A Deep Learning Based Approach for Banana Plant Leaf Diseases Classification and Analysis

Guide: Prof. D. D. Pukale **email id:** pukaledd@gmail.com

Name	email id
1) Akshara Gupta	akshara.gupta28091996@gmail.com
2) Nidhi Kamath	kamathnidhi98@gmail.com
3) Pallavi Mali	malipallavi1997@gmail.com

Abstract

India is a country where agriculture is very important sector. The production and profit gained from agriculture mainly depends on the quality and quantity of the crop being grown. For this it is very important that the plants should be protected from any of disease that may adversely affect the quality and quantity of the crop. Thus, it is very important to detect the disease affected crop if any and diagnosis of the disease at the early stage itself. This can reduce the loss of the crop. In our project, a deep-learning approach is being proposed to detect and classify banana leaf diseases. In particular, we make use of the LeNet architecture as a convolutional neural network to classify image data sets. Our system can efficiently predict the banana leaf disease and will suggest remedies for the disease being predicted.

Keywords

Banana plant diseases, Deep learning, Classification, Convolutional Neural Network (CNN), Ratio of Infected Area (RIA), K- Nearest Neighbor (KNN), Scale Invariant Feature Transform (SIFT), Rectified non-linear activation function (ReLU).

Introduction

Overview

Agricultural productivity is something on which economy highly depends. This is the one of the reasons that disease detection in plants plays an important role in agriculture field, as having disease in plants are quite natural. Automatic plant disease identification and classification is also an inevitable area that necessitates the development of automated computer vision or machine vision system with the use of image processing technique. Major banana diseases that express the symptoms on leaves are panama disease, moko disease, sigatoka disease, black spot, banana bunchy top, infectious chlorosis, banana streak virus and banana bract mosaic virus disease.

Brief Description

In our project we have developed a system that predicts banana leaf disease from the image of affected banana leaf. For this purpose, we are using deep-learning approach to detect and classify banana leaf diseases. In particular, we make use of the LeNet architecture as a convolutional neural network to classify image data sets. To train the system we are using images of banana leaf that undergo various image processing steps in order to classify the input image and thus predict its disease affected.

Problem Definition

To develop a system that efficiently predicts disease affected to a banana tree by using its leaf image. The system will also provide symptoms of the disease that is being predicted and its remedial actions.

Objectives

- To provide accurate and easy detection of disease.
- To provide symptoms and remedial assistance for the disease detected.

SYSTEM ARCHITECTURE

Architectural Diagram is graphical representation of the concepts, their principles, elements and components that are part of an architecture.

