IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-6, Issue-12, Dec 2018 E-ISSN: 2347-2693

Plant Disease Detection System for Agricultural Application in Cloud Using CNN

Raghavendran.S[1*], P.Kumar[2], Silambarasan. K[3]

[1, 3]Centre for Information Technology and Engineering, Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli-627012, Tamilnadu, India
[2]Centre for Information Technology and Engineering, Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli-627012, Tamilnadu, India

[*]Corresponding Author: vsraghavendran@gmail.com, Tel.: +91-95662-17267

Available online at: www.ijcseonline.org

Accepted: 10/Dec/2018, Published: 31/Dec/2018

***Abstract*—** Plants are cultivated for food, medicine, clothing, shelter, fiber, and beauty for thousands of years. Fungi, bacteria, and viruses are the causing source of plant disease. So, need of an Automatic detection of plant disease for this problem. A traditional method of plant disease detection is not efficient and also unreliable. Due to pest attack, nearly 18% of crop yield is lost in worldwide during every year. Identification of plant disease is difficult in manually but which is a key factor to preventing the losses. In existing, a module is applied in a farm, that contains large number of different sensors and also a device is used for converting and transfer data for monitoring and controlling purposes. And then Image processing is showing the disease visually. In this, we approach a Convolutional Neural Network (CNN) classification model deployed in a smart phone app and also responsible to predict the plant disease for dynamic plants image. This method is generic and useful. Frequently, we should adding and updating new diseases in the datasets and then cloud computing is used for storing, retrieving and serving data. Captured image of normal plants are stored in the cloud server, and these images are compared with the diseased plant leaves in the cloud campus. This paper presents a automated detection of various diseases associated with crops and also given a proposed methodology for computing amount of diseases in various crops.

***Keywords*—** Convolutional Neural Network (CNN),Cloud Computing, Advanced Neural Network

I. Introduction

In general, the plant normal routine life affected by causal agent which is continuously disturbed the plants physiological growth and also disrupts the plants structure, function and other activities. India has progressed and achieved a goal in various sectors, but that are not compatible with new available technologies. In agriculture, the major threat is loss of food security by diseases and pest infestations. By this threat a smallholder farmers income only affected. The proposed paper provides an effort to create an automatic image-based classification system. Classification technique is K-Means Algorithm and SVM technique. The features of the plants were extracted and then sent the images for the segmentation process. Already, the large number of samples is stored; this will provides the true and false positions, the true and false negativities, the accuracy and the specificity. This method is not applicable to view the infections through Mobile Application [1].Remote sensing provides the real time farm details to farmers by this architecture. The project therefore involves a system architecture which allow user to achieve all above activities in real time so that farmers can view their farm details from remote location. This remote sensing application only suitable for the finding bugs. Uploading pictures in a dataset is difficult [2]. The advanced Neural Network (NN) techniques available to process hyper Received spectral data, with a special emphasis on plant disease detection. Spectral Disease Index (SDI) is the ratio of different spectral bands of pure disease spectra. We also highlight current challenges and future trends of hyper spectral data. It does not recognize simplest household plants because the admin not maintain properly and languages not working properly [3-6]. A novel web enabled disease detection system (WEDDS) based on compressed sensing (CS) is proposed to detect and classify the diseases in leaves [15]. Statistical based thresholding strategy is proposed for segmentation of the diseased leaf. CS measurements of the segmented leaf are uploaded to the cloud [16] to reduce the storage complexity Disease identification is poor. Many times false identification of diseases. False identification leads to loss of farmer and app users [7-10].

