LEAF OR SEED CLASSIFICATION OF A PLANT FOR IDENFICATION OF PEST USING DEEP LEARNING

P. Ravindra Department of Computer Science, K.B.N. College, Andhra Pradesh, India
P. Bharathi Devi Department of Computer Science, S.K.B.R.Government Degree College, Macherla, Andhra Pradesh, India
[1]ravindraponugumati@gmail.com, [2] bharathipatnala@gmail.com

Abstract

Today Agriculture comes into picture with a need of technological innovation to save the farmers life and increase the productivity of crops. Most of the farmers attempted suicides because of huge lost in their crops. The farmers look after the crop as like their children. If the crop gives not profit they felt like everything is lost in their life. In Andhra Pradesh, the government give high priority for Agriculture in their budget which was introduced in the year 2019, to increase the productivity of crops and give lots of hope to the farmers. The crop may be destroyed due to the weather conditions, Soil erosion, pest of the crop and damage of a seed. To overcome these problems, it's time to train a model which predict the plant condition and give a notification to the farmer. This paper aims to depict various classification models applied on seed or leaf of plant using deep learning.

Keywords: Image Classification, Seed Classification, Agriculture, Pest Control, Computer Vision.

I Introduction

In the Present era everything is digitized and everyone needs to take the support of technology for speed and accurate outcome in their business or in their individual life. Even in every sector whether may be medicine, agriculture, cyber world, etc., are using technology to predict their results. So it's time for researcher to think over about designing of a machine that predicts the results based on the trained dataset given by the user. Modern computer vision, which is based on artificial intelligence, machine learning, and deep learning, is showing promise in this regard[1]. All these terms may create confusion to the persons who have an interest to do research in the above said fields. Artificial Intelligence (AI) creates a simulation of human brain by using machine and using AI one can design machines which can solve the real world problems as humans do. Machine learning is a subset of AI, which train the algorithms to take decisions. Deep Learning is a subset of Machine learning, which takes decisions based on patterns. The relation between AI, Machine learning and Deep learning as shown below.

Cultivating the crop is a major step in the field of agricultural. As seventy percent of the population in India are cultivating the crops, the improvement in the GDP of the nation is mainly depends on the improvement in the productivity of agricultural plants. If the agricultural plants are free from various crop related diseases certainly there is a improvement in the productivity and there by GDP of the nation[2]. The plant diseases are mainly caused by viruses, bacteria, and fungi. A fungal infected leaf is primarily detected from its morphological structure. At the starting stage, spots on fungal infected leaves turn into brown colour. When there is increase in number of spots, the spots start to touch one another and the entire leaf is infected. Most of the fungal infected spots are in active stage in the wet atmospheric conditions. The presence of bacteria on the leaves of plants is easily identified by looking dark and necrotic spots on them. Even though bacteria is having simpler life cycle, its number will multiply during the process of binary fusion under cool and wet conditions[3]. The binary fusion process, divides the bacteria to reproduce in such a way that a single bacteria can multiply very quickly with in a hour. The reproduction of bacteria takes place when the temperature of surrounding area is in the range of 25-

DOI : 10.36893.DRSR.2022.V09I01N01.992-1004

30^0C (77-86F).Virus is a microscopic particle which subsist of hereditary and protein. Various signs and symptoms of plant diseases can help the farmers to some extent in preventing the crops. The symptom of a diseased plant is a discernible consequence of the disease on the plant's leaf, while the sign of a plant's disease is a physical proof of the pathogen. . Some of the examples of general signs and symptoms of fungal infected, bacterial infected and virus infected are mentioned here under.[4]

Signs of Fungal diseased leave:

1. Leaf (common) rust: It is generally observed in Roses, daylilies, beans, lawns, tomatoes and also in sophisticated plants. It can be seen on the lower surfaces of leaves.

2. Stem rust: Mostly observed in bread wheat, barley, durum wheat, and triticale.

3. Scierotinia: This particular fungal is capable of completely breach the plant host. It is observed in all most all plants.

4. Powdery mildew: It appears as a white colour (looks like leaves are dusted with flour) on the leaves. It affects a wide range of plants and kills the plant nutrient particles.

Symptoms of Fungal disease leave:

1. **Birds- eye spot on berries:** It is look like dark and round spots which are surrounded by lighter tissue. Usually observed on rubber trees.
2. **Damping off of seedings:** It affects seeds at the root level.
3. **Leaf spot:** Generally observed in seeds andalso appeared in some plants after its progress in seeds.
4. **Chlorosis:** Due to lack of chlorophyll the leaves are turned into yellow shades.

