Third International Conference on "Materials, Computing and Communication Technologies"
in association with International Journal of Scientific Research in Science,
Engineering and Technology
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)

Image Processing and Segmentation in Deep Learning Using CNN Algorithm for Leaf Disease Detection

K.P.Sriram, K.Reshmaa and K.Sowhanthika

Department of Electronics and Communication Engineering, Annai Vailankanni College of Engineering, Tamil Nadu, India

ABSTRACT

India is fast developing country and agriculture is the back bone for the countries development in the early stages.Leaf disease detection requires huge amount of work, knowledge in the plant diseases, and also require the more processing time. The objective of this research is to make use of significant features and prediction is done using CNN technique. This method mainly captures the image of a leaf, it is uploaded and then it is retrieved from the server.The main objective of this project is to find out whether the leaf is defected or not. if the leaf is in green color, then there is no defect in the leaf. if the leaf is spotted with black dots then it is shown to be affected by some disease and then we are predicting the disease of leaf and its lifetime is also too low. This approach can significantly support an accurate detection of leaf disease. By computing amount of disease present in the leaf, we can use sufficient amount of pesticides to effectively control the pests in turn the crop yield will be increased. We can extend this approach by using image processing technique. The user can also able to view the result in the mobile using the mobile app development.

I. INTRODUCTION

Arduino Agriculture is thecornerstone of all cultures and civilizations. In order for any country to effectively achieve stable economic growth, improvement in agricultural productivity and fiscal restraint are considered necessary. A division of agricultural science can be used as a plant pathology to treat fungi, bacteria, viruses, nematodes, and other microbes that cause plant pathogens. Plants can be fail to reduce their skill to survive/ reproduce because of plant diseases and disorders. Any unhealthful illness that affects the look or function of a plant is known to be a plant disease. Plant diseases can lead to crop losses. It is found that crop losses have increased from 34.94% in 1965 to about 42.12% in the late 1990s because of pests and crop diseases. And this phenomenon is very disturbing. Because of that it is compulsory to find safe and effective for treat and identify crop diseases. Harvested plants are more vulnerable to disease than their related species. Identifying and diagnosing diseases is therefore an essential and urgent operation. Necked eye observation by experts is the ultimate method used in enactment to diagnose and identify plant diseases. Nonetheless, that needs constant supervision of experts who may be incredibly expensive in farm lands and may be critical when it comes to gardening recruiting experts.

II. BACKGROUND

Because plant diseases are inescapable, disease detection plays a key role in agriculture. Plant pathogens consist of fungi, organism, bacteria, viruses, phytoplasmas, viriods etc. Three components are absolutely necessary for diseases to occur in any plant system and which may infect all types of plant tissues including leaves, shoots, stems, crowns, roots, tuber, fruits, seeds and vascular tissues. Plant diseases still claim 10 to 16 % of the total global harvest. Therefore, detection and classification of diseases is an important and urgent task.

Even though naked eye observation by specialists has been considered as the predominant method of identifying crop diseases and pests, with the rise of technology it can archive a better accurate and reliable observations and save our valuable crops and cultivators by providing precise information about crop diseases in a very efficient way.

For detection of crop diseases and pests in agricultural applications a tremendous amount of researches have been carried out use of various kinds of procedures. Above kinds of researches will be establishes in upcoming chapters. Lately, with the evolution of mobile phone industry mobile phone and server based approaches has been appointed for crop disease recognition.

High quality and high resolution camera, high performance processing and large-scale built in accessories are included extra precedence resulting building automated disease recognition systems. The growth of machine learning technology and artificial intelligence has been engaged to escalate the accuracy, reliability and efficiency of predictions.

In this project primary research was done using paper surveys, the information that has been gathered by visiting various kinds of local agricultural environments. And the secondary research of the project was done using research papers, journal articles and e-books on image processing, machine learning and artificial intelligence while observing the alternative solutions that currently available. The below titles will establish the existing solutions and similar systems present in the current market and the technologies will be used.

III. METHODOLOGY

This section of the report establishes various kinds of research methodologies that have beencarried out throughout the project time line and important discoveries acquired through theseresearchmethodsfollowedbytheempiricalculminationswhichhavebeenfabricatedbyanalyzingallthefeasible waysthatcould betaken to addresstheabovementionedissue.

Research methods

The main two research methods that are subsequently verified to deliver the most suitable andfeasible methodology in order to perform research and analysis of this scope. Primary researchcontains of engaging and insightful ways to gather data and important information, such asdiscussions, surveys, assessments, questionnaires and etc. And secondary-research focuses solelyon existing literature, it has been examined and studied for feasibility studies through reviewingdifferent kinds of journal articles, journals, books and other

reliable sources. In addition, toolssuch as tutorials and existing community websites such as Stack Overflow and GitHub have alsobeenused.

Primary research

Performing a primary research is important in order to get along with the system specificationsand a good design of a system because system requirement specifications and client needs can beestablishes through a proper primary research. This form of research was necessary to determineclient needs, problems that they currently face and how much impact would hold if theprojectsucceed.

Secondary research

Analysis and review of current existing literature can be taken as the second-research of theproject. For the dissertation aspect of this project, journal articles and books were mainly used togather information. The journals and research papers have been selected as clearly and firmlyviable sourcesprovidingprecise knowledgewithlawfulauthorization.

