International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Diseases Recognition for Oryza Sativa Leaf Plant Based on Artificial and Convolutional Neural Network

B. Karthiga

Associate Professor, Dhanalakshmi Srinivasan Engineering College, Perambalur, India

Abstract: ***Plant disease is one of the major problems in the agriculture sector. Plants are affected by a various factor such as bacteria, fungi, viruses etc. In this Project, we propose a structure to detect a paddy leaf disease more accurately. The proposed system consists of artificial and convolutional neural network (feed-forward artificial neural network) for plant disease classification. The different types of classifier is analysed. ANN consists of machine learning algorithm and it is trained by choosing feature value that may well classify four type of diseased samples appropriately. CNN architecture includes the three hidden layer (convolution, pooling, fully connected layer) and it used to classify more accurately. As a result, few diseases that usually occurs in paddy plants such as bacterial blight, brown spot, leaf blast and leaf streak are detected.CNN model achieves more accuracy for identifying the leaf disease in the paddy plant thereby showing the feasibility of its usage in real time application.***

Keywords: Deep learning, CNN, Paddy plant

1. Introduction

Plant pathology is scientific study of diseases in plants caused by infectious organisms and physiological factors. Organisms are suffered from bacteria, fungi, viruses, phytoplasmas, protozoa and parasitic plants. Oryza sativa is a scientific name of rice. It is called Asian rice and African rice is called by oryza glaberrima. Rice is most common food for a large part of the world's human population; particular in asia. Rice is the third highest world wide production of agricultural field. Paddy leaf is suffered from bacterial leaf blight, brown spot, leaf blast and leaf streak. Show the below table of Paddy leaf plant diseases description.

Table1: Diseases model dataset

Image	Scientific Name	Name	Description
	Xanthomonas Campestris Pv.Oryzae	Bacterial leaf blight	Yellow color multitudes appear on leaf
	Bipolaris oryzae	Brown spot	Dart reddish margins are formed in plants leading to blackening of seeds.
	Pyricularia grisea	Leaf blast	Black differences are realized in plant and they initiate to break.
	Xanthomonas translucens PV.undulosa	Leaf streak	Dark brown to purple discoloration on the stem below the head above the flag leaf.

2. Proposed System

Several classification methods like support vector machine, artificial neural network, k-nearest neighbors and maximum likelihood classifier are used. Here we are consider two different type of classifier such as Artificial neural network and Convolution Neural network.

Artificial neural network is class of machine learning algorithm. It consists of training dataset. Quick to train model and good result with small dataset. Convolutional neural network is class of deep learning. It does not need a training dataset. Require a large dataset. The proposed system consider the two basic modules:

- Disease Identification: Identification of disease exaggerated.
- Severity of disease is classified.
- Disease Identification is all about detecting what type of impurity are occurs in the paddy crop. Severity of the diseases are classified using ANN and CNN.

Disease Identification: Paddy leaf diseases images are collected through the internet. Here we have collected four different type of diseases images such as Bacterial blight, leaf blast, Leaf streak, Brown spot. These images are different size and different background. So the image are resized using MATLAB coding. Reduced images are collected and segregate the different dataset. The dataset are stored in the database. MATLAB coding used to compare input image with database, we are get the correct result.

Section I

3. Processing steps

For detecting various paddy crop diseases of Leafblast, Bacterial blight, Brown spot, Leaf streak the image processing techniques namely image pre-processing, image segmentation, feature extraction and classification of an image are performed.

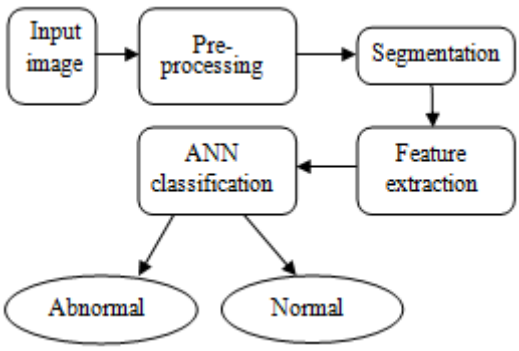


Figure 1: ANN Block Diagram

A. Image Preprocessing

Preprocessing is the primary process of image processing. The aim of pre-processing is an improvement of image data that suppresses unwanted distortions or enhances such as salt and pepper and blur.

