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ML Based Banana Leaf Disease Classification

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Abstract— Banana leaf disease classification is an application which supports farmers by making easier to analyse, detect and control plant pathogens. In order to protect the crops with the feasible cost, banana crop infection symptoms need to be identified and treated at the initial stage. This can be analysed and bifurcated through the computer vision system which uses interpretation of information by image processing techniques. The project is implemented with the infected banana crop leaves. These infected leaves are classified and bifurcated by the aspects of machine learning. The project team tested 50 infected leaves and are successful in getting around 80% prediction accuracy.

Key words: *Back Propagation Neural Network (BPNN), Principal Component Analysis (PCA), Support Vector Machine (SVM), Image processing, ANFIS (Artificial Neural Network Fuzzy Interference System)*

I. INTRODUCTION

Notable part of the population depends on the agriculture as their occupation. This plays a role as an important sector by providing food and livelihood. Agriculture contributes to the economy of the country as well. One of the major and dependable food and fruit crop is banana. This brings abundant income to the farmer and country as well. Various diseases are hindering the production of maintained banana crop. Pests causing diseases seems to be the prominent threat to the production of banana crop leading to the financial crises. Detection and analysing of banana crop plant diseases precisely in the beginning stages provides farmers to have a controlled and a healthy growth of the crop. Variations can be noted in the affected diseases. If the symptoms are displayed at the initial stages provides farmers to have a controlled and a healthy growth of the crop. Variations can be noted in the affected diseases. If the symptoms are displayed at the initial stage plant's crop can be rescued else if found in the later stage leads to the collapse in the growth rate of the banana.

Maintaining and monitoring over the plant helps to detect the disease and pest infecting at the prior stages. Hence stabilizes the quality of the plant with the reduction in yield loss. Based on the symptoms expressed on the leaf of the plants many farmers fail to identify the diseases. Thus the detection and diagnosing services provided by the sources such as research institutes and the advisory board are becoming prominent supporters for the cultivators of banana crop.

II. LITERATURE SURVEY

A literature survey or a literature review in a project report is that section which shows the various analyses and research made in the field of your interest and the results already published, taking into account the various parameters of the project and the extent of the project. It is the important part of your report as it gives you a direction in the area of your research. Descriptive papers may or may not contain reviews, but analytical papers will contain reviews. A literature review of the current implemented paper contains 8 published researches in the implemented field. Referred papers range is from 2006 to 2019.

Michael Gomez Selvaraj et al. [1] has proposed a paper on deep learning is a novel method for image processing and object detection with greater accuracy in the classification of various crop diseases. [1] Transfer learning is one such popular approach in deep learning, where pre-trained models are adapted to do a new task.

Prof. N. A. Auti et al. [2] applies deep-learning technique to detect and classify the banana leaf disease. It also makes use of LeNet architecture as a convolutional neural network to classify image data sets.

Wenzhi Liao et al. [3] authors exploits the fusion of close range hyper spectral (HS) image and high-resolution (HR) visible RGB image for potential disease detection in banana leaves.

Jihen Amara et al. [4] identifies two prominent banana diseases namely banana sigatoka and banana speckle by applying deep neural network technology. The author here has made use of LeNet architecture as a convolutional neural network to classify image data sets.

Basavaraj Tigadi et al. [5], author has proposed software solution for automatic plant disease detection and finally the percentage infection using image processing technique.

Vipinadas. M. J et al. [6] proposed a system which is a well-organized module that identifies the Black sigatoka disease and Panama wilt disease on banana leaf. The disease grading has been done using ANFIS (Artificial Neural Network Fuzzy Interference System) classifier. Finally, classifiers comparison has been performed using confusion matrix.

A. Camargoa et al. [7] provides a various method to detect plant diseases using image processing technique. This system is also a well-organized module that identifies the Black sigatoka disease and Panama wilt disease on banana leaf.

Karthik .G et al. [8] identifies the infected leaves using Economic Threshold Level (ETL) algorithm. It detects and prevents the banana streak viral disease using Embedded Linux development board interfaced with a camera.

III. METHODOLOGY

An architecture description is a formal description and representation of a system, organized in a way that supports reasoning and behaviour of the system. Fig.3.1 represents the system architecture of the application in the form of display Model which will help a user to identify options available in the application. This diagram represents the relationship between different components which represents interaction between them. System architecture diagrams helps to understand, clarify and communicate ideas about the system structure and the user requirements that the system must support.

