"PLANT DISEASE DETECTION USING CONVOLUTIONAL NEURAL NETWORK"

[1]KETAN P. PISE
Dept. of Information Technology, Shri Sant Gajanan Maharaj College of Engineering, Shegaon, Maharashtra, India
kalpak987@gmail.com, kppise@ssgmce.ac.in

[2]JAYASHRI SALAMPURIYA
Dept. of Information Technology, Shri Sant Gajanan Maharaj College of Engineering, Shegaon, Maharashtra, India
SALAMPURIYAJAYU@GMAIL.COM

[3]AMITKUMAR MANEKAR
Dept. of Information Technology, Shri Sant Gajanan Maharaj College of Engineering, Shegaon, Maharashtra, India
asmssgmcoe@gmail.com

ABSTRACT: *The underlying principle is the deep learning algorithms and image processing, which will combinedly forms to make a solution to identify from which types of disease plants are suffering from. Deep learning based on Convolutional Neural Network (CNN), therefore a CNN model developed in order to classify between healthy and diseased plants of pepper bell, potato and tomato plants. The model consists of convolution layers followed by activation layers and pooling layers. It consists of two dense layer, relu function and sigmoid function is used to detect probability of presence of disease or not. To remove overfitting problem dropout is set of values of 0.25 and 0.5. Hence the paper provides an insight of creativeness to develops a plant disease detection platform.*

***Keywords*:** Deep Learning; Convolutional Neural Networks; Plant Disease Classification; Image Processing

1. INTRODUCTION

Agriculture is the primary source of livelihood in India. As India's economy is based on agriculture production, greater care of food production is necessary. Identifying plant disease is key to preventing yield losses and the quantity of agricultural produce. Monitoring of heath and disease detection in plants is very important for sustainable agriculture Naked eye methodology could be a ancient methodology of distinguishing the diseases that involves immense man power, inaccurate, time overwhelming and not applicable for larger fields. In addition, it's terribly valuable because it needs continuous watching by the consultants. There's need of the system that automatically not only classify or detect the disease but also provide an appropriate solution within time. This can be done by deep learning efficiently and reliably. The advantage of using deep learning is to avoids the use of hand engineered feature, take less time in testing and provide solution quickly [2].

Among various learning approaches, currently various machine learning and deep learning methods are created and deployed such as supervised learning models are deployed for image classification and detection in agriculture as well as in many other fields like video shriveling, medical, face recognition etc. In this paper, we use CNN as model for developed works with the principle of Convolutional Neural Network i.e., extracting appropriate features automatically ([5], [16], [7])

Supervised models are deployed in agriculture to perform various tasks like image classification, image segmentation and object detection. On giving raw data deep learning can extract feature automatically it is main advantage of using deep learning. on the basis of number of layers and various functions architecture of each models may vary from one another. The base part of every deep learning model for computer vision and image processing application is the Convolutional Neural Network (CNN). Various layers that CNN incudes are convolution layer, pooling layer, fully connected layer, activation layer, etc.

The rest of this paper, Literature Survey discussed in Section II. Methodology in Section III. Finally Concludes the Paper in Section IV.

2. LITERATURE REVIEW

In this section, varied technique of image process for disease detection is mentioned.

Convolution is that the initial layer to extract options from associate degree input image. Convolution preserves the link between pixels by learning image options victimization little squares of computer file. it's a mathematical process that takes 2 inputs like image matrix and a filter or kernel. Wenjing Huang et al developed the new spectral indices for distinguishing the winter wheat illness. They contemplate 3 completely different pests (Powdery mildew, yellow rust and aphids) in winter wheat for his or her study. the foremost and therefore the least relevant wavelengths for various diseases were extracted victimization RELIEF-F algorithmic program. Relief is associate degree algorithmic program developed by Kira and Rendell in 1992 that takes a filter-method approach to feature choice that's notably sensitive to feature interactions. [1][2] it absolutely was originally designed for application to binary classification issues with separate or numerical options. Relief calculates a feature score for every feature which might then be applied to rank and choose prime evaluation options for feature choice. or else, these scores could also be applied as feature weights to guide downstream modelling. Relief feature evaluation is predicated on the identification of feature worth variations between nearest neighbor instance pairs. If a feature worth distinction is discovered during a neighbor instance combine with constant category (a 'hit'), the feature score decreases. or else, if a feature worth distinction is discovered during a neighbor instance combine with completely different category values (a 'miss'), the feature score will increase. the initial Relief algorithmic program has since impressed a family of Relief-based feature choice