Signs of Bacterial disease leave:

1. **Bacterial bleed or drain (Ooze):** If the plant leaves are affected by this bacteria one can observe cracks on the leaf surface. Plants which are under stress may affect this type of bacterial disease.
2. **Hydro sis (Water-soaked lesions):** it is mainly observed in plant cellular parts.

Symptoms of Bacterial disease leave:

1. **Leaf spot with yellow halo:** Generally observed in seeds andalso appeared in some plants after its progress in seeds.
2. **Fruit spot:** It is a symptom of disease generally caused by bacteria or fungi. This fruit infecting organism may also affect the other parts of plants.
3. **Canker:** It is a destructive fungal disease mainly observed in plants like apple and other trees that results in damage to the bark.
4. **Crown gall:** It is observed in plants like pear, apple, cherry, apricot etc. It is detected by overgrowth on roots and at the crown.
5. **Shepherd's crook bacteria:** observed in woody plants.

Signs of Viral disease leave: Viral can't be seen.

Symptoms of virus disease leave:

1. **Mosaic leaf pattern:** Mosaic leaves are in yellow, white, and light dark green colours. Generally plants like tomatoes, cauliflower, squashes, cucumbers and more than one hundred and fifty types plants are affecting by this virus.

DOI : 10.36893.DRSR.2022.V09I01N01.992-1004

2. **Crinkled leaves:** these are caused by many ways like insect damage, abiotic disorders.
3. **Yellowed leaves:** Due to over watering or under watering moisture content of plants increases and the leaves are turned into yellow colour.
4. **Plant stunting:** It is caused by infectious or non-infectious means.

The signs and symptoms of various disease related of plants are helpful in identifying the diseases at an early stage so that heavy loss of crops are avoided. There are number of disease detected methods are developed based on segmentation and classification of plant leaf image and seeds. But now a days deep learning based disease detecting of plants giving promising results.

Methods of Deep Learning Based Image Segmentation

In todays computer vision technology, Deep Learning methods have been very popular. The technology of deep learning spread over different areas of image processing field. It includes deep learning based image classification, detecting the objects in the images, face recognition, analysis of video sequences, processing of images in robots and autonomous vehicles. Most of the computer vision techniques require an intelligent system for segmenting the images for a better understanding of image, which enables user to get accurate detection as well as recognition results. Now a days Deep Learning technique for segmenting the images creating wonders in identifying the real world objects. Dividing the image into meaningful segments(parts) and identifying them is known as Image Segmentation. Each part represents object or parts of the object and inturn each object includes set of pixels or super pixels.[5]

There are two levels in segmenting the image. One is Semantic Segmentation level and other one is Instance Segmentation level. The Semantic Segmentation level tries to classify entire pixels of an image into classes of various object based on the meaning. The classes are semantically interpretable and belong to real world. The Second level is the Instance Segmentation tries to identify each and every instance of each class object of the image. This level does not categorize every individual pixel.

Non-Deep Learning Image Segmentation Methods

All these methods require human expertise and intervention. They also depend more on the algorithm rather than machine.[6]

1. Thresholding:- In this method of segmentation a particular threshold value is maintained whichis used to separate the pixels. The pixels having low value than the threshold value will come under one level and thepixels having higher value of threshold will come under another level. That is this method intended for dividing the whole image into background image and foreground image. Because of this the objects present in the image are isolated one another. In real time after segmentation using threshold method we can observe colour image into two parts as light colour pixels and dark colour pixels otherside of the image whereas the gray image will appear into binary image.
2. K-Means Clustering:- It is a segmentation algorithm used to identify the groups in the image based on a similarity. The number of groups identified is considered as the value of K.
3. Image Segmentation Based on Histogram:- Image histogram is used to group the pixels. It is mainly based on gray levels of the image. The background is one large object for which we can observe high level in the histogram. The low values indicates the object in the image which are having another gray level.
4. Edge Detection:- Based on the brightness of the image this method recognizes the sudden changes and discontinuities in the image. After identifying the discontinuities it arrange those discontinuity points as curved lines or edges.

DOI : 10.36893.DRSR.2022.V09I01N01.992-1004

Image Segmentation based on Deep Learning:-

There are various architectures that uses deep learning methods for performing segmentation of images. The main advantage of using deep learning is that the involvement of humans is less almost null i.e., Automated and also methods are not algorithm oriented they are all depends on the sophisticated machines.[7]

