ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 6, Issue 5, May 2019

IoT Based Plant Disease Classification and Intimation Using Image Processing

S.DHARIKA[1], J.AUGUSTINJACOB[2], R.AMIRTHAVALLI[3]
[1,3]PG Scholar, Department of ECE, Sri Vidya College of Engineering and Technology, Virudhunagar, India.
[2]Associate Professor, Department of ECE, Sri Vidya College of Engineering and Technology, Virudhunagar, India.

Abstract: For preventing the losses in the yield and quantity of the agricultural product, Classification is performed, if proper analysis is not taken in this approach or classification, then it produce serious effects on plants and due to which respective product quality or productivity is affected. Disease classification on plant is very critical for supportable agriculture. It is very difficult to monitor or treat the plant diseases manually. It requires huge amount of work, and also need the excessive processing time, therefore image processing is used for the detection of plant diseases. Plant disease classification involves the steps like Load image, pre-processing, segmentation, feature extraction, SVM Classifier and the same to be informed through mobile notification in IoT.

Keywords: RGB Image, Segmentation, Pre-processing, SVM classifier.

I. INTRODUCTION

India is a cultivated country and about 80% of the population depends upon on agriculture. Farmers have large range of difference for selecting various acceptable crops and finding the suitable herbicides and pesticides for plant. Disease on plant leads to the convincing reduction in both the quality and productivity of agricultural products. The studies of plant disease refer to the studies of visually observable patterns on the plants. Support Vector Machines (SVM) classification approach are proposed and used in this paper. Health of plant leaf and disease on plant leaf plays an important role in successful cultivate of crops in the farm.

Agriculture

In the modern era, agriculture does mean betterment of human life instead of merely feeding the growing population. Agriculture and allied sectors like forestry and fisheries accounted for 17.32% of the Gross Domestic Product (GDP), i.e., about 50% of the total workforce; although, the contribution of agriculture towards the India's GDP is progressively declining every year [1]. The progressive declination in agriculture growth occurs due to various plant diseases. Traditionally, a visual estimate for identifying the disease and calculation of disease severity is based on characteristics of plant disease symptoms and visible signs of pathogens. The severity of disease is evaluated through naked eyes observation by the skilled person of the same field and subjected to intensive research and investigation. This technique may need relatively higher consumption of time and demanding experienced individual with well-developed skills for disease diagnosis [2].

Plant Pathology

Plant Pathology was originated from Greek word "Phytopathometry" (*phyto* means "plant"; *pathos* means "disease" and *metron* means "measure"). It is the scientific method or branch of agriculture science, which deals with the diseases in plants caused by pathogens (infectious organisms) and surrounding environmental conditions (physiological factors). Somewhere, it may also known as a branch of science that has a dignified aspiration of protecting the crops, those providing food for humans and animals [7, 8]. Among all branches of science; Nematology, Soil Science, Virology, Genetics and Plant Breeding, Weed Science, Bio-Technology, Meteorology and Mycology, plays a key role in raising the crops and in suitable management of plant diseases. The fundamental concept in Plant Pathology is represented by the disease triangle . Edge of the triangular part represents a factor that is responsible for disease development: a host, a pathogen (the agent that causes disease), and favorable environment. The occurrence of all three factors must be simultaneously for a plant disease to develop. Without the right host in the right environmental conditions and suitable pathogens cannot cause any harm to plants [9].

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 6, Issue 5, May 2019

II. Problem Definition

Various leaf diseases cause severe losses to farmers resulting in a major threat to the growers. To minimize above losses, a support system is required to timely assess the foliar diseases of crops. Image processing approach is a non-invasive technique which provides a reliable, cost-effective, and accurate solution to the farmers in minimal time to optimize the yield losses. This study aims to investigate the possibility of quantitative detection of Tikka disease of Groundnut crop at each stage of disease development and to find the severity threshold level for spraying fungicides before crop yield becomes severely affected. Image processing is basically contains the following three steps.

a) Importing the image with ocular scanner or by digital photography.

b) Analyzing and handling the image which includes data condensation and image enhancement and spotting patterns that are not to human eyes like satellite photographs.

c) Output is the last stage in which result can be changed image or report that is based on image.