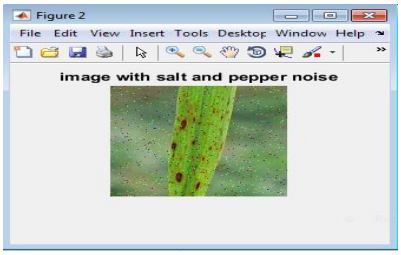


Figure 2: Image with salt and pepper noise

B. Image Segmentation

Image segmentation is the process of partitioning or dividing an image into its constituent parts or objects. There are number of algorithm available for segmentation procedures. Here we have used the thresholding. Thresholding can be used to create binary images. It is simplest method replace each pixel in an image with black pixel if the image intensity $I_{i,j}$, is less than some fixed constant T i.e ($I_{i,j}$<T), or a white pixel if the image intensity is greater than that constant.

C. Feature Extraction

Feature extraction starts from the initial set of data measurement and builds derived values intended to be informative and non-redundant, facilitating the subsequent learning and generalization steps and in some cases leading to better human interpretation.

The paddy leaf diseases consists of dissimilar lesion shape and lesion color on account of more than a few kinds of diseases such as bacterial blight, brown spot, leaf streak, leaf blast. Features for example shape, color play a most important role in infection identification. The Shape can be identified by determining the breadth and height of the paddy diseased image to measure the object pixel count. The pixels are then used to discriminate RGB values to calculate the Grey-Level Co-occurrence Matrix (GLCM).

The primary step is the departure of RGB modules from the unique colored images. The next step is the computation of mean, standard deviation, variance, and skewness from the separated RGB components using the following equation

$$mean = \frac{1}{p}\sum_{i=1}^{p} zi = \frac{z1+z2+\cdots+zp}{p} \quad (1)$$

Here p-total number of pixels

Z_i=ith pixel value

$$\text{standard deviation} = \frac{1}{p}\sum_{i=1}^{p} zi\sqrt{(zi-\infty)^2} \quad (2)$$

$$\text{variance} = \delta * \delta \quad (3)$$

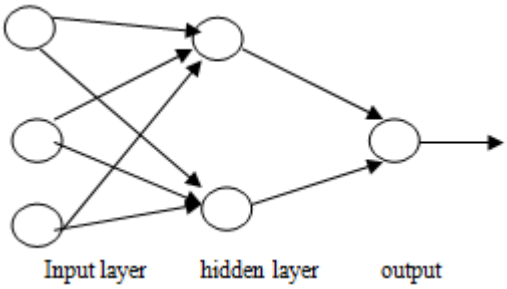
$$\text{skewness} = \frac{\frac{1}{p}\sum(zi-z')^3}{\frac{1}{p}\sum(zi-z')^{\frac{3}{2}}} \quad (4)$$

The following mathematical representation is used for determining the complex text features of paddy leaf diseased images.

D. ANN classification

Artificial neural network is composed of many artificial neurons that are linked together specific network architecture. It can be consider the three layer such as input layer, hidden layer, output layer. Input presented parallel

.there are no separate memory address for storing data. Hidden layer in between input and output layer, where artificial neurons take in a set of weighted inputs and produce an output through an activation function. Output layer is compare the input image with diseased paddy leaf present in database.



Section II

4. CNN Classification

A convolutional neural network is a class of deep, feed forward artificial neural network, most commonly applied to analyzing the visual imagery. It was inspired by biological processes. The network learns the filters as like algorithm were hand-engineered. They have application in the area of video recognition, recommender systems and natural language processing.

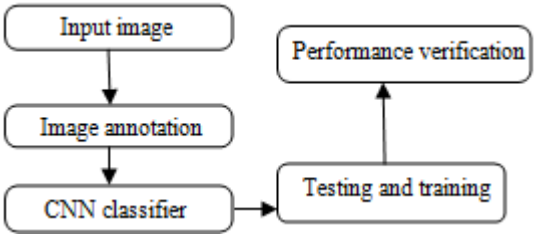


Figure 4: CNN block diagram

It consists of three type of layer

- Convolution layer
- Pooling layer
- Output layer

A. Convolution layer

Here we are taken input image size 6*6. Weight matrix size is 3*3.Weight matrix used to extract some feature from original image. Weight matrix will track across the input image and it covered all pixels at least one time and it is finally give the convolution output. Weight matrix act as a filter. it is used extract particular information from original image. 6*6 input image converted into 4*4 convolution output. For example paintbrush consider the weight matrix. Paintbrush first paint the wall horizontally and come down and next row horizontally.