1. Image Segmentation Using CNN:- In this type various segments of image are applied to the CNN as an input. The CNN scans the segment of the image upto it covers the whole image through various filters and label all of them. Based on the labelling of the image the layers in CNN architecture performs the segmentation and classification process on the images. At the fully connected layer one can get output image.
2. Fully Convolutional Networks:- The main disadvantage of CNN is that, the fully connected layers of CNN are not capable of managing various input image sizes. This drawback is overcome by the fCNS. The last output layer of FCN has a very high field which corresponds to the width and height of the image. Because of this reasons, the fCNS are capable of segmenting the input images having different sizes. Another advantage with this FCN is that they can also find the context as well as location of corresponding object in the image.
3. Ensemble Learning:- This architecture incorporates the result of more than two relevant models into a single one. This type of models can give better prediction accuracy at a decreased generalization error. Because of reduced error rate and improved accuracy, these models facilitate correct classification of images as well as segmenting the images. Segmenting the image includes learning the image through number of weakbase learners. This learning will takes place number of times, which include classification, combining their outputs.
4. DeepLab:- It makes use of ImageNet which is a pre trained network for extracting the features of images. Instead of using regular convolution it uses Atrous convolutions. The main intension of using DeepLab is to capture the multi-scale contextual Image data. The DeepLab is composed with three important components. Atrous convolutions, ResNet and Atrous spatial pyramid pooling. The Atrous convolution is a factor that enables the expansion or contraction of the convolutional filter view. ResNet is a deep network. It has a framework that enable in training thousands of layers while continuing the performance of the model. The third component Atrous spatial pyramid pooling provides the multi-scale data of the image.
5. SegNet Neural Network:- It is an architecture that uses encoders and decoders. It is also called as semantic pixel wise segmentation. It includes the encoding of the input image that converts the image into low dimension images, which are recovered through orientation in various at the decoder. The segmented image is available at the decoder end.

Applications of Image Segmentation:-

Image Segmentation finds applications invarieties of fields.[8]

1. Object Detection & Face Detection:- Object can be semantically classified into various classes like, humanfaces, cats, buildings, cars etc., The face detection includes various algorithms that can detect and examine the presence of facial features. Medical imaging trying to extract medically related data from medical images.
2. Video Surveillance- It includes finding a moving object in video footages mainly finds applications in the areas like security, human-computer interaction, traffic control, and video editing.

DOI : 10.36893.DRSR.2022.V09I01N01.992-1004

(i) Self-Driving Vehicles:- Self-Governing vehicles must be able to distinguish and figure out their environmental conditions to drive carefully. The semantic segmentation is able to provide self-governing cars to identify which area in the image is safe for driving.

(ii) Iris recognition:- Iris recognition is a biometric method that identifies the critical patterns of an iris(inner part of eye). It make use of automated patterns to do the analysis on video images of human eye.

II Related work

Detection of Strawberry Plant Disease based on Leaf Supot using Color Segmentation in Journal of Physcis: IOP conference Series, 1230 012092, DwiEstiKusumandari et., al., 2019

The author considered the strawberry plant in order to find a leaf pest. Using digital image processing techniques, the author hoped to minimise the spread of a disease in these plants in this model. The technique was carried out on advanced images, which included image enhancement, shading division from RGB to HSV shading space, and local division to determine the location of damaged and immaculate leaves. The authors used the Canny Filter Method to determine the edge value of the object. The authors employed the Gabor Method and the Threshold Method to extract form features.[9]

Tomato Plant leaves disease classification using KNN and PNN, International Journal of Computer Vision and Image Processing, vol 9, issue 1, Jan-March 2019, pp.51-63, Balakrishna K, Mahesh Rao

The authors of this paper used the KNN technique to propose a model for recognising and classifying good and diseased tomato leaves.The authors then employed PNN, KNN, Sobel edge detection, HSV Format, Morphological operation, and Gabor filter technique to classify diseased leaves.The authors discovered that the PNN Classification is superior to the KNN Classification..[10]

Pattern Recognition Techniques for Cotton Leaf Disease Identification, International Conference on Pervasive Computing (ICPC), 2015,R.V.Kshirsagar, P.R.Rothe

The scientists created a pattern recognition system to help identify and classify three cotton leaf diseases: Myrothecium, Alternaria, and Bacterial Blight.The photographs were taken at Nagpur's Central Institute of Cotton Research.They employed an active contour model for picture segmentation, with an 85% classification accuracy..[11]

Leaf Image Classification using Deep Neural Networks to Recognize Plant Diseases Computational Intelligence and Neuroscience, SrdjanSladojevic, Marko Arsenovic, AndrasAnderla, DubravkoCulibrk, and DarkoStefanovic, 2016,

The researchers created a new model that can distinguish 13 different forms of plant illnesses from healthy leaves .In the picture pre-processing step, the model was trained and validated after collecting the photos. The images were then trained using a Deep Convolution Neural Network after the augmentation, which increased the dataset with slight distortion to the images. The back propagation approach was used to train the softmax classifier from scratch. In a separate class exam, the precision ranged from 91 % to 98 %, according to the results..[12]