II. PROPOSED SYSTEM

The proposed system targets on plants grown on even a small scale area. The diseases are identified from the single leaf of an affected plant. Our main objective is to detect disease in an earlier stage because the affected plant spreads the disease very rapidly to other plants which will reduce the losses. A single leaf is taken from a diseased plant for the classification process. The proposed system, uses a prominent deep learning technique that is Convolutional Neural Network (CNN). Two in built architecture models are in CNN that are Inception v3 and Mobile Net. These two architectures are analyzed to study both in terms of accuracy, training speed. Limited numbers of normal and diseased plants datasets are used by Generative Adversarial Networks (GANs). To overcome the traditional methods we use a end-to-end supervised training deep convolutional neural network architecture. This is a applicable for very large number of classes and also practical hope for a classification problem. The multiple input maps with convolution give output map. Already we know that,

$${}_j^{\ell} = f\left(\sum_{i\in M_j} \mathbf{x}_i^{\ell-1} * \mathbf{k}_{ij}^{\ell} + b_j^{\ell}\right)$$

This computation is done for each map *j* in the convolutional layer and then pairing it with the analogous map in the sub sampling layer,

$$\boldsymbol{\delta}_j^{\ell} = \beta_j^{\ell+1}\left(f'(\mathbf{u}_j^{\ell}) \circ \mathrm{up}(\boldsymbol{\delta}_j^{\ell+1})\right)$$

Now, we compute the gradients for *b* and *β*. The additive bias is the sum of sensitivity map elements,

$$\frac{\partial E}{\partial b_j} = \sum_{u,v}(\boldsymbol{\delta}_j^{\ell})_{uv}$$

Then the gradient for *β* is given by

$$\frac{\partial E}{\partial \mathbf{k}_{ij}^{\ell}} = \sum_{u,v}(\boldsymbol{\delta}_j^{\ell})_{uv}(\mathbf{p}_i^{\ell-1})_{uv}$$

Error function can be computed by,

$$\frac{\partial \tilde{E}^n}{\partial c_i} = \frac{\partial E^n}{\partial c_i} + \frac{\partial \Omega}{\partial c_i}$$

In this paper, bibliographic analysis involves following two steps

(a) Collection of related work.

(b) Detailed report and study of these collected works.

The first step shows that, the related works are collected by using the CNN technique in the agriculture. The following criteria were used to define convenient application of CNN:

1. To addressing the problem of plants use a CNN or CNN-based approach.

2. Target some problem or challenge which plant is a root cause of the disease.

3. The well-defined performance metrics are Shown by the practical results which represents given technique was successfully used.

Some performance metrics are defined as below,

- Root Mean Square Error (RMSE): Difference between predicted values and observed values from the Standard deviation.

- Quality Measure (QM): By multiplying Sensitivity (proportion of pixels that were detected correctly) and Specificity (Proportion of detected pixels are truly correct).

Life CLEF Metric (LC): A score related to the rank of the correct species in the list of retrieved species during the Life CLEF.

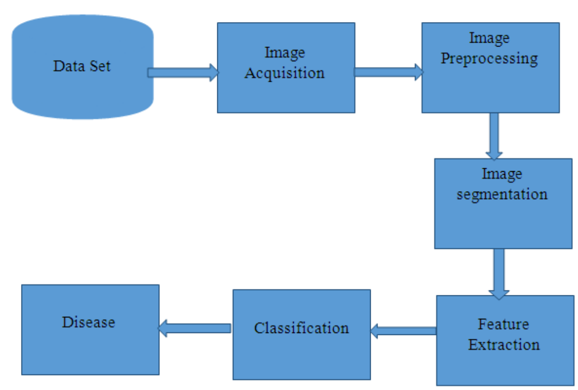


Fig 1: Block Diagram

The block diagram explains that whether the plant is affected by the disease or not. The images of the unhealthy plants are loaded in the data set. Then the visual characteristics of the image are converted into digitally encoded representations by the image acquisition operation which shows an interior structure of the plants. After that the unwanted distortions are cleared and the images are enhanced by the preprocessing. The digitally encoded images are partitioning as multiple segments that is called as super-pixels. Here manageable groups are formed by reduced set of raw variables for processing, but the image sets are describing the original data set accurately and completely. In this we are using a CNN as classification tool. After classification the images are compared with the images which are stored in the cloud environment. The cloud environment is nothing but a storage area. Then, that cloud campus shows the plant is affected by the disease or not.