III. Methodology

Computer vision has been applied in agriculture for various things: quality inspection example, qualitative sorting of potatoes by color analysis machine (Hasankhani & Navid, 2012). They have also been used for evaluation purposes as they provide suitably rapid, economic and consistent objective assessment (Brosnan & Sun, 2004). Owomugisha et al., (2014), describes machine vision as having superior speed and accuracy which has significantly lead to its application in crop disease detection. According to Owomugisha et al., (2014), computer vision is an area of interest for most researchers. The rising opportunity is the need to bring mobility and flexibility to the already developed model. Computer vision is not limited by physical, personal and environmental factors making it more effective (Kanjalkar & Lokhande, 2013).

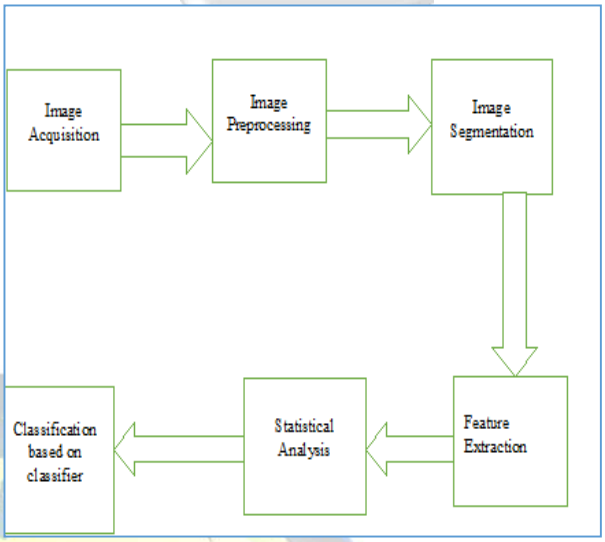

Fig 1. Disease Detection Algorithm.

Image Acquisition- The digital images are acquired from the environment Can be done through the use of a cameras or sensors.

Color Transformation- RGB images are converted to a standard color space which is Hue Saturated Images (HSI). HSI is popular as it is based on human perception. The color features that are involved include: the skewness of the image, the mean, the standard deviation, and kurtosis. M represents are the dimension of the image. Pij are the values of the color on the i^{th} and j^{th} columns (Kadir, Nugroho, Susanto, & Santosa, 2013).

Image Segmentation- Used to distinguish objects from their backgrounds or to partition their images to related portions. Image segmentation simplifies representation into something that can be understood. Segmentation involves removing the image from the background. The adaptive threshold has been proven to work. An intensity histogram was built consisting of 20 major bins. Two peaks that represented the leaf and background were built. The least values lying between the background and the leaf were obtained and used as the threshold to separate the leaf from its background (Kadir et al., 2013).

According to Gavhale & Gawande (2014) the techniques of image segmentation include:

a) Region based – This technique involves grouping of related pixels. The boundaries of the area are then identified

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 6, Issue 5, May 2019

for segmentation and atleast one pixel related to the particular region is considered. The edge flow is the converted into a sector and other edges detected for segmentation.

b) Edge based – In this technique, the boundary to segment is identified. The edges help with identification of discontinuities in the image. Support vector machine is used for the classification.

c) Threshold based – The segmentation is done based on the values that are obtained from the histogram. Of the edges from the original image. Accurate edge detections result in accurate threshold. The advantages of this method is that it involves fewer computations compared to other methods. However it is not suitable for complex images.

d) Feature based clustering – This method involves conversion of images into histogram upon which clustering is done. The pixels of the image are clustered using the Fuzzy c technique images.

e) Model based – referred Markov Random Field. It works in combination with edge detection to accurately identify the edge

f) Feature Extraction- This is the process of simplifying the amount of resources required to describe a large data set accurately. It can also be viewed as transforming images into features. In cases of leaf disease identification, the features would be selected according to the diseases thus more discriminative. Feature extraction involves color, shape and texture. Gavhale & Gawande, (2014) describe texture as the main point of focus for most researchers in leaves disease detection and detail the process as

Artificial Neural Networks

A Neural Network (NN) as a system that is comprised of several artificial neurons and weighted links binding them. The artificial neurons processing the information are organized into interconnected layers along chosen patterns. Every neuron in its layer, receives some type of stimuli as input, processes it and sends through its related links an output to neighboring neurons. The networks heavily rely on learning in order to adapt to their environments. The neural network is composed of four main sections:

a) Input which is a node that activates upon receiving a trigger from incoming signals

b) Interconnections between nodes

c) An activation function (rule) which transforms inside a node, input into output

