A Comparative Study on Detection of Disease in Plants

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1. Introduction

- Agriculture is the backbone of our country. Many farmers are still struggling hard in detecting diseases which are affecting plants, vegetation crops and cereals. Though experts are available to detect the diseases, still prediction by naked vision may not be correct every time. Therefore, it will be effective to have an automated expert system.

- Even though research is done periodically to predict the disease in plants, accuracy in finding the right disease and diagnosis are still not perfect. In this paper, accuracy is the main performance measure to be concentrated in detecting the right type of disease in plants.

- We have performed a comparative analysis on plant village dataset which consists of approx 54,000 images divided into 38 categories by species and disease.

1.1 Motivation

- Agriculture is the backbone of India now it is facing several difficulties which includes diseases, selection of quality seed, water scarcity etc.

- One of the main issues of agriculture field is plant diseases which causes farmers a huge loss either in loss of crop or unnecessary use of drugs. Hence early detection of a plant disease can prevent its spreading hence the loss of yield.

- As much as 40 per cent of the world's agricultural crops are lost to pests each year, according to a recent report.

2.1 Literature Survey

- In [2], the authors presented an idea of mobile phone approach. Image captured using mobile phone is used as the query image whose features are compared with that of the database image using CBIR technique. Images are retrieved mainly based on three features like color, texture and shape. The resultant images are segmented using k-means clustering and Euclidean Distance measure is calculated to find the nearest matching image to the query image and the result is returned to the user via android phones.
- In [3], the authors presented the prediction of leaf diseases based on Hierarchical clustering, k-means clustering and Fuzzy C- Mean (FCM) clustering. The clustering techniques produced many diseased and undiseased clusters. In that Hierarchical clustering produced better accuracy in terms of performance. Then the features are extracted for disease classification using SVM classifier.

Continued…

- In [4], the authors had taken the approach of CBIR Technique, which is used for content-based retrieval of images. Both the query image and database image are extracted based on color, shape and texture and are stored in a separate database which has undergone similarity measurement using Euclidean distance. The output images are retrieved based on the threshold value.

3 Methodology And Setup of Experiment

- Methodology includes the following steps to achieve the objective of the project during the project development and that are- Image Acquisition, Image Preprocessing, Content Based Image Retrieval (CBIR), Color Retrieval, Texture Retrieval, Shape Retrieval, Image Segmentation, Feature Extraction and Classification etc.

- Data set was taken form Kaggle[1] and the libraries such as fastai , tensorflow and pytorch was used.

- We also used the concept of transfer learning in our model.

4. SUMMARY OF RESULTS

For Fastai the accuracy achieved after training was 99.68 percent.

epoch	train_loss	valid_loss	accuracy	error_rate	time
0	0.349890	0.171826	0.946974	0.053026	14:09

epoch	train_loss	valid_loss	accuracy	error_rate	time
0	0.134691	0.068058	0.976463	0.023537	20:05
1	0.056079	0.040512	0.988818	0.011182	20:24
2	0.023028	0.017932	0.994950	0.005050	21:03
3	0.006183	0.012432	0.996844	0.003156	21:17

