1.1PROPOSED DIAGRAM

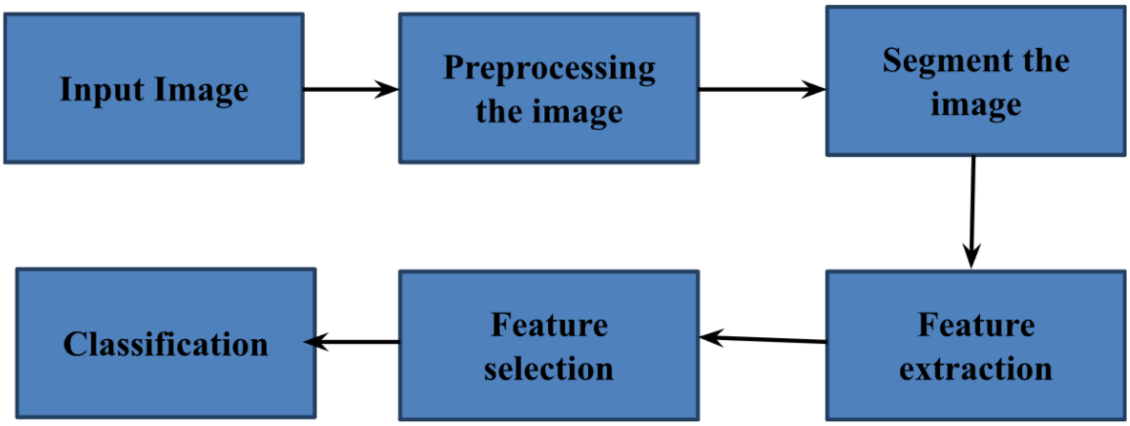

Figure No.1: Stages of the proposed approach

1.2 DATA COLLECTION

The initial step of developing a deep learning network is to collect thedataset. Kaggle was used to obtain the online dataset.

[**Link:https://www.kaggle.com/datasets/rashikrahmanpritom/plant-disease-recognition-dataset**]

The images as well as the labels associated with each image are required. These labels should come from a finite set of groups, such as: Rust, Powdery, Healthy. Additionally, the amount of images for every group should be relatively unvarying (i.e., identical amount of samples in each group) then the classifier will become naturally biased to over-fitting into these highly-represented groups. There are various ways to overcome class imbalance, which is a common problem in machine learning. Avoiding class imbalance is the best way to reduce learning because of class imbalance. As the major focus of the system is detection of plant disease, the data is gatheredas images. The dataset obtained consists of several images with the presence of defected and in several images with the healthy.

Figure No.2: Input Images

1.3. PRE-PROCESSING

The main purpose of pre-processing is to advance image highlights required for further processing. Additional preprocessing requires the input image to be converted to grayscale. The image is then threshold and further erosion and dilation is applied to the threshold image. This image is utilized to extract the contours and extreme points. 3.4 Training the goal here is for the network to learn how to identify every category in the labelled data. Whenthe model makes an error, it learns from the error and corrects itself. In general, a form of gradient descent is applied for training the network. 3.5 Evaluation The network is presented with all the images from the testing set to predict the label of the image. The model's predictions for the images fromthe testing set are then tabulated. The predictions of the model are then compared to the ground truth labels from the testing set. The depiction of the category the image belongs to is done by the ground truth label. Based on the number of predictions the classifier gets correct, collective information like f-measure, precision and recall, that measure the performance of the network all together, are computed.

1.4 PROPOSED METHOD – CNN

The main objective of the proposed model is to predict the plant disease. The convolutional neural network is used to implement the proposed model.

The convolutional neural network has four layers namely convolution layer, pooling layer, flattern layer and dense or fully connected layer.

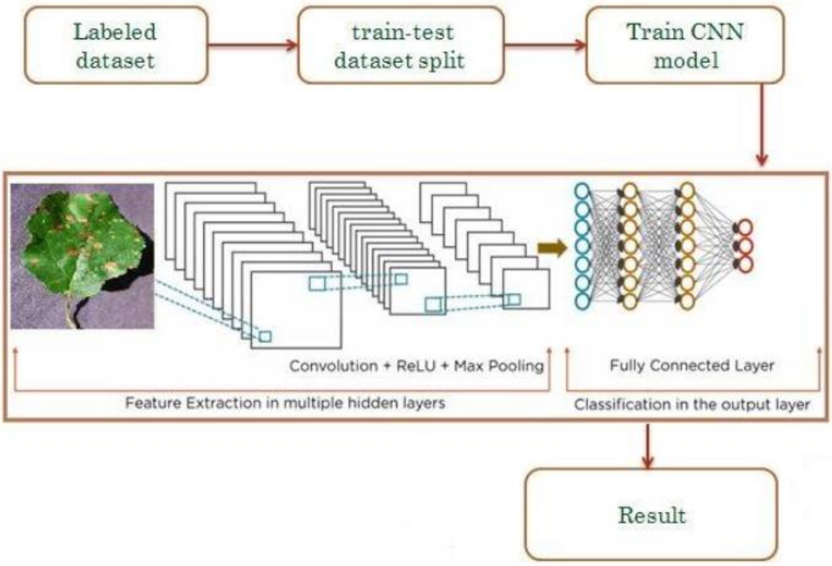

Figure No.3: Proposed Diagram for CNN

1.1.1 Convolutional Layer

The important features are extracted from the leaf in the convolutional layer. The kernels or filters are used to extract the features from image. The kernels are operated on input image and the feature map is generated.