9	5	114	50	89	55
76	25	216	200	55	78
92	78	11	0	91	205
73	3	7	82	10	96
12	88	100	22	1	81
210	36	65	78	215	8

1	0	1
0	1	0
1	0	1

=

251	349	504	365
450	321	288	527
218	195	285	318
443	299	319	245

Input image * weight = convolution output

Show the below figure convolution layer weight

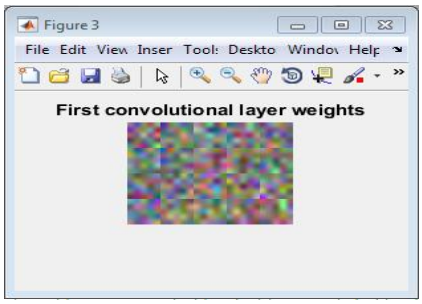


Figure 5: Convolutional layer weight

B. Pooling layer

After the convolution process image size too large, it reduced to using the pooling operation. Pooling layer used to 4*4 image size reduced into 2*2 image. Most commonly apply the max pooling operation to convolution output. It consists two type: stride, padding.

251	349	504	365
450	321	288	527
218	195	285	318
443	299	319	245

450	504
443	319

convolution output = max pooling

Here we are taken stride as 2, So pooling size also like 2. It consists highest value of first 2*2 matrix. It performed entire image finally we get the pooling layer output.

C. Output layer

Convolution and pooling layer used to extract the feature and reduce size from original image. We get final output to apply a fully connected layer to make an output equal to the number of classes we needed. It connected every neuron in one layer to every neuron in another layer. It is principle of multi-layer perceptron (MLP). The compressed matrix vigor through a fully connected layer to classify the images.

Algorithm: Convolutional neural network inured recognize the paddy leaf diseases.
Input: Paddy cropped disease image.
Output: Classified diseased image and accuracy measures.
Step1: Start
Step2: Collect the leaf images and segregate the different type of dataset.
Step3: Collect the data train in our coding model.
Step4: Apply CNN algorithm for image classification.
Step5: CNN classifier perform the 3 different type of layers.
Step 6: Show the window which diseases occur the leaf and how do prevent it.
Step7: Stop.

5. Experimentation and Results

For detection of paddy plant diseases, downright 150 septicity inclined test images were identified and applied to train set. The diseases include bacterial blight, leaf blast, brown spot and leaf streak of paddy plant. CNN consists of an input layer, three hidden layers and the output layer. The leaf image size 150*150*3 are assumed to be the input layer. In the selected 150 images,25 images are healthy leaf

and 125 images are a diseased leaf. Show the below Brown spot diseases output.

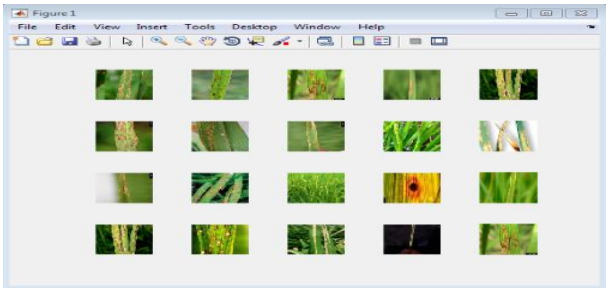


Figure 6: Trained dataset

Figure 7: Input image of Brown spot

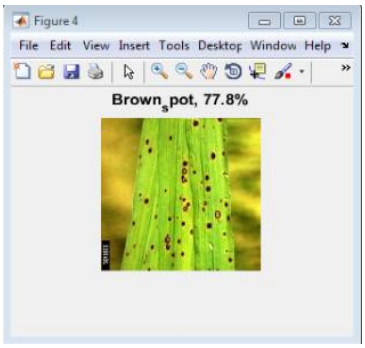


Figure 8: Brown spot

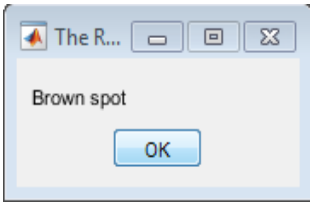


Figure 9: Output

Parameter measurement:
Accuracy is defined as the ratio of testing dataset and total number of training dataset. The below equation Predicts accuracy

$$Accuracy(\%) = \frac{\text{testing dataset}}{\text{total number of tranning datast}} * 100$$