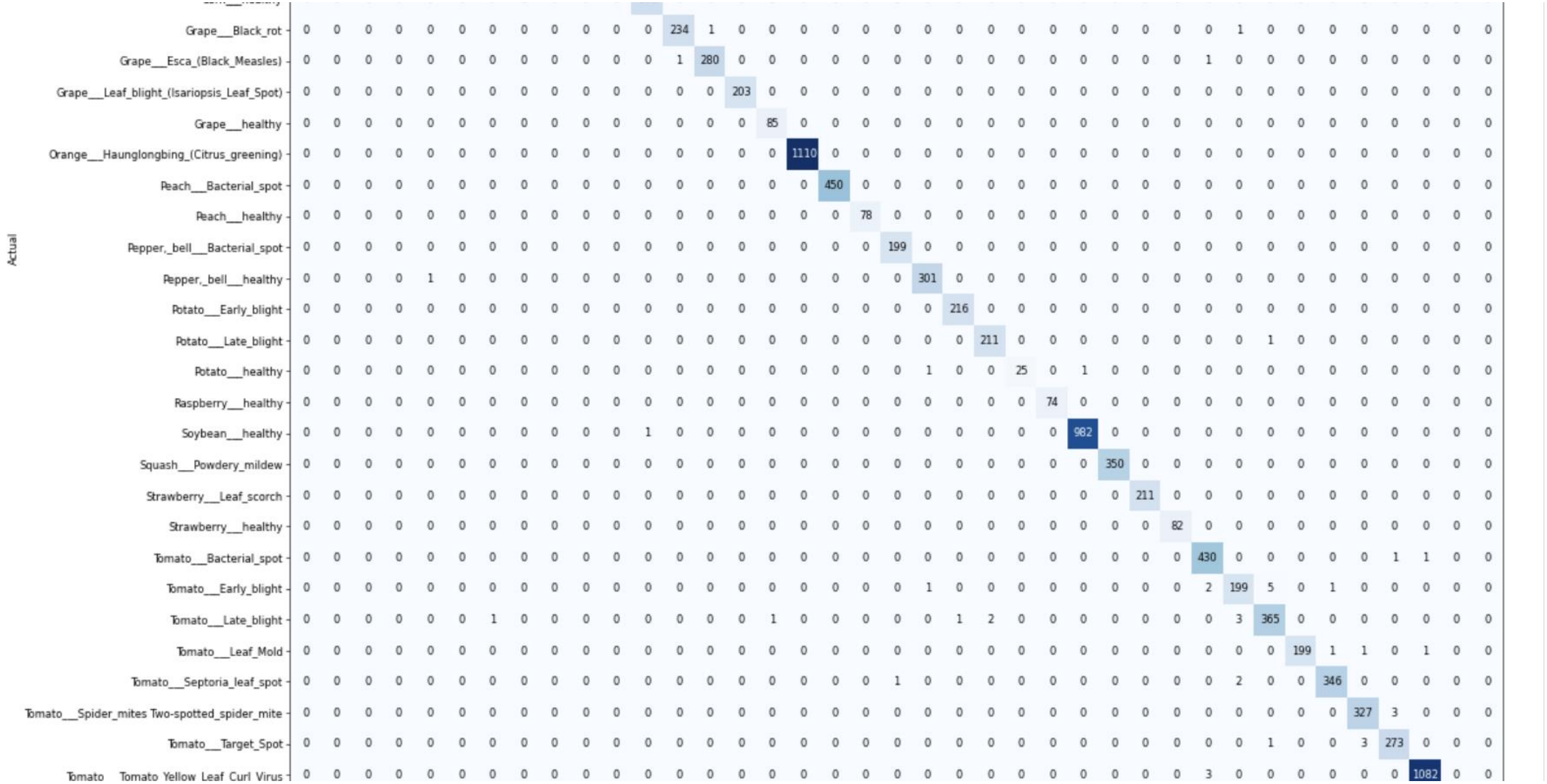
For Pytorch the accuracy achieved after training was 98.9 percent.

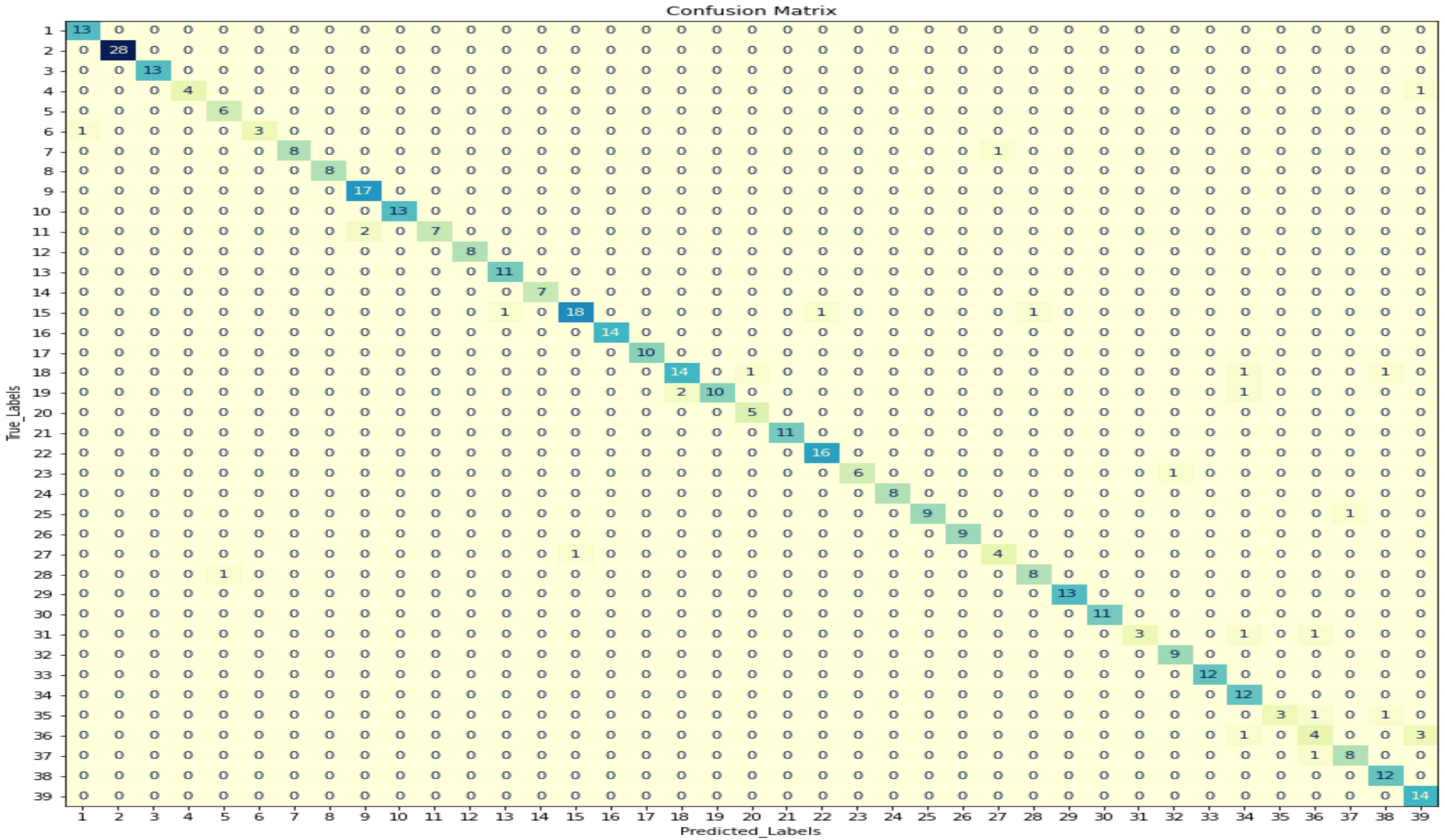
```
Train Accuracy : 96.7
Test Accuracy : 98.9
Validation Accuracy : 98.7
```