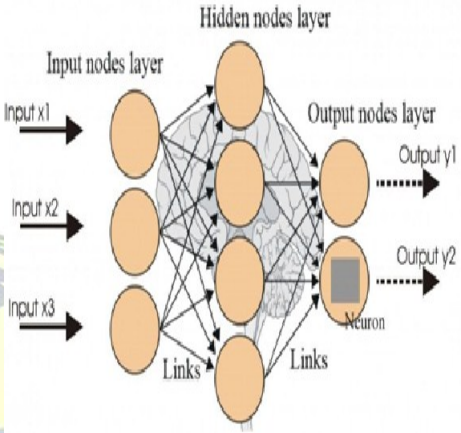

Fig 2. Artificial neural network

the feed-forward, the feedback and the back propagation neural networks, probabilistic neural networks. The research will employ the back propagation neural network for classification of the diseases affecting the maize leaf.

Applications of Artificial Neural Networks

- Useful in pattern recognition, identification, generalization, abstraction and interpretation of incomplete and noisy inputs. Example of areas of application include handwriting recognition, image recognition, and voice and speech recognition, weather forecasting.
- Useful in financial applications as it provides some human characteristics to problem solving that are difficult to simulate using the logical, analytical techniques of expert systems and standard software technologies.

IV. System Design And Architecture

This section of the paper details the design structure of the proposed solution by incorporating the various requirements collected in the previous chapter through the various interactions with the potential users and experts. To achieve this, design diagrams under the Unified Modeling Language were drawn and detailed information for each design diagram put down. Design diagrams and structures

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 6, Issue 5, May 2019

put down for the purpose of the model included a use case diagram with detailed follow-up use case descriptions, System Sequence Diagrams, and an activity diagram.

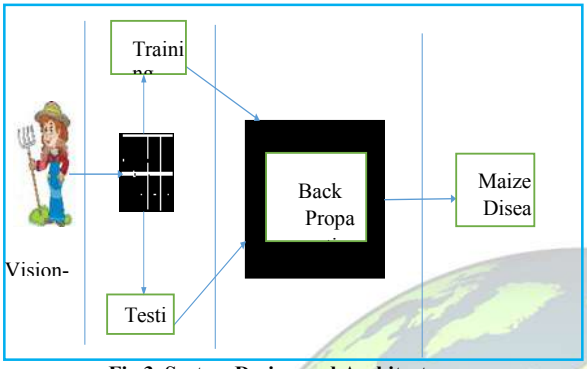

Fig 3. System Design and Architecture

The system is associated with several use cases involved in the process of identification of the leaf diseases that affect maize.

Extracting pixel values- the model obtains the binary values of the leaf images that were captured using the mobile phone camera. The values that were extracted included the red, green and red components of the two dimension maize leaf image that was captured.

Initialize classification- This use case demonstrates the process of identifying the attributes that would be used as the inputs for the neural network as well as the number of hidden layers that would be used. The expected outputs were also identified during the initiation function. The activation function used was also identified.

Normalization of the data- The data used in the process varied in the range of values obtained from the leaf. The noise in the data was removed to allow for more accurate predictions.

Implement the algorithm- The system implemented the back propagation neural network algorithm. This algorithm was used due to its proven ability to learn with any kind of data presented to it, its adaptability and highly accurate classification output at a fast speed.

Classify leaf disease- This process was effected by providing to the system the set of training data from which it was expected to learn the environment and expectations. A test set was then presented to the system to validate that the system was classifying correctly.

Generating classification output- The system presented the classification of the disease based on the new images provided to it.

V. Implementation And Testing

Image Capture of the Leaf

The image was captured using the mobile phone camera. The image was then set as a preview enabling the user to see the image they had captured. The camera that was used during the research was 13 megapixels. The application scaled the image down to so as to ensure it did not consume a lot of memory space. The user took the image at a close range since some diseases had breaks between the streaks and this could only be captured if the distance between the camera and the object was too large. A distance of in the range of 1meter to 1.5 meters was preferred so as to ensure that the features of the image were clearly captured. The camera allowed for the object to be zoomed in or out thus ensuring that the farmer obtained a clear view. If the captured image was unclear, the application allowed the user to capture another image. The image was then saved to a folder in the gallery.

Fig 4. Maize Leaves affected by Maize streak Virus

Fig 5. Leaves affected by MLND.

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 6, Issue 5, May 2019

VI. Result And Discussion

The vision-based model was implemented by using features of the leaf images that were captured in order to classify the diseases affecting the maize crop. The model was tested for correct classification on the basis of accuracy, precision, and the error that was obtained. The model was considered quite suitable in comparison to the other methods discussed in the research. Farmers in Nyeri County largely depended on the visual examination for identification of the disease affecting the leaves.