Table 2: Comparison between ANN and CNN

Type of diseases	Accuracy%	
	ANN	CNN
Bacterial blight	83	94
Brown spot	78	85
Leaf blast	85	92
Leaf streak	84	90

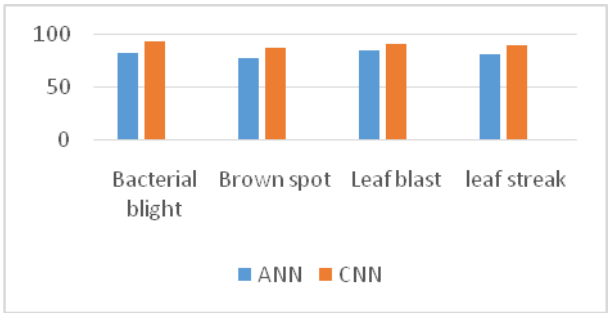


Figure 10: Accuracy between ANN and CNN

6. Conclusion

The various diseases of paddy are collected and process an ANN and CNN architecture to detect bacteria blight, brown spot, leaf blast and leaf streak diseases .MATLAB language are used to detect the diseases more efficiently. Each hidden layer extracts different information from image data and improves biases and weights to make classification more accurate.CNN achieve the high accuracy compared than ANN but time consuming. The enquiries work can added to be protracted to reduce the false classification by means of other classifiers for feature extraction in the middle of a number of paddy crop diseases.

References

[1] Savakar D G. and Anami B S, Improved Method for Identification and Classification of Foreign Bodies Mixed Food Grains Image Samples, International Journal of Artificial Intelligence and Machine Learning, Vol.9, Issue.1, 2009, pp.1-8.
[2] Vibhute A. and Bhode S K, Applications of Image Processing in Agriculture: A Survey, International Journal of Computer Applications, Vol. 52, Issue. 2, August 2012, pp.34-40.
[3] Landge P S., Patil S A., Khot D S., Otari O D. and Malavkar U G, Automatic Detection and Classification of Plant Disease through Image Processing, International Journal of Advanced Research in Computer Science and Software Engineering, Vol.3, Issue.7, July 2013, pp.798801.
[4] Barbedo J C A, Digital Image Processing Techniques for Detecting, Quantifying and Classifying Plant Diseases, Springer Plus, Vol.2, Issue.660, 2013, pp.1-12.
[5] Rathod A N., Tanawal B. and Shah V, Image Processing Techniques for Detection of Leaf Disease, International Journal of Advanced Research in Computer Science and Software Engineering, Vol.3, Issue.11, November 2013, pp.397-399.
[6] Bauer S D., Korc F. and Wolfgang Forstner, The Potential of Automatic Methods of Classification to Identify Leaf Diseases from Multi-spectral Images, Precision Agriculture, Vol.12, 2011, pp.361-377.
[7] Pacheco, A. et al. Reconstruction of High Resolution 3D Objects from Incomplete Images and 3D Information. International Journal of Interactive Multimedia and Artificial Intelligence, Issue 6, pp. 7-16. DOI: 10.9781/ijimai.2014.261 .
[8] Sungkur R K., Baichoo S. and Poligadu A, 2013, An Automated System to Recognize Fungi-caused Diseases

on Sugarcane Leaves, Proceedings of Global Engineering, Science and Technology Conference, Singapore, 3-4 October, 2013.

[9] Cui D., Zhang Q., Li M., Hartman G L. and Zhao Y, Image Processing Methods for Quantitatively Detecting Soybean Rust from Multi-spectral Images, Biosystems engineering, Vol.107, Issue.3, 2010, pp.186-193