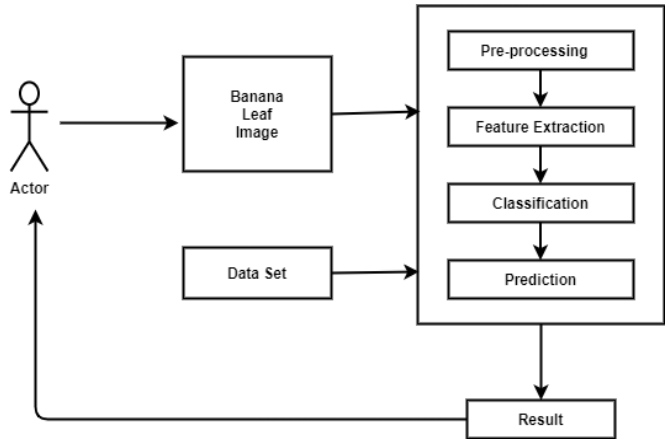

Fig.3.1 System architecture

Fig. 3.2 shows the operations that can be performed by the admin with the database. Level 1(Admin) diagram represents the working phenomenon of the admin dataflow in detail. Admin logs into the system by using the credentials. Dataset management operations, loading the dataset operations, user management operations are the types of operations handled by the admin.

Fig.3.3 shows the operations that can be performed by the user and the interactions that take place with the database. Above diagram (Fig 3.3) represents the working phenomenon of the user dataflow in detail. User logs into the system by using the credentials, by inserting the test image and further classification and hence disease name is displayed.

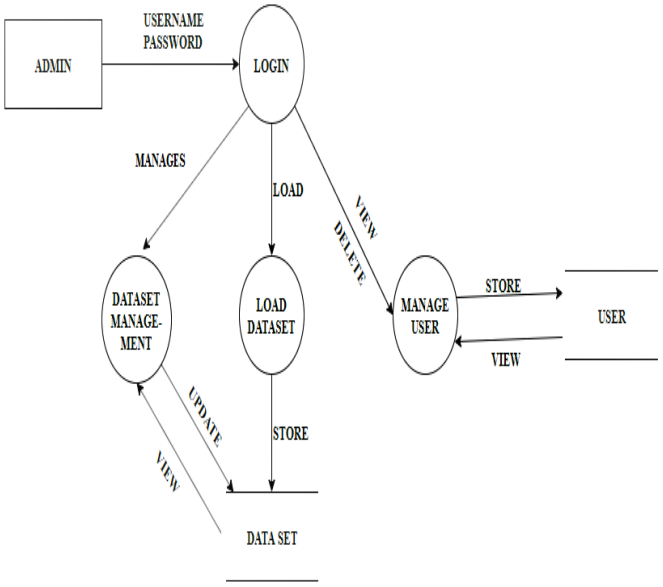

Fig 3.2 Data flow diagram for admin

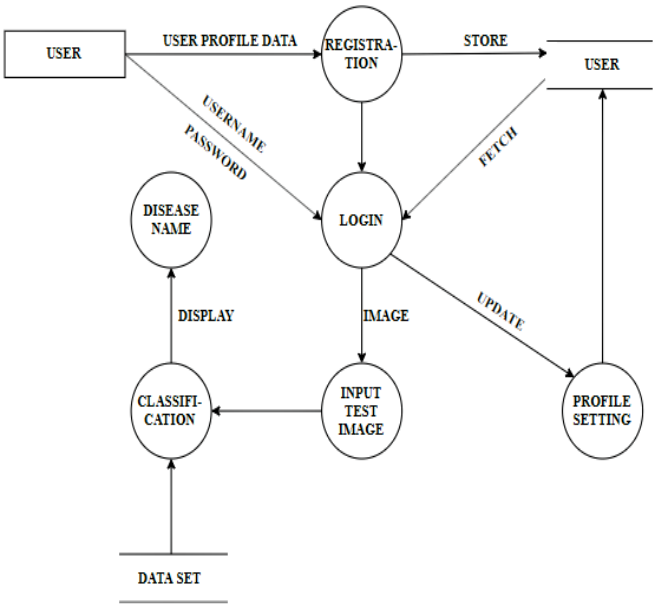

Fig 3.3 Data Flow Diagram for Users

IV. IMPLEMENTATION

Fig 4.1 shows as the starts with the application ,the application validates whether the credentials are appropriate or not.If yes then the testing image is taken in charge which holds feature extraction and classification or other options like manage database,updating the new set of data and user related concept management.