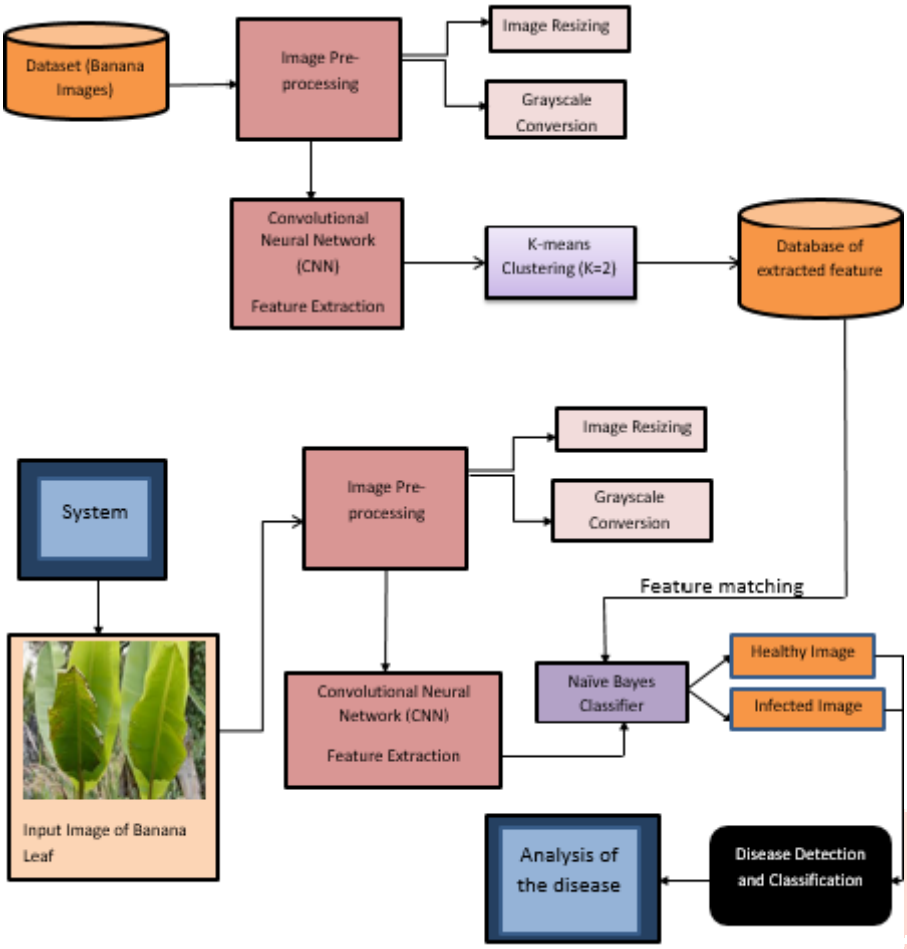

Fig. 4.1 Architecture Diagram

The system architecture shows how the system exactly works. Initially the system is trained by banana leaf image dataset in order to train the system for disease prediction. The features extracted from train data by using CNN algorithm and is stored in train.arff for further analysis. The user will feed the system with a banana leaf image that is to be tested for disease prediction. The features extracted from test image will be stored in test.arff. After this, the system will compare the test.arff and train.arff and predict the disease using KNN algorithm.

Related Works

SR NO	YEAR	AUTHOR NAME	PAPER NAME	PAPER DISCRIPTION	PAPER LIMITATIONS
1	2010	1.Sindhuja Sankarana, 2.Ashish Mishraa, 3.Reza Ehsania,*, 4.Cristina	A review of advanced techniques for detecting plant diseases	Diseases in plants cause major production and economic losses in agricultural industry worldwide. Monitoring of health and detection of diseases in plants	Recent reports in the literature support the notion that both volatile profiling and changes in spectral reflectance can be used

		Davisb		and trees is critical for sustainable agriculture. To the best of our knowledge, there is no sensor commercially available for real-time assessment of health conditions in trees.	for non-invasive field monitoring of plant diseases. Plants and trees release volatile organic compounds (VOCs) as a result of the metabolic activities taking place within its shoots, leaves, flowers, or fruits.
2	2008	1.Nur Badariah Ahmad Mustafa, 2.Nurashikin Ahmad Fuad, 3.Syed Khaleel Ahmed, 4.Aidil Azwin Zainul Abidin, 5.Zaipatimah Ali, 6.Wong Bing Yit, and 7. Zainul Abidin Md Sharrif	Image Processing of an Agriculture Produce: Determination of Size and Ripeness of a Banana	This will help the farmer to grade the fruit, the seller to price it optimally and the customer value for money. Bananas are classified according to sizes, shapes, textures, colors and taste. The process of getting the size and ripeness of a banana is done from its image using the Image Processing Toolbox in MATLAB	Future work will involve implementing artificial intelligence methods such as fuzzy logic and/or neural networks, in determining the quality of the banana itself based on the size and ripeness,
3	2013	1.D. Surya Prabha & J. Satheesh Kumar	Assessment of banana fruit maturity by image processing technique	Maturity stage of fresh banana fruit is an important factor that affects the fruit quality during ripening and marketability after ripening. The ability to identify maturity of fresh banana fruit will be a great support for farmers to optimize harvesting phase which helps to avoid harvesting either undermatured or over-matured banana	We explored color and size value features of fresh banana fruit images to classify under-mature, mature and over-mature category,both the color and size value are reliable index to determine the right time of harvest; the mean color intensity algorithms in conjunction with area algorithm developed in this study could be employed commercially while devising a complete

