International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 05 | May 2021 www.irjet.net p-ISSN: 2395-0072

WEED DETECTION IN INDIAN FIELDS AND DISEASE DETECTION USING CONVOLUTIONAL NEURAL NETWORK

Lijo Jacob[1], Aishwarya Patil[2], Karishma Patil[3], K .S. Charumathi[4]

Students, Department of Information Technology, Pillai college of Engineering, New Panvel, India
[4] Professor, Department of Computer Engineering, Pillai college of Engineering, New Panvel, India

---

Abstract - *Agriculture is a vital source of living for humankind. In today's time we are facing various difficulties in agriculture fields. Due to many problems, hurdles and damages the quality of the crop is affected. One such concerning problem is weeds and plant diseases. To overcome this, we need to detect the weeds and treat/remove them. But practically, this job is difficult and time consuming manually, so here we turn towards technology. Implementing machine learning methods such as Convolutional Neural Networks (CNN) on agriculture can help to classify the plants. Then the use of the automatic plant type identification processes could offer a great help for the guidance to the farmers in the use of pesticides, fertilization and harvesting in order to improve the quality and the production processes of crops and plants in the fields.*

Key Words: **Pre-processing, Image Processing, Neural Networks, Histogram, Contrast, Homogeneity, Classifier, Supervised Classifier**

1. INTRODUCTION

The health of the crops and plants has been monitored at different levels in the Agriculture Department. Various Crops and their details have been studied as research about the damages caused on them based on their types is done. To get a clear picture on the overall quality of crops, the analysis is done by the different image processing techniques for the vision system which has no human interference and that system used in the agriculture field. This system gives a clear idea and helps to make proper decisions by the use of the information provided by machine learning techniques, image processing as well as neural networks (classifiers). The system provides the report on observations on disease detection by sensing the Image data which is provided by the image processing techniques. The system gives real time identification of the crops, diseases, weeds. The system works on two phases: The first phase works on training data set, the second phase works on processing on test data where input image size is changed as well as colour and texture features like energy, contrast, homogeneity and correlation is obtained. Then the classifier will classify the test images automatically to decide leaf characteristics. For such techniques neural network is used based on learning on training data. The simulated result shows that network classifier provide the minimum error and better accuracy in classifying the images.

2. LITERATURE SURVEY

In this literature survey, the relevant techniques are reviewed. It describes various techniques used in the following research paper work. Various techniques in this category are listed here. They are image segmentation, image processing and machine learning classification techniques, neural networks. These techniques have various advantages and are used extensively in literature.

[1] Mansoor Alam, "Real-Time Machine-Learning Based Crop/Weed Detection and Classification for Variable-Rate Spraying in Precision Agriculture", 2020

This paper presents a real-time computer vision based crop/weed detection system for variable-rate agrochemical spraying. Weed/crop detection and classification were performed through the Random Forest classifier. The classification model was first trained offline with our own created dataset and then deployed in the field for testing. Agrochemical spraying was done through application equipment consisting of a PWM-based fluid flow control system capable of spraying the desired amounts of agrochemical directed by the vision-based feedback system. The results obtained from several field tests demonstrate the effectiveness of the proposed vision-based agrochemical spraying framework in real-time.

[2] Yingying Dong, "Monitoring and forecasting for disease and pest in crop based on WebGIS system", 2019

The manuscript aims to bring together and produce cutting edge research to provide crop pest and disease

monitoring and forecasting information, integrating multi-source (Earth Observation-EO, meteorological, entomological and plant pathological, etc.) to support decision making in sustainable management of pest and disease. Taking national disease -- a fungal disease of wheat rust and national pest -- a serious insect pest locust as the experimental object, we conducted the research. Moreover, an automatic system is developed to do the disease and pest time series monitoring and forecasting, also the visual display of the thematic maps and analysis reports.