Final CNN training parameters values are shown in the following table 1,

Parameter	Value
Batches/epoch	10,000
Batch size	32
Momentum	0.86
Weight decay	0.000512
Learning rate	0.01–0.0001

III. METHODOLOGY

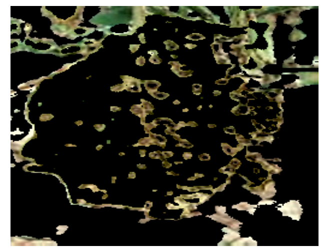
The following table shows that, the sample leaf is Healthy or Unhealthy

S.No	Samples	Healthy/ Unhealthy	Accura cy	Affected Area
1	Sample 1	Unhealthy	97%	20.16%
2	Sample 2	Unhealthy	97%	15.31%
3	Sample 3	Unhealthy	95%	15.01%
4	Sample 4	Healthy	95%	32.13%
5	Sample 5	Unhealthy	98%	14%

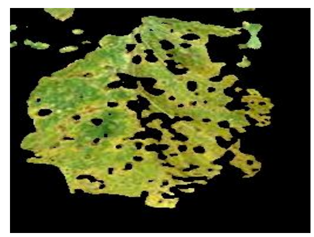
The images are loaded to data set and which segment the images and then the cloud campus exhibit the leaf is affected or not affected by disease.

Contrast Enhanced

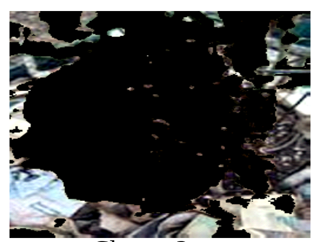
Fig 2: Captured Images



Cluster 1



Cluster 2



Cluster 3

Fig 3: Cluster Images

Fig 2 shows the naturally captured image of plant leaf is considered as a input image. We are splitting three clusters for the identification process. In cluster 1 the outer layer of the capture image is highlighted. In cluster 2 the leaf part only projected. In cluster 3 the background parts are projected. These clusters are defined for the prediction of the disease correctly. Finally the clustered images are compared with the cloud environment which has a natural healthy leaf image.

IV. Results and Discussion

Farmers facing loss in agriculture because of the plants which are affected by pests, pathogens and weeds. In our system specialized deep learning techniques are used that is Convolutional Neural Networks which detect the plant diseases with help of leaf images of healthy or diseased plants. The images needed for the experiment is captured from various places by camera and also gathered from various resources. Our experimental results and comparisons of system provide the accuracy level of both healthy and unhealthy with the affected area. Pests diseases are generally not a major problem in organic systems, since healthy plants living in good soil with balanced nutrition are better able to resist pest/disease attack. We hope our proposed system will make a suggestive contribution to the agriculture research.

References

[1] Nasir, Fakhri A. M. Nordin Rahman A., and A. Mamat Rasid. "A study of image processing in agriculture application under high performance computing environment." International Journal of Computer Science and Telecommunications 3, no. 8 (2012): 16-24.

[2] Prasad, Shitala, K. Peddoju Sateesh, and Ghosh Debashis. "AgroMobile: a cloud-based framework for agriculturists on mobile platform." International Journal of advanced science and technology 59 (2013): 41-52

[3] Mohanty, Sharada, David P. Hughes, and Salathé Marcel. "Using deep learning for image-based plant disease detection." Frontiers in plant science 7 (2016): 1419.

[4] Radford, Alec, Metz uke, and Chintala Soumith. "Unsupervised representation learning with deep convolutional generative adversarial networks (2015)." arXiv preprint arXiv:1511.06434

[5] Yan Simon, Karen, and Zisserman Andrew. "Very deep convolutional networks for large-scale image recognition." arXiv preprint arXiv:1409.1556 (2014).

[6] David Hughes, , and Salathé Marcel. "An open access repository of images on plant health to enable the development of mobile disease diagnostics." arXiv preprint arXiv:1511.08060 (2015).

[7] Szegedy, Christian, Vanhoucke Vincent, Ioffe Sergey, Shlens Jon, and Zbigniew Wojna. "Rethinking the inception architecture for computer vision." In Proceedings of the IEEE conference on computer vision and pattern recognition, pp. 2818-2826. 2016.