					field based automatic detection system for banana fruit maturity detection.
4	2008	1.A. Camargoa,*, J.S. Smithb	An image-processing based algorithm to automatically identify plant disease visual symptoms	This paper describes an image-processing based method that identifies the visual symptoms of plant diseases, from an analysis of coloured images. The processing algorithm developed starts by converting the RGB image of the diseased plant or leaf, into the H, I3a and I3b colour transformations. To test the accuracy of the algorithm, manually segmented images were compared with those segmented automatically. Results showed that the developed algorithm was able to identify a diseased region even when that region was represented by a wide range of intensities	To justify this statement, the algorithm was tested on a very diverse set of images and segmentation performance was estimated. Because of the complexity of the images used in this study, the strategy proposed here may be suitable for other type of images whose targets are different to that of images showing diseased plants. The next stage of developing a disease classification system is to extract parameters of the diseased region and classify the image accordingly
5	2012	1.Norhashila Hashim 2.Rimfiel Bin Janius 3.Laszlo Baranyai 4.Russly Abdul Rahman 5.Azizah Osman 6.Manuela Zude	Kinetic Model for Colour Changes in Bananas During the Appearance of Chilling Injury Symptoms	The impact of chilling injury (CI) on the colour of bananas at different ripening stages was investigated. Bananas were stored at 6 and 13 °C for 2 days to induce CI symptoms. Cold storage is one of the most commonly used postharvest processes for enhancing the shelf life. However, when fresh produce is exposed to a temperature below its tolerance threshold, chilling injury (CI) symptoms might appear which strongly	The data could be used to develop a monitoring system to detect or predict the appearance of CI symptoms in fruit. In future work, the authors will address a better insight in the pigment changes during development of CI symptoms.

				affect the fruit quality and marketability	

DESIGN OF THE STUDY

Proposed Algorithm :-

Step 1: Register new user.

Step 2: User Login.

Step 3: User upload image of banana leaf.

Step 4: The system is trained by banana leaf images stored in trainset and tuneset folder using Convolutional Neural Network algorithm. CNN is used to extract features and classify the image in different categories. The extracted features are written in train.arff file for further use.

Step 5: The image uploaded by the user is considered as test image. This test image undergoes feature extraction process using CNN algoritrhm. These extracted features are written in test.arff.

Step 6: The train.arff and test.arff are compared for prediction using KNN algorithm where the K- nearest neighbor is being calculated. This gives the prediction of test image class to which the image belongs to.

Step 7: The prediction of uploaded image is being displayed along with the analysis report which consist of disease name, its symptoms and remedies.

Tools Used

- JDK 1.8 or higher version
- Eclipse Mars or higher version
- MySQL 5.7 or higher version
- Tomcat 8 or higher version

Software Requirement:

- Operating System : windows 8 and above..
- Application Server : Tomcat5.0/6.X
- Language : Java

- Front End : Java 8
- Database : MySQL

Hardware Requirement: The hardware design of the system includes designing the hardware units and the interface between those units.

- Processor - Intel i3/i5/i7
- RAM - 4 GB (min)
- Hard Disk - 50 GB

Statistical Technique Used

We have used image processing techniques such as image resizing, feature extraction in our project to extract the information from banana leaf images. Further the classification of image is done in order to predict the disease affected. The system is initially trained by the features extracted from the train images. The input banana leaf image is considered as test image that is to undergo prediction. For disease prediction we are using Convolutional Neural Network (CNN) and K-Nearest Neighbor (KNN).

Experiment Result:

The result of our system is, it predicts the disease of the banana leaf image that is fed as an input to the system. The prediction time is negligible. We get the exact prediction, the system is trained by dataset of images for all the disease that are to be predicted, viz. mosaic, panama wilt, black sigatoka, yellow sigatoka, streak. After training the system by these images, the test image (input banana leaf image) is fed and then the systems give the prediction.

Future scope:

In future we plan to implement our project as an application that we help the farmers to improve the quality and quality of their agricultural production.

Conclusion:

The system that is being developed in our project, efficiently predicts banana plant disease from its leaf image. The system uses Convolutional Neural Network and KNN algorithm for disease prediction. The system predicts banana diseases viz. mosaic, black sigatoka, yellow sigatoka, panama wilt, streak. The

system also provides the user with analysis report that consist of the symptoms and remedies of predicted disease.

Reference:

1. Back propagation applied to handwritten zip code recognition http://yann.lecun.com/exdb/publis/pdf/lecun-89e.pdf

2. Identifying multiple plant diseases using digital image processing http://www.sciencedirect.com/science/article/pii/S153751101530266X

3. A new colour vision system to quantify automatically foliar discolouration caused by insect pests feeding on leaf cells http://www.sciencedirect.com/science/article/pii/S1537511015000495

4. Image processing methods for quantitatively detecting soybean rust from multispectral images http://www.sciencedirect.com/science/article/pii/S1537511010001303

5. Automatic detection of powdery mildew on grapevine leaves by image analysis: Optimal view-angle range to increase the sensitivity http://www.sciencedirect.com/science/article/pii/S0168169914000611