[3] Ukrit Watchareeruetai, Pavit Noinongyao, Chaiwat Wattanapaiboonsuk, Puriwat Khantiviriya, "Identification of Plant Nutrient Deficiencies Using Convolutional Neural Networks", 2018

A novel image analysis method for identifying nutrient deficiencies in plants based on its leaf is proposed. First, the proposed method divides an input leaf image into small blocks. Second, each block of leaf pixels is fed to a set of convolutional neural networks (CNNs). Each CNN is specifically trained for a nutrient deficiency and is utilized to decide if a block is presenting any symptom of the corresponding nutrient deficiency. Next, the responses from all CNNs are integrated to produce a single response for the block using a winner-take-all strategy. Finally, the responses from all blocks are integrated into one using a multi-layer perceptron to produce a final response for the whole leaf. Validation of the proposed method was performed on a set of black gram (Vigna mungo) plants grown under nutrient controlled environments. A dataset consisting of 3,000 leaf images was collected and used for experimentation. Experimental results indicate the superiority of the proposed method over trained humans in nutrient deficiency identification.

[4] Sachin D. Khirade, A. B. Patil, "Plant Disease Detection Using Image Processing", 2015

This paper discussed the methods used for the detection of plant diseases using their leaves images. Identification of the plant diseases is the key to preventing the losses in the yield and quantity of the agricultural product. The studies of the plant diseases mean the studies of visually observable patterns seen on the plant. Health monitoring and disease detection on plants is very critical for sustainable agriculture. It is very difficult to monitor the plant diseases manually. It requires a tremendous amount of work, expertise in plant diseases, and also requires excessive processing time. Hence, image processing is used for the detection of plant diseases. Disease detection involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification.

3. EXISTING SYSTEM

In the existing system, the crops are observed by the system periodically and the diseases get identified after the Histogram Matching and Edge Detection Techniques machine learning techniques. These techniques help to train the databases and also help to make a proper decision regarding the diseases of the crops. Diseases get cured by the proper and correct pesticides that are going to be suggested by the machine learning algorithm. Disadvantages of existing system are that the result is not available in real time. Some conditions like new diseases will come into the picture where this system is going to fail. It only works on crop diseases as well as it does not identify major and minor disease.

4. PROPOSED SYSTEM

In our proposed system, we are working on a system where the crop gets analyzed and identified according to its characteristics and then the major and minor diseases get identified by the disease detection technique by taking the picture uploaded by the user. Then the pest as well as weed is also identified by pattern and measurement of that pattern after the Image Segmentation and Image Pre-processing Methods the NN Classifier get applied on that image. The neural networks learn the pattern by the iteration of K Clusters. This way we can identify the diseases and suggest proper pesticides and also give farmers the proper information of pesticides as well as share the location of best pesticides shops near them.

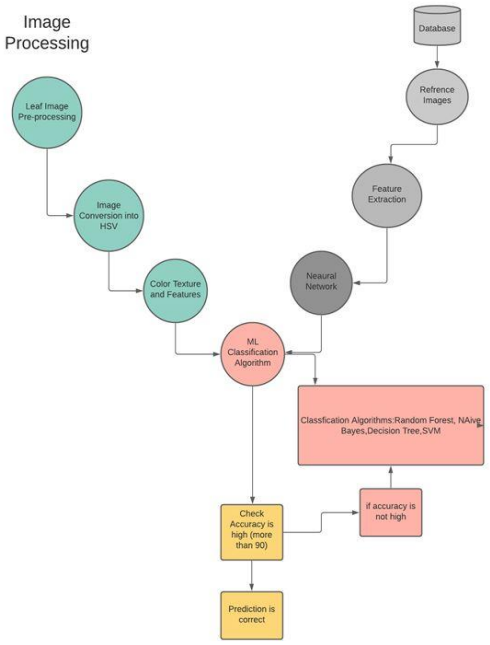

Fig -1: Proposed system architecture

4. IMPLEMENTATION DETAILS

4.1 Crop Identification

The machine learning and databases of images of the crops helps to identify different images according to their characteristics. Once the pattern is measured and the image is recognized the crop name and its characteristics is appeared on the screen of the system.