Avocado Leaf State may be easily identified via image processing.XXII Symposium on Image, Signal Processing, and Artificial Vision, ItamarF.Salazar-Reque, INICTEL-UNI, 2019. (STSIVA)

The Avocado has supplied mainly from Peru region and the authors from that place taken Avocado leaves as a consideration for their research study and they designed a model to identify the state of the Avocado. The

DOI : 10.36893.DRSR.2022.V09I01N01.992-1004

proposed method used K-means for image segmentation and created two clusters in a superpixel level. The photos were categorised into four states using this method: healthy, iron deficiency, magnesium deficit, and red spider plague. In spite of the mistakes brought about in the leaf division process the characterization technique demonstrates great execution. This is mostly due to the fact that histogram rates provide sufficient data for the characterization task, particularly for RSP images with large R/G segments. Because a direct blend of B and G components may easily do this, a yellowness highlight has been omitted. This accuracy of this method is 96.8% and an average F-score is 0.98.[13]

Image Processing and Machine Learning Techniques for Disease Detection and Classification in Plants,AIP Conference Proceedings, 2095, 030018, S.Poornima, S.Kavitha, S.Mohhanavalli, N.Sripriya (2019),

This model used to detect diseased in plant using Image Processing and Machine learning techniques. In this model the authors designed a model which identified the diseased leaf and also the affected area of a disease in a leaf. The proposed model also attempted to determine the colour and form of the impacted area of a leaf, as well as the boundaries of the affected area. There are various leaves related to Potato, Coffee, Tomato, Pepper etc., are considered as an input to find out the diseases like black spot, anthracnose, cercospora leaf spot etc., The proposed model contained four steps after Image Acquisition. To identify the distortion in an image, they applied Median and Sobel Edge detection techniques. In the segmentation process, the edge based and color based techniques used to the diseased portion of the leaf. The features from the segmented diseased region are extracted using the Multi class SVM. In tomato and pepper plants, disease identification accuracy was higher than 90%, while overall classification accuracy was reported to be 65%.[14]

Deep Learning was used to identify Peach Leaf Disease infected by XanhomonasCampestris. In Asian Agricultural and Biological Engineering Association, edited by Kekezhang, Zheyuan Xu, Shoukun Dong, Canjian Cen, and Qiufeng Wu, published by Elsevier in 2019.

In this model they used CNN to know the peach leaf diseased infected by XanthomonasCampestirs using deep learning. Xanthomonascampestris is a bacterium that can infect plants in a variety of ways. For example, dark spoil, scourge, spot, bacterial ulcer. Plants contaminated by Xanthomonascampestris could straightforwardly realize broken foods grown from the ground impact the natural products groupers fall in financial problem and debase diet sound. They collected the peach leaves images infected by Xanthomonascampestris dataset from the open access library which is PlantVillage. They used MATLAB tools for implementing KNN, BP and SVM for classifying the images. Confusion matrix of each method in CNN displayed that the accuracy of 100% in the images infected by Xanthomonascampestris.[15]

Wei-zhen Liang, Kendall R. Kirk, and Jeremy K.Greene, Estimation of Soybean Leaf Area, Edge, and Defoliation Using Color Image Analysis, Elsevier Journal of Computers and Electronics in Agriculture, pp.41-51, 2018.

Soybeans are an important crop in the United States, providing the largest source of animal protein feed and the second largest source of vegetable oil.The goal of this project is to figure out how to use RGB photos collected in the field to assess % defoliation of the soybean beetle and leaves.To analyse sets of images and compute leaf territory for two classes with eight different shade groups, the Mahalanobis separation arrangement approach was used.The clever edge identification computation provided a reliable method for recognising leaf edges, with edge t2=20 being the best incentive for evaluating soybean leaf edges.The division's results showed a 96 percent presentation for merging soybean leaves.Separation grouping of Mahalanobis.[16]

DOI : 10.36893.DRSR.2022.V09I01N01.992-1004

Vision-based Pest Detection based on SVM Classification Method, M.A.Ebrahimi, M.H.Khoshtaghaza, S.Minaei, B.Jamshidi, in Journal of Computers and Electronics in Agriculture published by Elseiver, 2017, pp.52-58

Thrips are the most dangerous pest in strawberry greenhouses.The goal of this study is to use the SVM Classification approach to detect the pest thrips in a strawberry canopy crop.The SVM Classification approach can be used to group the parasites and identify the target parasite.The image processing technique used in this model, together with the SVM strategy and the selection of an acceptable region and shade list, was successful in identifying thrips with an error rate of less than 2.5 %.[17]

Yang Lu, Shujuan Yi, Nianyin Zeng, Yurong Liu, and Yong Zhang in Neurocomputing published by Elsevier, 2017, pp.378-384.

