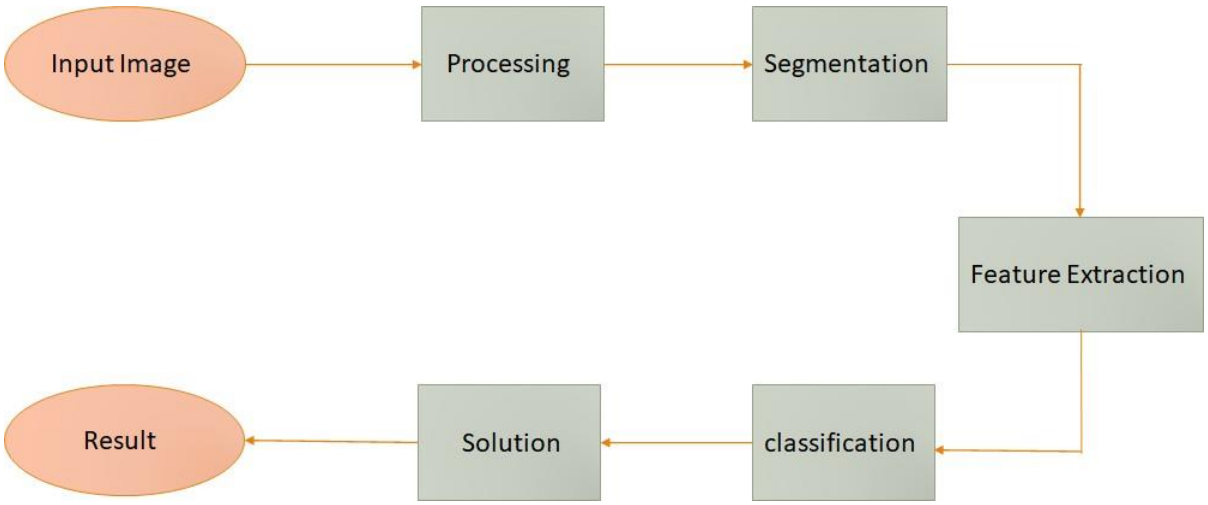


Fig : Class Diagram

4.5 SYSTEM ARCHITECHTURE

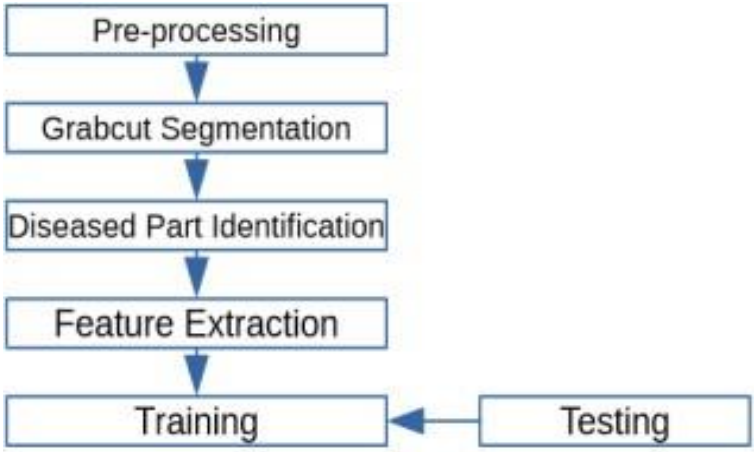


Fig.2.Architecture of the system

The farmers are the consumers of the proposed program. All rights of access are granted only to the farmers and will be user friendly as per the farmers need. Most pictures of the sunspots on the leaves. After improvement of sun spot on the image, which can be falsely recognized as a powdery mildew disease due to almost similar color characteristics due to processing steps. Each segment of the hyper line has the two endpoints described in the terms of continuous attribute values and the corresponding membership function. The membership function processes the constant values of the attributes and gives the hyper line segments the membership of each input sequence.

These endpoints and membership functions are specified as continuous attributes only and cannot process discrete attributes. Yet data from the real world contains both continuous attributes and discrete ones .