algorithms (RBAs), together with the Relief-F algorithmic program. on the far side the initial Relief algorithmic program, RBAs are tailored to (1) perform additional dependably in screaming issues (2) generalize to multi-class issues (3) generalize to numerical outcome (i.e. regression) issues, and (4) to create them strong to incomplete (i.e. missing) information. The classification accuracies of those new indices for healthy and infected leaves with mildew, yellow rust and aphids were 86.5%, 85.2%, 91.6% and 93.5% severally [1]. increased pictures have prime quality and clarity than the initial image. Colour images have primary colours red, green and blue. It is become difficult to implement the applications using RGB values. Because RGB ranges in range i.e. 0 to 255. Hence, It's better to convert the RGB images into the grey images. Then the histogram equalization is applied in order to distributes the intensities of the images to enhance the plant disease images.

M.Jhuria, A.kumar and Rushikesh Borse proposed "Image Processing for Smart Farming: Detection of Disease and Fruit Grading" [3] they used Artificial Neural Network in image classification to detect disease in fruit plant. For this they select apple and grapes. To mapped original features, they used Euclidean Distance concept and mainly they used colour, morphology and texture as a feature for classification. They also work on grading system. Advantage is they show how can be easily known quality of fruit by using weight of fruit and this will help in smart framing [3].

Hari, S.S., Sivakumar, M., Renuga, P., karthikeyan, S., & Suriya, S.(2019)."Detection of Plant Disease by Leaf Image using CNN" [14]. In this they used CNN for plant disease detection. They explain CNN algorithm its different layers such as Convolutional layer, Maxpooling layer, ReLU Activation Function, etc. They trained their PDDNN model from very basic level to focus on plants and its type of diseases. Their model consists of layers from layer 0 to layer 16. The advantage of their proposed methodology that it produces 86% accuracy and they mentioned that as they used very few numbers of classes of plant they will increase it in future.

Suma, V., Shetty, R.A., Tated, R.F., Rohan, S., & Pujar, T.S.(2019) [15]."CNN based Leaf Disease Identification & Remedy Recommendation System". Here in this paper thet take care that only the part of the plant that is affected by disease only focus on it and never disturbed the other part or not to harm soil condition. In this they collect data from PlantVillage website and data comprised from more than 5000 images and 1000 images were used to validate. They used 2 algorithms machine learning algorithms and ANN algorithms. They divide dataset like for training 70%, for validation 10% and for testing 20%. By applying networks, they get 99.32% classification ability. They clear that reliable result can be achieved by applying their proposed methodology.

Hidayatulaoh, A., Nursalman, M., & Nugraha, E.(2018) [16]." Identification of Tomato Plant Diseases by Leaf Image Using Squeezent Model" in this they work on tomato plant disease. For that they used squeezent architecture, so that the model will work on smartphone devices, server computing and microcontroller devices because the model that was produced by this architecture is with relatively small size. They took 7 types of tomato plant diseases in consideration and for the development of model they used keras deep learning frameworks. They work on image data that was compressed from 1400 images of plant leaves which they took from Vegetable Crops Research Institute (Balitsa) in Lembang. Here they used confusion matrix to calculate effectiveness of classification at each epoch. They gave different tables and according to that they got results that accuracy is directly depending on number of epoch and inversely depend on computational time and the average accuracy they got was 86.92%

3. METHODOLOGY

In Fig 3.1 shows workflow diagram showing the experimental design of a CNN. Which helps predict whether the plant is infected or not.

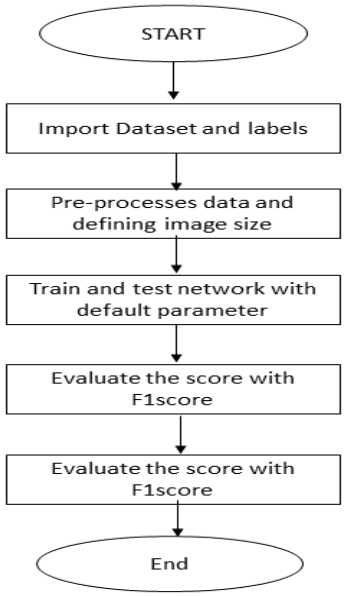

Fig 3.1

The convolutional neural layer receives as input a RGB image or an output of another layer for further processing. CNN image classifications take an input image, process it and classify it under certain categories (E.g. Tomato, Potato, Pepper Bell). Computers sees a input image as array an pixels and it depends on the image resolution. Based on the image resolution, it will see h x w x d (h = Height, w = Width, d = Dimension). Eg., An image of 6 x 6 x 3 array of matrix of RGB (3 refers to Red, Green, Blue values) and an image of 4 x 4 x 1 array of matrix of grayscale image.