Rice infections have a significant impact on rice production. It also poses a huge threat to food security. In this way, concluding and identifying rice maladies plays an important part in ensuring rice's high return, high quality, and high efficacy. In the realm of rural data, programmed distinguishing proof and determination of rice ailments are in high demand. The authors suggested a new rice disease classification system based on deep Convolutional Neural Networks technologies. CNNs are trained to distinguish 10 common rice illnesses using a dataset of 500 normal images of sick and healthy rice leaves and stems collected from a rice trial field. The suggested CNN-based model achieves precision of 95.48 % under the 10-overlay cross-approval procedure.[18]

Identifying multiple plant diseases using digital image processing, Elsevier Publication, Jayame Garcia ArnalBarbedo, Luciano VieriaKoenigkan, Thiago Teixeira Santos, Biosystems Engineering, 147, 2016, pp.104-116.

In this article, the database contained 82 different disorders over 12 plant species of images were stored like Coconut Tree, Grapevine Tree, Sugarcane Tree, etc. In the first step, segmentation of the leaf done by using Guided Active Contour (GAC) method. In the next step, the symptom segmentation was done based on pixel values of an image.70% images in the database used for training and 30% images were used for testing. After Symptom Segmentation, the colour transformation has done by HSV, L*a*b* and CMYK. These three stages are basic processing and the core process contains the calculation of intensity histogram, Histogram Cross Correlations, Pairwise Correlation Comparison, Disease Likelihood Estimation and Disease Ranking. The test results compared with various existing models and proved it better than those models.[19]

Image Segmentation and Soft Computing Techniques for Detecting Plant Leaf Diseases, A.K. Misra and Vijai Singh, in Information Processing in Agriculture, 2016.

Images can be captured using a digital camera, and the image quality can be improved by applying a smoothing filter in the pre-processing of the input image. After that, the threshold value is used to mask green pixels. The red, green, and blue components of the pixel are assigned zero values if the pre-computed threshold value is larger than the intensity of the green component. Remove the masked cells from within the infected clusters' bounds. Classify leaf diseases using a genetic algorithm to divide a set of unlabeled points into K clusters. The classification is done using the SVM Classifier and the Minimum Distance Criterion, and the accuracy is 95.71 %. [20]

Plant Disease Classification using SVM and ANN Using Feature Reduction Technique,International Journal of Interactive Multimedia and Artificial Intelligence, Vol. 3, No. 1, pp. 6-14, JagadeeshD.Pujari, Rajesh Yakkundimath, and AbdulmunafSyedhusainByadgi.

DOI : 10.36893.DRSR.2022.V09I01N01.992-1004

In this study, the various plant diseases like fungal, bacterial, viral, nematodes, deficiency and normal are considered for recognition and classification. For both, 900 sample photos have been obtained.These were gathered from the University of Agricultural Sciences, Dharwad's Plant Pathology department.. In the pre-processing stage, shade correction, removing of artifacts and formatting has done. After that color feature extraction using RGB, HIS Color models and texture feature using GLCM has done. Both SVM Classifier and BPNN Classifiers are used for classifying the images and also they made a comparison work is done between these two models. In this study, the model SVM Classifier proved to be a powerful tool for classification of plant diseases has been proved.[21]

Shiv Ram Dubey and Anand Singh Jalal, 2015, Springer-Verlag London, Apple illness classification using colour, texture, and shape information from images

Based on colour, texture, and shape classification, our model discovered a disease in apples.

The contaminated region of an image can be identified using the K-Means clustering method, and image attributes such as colour, texture, and form can be retrieved from the segmented area of the image and then concatenated using MSVM.SVM is used to distinguish between healthy and contaminated apple sets.Apple illnesses such as apple blotch, apple rot, and apple scab were investigated.The contaminated apples were easily identified based on the results..[22]

The various works which are used to classify the leaf and seed are tabulated below.

Table 1: Comparitive Study on Disease on a Leaf

Name of the Author	Name of the Model	Classifiers used in the Model	Outcome
DwiEstiKusumandari	Color Segmentation for Detection of Strawberry Plant Disease Based on Leaf Supot	Canny Filter Method, Gabor Method and Threshold Method	Identified strawberry plant diseases
Balakrishna K, Mahesh Rao	Disease categorization of tomato plant leaves using KNN and PNN	KNN and PNN	Identified Tomoto plant diseases
P.R.Rothe, R.V.Kshirsagar	Pattern Recognition Techniques for Cotton Leaf Disease Identification		Identified three cotton leaf diseases mainly Myrothecium, Alternaria and Bacterial Blight
SrdjanSladojevic, Marko Arsenovic, AndrasAnderla, DubravkoCulibrk and DarkoStefanovic	Leaf Image Classification using Deep Neural Networks to recognise plant illnesses	back propagation algorithm	From healthy leaves, 13 different forms of plant diseases were identified.
An image processing method for detecting Avocado Leaf States automatically.	ItamarF.Salazar-Reque	K-means	Healthy, Fe deficiency, Mg deficiency, and red spider plague are the leaf statuses identified.