Extraction of the features of the leaves under sequence of convolution layers decreases the amount of time compared to manual features. In this system after the user logins he should upload the image of the diseased leaf after clicking on upload button he will get the desired result whether the leaf is unhealthy and the name of the disease and in addition it will also specify the fertilizers to be used. Working of CNN: Convolutionary Neural Networks are complete feed-forward-neural networks in machine learning. CNNs are used for image detection and identification as it gives high precision results. The CNN follows a hierarchical model that works with the construction of building a model.

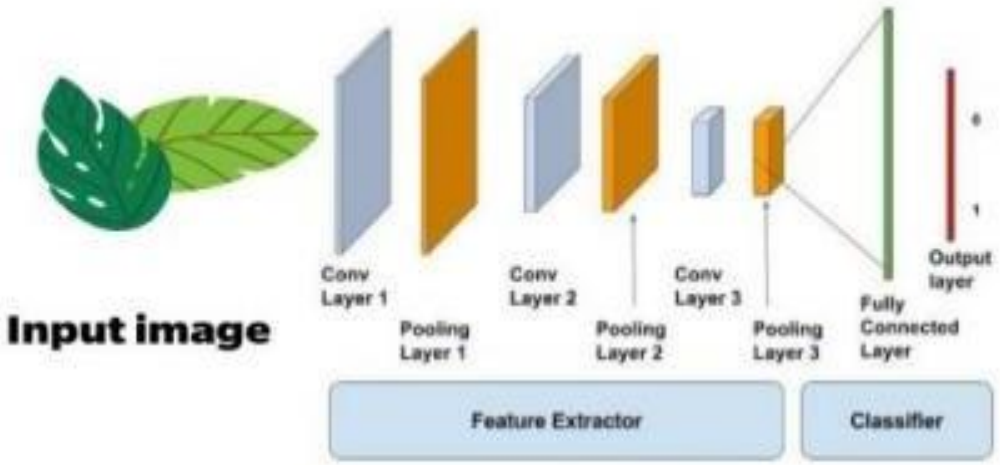


Fig.-. Flow of the system

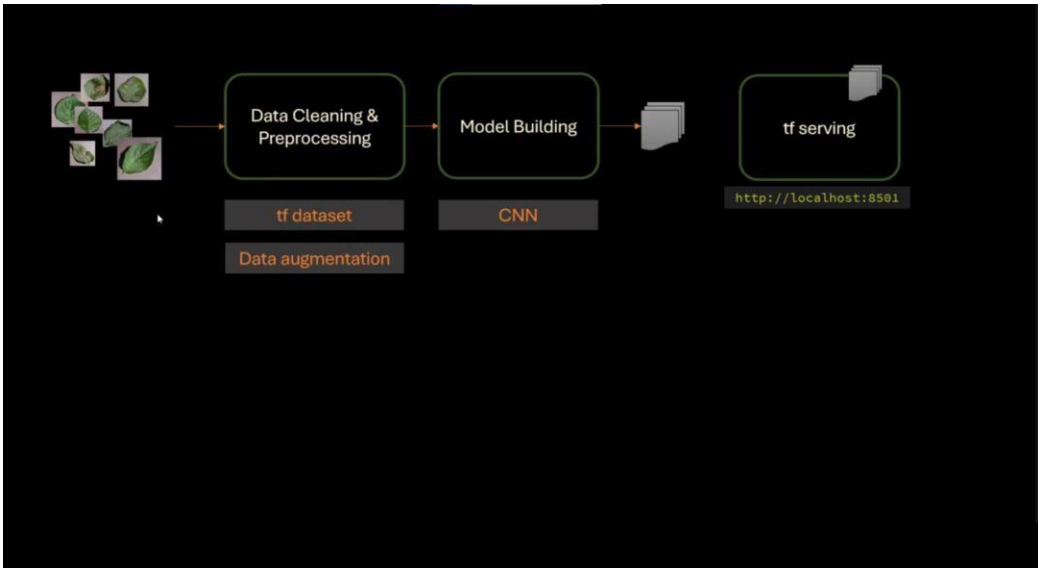


Fig : Implementation

4.6 STATE-TRANSITION DIAGRAMS OR ENTITY RELATIONSHIP DIAGRAMS

- When a machine views an image, an array of pixel values will appear. Depending on the image resolution and scale, an array of numbers 32*32*32*3 (here 3 refers to the RGB values) will appear.

