IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-8, Issue-2, Feb 2020 E-ISSN: 2347-2693

Quality Assessment of Crops Through Disease Detection Using Machine Learning

Vandita Mathad[1*], Greeshma R.R.[2], Harshitha J.V.[3], Deepika S.[4], Snigdha Sen[5]

[1,2,3,4,5] Department of Computer Science and Engineering, Global Academy of Technology, Bangalore, India

**Corresponding Author: vanditamathad@gmail.com*

DOI: https://doi.org/10.26438/ijcse/v8i2.99102 | Available online at: www.ijcseonline.org

Accepted: 17/Feb/2020, Published: 28/Feb/2020

Abstract— Agriculture plays an important role in our country, crops are considered to be vital as they are the source of energy to mankind. Due to environmental conditions, crops are getting affected with many diseases. Farmers are not able to detect these diseases at an early stage. Disease in a crop leads to low productivity. Thus, assessment of crop condition is vital. Quality assessment of crops deals with assessing the quality and minimizing the loss of crops. It provides the fundamental information for understanding the quality of the crops and its diseases. There are various Machine Learning algorithms for detection and classification of diseases. Use of machine learning algorithms like CNN not only yields better results but it is also a cost efficient solution and it analyzes the data from different aspects, and classifies it into one of the predefined set of classes. In machine learning, Convolutional Neural Networks are complex feed forward neural networks. CNNs are used for image classification and recognition because of its high accuracy. CNN follows a hierarchical model which works on building a network and finally gives out a fully-connected layer where all the neurons are connected to each other and the output is processed. CNN outperforms most of the ML algorithms when it comes to image classification provided there are large number of images present in the dataset. The morphological features and properties like color, intensity and dimensions of the plant leaves are taken in to consideration for classification. Thus, detection of disease in early stage will be beneficial for farmer so that necessary actions can be taken.

Keywords- Machine Learning, Segmentation, Clustering, CNN

I. INTRODUCTION

The growing field of interest in today's world is agriculture. It is one of the important occupations practiced in India and covers about 60% land. With the change in the environment due to factors like pollution, global warming, natural disasters etc farming has become difficult for farmers. Thus modern agriculture or modern farming is used nowadays for profitable farming. The latest techniques used in agriculture helps to analyze the soil condition of the fields, temperature, the pesticides that is best suited for specific crops, disease diagnosis, water level to be used etc. Plant disease diagnosis uses techniques like Machine Learning Algorithms, Image Processing Techniques, Deep Learning etc. for identification of healthy and diseased crops. Machine Learning plays a crucial role in this field. The crop as a whole or the leaves of the plants are taken into consideration and analyzed by these techniques. The symptoms present on the leaves or the crops are processed with the help of image processing. These are the main source for the detection of diseases. They can be of various types depending on the stages of the disease. Thus, detection of the diseases at any stage should be possible. Machine Learning is a technique in which the system learns automatically using the information provided. It improves with experience without being explicitly programmed unlike other techniques.

II. RELATED WORK

There are various studies and research done on crop condition assessment using machine learning. Crop condition has to be identified and appropriate pesticides has to be recommended which in turn increases the crop cultivation in agriculture. In [1] they have designed system which uses images dataset for identifying the condition (healthy and diseased) of the crops. Images with better quality produce better results and leads to the development of more accurate image analysis tools. It is more efficient if diseases are automatically classified and detected from leaf images which is implemented in [2] The developed model was able to detect leaf presence and distinguish between healthy leaves and 13 different diseases, which can be visually diagnosed and different tests were performed in order to check the performance of newly created model. The diseases can also be classified based on pattern of defect which is proposed in [3] where five classes of crops were tested and three types of

crop diseases for each class. Artificial neural network can also be used which also requires feature extraction system which is used in [4] to classify the health of a cotton leaf plant. The prediction of the outcome was taken randomly by neural network process. This method predicted the data correctly with minimized error. Similarly, Random Forest is also a image classifier which is used in [5] the model was trained using 160 images of papaya leaves. The model could classify with approximate 70 percent accuracy. The accuracy can be increased when trained with vast number of images and by using other local features together with the global features.

III. CNN

Among various network architectures used in deep learning, convolutional neural networks (CNN) are widely used in image recognition. CNNs consist of convolutional layers, which are sets of image filters convoluted to images or feature maps, along with other (e.g., pooling) layers. In image classification, feature maps are extracted through convolution and other processing layers repetitively and the network eventually outputs a label indicating an estimated class. Given a training dataset, CNN, unlike traditional machine learning techniques that use hand-crafted features, optimizes the weights and filter parameters in the hidden layers to generate features suitable to solve the classification problem. In principle, the parameters in the network are optimized by back-propagation and gradient descent approaches to minimize the classification error.

Revealing the CNN to extract the learned feature as an interpretable form not only ensures its reliability but also enables the validation of the model authenticity and the training dataset by human intervention. In this study, a variety of neuron-wise and layer-wise visualization methods were applied using a CNN, trained with a publicly available plant disease image dataset.