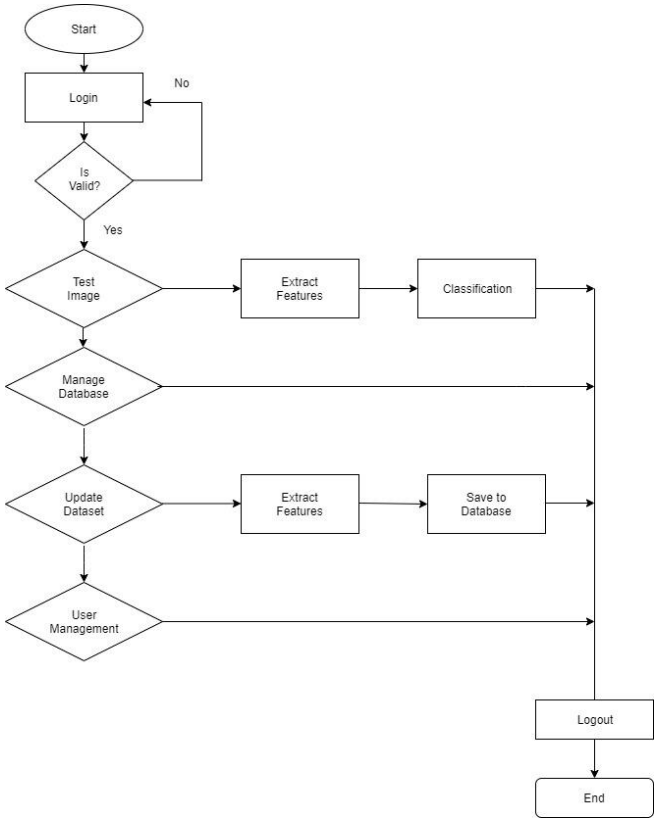

Fig 4.1 Control flow diagram for admin

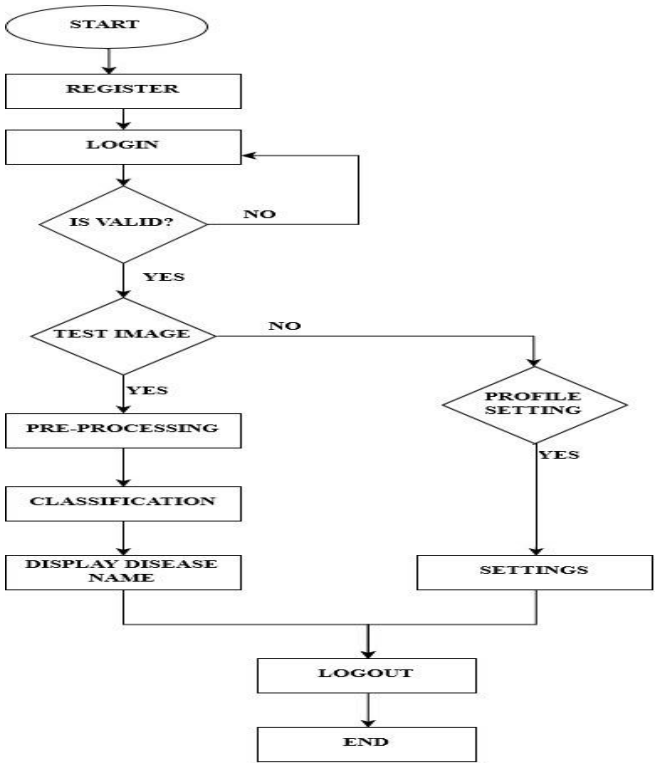

Fig 4.2 Control flow diagram for user

Fig 4.2 shows the user part of the application also checks and validates the credentials and hence the further options are carried out if the option is of testing the image then sequential steps are pre-processing, classification, display disease name. The other option of profile setting can be chosen as well.

A. *Algorithm*:

Neural Networks is one of the most popular machine learning algorithms at present. It has been decisively proven over time that neural networks outperform other algorithms in accuracy and speed. The algorithm used in the implementation is CNN (Convolutional Neural Networks). CNN is one of the variants of neural networks used heavily in the field of Computer Vision. It derives its name from the type of hidden layers it consists of. The hidden layers of a CNN typically consist of convolutional layers, pooling layers, fully connected layers, and normalization layers. Here it simply means that instead of using the normal activation functions defined above, convolution and pooling functions are used as activation functions.