- The first layer in CNN is always a convolutional layer. In it is entered the image (matrix with pixel values).

- The input matrix reading will start at top left of the image. Next there the program selects the smaller array called a filter.

- The filter then induces convolution. It sums up all those multiplications and, in the end, you have the result in the form of one number.

- This is the result of only one part of the image this has to be done to the complete image so keeps on repeating and moves forward.

- A matrix is obtained after passing through all locations, but lowers than an input matrix. Once the image moves through one convolutional layer, the input for the second layer is the output of the first layer. And with any more convolutional sheet, that happens.

- After each process of the convolution the nonlinear layer is added. The layer of pooling reflects the nonlinear structure.

- It deals with picture width and height, and conducts down sampling on them. As a result the volume of the image is reduced. If the sequence of convolutionary, nonlinear and pooling layers is complete, a completely connected layer is added.

- This layer takes information from convolutionary networks for the output. In the last step it is connected to a fully connected layer which result N number of dimension matrix, where N is nothing but the number of classes

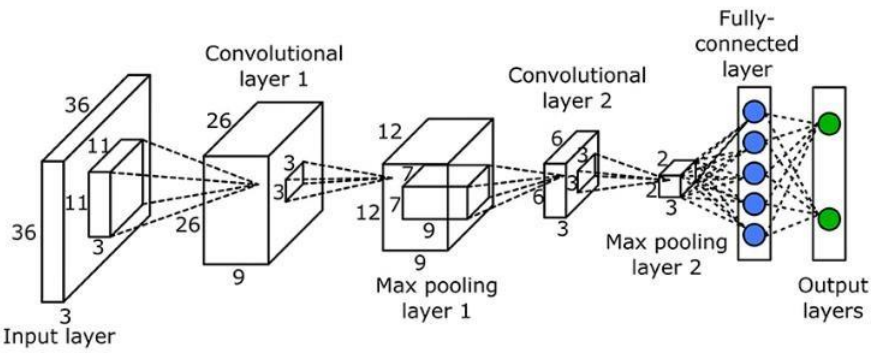


Fig. CNN Model

5. IMPLEMENTATION DETAILS

5.1 Software Used:-

1. **Operating System:** Windows compatible with Jupyter Notebook.
2. **Platform:** Jupyter Notebook /Google colab/Kaggle
3. **Browser:** Google chrome/Firefox.
4. **Programming Language:** Python 3.7 and above.
5. **Web servers:** localhost.

5.2 Hardware Used:-

1. **RAM: 6** GB and above.
2. **Processor:** intel 5 and above or Ryzen 5 and above.
3. **GPU:** At most 2 GB.
4. **HDD:**50 GB and above.
5. **Peripherals:** Mouse, Keyboard, Monitor

5.3 Technology Details:-

1. **Languages Required:** Python, HTML,CSS, JavaScript.
2. **Frameworks Used**: Flask.

6. RESULT

Below figure shows training being processed on our dataset:

Training Output

```
First Image To Predict
Actual Label: Leaf_blight
Predicated Label:  Leaf_blight
```