IV.METHODOLOGY

Machine learning is the scientific study of algorithms and statistical models that computer systems use to perform a specific task relying on patterns and inference. It has various types of models such as ANN, Decision Trees, Support Vector Machines, Bayesian Networks, and Convolutional Neural Networks. CNN consists of input, output and multiple hidden layers. The hidden layers of a CNN typically consist of a series of convolutional layers that convolve with a multiplication or other dot product.

Images of healthy and disease affected leaves are taken and segmentation is done using K-means clustering algorithm. Later the features are extracted and fed to the CNN classifier, from which the leaf is categorized as either infected or healthy and thereby the quality of the crop is assessed. Hence by knowing the quality of the crop, it can be treated with necessary pesticides to remove the infected disease if present.

1. Image acquisition: Image Acquisition is the process of collection of images. Healthy leaves are plain in texture without any spots on them where as diseased leaves show the presence of spots or damaged areas on the leaf. Images of each type are collected and separated into two folders; Healthy and Diseased.

Fig. 1

2. Image pre-processing: Image pre-processing includes converting RBG images into Grayscale images using Python. An RGB image means the images present with its original colours. Grayscale images have the combination of black and white. Conversion of RGB to grayscale is done for enhancing the dataset available.

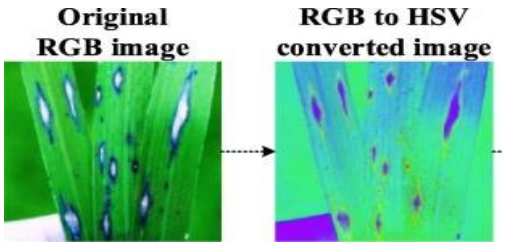

Fig. 2

3. Segmentation: Image segmentation breaks the image down into meaningful regions. It divides the image into multiple segments. The goal is to simplify or change the representation into more meaningful image. It differentiates between the objects we want to inspect further and the other objects or their background. It consists of segmenting the converted gray scale images using K-Means Clustering.

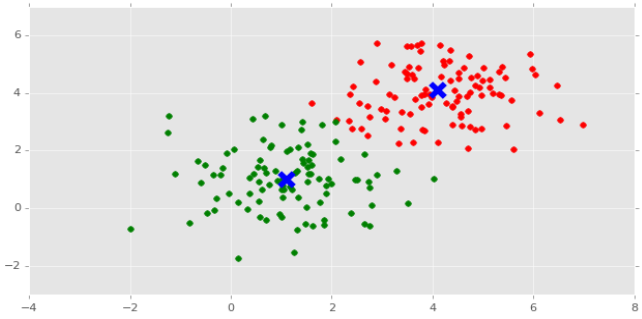

Fig. 3

4. Classification: The dataset is trained using Machine Learning algorithm. The training dataset consists of both healthy as well as diseased images. Convolutional Neural Network (CNN) algorithm is used to train the images and then classified. Now on providing testing data the system detects whether the image is healthy or unhealthy.

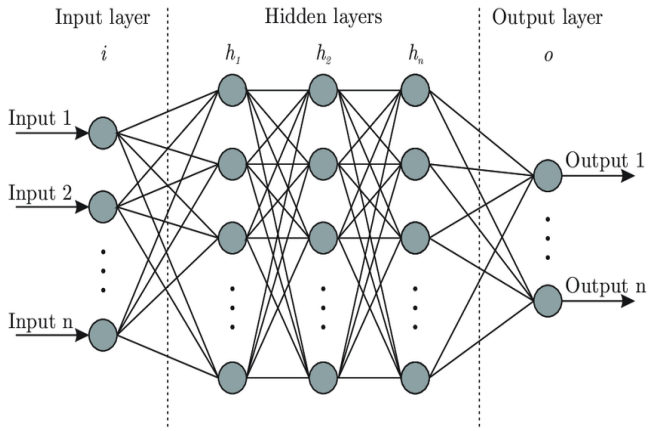

Fig. 4

V. RESULTS AND DISCUSSION

On conducting the above mentioned process we are able to detect if any disease is present in the crop by using convolutional neural networks and also classify the type of disease using K-means classifier. The quality of the crop is assessed based on this outcome as healthy or diseased crop. Pesticides are recommended with respect to the type of disease and quality of the crop. The performance of the model can be obtained by calculating the accuracy of the results which is expected to be more efficient than the previous models.

VI. CONCLUSION AND FUTURE SCOPE

The proposed system periodically monitors the cultivated field. The developed model is able to detect diseases in the crop at an early stage and distinguish between healthy leaves and diseased leaves by using various segmentation and classification algorithms. Machine learning techniques are used to train the model which helps to take a proper decision regarding the detection and classification of diseases. Three types of diseased crops are considered, as it is known that convolutional networks are able to learn features when trained on larger datasets, large number of healthy and diseased leaves dataset are trained to the model. By determining the diseases if present, the quality of the crop is assessed. Also the pesticide as a remedy is suggested to the farmer for infected diseases to control it. The complete procedure is described, from collecting the images used for training and validation to image pre-processing and segmentation and finally the procedure of training the deep CNN. Different tests are performed in order to check the performance of newly created model.