4.2 Weed Identification

The weed identification is done by the measurement of the pattern and by use of recognition of the digital image. Then the result is displayed which consist of the name of the weed and various species of the weed.

4.3 Image Segmentation

Segmentation is the process where we have to divide the digital image in multiple sections (set of pixels). Segmentation only leads to delineation of the image into something where it is easy to understand.

4.4 Image Pre-Processing

In Image Pre-Processing notable growth, the unswerving of optical inspection, added masks or the filters and the details are improved and some of the faster and speedy evaluation. Optimization happens in just a few steps.

Fig -2: Image of infected leaf

Image Pre-Processing depends on the three important parts which are as follows:

4.4.1. Color Space Conversion:

In Color Space Conversion (Hue, Saturation, value) algorithm is used for classifying the hue, saturation, value from different RGB Values. Firstly the RGB Image is changed to gray scale image and then only one factor remains in the image which is intensity value of the pixels. If the color is present in the image or the color of the object then that color is the Foreground and background Side color of the remaining image. The gray scale image is at (0) is Black and (255) is white.

4.4.2. Texture Feature:

For Texture Feature we have used an Grey Level Co-occurrence Matrix algorithm which is also called as GLCM. The values of the Grey Level Co-occurrence Matrix 3x3 i x j x n matrix where N is called as number of GLCM is calculated . This happens due to different arrangements and places used in algorithms.

4.4.3. Shape Feature:

In the Shape Feature we have used Lloyd's Algorithm to find the best part of the picture which is going to be cropped as there are lots of shapes of the images. Firstly in this algorithm the image Part is separated either by stochastic way as well as some heuristic data. After that some parameters are calculated which are median of each group. The nearest separated part is taken into consideration which is closest to the median and again the new median is calculated. The K-mean and Lloyd algorithms both are the same. But in some way Lloyd algorithm solves problem of K-Means.

4.5 Feature extraction work

Local Directional Pattern is used in the spatial structure local Image pattern. There are 8 different Directions to have digital Image, the LDP Operator quantifies each response values of each pixel where it was located and they generate magnitude with them. Edge consists of lot of illuminates and noise is unaffected than intensity values. As you can see edge responses are more stable than intensity values LDP gives the pattern as it is when light monotonically changes.

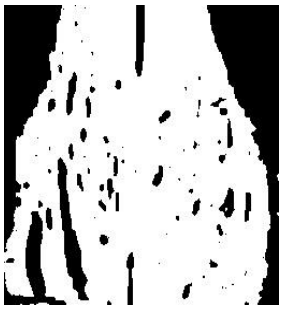

Fig -3: Segmented image of infected leaf

4.6 Machine learning classification Algorithms

Following algorithms will be applied on features obtained above.

1) Decision tree: It calculates entropy and information gain and output generated but has a problem of over fitting. We will generate modules with the selected feature.

2) NN: It's an artificial neural network. Here we give input layer, hidden layer and output layer. Then with the feature we calculate output.

3) SVM (support vector machine): It's a good binary classifier. We will train with features and models will be generated.

We are using sk learn python library.

4) Multiple Logistic regression:-, the logistic model (or logit model) is used to model the probability of a certain class or event existing such as pass/fail, win/lose, alive/dead or healthy/sick.

5) Naive Bayes: It calculates probability of occurring in a certain class. Model will be generated using pickle and stored.

6) Random forest: - Random forest avoids over fitting problem and model will be generated, stored into pickle.

All this machine learning model will be generated and its precision, recall, f1 score and accuracy will be calculated.

4.6.1 Clustering

Dbscan is used for outlier's detection. Outliers are specific entries in a dataset that are different from other points and don't play a vital role in classification. In statistics, an outlier is an observation point that is distant from other observations.