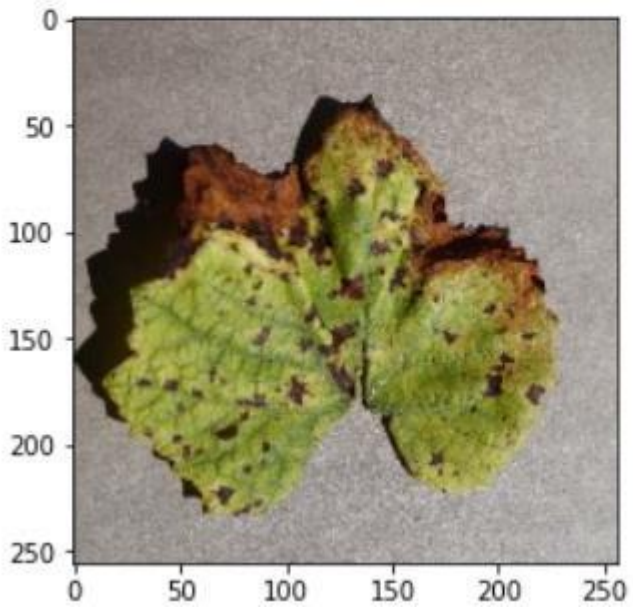


Fig : Output of Training

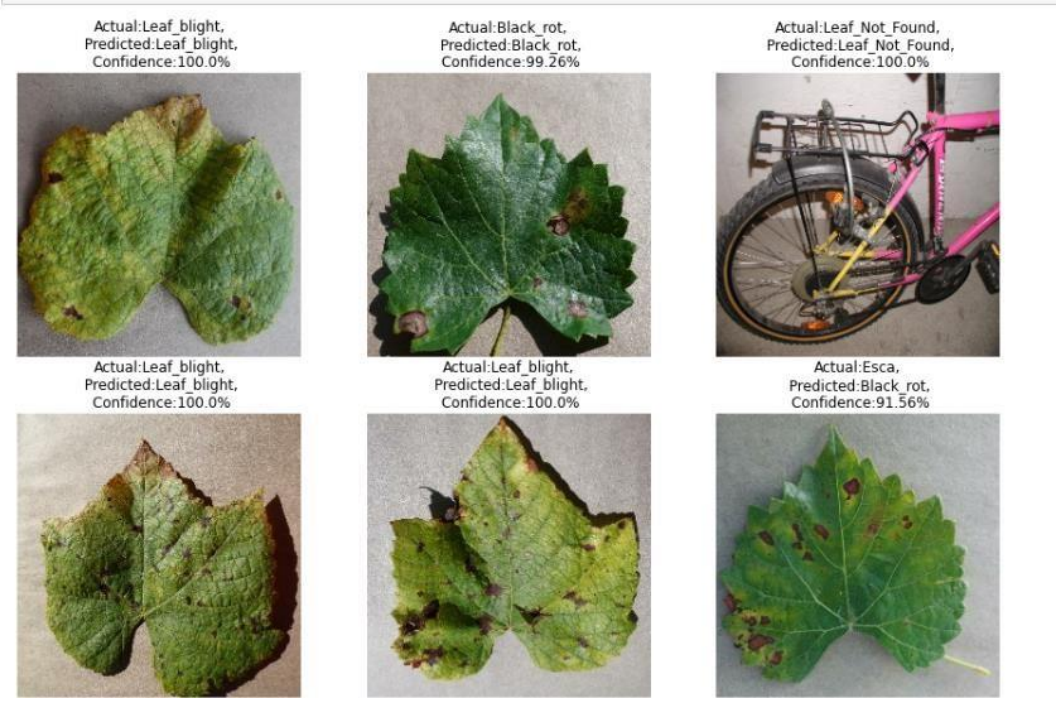


Fig.: Model being trained

Below figure difference between the amount of data loss and amount of data validated correctly.

```
Text(0.5, 1.0, 'Training And Validation Accuracy')
```