ACKNOWLEDGMENT

We wish to thank our project guide Ms.Snigdha Sen, Assistant Professor, Dept. of CSE for guiding and correcting various aspects in the paper with attention and care.

REFERENCES

[1] R. Poonguzhali, A.Vijayabhanu, "*Crop Condition Assessment using Machine Learning*",International Journal of Recent Technology and Engineering (IJRTE), Vol.**7**, Issue-**6S2**, April **2019.**

[2] SrdjanSladojevic, Marko Arsenovic, AndrasAnderla, DubravkoCulibrk, and Darko Stefanovic, "*Deep Neural Networks Based Recognition of Plant Diseases by Leaf Image Classification ",* Hindawi Publishing Corporation Computational Intelligence and Neuroscience, Volume **2016, 29** May **2016.**

[3] Omkar Kulkarni, "*Crop Disease Detection using Deep Learning*", **2018** Fourth International Conference on Computing Communication Control and Automation (ICCUBEA)

[4] Nikhil Shah, SarikaJain,*"Detection of Disease in Cotton Leaf using Artificial Neural Network",* IEEE **2019**

[5] Shima Ramesh, Mr. Ramachandra Hebbar, Mr. P V Vinod, "*Plant Disease Detection Using Machine Learning"*, **2018** International Conference on Design Innovations for 3Cs Compute Communicate Control.

[6] Radhika Deshmukh, ManjushaDeshmukh, "*Detection of Paddy Leaf Diseases*", in: International Conference on Advances in Science and Technology**, 2015.**

[7] P. R. Reddy, S. N. Divya, and R. Vijayalakshmi, *"Plant disease detection techniquetool—a theoretical approach,"* International Journal of Innovative Technology and Research,**pp. 91–93, 2015**.

[8] P. R. Rothe and R. V. Kshirsagar, *"Cotton Leaf Disease Identification using Pattern Recognition Techniques",* International Conference onPervasive Computing (ICPC),**2015**.

[9] Pasalu IC, Mishra B, Krishnaiah NV, Katti G, "*Integrated pest management in rice in India: Status and prospects"*. In: Birthal PS, Sharma OP (eds) Proceedings 11. Integrated pest management in Indian agriculture. National Centre for Agricultural Economics and Policy Research (NCAP)/National Centre for Integrated Pest Management (NCIPM), New Delhi, pp. 25–49,**2004**

[10] Singh, V., & Misra, A. K , *"Detection of plant leaf diseases using image segmentation and soft computing techniques"*. Information processing in Agriculture, 4(1), 41-49, **2017**

[11] Prajapati, H. B., Shah, J. P., & Dabhi, V. K , "Detection and classification of rice plant diseases". Intelligent Decision Technologies, **11(3), 357-373, 2017**

[12] Mohan K. J, Balasubramanian M , & Palanivel S, *"Detection and recognition of diseases from paddy plant leaf images"*. International Journal of Computer Applications, **144(12), 2016.**

[13] Ferentinos, K. P, *"Deep learning models for plant disease detection and diagnosis"*. Computers and Electronics in Agriculture, **145, 311-318, 2018.**

[14] Zhang S, Huang W, Zhang C,*"Three-channel convolutionalneural networks for vegetable leaf disease recognition"*. Cognit Syst Res **2019;53:31–41.**

[15] Barbedo JGA, "*Plant disease identification from individual lesions and spots using deep learning*". Biosyst Eng **2019;180:96–107**

[16] Liu B, Zhang Y, He D, Li Y, "*Identification of apple leaf diseasesbased on deep convolutional networks*". Symmetry **2018;10:11**

AUTHORS PROFILE

Snigdha Sen, currently working as an Assistant Professor in Department of Computer Science and Engineering, Global Academy of Technology, Bangalore, India. Having around 10 years of teaching experience. Pursuing PhD in Machine Learning from IIIT, Allahabad. Completed Masters in Information Technology from Jadavpur University, Kolkata. Area of interest lies in Machine Learning, Bigdata, Internet of Things and Cloud Computing.

Vandita Mathad, pursuing BE at Global Academy of Technology, Bangalore. Areas of interest Lies in Machine Learning, Big data Analytics, Cyber Security.

Greeshma RR, pursuing BE at Global Academy of Technology, Bangalore. Areas of interest Lies in Machine Learning, Big data Analytics, Data Science.

Harshitha JV, pursuing BE at Global Academy of Technology, Bangalore. Areas of interest Lies in Machine Learning, Big data Analytics.

Deepika S, pursuing BE at Global Academy of Technology, Bangalore. Areas of interest Lies in Machine Learning, Data Analytics, Cyber Security.