DOI : 10.36893.DRSR.2022.V09I01N01.992-1004

S.Poornima, S.Kavitha, S.Mohhanavalli, N.Sripriya	Image Processing and Machine Learning Techniques for Disease Detection and Classification in Plants	SVM	found the diseases like black spot, anthracnose, cercospora leaf spot
Kekezhang, Zheyuan Xu, Shoukun Dong, Canjian Cen, Qiufeng Wu	Deep Learning is used to identify XanhomonasCampestris -infected Peach Leaf Disease.	CNN	Identified the peach leaf infected by XanthomonasCampestirs disease
Wei-zhen Liang, Kendall R.Kirk, Jeremy K.Greene	Color image analysis was used to estimate the area, edge, and defoliation of soybean leaves.	canny edge identification	evaluated the percentage of defoliation of the soybean beetle
M.A.Ebrahimi, M.H.Khoshtaghaza, S.Minaei, B.Jamshidi	SVM Classification Method for Vision-based Pest Detection	SVM	Thrips in crop of strawberry canopy
Yang Lu, Shujuan Yi, Nianyin Zeng, Yurong Liu, Yong Zhang	Using Deep Convolutional Neural Networks to detect rice illnesses	CNN	Identified rice infections
Jayame Garcia ArnalBarbedo, Luciano VieriaKoenigkan, Thiago Teixeira Santos,	Using digital image processing to identify numerous plant diseases	Guided Active Contour	Identified plant diseases like Coconut Tree, Grapevine Tree, Sugarcane Tree etc.,
Vijai Singh A.K.Misra	Image Segmentation and Soft Computing Techniques for Detecting Plant Leaf Diseases	SVM	**Detection of Plant Leaf Diseases**
JagadeeshD.Pujari Rajesh Yakkundimath and AbdulmunafSyedhusainByadgi	Plant Disease Classification Using Feature Reduction Techniques Using SVM and ANN	SVM and BPNN	Identified various plant diseases like fungal, bacterial, viral, nematodes, deficiency
Shiv Ram Dubey Anand Singh Jalal	Color, texture, and shape data from images are used to classify apple diseases.	K-Means and SVM	Diseases of apple like apple blotch, apple rot and apple scab were identified

III Proposed Methodology

Based on the reviews mentioned in section II, the following skeleton is depicted. The following figure gives the outline of study the image classification.

DOI : 10.36893.DRSR.2022.V09I01N01.992-1004

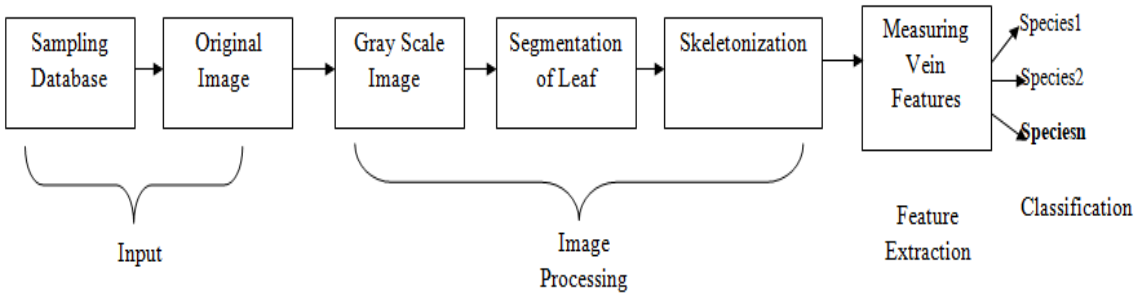

Figure 1: Classification of Image

In order to study the taxonomy of leaf i.e., whether the leaf having any pest or whether is it a medicinal plant or not then there is a need of classify the leaf image to know its structure. In image classification, the sampling database and the original image are considered as input and then process the image then extract the features to know which species it is. To process the image, first convert the original image into gray scale image, segment the leaf and then extract the skeleton of a leaf. After that measure the features of veins.