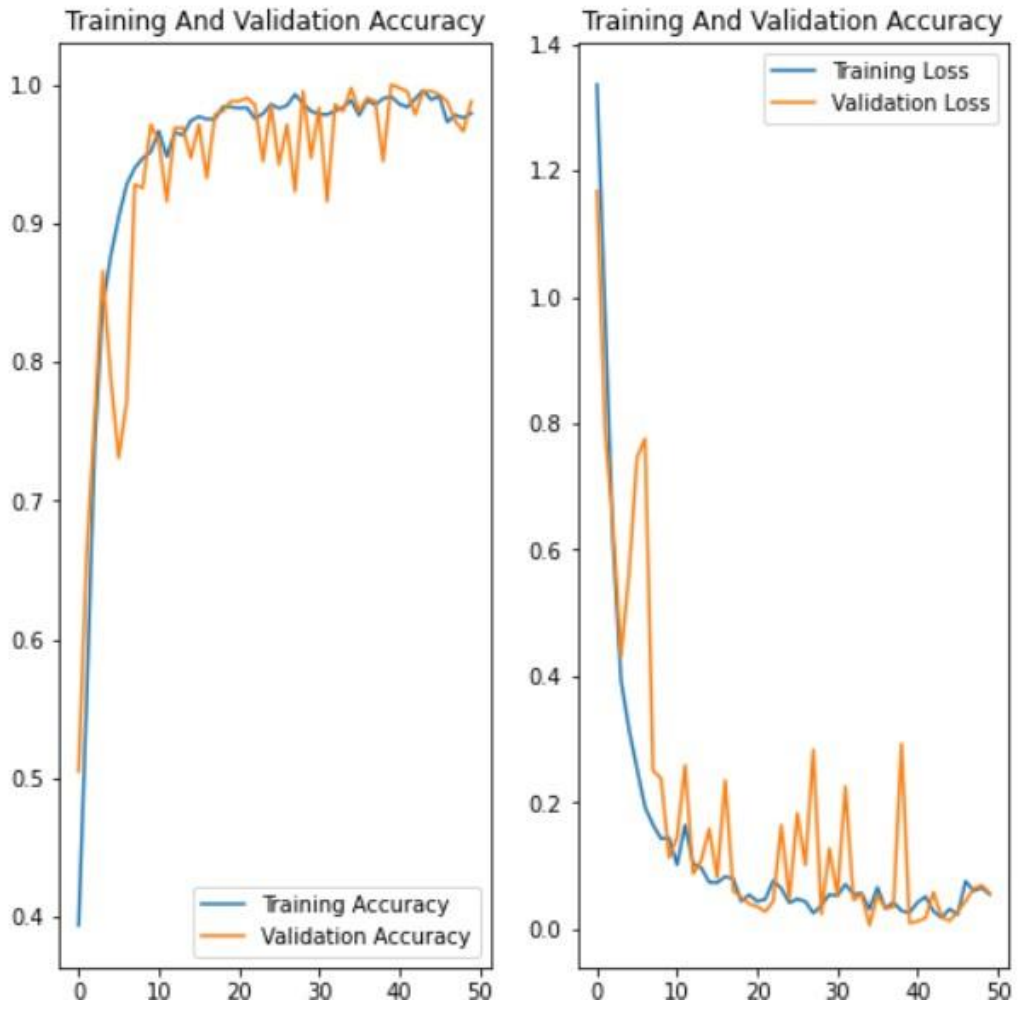


Fig. Results after training

Below figure shows that as per the users input the model predicts correct disease and solution to that disease

Testing Output -

6.1 SNAPSHOTS

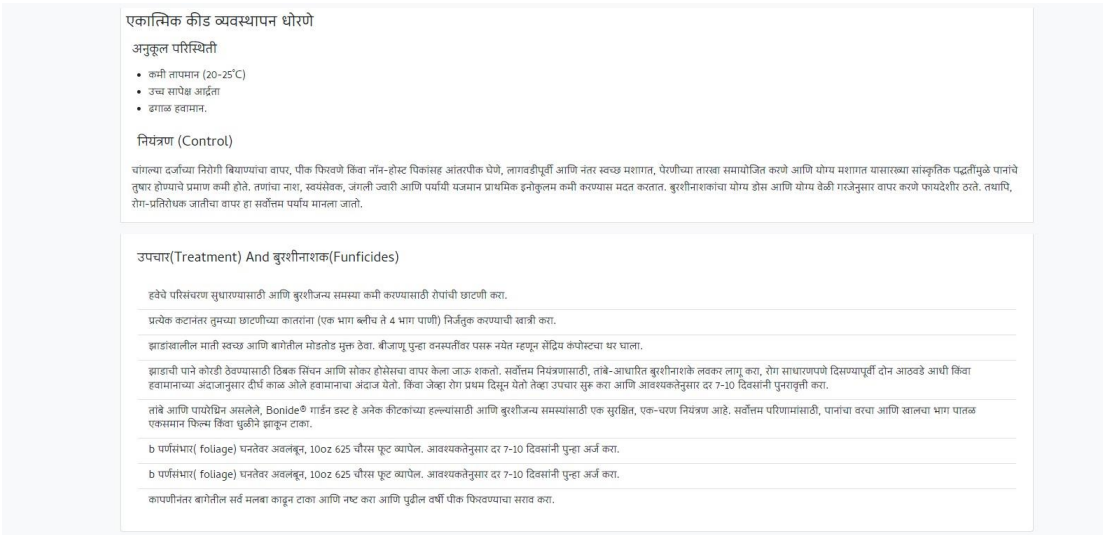
Leaf Blight(करपा)