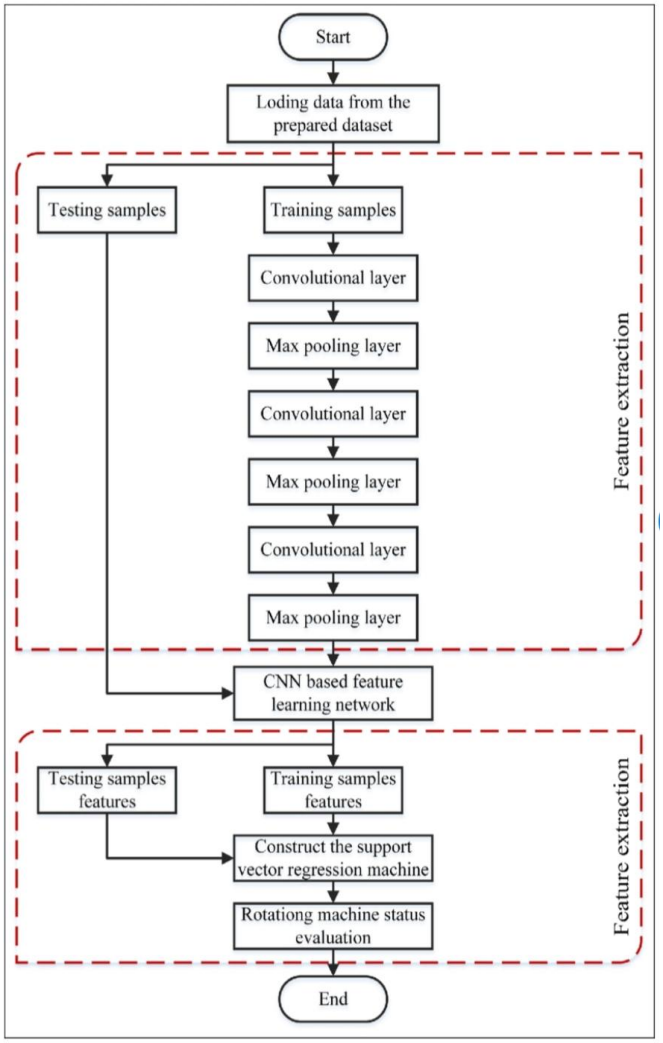

Fig 4.3 CNN flow Chart

V. RESULT

The implemented project contains around 1200 images as a training data set file which is implemented to detect the disease of 4 different types. Prediction accuracy lies around

80%.The implemented project is based up on CNN algorithm. As the user logs into the web interface he can insert the image of the suspected infected image hence the result of the predicted disease of the suspected leaf is displayed.

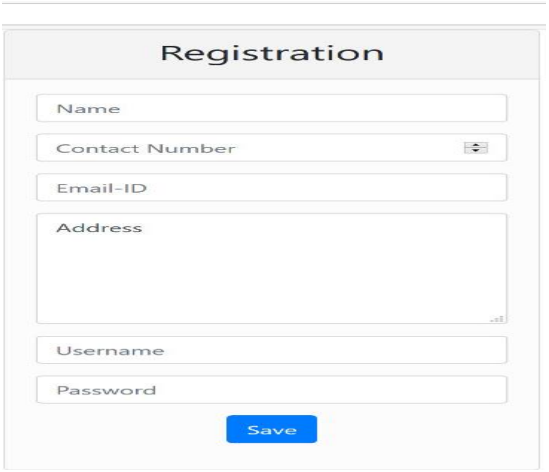

Fig 5.1 Registration Page

The Web Interface deals with the displaying of the sequential page as per the control flow. As the user interface displays user need to enter his credentials later these saved details are checked and validated for the up next procedures.

Fig 5.2 Infected image uploading

The interface provides option for uploading the image of the infected leaf.Once uploaded this image will be processed and compared with the dataset.Hence provides with the result.The next Sequential part of the web application displays as followed by steps such as the processing,feature extraction and compared with dataset results in detected and classified disease name as the output for the given input image. Fig 5.3 and Fig 5.4 is provided as an instance of final output of the identified disease.

Fig 5.3 Output Image

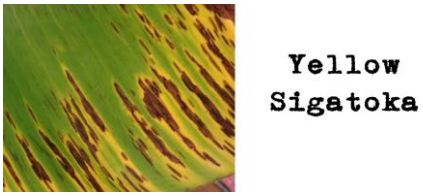

Fig 5.4 Output Image

VI. CONCLUSION

By considering particular region out as a suspected part result can be obtained in an effective manner. Hence by distinguishing the variations in the intensity exact area of infection could be easily detected. Training data is around 180 images, testing data is 50 images which helps in detecting 4 various diseases infecting the banana leaf. The further step of the implementation deals with the disease classification relying on the parameters of the affected region. Thus, this automated machine results in identifying and classifying the disease. Hence, making a visible progress in the growth of the healthier crop. Indeed, boosting up the crop rate of banana.

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