3.1. Pre-processing images data

We are taking dataset containing pepper bell, potato and tomato plants of 15 different types of diseased and healthy plants. Most of images in dataset are of different shapes, which brings us to pre-Processing data making of default size 256 X 256. Most of images are taken from plant village dataset. Pre-processing includes reduction in size and cropping the image to a specified size and region of interest respectively. It also enhances the image to the required colour scale and is processed.

Fig. No. 3.2

3.2. Convolutional Neural Network (CNN)

Convolutional Neural Network (CNN) is a supervised deep learning technique, Components of a CNN model includes activation functions, pooling layers, convolutional layers, fully connected layers, etc. As per the Fig no.3.3, the use of this network layer specified might vary. Input received is read as pixel values to produce feature map representing. The layer receives as input RGB image or an output of another layer for further processing. colour image can be represented in tensor flow and the matrix representation of each channels namely Blue, Green and Red. Training can be done by varying the basis of following hyper parameter Number of filters, Padding, Stride, Spatial-extent.

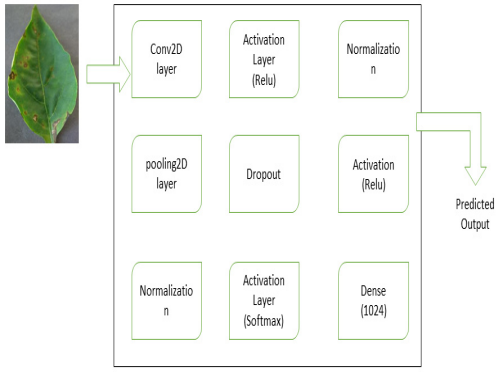

Fig No. 3.3

Convolution is the first layer to extract features from an input image. Convolution preserves the relationship between pixels by learning image features using small squares of input data. It is a mathematical operation that takes two inputs such as image matrix and a filter or kernel.

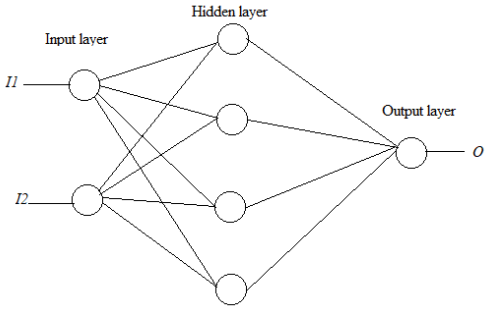

Fig No. 3.4

Neural Networks consists of following layers

1. Activation Layer

In artificial neural networks, the activation function of a node defines the output of that node given an input or set of inputs. A standard computer chip circuit can be seen as a digital network of activation functions that can be "ON" (1) or "OFF" (0), depending on input. The purpose of the activation function is to introduce non-linearity into the output of a neuron.

Tanh: This non-linearity takes in the output of neuron real valued number to the range [-1,1], which is mathematically represented as

$$\tanh(x) = 2\sigma(2x)-1$$

Sigmoid: A standard choice for a *sigmoid function* is the logistic function shown in the first figure and defined by the formula

$$\sigma(x) = 1/(1+e^{-x})$$

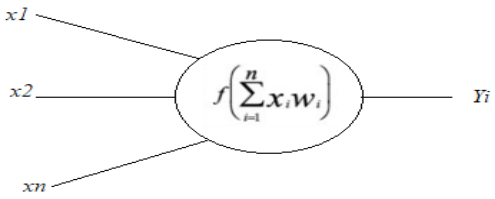

Fig No. 3.5

2. Pooling layer

Its function is to progressively reduce the spatial size of the representation to reduce the amount of parameters and computation in the network. Pooling layer operates on each feature map independently.

The most common approach used in pooling is max pooling. Its function is to progressively reduce the spatial size of the representation to reduce the number of parameters and computation in the network.

4. CONCLUSION

Agriculture suffers from a severe downside, plant diseases, that reduces the assembly and quality of yield. Besides, the shortage of medical specialty tools in underdeveloped countries contains a devastating impact on their development and quality of life. Hence, there's associate degree imperative got to notice the plant diseases at the first stage with reasonable and simple to use solutions. This gift study deals with CNN that's the automated health problem detection victimization image process techniques. It involves loading a picture, image pre-processing, image segmentation, feature extraction and classification. Development of automatic detection system victimization advanced technology like image method facilitate to support the farmers among the identification of diseases at associate degree early or initial stage and provide useful knowledge for its management. Concludes that these disease detection techniques show a potency and accuracy specified they need the power to run the system developed for detection of diseases besides having some limitations. Therefore, there's tons which will still be wiped out this field for improvement of the prevailing works.