Figure 1: Original Image

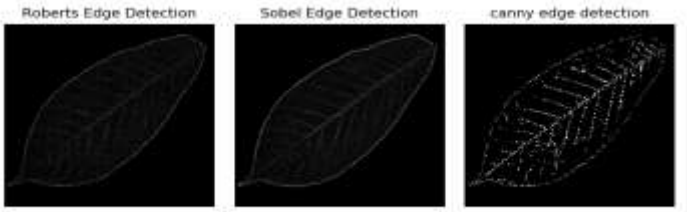

Figure 2: Edge Detection using various methods

DOI : 10.36893.DRSR.2022.V09I01N01.992-1004

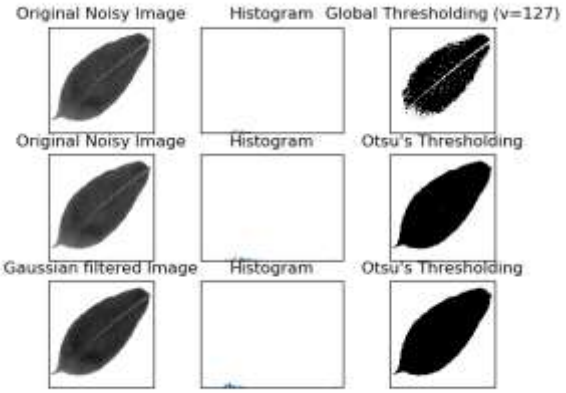

Figure 3: Identifying the Noise of a leaf

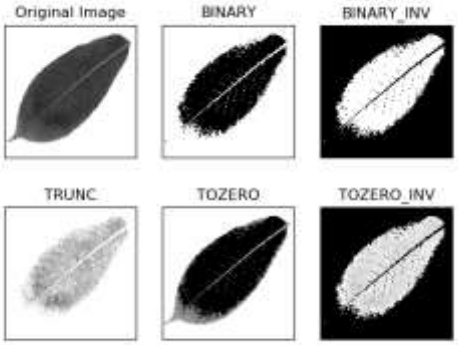

Figure 4: Image Thresholding

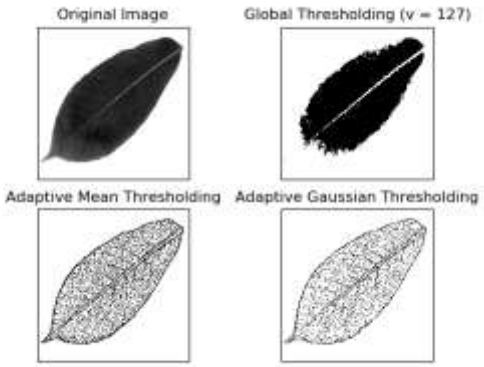

Figure 5: Adaptive Thresholding

Images were acquired from many sources and were in varied designs, with varying goals and quality.

Pictures that will be used as a dataset for a deep neural network were pre-handled to ensure uniformity in component extraction. The dataset's images were reduced to 256x256 pixels to save time during preparation, which was then recorded using a Python script and the OpenCV system. In image pre-processing stage, the authors collected banana leaf for identifying the pest and convert into grayscale image and observed the edge

DOI : 10.36893.DRSR.2022.V09I01N01.992-1004

detections and vein detection by using different methods like Sobel Edge detection, Canny Edge detection, etc., and also applying thresholding methods to identify the noise detection of a leaf. The above process depicted in the figures 1, 2, 3,4 and 5. Later the authors identified few models for image analysis R-CNN and faster R-CNN methods will be applied and will observe which methods give better accuracy to find the pest of a leaf in future.

IV Conclusion

The importance of deep learning in identifying the pests attacks in leaf and also classifying the seeds to improve the crop cultivation discussed in this article. This paper demonstrated the various works done by various researchers. And also the authors mentioned the various types of disease attacked to the leaf and the concepts of image segmentation were also discussed. The main goal of future work will be to create a whole framework consisting of numerous components connected to various types of pests as a trained model that captures leaf photos and accurately determines the pest of a leaf. The authors are also planning to gather various leaf images of different fruits or vegetable and also identified the diseases related to that particular leaf. After that the authors will apply CNN models to improve the classification accuracy. By using these models the farmers can identify the attacks in the early stage so that the trained model will plays vital role in the field of agriculture.

References

[1] ItamarArel, Derek C.Rose and Thomas P.Karnowski, "Deep Machine Learning- A New Frontier in Artificial Intelligence Research", IEEE Computational Intelligence Magazine, pp.13-18, Nov.2010.