Validation of the Model

The model was validated for accuracy, precision, recall ratio using the confusion matrix. A cross validation of 10 folds was used to test the model. 15 out of 19 instances presented to the network were correctly classified. This resulted to accuracy 78.94%.

Table 1. Classification of output

Correctly Classified Instances	15	78.9474 %
Incorrectly Classified Instances	4	21.0526 %
Mean absolute error	0.1688	-
Total Number of Instances	19	-

VII. Conclusion

As highlighted in the interview with an extension worker who works closely with farmers in Nyeri County, farmers face a number of challenges in identifying and consequently managing the diseases affecting their crops. One of the major problems is misdiagnosis which is based on the experience of the farmer. Misdiagnosis results in the farmer taking the wrong action and thus obtains a low yield. (Ghaiwat & Arora, 2014a) emphasized that misdiagnosis of crop diseases is as a result of overreliance of experience based on the visually observable characteristics of the diseases affecting the crops. It also takes some time for the limited number of extension workers to visit various farms in the rural areas.

The research lays its emphasis of taking advantage of computer vision techniques as well as machine learning algorithms for the classification of the various diseases. The farmers are able to act as soon as they receive the prescription from the application.

The research relies on pixel features of the images that are captured by the farmers. Once the pixel values are obtained, the data is normalized so as to minimize the range of values returned. Back propagation neural network is used to classify the neural network and the diagnosis and prescription are provided to the farmer.

Reference

[1]. *Plant Chili Disease Detection Using The Rgb Color Model* By Zulkifli Bin Husin, Ali Yeon Bin Md Shakaff, Abdul Hallis Bin Abdul Aziz, And Rohani Binti S Mohamed Farook, Research Notes in Information Science (RNIS) Volume13, May 2013.

[2]. *Image Processing Approach For Grading And Identification Of Diseases On Pomegranate Fruit* By S. Gaikwad, K. J. Karande /(IJCSIT) International Journal of Computer Science and Information Technologies Vol. 7 (2), 519-522, 2016.

[3]. *A Review For Agricultural Plant Diseases Detection Using Different* Techniques By Mr.N.P.Kumbhar, Dr.Mrs.S.B.Patil , International journal of Electrical and Electronics Engineering(IJEEE) vol no.9,Issue no.1,January-june 2017.

[4]. *Disease Detection And Diagnosis On Plant Using Image Processing* By Mr.Khushal Khairnar,Mr.Rahul Dagade. Volume 108 – No. 13, December 2014.

[5]. *Rice Disease Identification Using Pattern Recognition, Proceedings* by Santanu Phadikar And Jaya Sil, 11th International Conference On Computer And Information Technology (ICCIT 2008) 25-27 December, 2008, Khulna, Bangladesh..

[6]. *Design Of Monitoring And Control Plant Disease System Based On DSP & FPGA*, by Chunxia Zhang, Xiuqing Wang, Xudong Li, Second International Conference On Networks Security, Wireless Communications And Trusted Computing in 2010.

[7]. *Infected Leaf Analysis And Comparison By Otsu Threshold And K-Means Clustering,* by Mrunalini R. Badnakhe, Prashant R. Deshmukh, International Journal Of Advanced Research In Computer Science And Software Engineering, Volume 2, Issue 3, March 2012.

[8]. *Image Processing For Smart Farming: Detection Of Diseases And Fruit Grading* by Monika Jhuria, Ashwani Kumar, Rushikesh Borse IEEE ICIIP, Pp.521-526, 2013.

[9]. *An Approach for Detection and Classification of Fruit A Survey*, by Zalak R. Barot1, Narendrasinh Limbad, Volume 4 Issue 12, December 2015.

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 6, Issue 5, May 2019

[10]. *Color Image Segmentation: Advances And Prospects In Pattern Recognition,* by H.D. Cheng, X.H. Jiang, Y. Sun, Jingli Wang, 34, PP.2259-2281, 2000.

[11]. T. Kobayashi, E. kanda, K. Kitada, K. Ishigurd and Y. *"Detection of rice panicle blast with multispectral radiometer and the potential use of multispectral scanner*."Torigoe-2000

[12]. Z. Qin, M. Zhang, T. Christensen, W. Li, and H. Tang, "Remote sensing analysis of rice disease tresses for farm pest management using wide-band airborne data", pp.2215-2217, 2003.