For Tensor flow the accuracy achieved after training was 85.27 percent.

```
scores2 = model.evaluate(test_ds2)
```

```
14/14 [==============================] - 10s 29ms/step - loss: 0.6517 - accuracy: 0.8527
```


Actual
Grape___Black_rot 0 0 0 0 0 0 0 0 0 0 0 234 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0
Grape___Esca_(Black_Measles) 0 0 0 0 0 0 0 0 0 0 0 1 280 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0
Grape___Leaf_blight_(Isariopsis_Leaf_Spot) 0 0 0 0 0 0 0 0 0 0 0 0 0 203 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Grape___healthy 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 85 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Orange___Haunglongbing_(Citrus_greening) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1110 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Peach___Bacterial_spot 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 450 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Peach___healthy 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 78 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Pepper,_bell___Bacterial_spot 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 199 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Pepper,_bell___healthy 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 301 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Potato___Early_blight 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 216 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Potato___Late_blight 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 211 0 0 0 0 0 0 0 1 0 0 0 0 0 0
Potato___healthy 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 25 0 1 0 0 0 0 0 0 0 0 0 0 0
Raspberry___healthy 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 74 0 0 0 0 0 0 0 0 0 0 0 0
Soybean___healthy 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 982 0 0 0 0 0 0 0 0 0 0 0
Squash___Powdery_mildew 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 350 0 0 0 0 0 0 0 0 0 0
Strawberry___Leaf_scorch 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 211 0 0 0 0 0 0 0 0 0
Strawberry___healthy 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 82 0 0 0 0 0 0 0 0
Tomato___Bacterial_spot 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 430 0 0 0 0 0 1 1 0 0
Tomato___Early_blight 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 2 199 5 0 1 0 0 0 0 0
Tomato___Late_blight 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 1 2 0 0 0 0 0 0 0 3 365 0 0 0 0 0 0 0
Tomato___Leaf_Mold 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 199 1 1 0 1 0 0
Tomato___Septoria_leaf_spot 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 2 0 0 346 0 0 0 0
Tomato___Spider_mites Two-spotted_spider_mite 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 327 3 0 0 0
Tomato___Target_Spot 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 3 273 0 0 0
Tomato___Tomato_Yellow_Leaf_Curl_Virus 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3 0 0 0 0 0 0 1082 0 0


Confusion Matrix
True_Labels
Predicted_Labels

5.2 Future Directions and Limitations

1. Nowadays there are relatively few expert level consultants available and it is very expensive to get their consultancy. Since the plant diseases degrade the quality and quantity of the plant, it is mandatory to use the technology for automatic detection and diagnosis of diseases.
2. We are also looking at some new prospects of disease detection. Like in image detection there are many favourable conditions required, the picture captures should be clear, there should be proper lightning.
3. We are also trying to work with the biochemical changes a plant experiences when the pest feeds over it.

6. References

1. [1] https://www.kaggle.com/datasets

2. [2] A.S Deokar, Akshay Pophale, Swapnil Patil, Prajakta Nazarkar, Sukanya Mungase, “Plant Disease Identification using Content Based Image Retrieval Techniques Based on Android System”, International Advanced Research Journal in Science, Engineering and Technology Vol. 3, Issue 2, February 2016

3. [3] N. Swetha, Mrs. Dr. N. Sasirekha, “Prediction of Leaf Disease using Segmentation with Hierarchical Clustering”, International Conference on Recent Innovation in Science, Technology and Management (ICRISTM-16) at Indian Federation of United Nations Associations (IFUNA), New Delhi, India, ISBN: 978- 81-932712-3-0. 12th June 2016

4. [4] Parash Mehta, Lavanya Saoji, Ankit Dodrajka, Tushar Chug, “Detection of Diseases on leaves and its possible diagnosis Using CBIR technique”, International Education and Research Journal (IERJ) EISSN No: 2454-9916 Volume: 2 Issue: 2 Feb 2


Thank
you!