करपा रोग हेल्मिंथोस्पोरियम टर्सिकम पास या बुरशीमुळे होतो. हा रोग ज्वारीच्या पानांवर विशेषत: दमट स्थितीत लालसर-जांभळा किंवा टॅन स्पॉट्स तयार करून विकसित होतो जे एकत्र येऊन मोठ्या जखमा तयार करतात. हे रोपांवर तसेच जुन्या झाडांवर हल्ला करते.या रोगाचा प्रादुर्भाव जांभळ्या किंवा लाल-रंजक जीनोटाइपवर नॉनपिग्मेंटेड किंवा टॅन जीनोटाइपपेक्षा जास्त असतो. भारतात हा रोग नियमितपणे हरियाणा, राजस्थान, उत्तराखंड आणि उत्तर प्रदेश या राज्यांमधील चारा ज्वारीवर मध्यम ते गंभीर स्वरूपात आढळतो. रोगाची तीव्रता अधूनमधून महामारीचे स्वरूप धारण करू शकते आणि पानावरील प्रकाशसंश्लेषण यंत्रांच्या मोठ्या प्रमाणात नुकसान झाल्यामुळे चारा उत्पन्न, गुणवत्ता आणि धान्य उत्पादनावर गंभीरपणे परिणाम करते.

लक्षणे आणि निदान

पाने

सुरुवातीला लहान, गोलाकार, लालसर तपकिरी डाग (1-8 मिमी) पानांवर दिसतात जे नंतर मोठे होतात आणि एकाग्र वलयांनी मोठे क्षेत्र व्यापतात. डागांच्या खालच्या पृष्ठभागाचा रंग राखाडी तपकिरी असतो. गंभीर ब्लाइटिंगमध्ये विघटन होते. गडद तपकिरी जखम पेटीओल्स, स्टेम आणि कॅप्सूलवर देखील दिसू शकतात. कॅप्सूलच्या संसर्गामुळे वाळलेल्या बिया अकाली फुटतात. द्राक्षांवर पानांच्या तुषारची लक्षणे सामान्यत: जुन्या पानांवर प्रथम दिसून येतात, वनस्पतीच्या पायाच्या सर्वात जवळ. पानांवर तपकिरी-काळे डाग लक्ष्यासारखे, एकाग्र वलयांमध्ये वाढतात. चिकट स्टेम ब्लाइटमुळे पाण्याने भिजलेल्या डागांच्या विपरीत, पानावरील डाग कोरडे दिसतात. जसजसा रोग वाढतो तसतसे पाने तपकिरी होतात, कुरळे होतात आणि मरतात



एकात्मिक कीड व्यवस्थापन धोरणे

अनुकूल परिस्थिती

- कमी तापमान (20-25°C)
- उच्च सापेक्ष आर्द्रता
- ढगाळ हवामान.

नियंत्रण (Control)

चांगल्या दर्जाच्या निरोगी बियाण्यांचा वापर, पीक फिरवणे किंवा नॉन-होस्ट पिकांसह आंतरपीक घेणे, लागवडीपूर्वी आणि नंतर स्वच्छ मशागत, पेरणीच्या तारखा समायोजित करणे आणि योग्य मशागत यासारख्या सांस्कृतिक पद्धतींमुळे पानांचे तुषार होण्याचे प्रमाण कमी होते. तणांचा नाश, स्वयंसेवक, जंगली ज्वारी आणि पर्यायी यजमान प्राथमिक इनोकुलम कमी करण्यास मदत करतात. बुरशीनाशकांचा योग्य डोस आणि योग्य वेळी गरजेनुसार वापर करणे फायदेशीर ठरते. तथापि, रोग-प्रतिरोधक जातीचा वापर हा सर्वोत्तम पर्याय मानला जातो.