[8] Andrew Howard G., Zhu Menglong, Bo Chen, Dmitry Kalenichenko, Wang Weijun, Tobias Weyand, Andreetto Marco and Hartwig Adam. "Mobilenets: Efficient convolutional neural networks for mobile vision applications." arXiv preprint arXiv:1704.04861 (2017).

[9] Giusti, Alessandro, Guzzi jérôme, Dan C. Ciresan, Fang-Lin He, Rodríguez Juan P, Flavio Fontana, Matthias Faessler et al. "A Machine Learning Approach to Visual Perception of Forest Trails for Mobile Robots." IEEE Robotics and Automation Letters 1, no. 2 (2016): 661-667.

[10] Augustus Odena. "Semi-supervised learning with generative adversarial networks." arXiv preprint arXiv:1606.01583 (2016).

[11] Zhao, Fuqing, Zongyi Ren, Dongmei Yu, and Yahong. "Application of an improved particle swarm optimization algorithm for neural network training." In Neural Networks and Brain, 2005. ICNN&B'05. International Conference on, vol. 3, pp. 1693-1698. IEEE, 2005.

[12] Vinod Nair, and E. Hinton Geoffrey. "Rectified linear units improve restricted boltzmann machines." In Proceedings of the 27th international conference on machine learning (ICML-10), pp. 807-814. 2010.

[13] Yann LeCun, Patrick Haffner, Bottou Léon, and Yoshua Bengio. "Object recognition with gradient-based learning." In Shape, contour and grouping in computer vision, pp. 319-345. Springer, Berlin, Heidelberg, 1999.

[14] Kaibo Duan, , S. Keerthi Sathiya, Wei Chu, Krishnaj Shirish Shevade, Neow and Aun Poo. "Multi-category classification by soft-max combination of binary classifiers." In International Workshop on Multiple Classifier Systems, pp. 125-134. Springer, Berlin, Heidelberg, 2003.

[15] S.K. Badugu, R.K. Kontham, V.K. Vakulabharanam, B. Prajna Calculation of Texture Features for Polluted Leaves "International Journal of Scientific Research in Computer Sciences and Engineering" Vol.6 , Issue.1 , pp.11-21, Feb-2018

[16] Sakshi kathuria "A Survey on Security Provided by Multi-Clouds in Cloud Computing" International Journal of Scientific Research in Network Security and Communication, Vol.6 , Issue.1, pp.23-27, Feb-2018

Authors Profile

Raghavendran.S has received his Master of Engineering (M.E) degree in Computer Science and Engineering from Anna University, Chennai, Tamilnadu, India in 2010 and Bachelor of Engineering (B.E) degree in Computer Science and Engineering from Anna University, Chennai in 2008. Currently, he is pursuing Research work leading to PhD degree in Centre for Information Technology and Engineering, Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli-627012, Tamilnadu, India. His area of Research includes Cloud computing, Image Processing, Virtual machine optimization, Network security and Internet of Things. He has published over 5 papers in peer-reviewed International Journals. His current research work includes Agriculture Applications using IoT and cloud environment.

Kumar Parasuraman obtained his M.Tech., Ph.D., degree in Information Technology - Computer Science and Engineering from ManonmaniamSundaranar University, India and M.B.A. degree in Systems from Alagappa University, India. He is currently working as an Assistant Professor with the Department of Information Technology and Engineering, ManonmaniamSundaranar University, Tirunelveli, Tamil Nadu, India. He has published around 70 research papers in International / National journals/proceedings/books. His current research interests include signal and image processing, visual perception, Cyber Security, Pattern Recognition and Big Data Analytics.

Silambarasan. K has Received his Master of Technology (M.Tech) degree in Computer Science and Engineering from SASTRA University, Tanjore, Tamilnadu, India in 2010 and Bachelor of Engineering (B.E) degree in Electronics and Communication Engineering from Anna University, Tamilnadu, India in 2006. Currently, he is pursuing Research work leading to PhD degree in Centre for Information Technology and Engineering, Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli-627012, Tamilnadu, India. His area of Research includes Cloud computing, Virtual machine optimization, Network security, Internet of Things. He has published over 6 papers in peer-reviewed International Journals and 2 IEEE conferences. His current research work includes Healthcare services using IoT and cloud environment.