1.1.2 Pooling Layer

The images are downsized in the pooling layer to reduce the computational complexity. There are two types of pooling namely max pooling and average pooling. The output of the convolutional layer is divided into NXN sub matrices.

The max pooling will take maximum value from each submatrix. The average value of each submatrix is calculated in the average pooling. The number of convolutional and pooling layer is used based on the requirements.

1.1.3 Dense Layer

The output of the convolutional layer or pooling layer is given as input to the dense layer. The dense layer will accept only flatten output. The inputs are flattening in the flatten layer. One or more dense layer is used to predict the plant disease. The output of the final dense layer is the network output. The whole process is called forward propagation. The input is multiplied with weighted and added all the inputs. It is represented in equation 1.

$$O1 = \sum_{j=1}^{m} w_j x_j \qquad (1)$$

Where w is weight of each input and x is the feature input. The output is given to activation function. It is represented in the equation 2

$$output = A(O_1) \qquad (2)$$

Where A is the activation function. The convolutional layers and dense layers have activation function. The ReLU (Rectified Linear Unit) activation function is used in convolutional layers and softmax activation function is used in the last dense layer.

The performance of the network is not as good as expected. Then error is calculated and it is propagated back to dense layer and convolutional layer to adjust the weights. This process is called as backpropagation. After adjustments’ weights, again forward and backward propagation is performed until the network reaches the expected performance.

1.5 Segmentation

This process is used to make it easier for the algorithm to analyze the image as the image are segmented into many useful and meaningful partsand the foreground and the background are discriminated using binarization methods. The binarized image is shown in the figure 6 and the edges are detected using the canny is shown in the figure 7. The binarization of the image is carried out using the OTSU algorithm as it employs global threshold value to separate the background from the foreground.

1.6 Extraction of Features

The region of interest ROI should be identified and then the features present in the area are extracted for further processing. Usually the features based on the textures, colors and shapes are extracted to facilitate the further classification processes. Feature extraction methods commonly used are histogram methods and gray scale co-occurrence matrix method. The region of interest ROI should be identified and then the features present in the area are extracted for further processing. Usually the features based on the textures, colors and shapes are extracted to facilitate the further classificationprocesses. Feature extraction methods commonly used are histogram methods and gray scale co-occurrence matrix method.

Figure No.4: Sample image

This sample image for a CNN in plant disease detection should focus on capturing clear visual indicators of the disease on the relevant part of the plant. Leaves are the most common plant part affected by disease and provide the best surface for image capture.

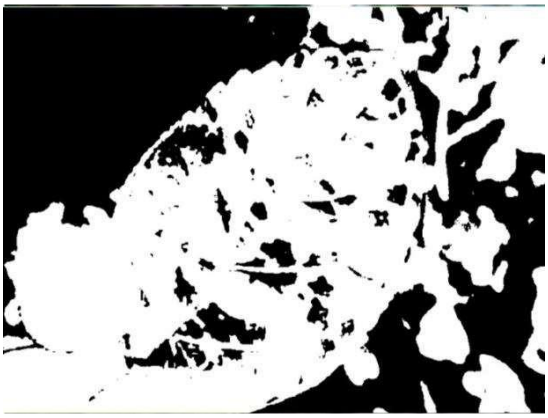

Figure No.5: Binarized image

CNNs rely on learning patterns from the data. Binarized images lack the rich information needed for the model to differentiate between healthy and diseased plant tissues, different diseases, or even variations within the same disease. If the goal is simply to count the number of diseased spots, binarization might help isolate them.

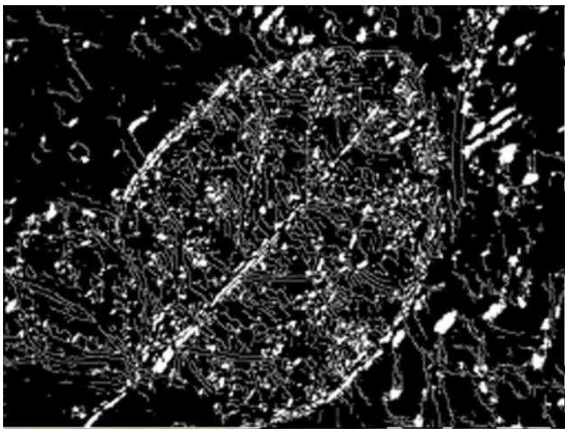

Figure No.6: Edge detected image