उपचार(Treatment) And बुरशीनाशक(Funficides)

हवेचे परिसंचरण सुधारण्यासाठी आणि बुरशीजन्य समस्या कमी करण्यासाठी रोपांची छाटणी करा.
प्रत्येक कटानंतर तुमच्या छाटणीच्या कातरांना (एक भाग ब्लीच ते 4 भाग पाणी) निर्जंतुक करण्याची खात्री करा.
झाडांखालील माती स्वच्छ आणि बागेतील मोडतोड मुक्त ठेवा. बीजाणू पुन्हा वनस्पतींवर पसरू नयेत म्हणून सेंद्रिय कंपोस्टचा थर घाला.
झाडाची पाने कोरडी ठेवण्यासाठी ठिबक सिंचन आणि सोकर होसेसचा वापर केला जाऊ शकतो. सर्वोत्तम नियंत्रणासाठी, तांबे-आधारित बुरशीनाशके लवकर लागू करा, रोग साधारणपणे दिसण्यापूर्वी दोन आठवडे आधी किंवा हवामानाच्या अंदाजानुसार दीर्घ काळ ओले हवामानाचा अंदाज येतो. किंवा जेव्हा रोग प्रथम दिसून येतो तेव्हा उपचार सुरू करा आणि आवश्यकतेनुसार दर 7-10 दिवसांनी पुनरावृत्ती करा.
तांबे आणि पायरेथ्रिन असलेले, Bonide® गार्डन डस्ट हे अनेक कीटकांच्या हल्ल्यांसाठी आणि बुरशीजन्य समस्यांसाठी एक सुरक्षित, एक-चरण नियंत्रण आहे. सर्वोत्तम परिणामांसाठी, पानांचा वरचा आणि खालचा भाग पातळ एकसमान फिल्म किंवा धुळीने झाकून टाका.
b पर्णसंभार(foliage) घनतेवर अवलंबून, 10oz 625 चौरस फूट व्यापेल. आवश्यकतेनुसार दर 7-10 दिवसांनी पुन्हा अर्ज करा.
b पर्णसंभार(foliage) घनतेवर अवलंबून, 10oz 625 चौरस फूट व्यापेल. आवश्यकतेनुसार दर 7-10 दिवसांनी पुन्हा अर्ज करा.
कापणीनंतर बागेतील सर्व मलबा काढून टाका आणि नष्ट करा आणि पुढील वर्षी पीक फिरवण्याचा सराव करा.

7 . LIMITATIONS

- ★ The task done by normal user could cause misinterpretation
- ★ The wrong format of image could cause wrong output
- ★ Blur of bad image could cause wrong output

8. FURUTE SCOPE :

Future work will be focusing on followed points:

1. To improve the detection rate of the classification progress, develop the combinations of algorithms on the fusion classification technique.

2. On detecting the right disease by using this system the farmers are provided with the knowledge about the proper mixture that should be used on the plants for the better growth of the plants.

3. To design an automated system which will be used to automatically spray the right mixture of fungicide using the spraying mechanism for the plants to grow and nourish in a healthy manner

9. CONCLUSION

In this project, four types of the grape leaves have been identified. Convolutional neural network models successfully implementing machine learning with Keras libraries yielding an accuracy of 97.37%. By using 80% images for training, and 20% images for testing, the classification algorithm used in this study allows the system to get a variety of samples. The results showed that to improve identification accuracy can be done by increasing the number of epochs and using a smaller learning rate. For further research, it is recommended to use more types of grape leaf disease and use other algorithms and other deep learning structures.. The project aims to detect the most common diseases occurring on a grape leaf, namely leaf blight , black rot , esca and healthy leaf using image processing technique under upbringing technology i.e., machine learning. In easier terms, the farmer will be able to accurately detect the type of disease a particular plant is having using the image of the plant. The proposed system is based on four important modules namely:

- Pre-processing.
- Segmentation
- Feature extraction.
- Classification using CNN

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