5. REFERENCES

[1]. Jingcheng Zhang, Linsheng Huang, Wenjiang Huang, Qingsong Guan, Juhua Luo, Jinling Zhao, Dong Liang, and Dongyan Zhang, "New Optimized Spectral Indices for

Identifying and Monitoring Winter Wheat Diseases", IEEE journal of selected topics in applied earth observation and remote sensing,Vol. 7, No. 6, June 2014

[2]. Annapoorani, T., Puspha Annabel, L. S., & Deepalakshmi, P. (2019). Machine Learning for Plant Leaf Disease Detection and Classification – A Review. 2019 International Conference on Communication and Signal Processing (ICCSP). doi:10.1109/iccsp.2019.8698004

[3]. Ashwani Kumar, Monica Jhuria, and Rushikesh Borse, "Image Processing For Smart Farming: Detection Of Disease And Fruit Grading", Proceedings of the 2013 IEEE Second International Conference on Image Information Processing (ICIIP-2013

[4]. Hughes, D. P., Mohanty, S. P., & Salathé, M. (2016). Using Deep Learning for Image-Based Plant Disease Detection. Frontiers in Plant Science, 7. doi:10.3389/fpls.2016.01419

[5]. T. Weyand, B. Chen, A. G. Howard, M. Zhu, D. Kalenichenko, W. Wang, M. Andreetto, and H. Adam, "Mobile Nets: Efficient Convolutional Neural Networks for Mobile Vision Applications," 2017.

[6]. K. P. Ferentinos, "Deep learning models for plant disease detection and diagnosis," Comput. Electron. Agric., vol. 145, no. September 2017, pp. 311–318, 2018.

[7]. A. Kamilaris and F. X. Prenafeta-Boldú, "Deep learning in agriculture: A survey," Comput. Electron. Agric., vol. 147, no. July 2017, pp. 70–90, 2018.

[8]. Usama Mokhtar, Mona A. S. Ali, Aboul Ella Hassenian, Hesham Hefny," Tomato leaves diseases detection approach based on support vector machines," IEEE,2015

[9]. Bashish, D.A., Braik, M., Ahmad, S.B., 'A Fremework for Detection and Classification of Plant Leaf and Stem Diseases', International Conference on Signal and Image Processing, pp. 113-118, 2010

[10]. Pujari, J.D., Yakkundimath, R., Byadgi, A.S., 'Image Processing Based Detection of Fungal Diseases In Plants', International Conference on Information and Communication Technologies, Volume 46, pp. 18021808, 2015

[11]. S. D. Khirade and A. B. Patil. "Plant Disease Detection Using Image Processing". In: 2015 International Conference on Computing Communication Control and Automation. Feb. 2015, pp. 768–771. DOI: 10.1109/ICCUBEA.2015.153

[12]. Usama Mokhtar et al. "Tomato leaves diseases detection approach based on support vector machines". In: Computer Engineering Conference (ICENCO), 2015 11th International. IEEE. 2015, pp. 246–250.

[13]. H Sabrol and K Satish. "Tomato plant disease classification in digital images using classification tree". In: Communication and Signal Processing (ICCSP), 2016 International Confer- ence on. IEEE. 2016, pp.

[14]. S. Santhana Hari, Mr. M. Sivakumar "DETECTION OF PLANT DISEASE BY LEAF IMAGE USING CONVOLUTIONAL NEURAL NETWORK".

[15]. R Amog Shetty, Rishab F Tated, Sunku Rohan, Triveni S Pujar "CNN based Leaf Disease Identification and Remedy Recommendation System", 978-1-7281-0167-5/19/$31.00 ©2019 IEEE

[16]. Hidayatulaoh, A., Nursalman, M., & Nugraha, E., "Identification of Tomato Plant Diseases by Leaf Image Using Squeezent Model", 978-1-5386-5693-8/18/S31.00 ©2018 IEEE

6. AUTHOR PROFILE

	**Ketan P. Pise** currently pursuing the B.E degrees in Information Technology from Shri Sant Gajanan Maharaj College of Engineering in Sant Gadge baba Amravati University.
	**Jayashri S. Salampuriya** currently pursuing the B.E degrees in Information Technology from Shri Sant Gajanan Maharaj College of Engineering in Sant Gadge baba Amravati University.
	**Amit kumar Manekar** Assistant Professor and Head of Department, Data Mining, Big Data Analysis and Internet Security