IV. DISCUSSION

Plant Safe is a deep learning based cross platform mobile application which is developed toidentify plant diseases by analyzing the plant leaf. Crop diseases recognizing machine learningmodel is developed using deep learning algorithm Convolutional Neural Network. In featureextractionof plantleavesthesystem hasinitiatedamechanismthataccede thesystem toautomate feature extraction process using a CNN based architecture. As the dataset which wasused to train the model it has used 10,000 images of diseased leaves which was categorized in to10 different classes for the classification. The diseased plant leaves that needs to be captured areall collected manually one by one visiting local real time agricultural areas and confirmed theselected plant diseases with the help of District Agriculture Extension Office-Gampaha. Allimages were captured in a clean and noiseless environment and were split into 3 groups namedtraining data that is used to train the machine leaning model, validation which was used tovalidate the model data and test data was used in testing the model with new data and make thedecision whether the model is a finemodel which performs well in real time data or not. Thefinal machine learning model consists with the overall training accuracy of 93.75% and 16.24%loss which can be more improved by necessitating more knowledge on CNN architecture designphase. When analyzing the confusion matrix along with the generated graphs it can come to afinalconclusionaboutthetrainedmachinelearningmodeltoidentifycrop diseases.

Thetrainingaccuracycanbemoreimprovedbysupportingmoredataandthedeveloperrecommends to perform the experiments on the same field by choosing traditional machinelearning techniques such as random forest, K-NN and SVM classifier and make a comparisonbetween on the model accuracy on each machine learning algorithm as well. Comparing the sizeof the dataset that has been used in real time machine learning models the size of the dataset thathas been used to develop this system can be improved more and if the dataset size is improvedthemodel

accuracyandrealtimepredictionresultscanbeimprovedbydesigntheCNNarchitecturewithmoreconvolutionallayers,activationfunctionsandfullyconnectedlayers.

V. CONCLUSION

The report emphasized about the design and implementation of a deep learning based crossplatform mobile application that identify crop diseases by analyzing plant leaves. In order todeliver a quality product the research is carried out on image processing techniques, artificialintelligence, traditional machine learning techniques and deep learning based approaches alongwith the similar system casestudy. In order to handle the feature extraction of diseased plantleaves it is used deep learning which can handle automatic feature extraction process. Each andevery selected technology for each and every task in this project has justified along with thesupportedevidences.

Furthermore, the developer has archived 93.75% accuracy for the deep learning model whichperforms well on both validation and real time data. The dataset for the project had to createmanually by visiting local agricultural areas and capturing images of various kinds of diseasedleaves. The strategy of this CNN architecture and the result of the model are based on bothvalidationandtestdataset.Throughouttherepresentationoftheconfusionmatrixwhichillustratetheaccuracyofthe testdatatheperformance ofthemodelhasbeendecided.

A server based cross platform mobile application that can recognize plant diseases by analyzingplant leaves will help a lot of farmers and people who gardening for their day to day usage in SriLanka. This will help for the people who don't have a knowledge in crop diseases to get aperception about the plant disease spectrums. A great accomplishment and a real move forwardwouldbetobeabletoreliablydeterminetheeffectofpestsandplantdiseasesoncropproductionbyintroducingtheaboveemphasizedsystem.

VI. REFERENCES

[1]. Arthur Kelmam, "Plant Diseases Encyclopedia. Britannica",2012.Available:http://www.britannica.com/science/plant-disease.

[2]. C. C. Tucker and S. Chakraborty. "Quantitative assessment oflesion characteristics and disease severity using digital imageprocessing",J.Phytopathology,1997,vol.145,pp.273–278.

[3]. S. Ahmad, J. F. Reid, M. R. Paulsen, and J. B. Sinclair, "ColorclassifierforsymptomaticsoybeanseedsusingimageprocessingPlantDisease",1999, vol.83,pp.320–327.

[4]. J. W. Olmstead, A. Gregory, and G. A. Lang., "Assessment ofseverity of powdery mildew infectionof sweetcherry leavesby digital imageanalysi", Hortscience, 2001,vol. 36, pp.107–111.

[5]. J. C. Lai, S. K. Li, B. Ming, N. Wang, K. R. Wang, R. Z. Xie,andS.J.Gao.,"Advancesinresearchoncomputer-visiondiagnosis of cropdiseases. Scientia Agricultura Sinica",2009,vol. 42,pp.1215–1221.

[6]. C. H. Bock, A. Z. Cook, P. E. Parker, and T. R. Gottwald.,"Automatedimageanalysisoftheseverityoffoliarcitruscankersymptoms.PlantDisease",2009,vol.93 ,pp.660–665.

[7]. C. H. Bock, G. H. Poole, P. E. Parker, and T. R. Gottwald.,"Plantdiseaseseverityestimatedvisually,bydigitalphotographyandimageanalysis,andbyhyperspec tralimaging", Critical Reviews inPlant Sciences,Mrach2010,vol. 29,pp.59–107.

[8]. H.Al-Hiary,S.Bani-Ahmad,M.Reyalat,M.Braik,andZ.ALRahamneh,"Fastandaccuratedetectionandclassificationofplantdiseases ",InternationalJournalofComputerApplications,2001, vol.17, pp.31–38.

[9]. D.W.ZhangandJ.Wang,"Designonimagefeaturesrecognition system of cucumber downy mildew based on BPalgorithm", Journal of Shenyang Jianzhu University (NaturalScience),May2009,