[2] Dennis Philip Garrity., et.al., "Evergreen Agriculture: a robust approach to sustainable food security in Africa", Food Security: Springer Series, ISSN:1876-4517, Vol.2, No.3, 2013

[3]Agrios GN, "Plant pathology", 5th edn. Elsevier Academic Press, New York,2005

[4]Jim Isleib, "Signs and Symptoms of Plant Disease: Is it Fungal, Viral or Bacterial?" accessed on December 19,
2012.https://www.canr.msu.edu/news/signs_and_symptoms_of_plant_disease_is_it_fungal_viral_or_bacterial

[5] G. Litjens et al., "A survey on deep learning in medical image analysis", *Med. Image Anal.*, vol. 42, pp. 60-88, Dec. 2017.

[6]M. Sezgin and B. Sankur, "Survey over image thresholding techniques and quantitative performance evaluation," *Journal of Electronic Imaging*, Vol.13, No.1, pp.146-165, 2004.

[7]Yu-Hsiang Wang, "Image Segmentation Tutorial"
http://disp.ee.ntu.edu.tw/meeting/%E6%98%B1%E7%BF%94/Segmentation%20tutorial.pdf

[8]JayaramK.Udupa, SupanSamarasekera, "Fuzzy Connectedness and Object Definition: Theory, Algorithms and Applications in Image Segmentation", Graphical Models and Image Processing, Vol.58, No.3, pp.246-261, 1996.

[9] DwiEstiKusumadari, Muhammad Adzkia, et.al., "Detection of Strawberry Plant Disease Based on Leaf Spot Using Color Segmentation", IOP Conf.Series: Journal of Physics: Conf.Series 1230, 012092, pp.1-8, 2019

[10] Balakrishna K, Mahesh Rao, "Tomato Plant leaves disease classification using KNN and PNN", International Journal of Computer Vision and Image Processing, vol 9, issue 1, pp.51-63, Jan-March 2019.

DOI : 10.36893.DRSR.2022.V09I01N01.992-1004

[11] P.R.Rothe, R.V.Kshirsagar, "Cotton Leaf Disease Identification using Pattern Recognition Techniques", International Conference on Pervasive Computing(ICPC), 2015.

[12] SrdjanSladojevic, Marko Arsenovic, AndrasAnderla, DubravkoCulibrk and DarkoStefanovic,Deep"Neural Networks based recognition of plant diseases by Leaf Image Classification", Computational Intelligence and Neuroscience, 2016.

[13] ItamarF.Salazar-Reque, "An Image Processing method to automatically identify Avocado Leaf State", INICTEL-UNI, XXII Symposium on Image, Signal Processing and Artificial Vision(STSIVA), 2019.

[14] S.Poornima, S.Kavitha, S.Mohhanavalli, N.Sripriya, "Detection and Classification of Diseases in Plants using Image Processing and Machine Learning Techniques", AIP Conference Proceedings, 2095, 030018, 2019,

[15] Kekezhang, Zheyuan Xu, Shoukun Dong, Canjian Cen, Qiufeng Wu, "Identification of Peach Leaf Disease infected by XanhomonasCampestris with Deep Learning", Asian Agricultural and Biological Engineering Association, Published by Elsevier, 2019.

[16] Wei-zhen Liang, Kendall R.Kirk, Jeremy K.Greene, "Estimation of Soybean Leaf Area, Edge and Defoliation using Color Image Analysis", Journal of Computers and Electronics in Agriculture published by Elsevier, pp.41-51, 2018

[17] M.A.Ebrahimi, M.H.Khoshtaghaza, S.Minaei, B.Jamshidi, "Vision-based Pest Detection based on SVM Classification Method", Journal of Computers and Electronics in Agriculture published by Elseiver, pp.52-58, 2017.

[18] Yang Lu, Shujuan Yi, Nianyin Zeng, Yurong Liu, Yong Zhang,"Identification of rice diseases using Deep convolutional Neural Networks",Neurocomputing published by Elsevier, pp.378-384, 2017.

[19] Jayame GarciaArnalBarbedo, Luciano VieriaKoenigkan, Thiago Teixeira Santos, "Identifying multiple plant diseases using digital image processing, Elsevier Publication, Biosystems Engineering", 147, pp.104-116, 2016.

[20] Vijai Singh, A.K.Misra, "Detection of Plant Leaf Diseases Using Image Segmentation and Soft Computing Techniques", Information Processing in Agriculture, 2016.

[21] JagadeeshD.Pujari, Rajesh Yakkundimath and AbdulmunafSyedhusainByadgi, "SVM and ANN Based Classification of Plant Diseases using Feature Reduction Technique", International Journal of Interactive Multimedia and Artificial Intelligence, Vol.3, No.1, pp.6-14, 2016.

[22] Shiv Ram Dubey, Anand Singh Jalal, "Apple disease classification using Color, Texture and Shape features from Images", Springer-Verlag London, 2015.

DOI : 10.36893.DRSR.2022.V09I01N01.992-1004