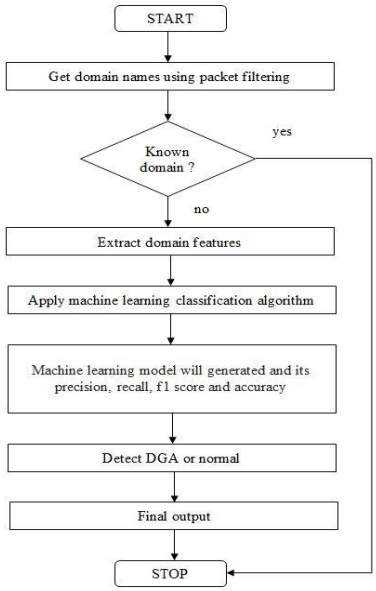

Fig -4: Flowchart

Once the model has been trained, a set of features is formed by a series of domains. Then, we go to the prediction stage. In this stage, we produce a complete time-series list of domain features from a domain name to be synthesized. For the input of real-time domains, we compare the predicted features with the features extracted from the observed new domain query.

5. EXPERIMENT DETAILS

From the above system, we analyzed the diseases of the plants using the neural networks. The experimental results will show about the identification of weeds and diseases of the plants.

Fig-5: Image of infected crop

The above image is an image of infected crop/weed which we will be using in our system to detect the diseases affected to it and it will also predict the name of the crop/weed.

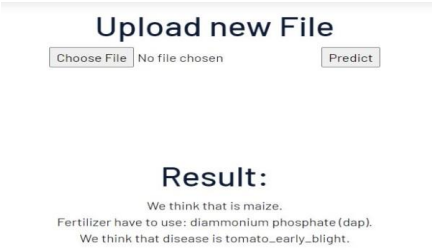

Fig -6: Prediction of weed and disease

In the prediction page of the website we upload the image of the crop or weed for detection. Once uploaded, the image is analyzed and compared with the trained datasets and the result of the name of the crop is predicted as maize and the disease detected is shown as tomato early_blight which can also be called as Southern corn leaf blight. It is a fungal disease of maize caused by the plant pathogen *Bipolaris maydis.* The system also suggests the fertilizers to be used to prevent such diseases.

6. CONCLUSION

For better production of the crops, the identification of diseases should be very accurate and with the use of machine learning and neural networks we will correctly suggest pesticides which will cure such diseases accurately. It will help farmers by providing proper and accurate information which is needed to them. It will also help agriculture consultants to identify the disease and suggest accurate cure of the disease with detailed information of pesticides in real time. Using this system we have shown real time identification of crop diseases according to their different characteristics and various species.

REFERENCES

[1] A. Camargo and J.S. Smith, "An image-processing based algorithm to automatically identify plant disease visual symptoms," Biosystems Engineering, vol.102, pp.9–21, January 2009.

[2] J.S. Cope, D. Corney, J.Y. Clark, P. Remagnino, and P. Wilkin, "Plant species identification using digital morphometrics: A review," Expert Systems with Applications, vol.39, pp.7562–7573, June 2012.

[3] Dr.K.Thangadurai, K.Padmavathi, "Computer Vision image Enhancement For Plant Leaves Disease Detection", 2014 World
Congress on Computing and Communication Technologies.

[4] Monica Jhuria, Ashwani Kumar, 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).

[5] K. Oki, S. Mitsuishi, T. Ito, M. Mizoguchi, "An agricultural monitoring system based on the use of remotely sensed imagery and field server web camera data," Giscience & Remote Sensing, vol. 46, pp. 305-314, 2009.

[6] G. F. Zhang, X. D. Liu, Y. Q. Zhu, and B. P. Zhai, "An open WebGIS-based monitoring system on crop pests and diseases," Journal of Nanjing Agricultural University, vol. 32, pp. 165-169, 2009.

[7] Kaur, S.; Pandey, S.; Goel, S. Plants disease identification and classification through leaf images: A survey. Archives of Computational Methods in Engineering 2019, 26, 507–530.