Integrated Management System For Sugarcane Disease Using Deep Learning Techniques-A Review

Rutuja Kadam, Aniket Jagtap, Rahul Joshi

Abstract: Indian economy mainly depends on the agriculture that why agriculture is one of the backbones of all business. Now worldwide agricultural and farm production India has the second rank. Indian agriculture is affected by various factors such as geographical, historical, climate, political, biological, due to topography and socio-economic factors. Now, sugarcane is one of the cash crops in India. The productivity of the sugarcane crop is decreasing due to the infection of various types of diseases, inappropriate conditions of soil and due to an incorrect diagnosis of disease. The sugarcane crop has various types of disease such as red rot disease, leaf spot disease, sugarcane mosaic virus disease, yellow spot disease, and brown spot disease. In this paper disused image processing and machine learning for the correct identification and diagnosis of sugarcane diseases. Here, disused the performance of existing approaches such as CNN (Convolutional Neural Network), K-Means Clustering, SVM (Support Vector Machine), Deep Learning, and Image processing technique. The drawback, main future perspective, and features of the previous approach in this area are summarized.

Index Terms: Sugarcane Diseases, Machine Learning, Image Processing, and Crop Production.

1. INTRODUCTION

Agriculture produces a civilized world, in India it is one of the agricultural countries, and the economy of India is mainly based on crop production. That is why agriculture is the backbone of business. Agriculture in India is influenced by various factors like geography, climate, historical, institutional, political, biological development, geographical, for all, and socio-economic factors. Agricultural production is mainly influenced by environmental factors. The weather affects the growth of crops, and the seasonal yield fluctuation is large. The spatial variability of soil properties interacting with weather causes spatial yield fluctuations. Crop cultivation is Agricultural Management, fertilizer spraying, irrigation; it can be used to offset harvest losses due to weather effects. As a result, harvest prediction represents an important tool for optimizing crop yields and assessing crop area insurance policies. Plant diseases and pests affect food crops, resulting in huge losses to farmers and threaten food security. In rural India sugarcane is one of the commercial crops and the sugar industry is the largest agro-based industries. From sugarcane forms the variety of products such as Jagger, Sugar, Molasses, Green Top, Filter Cake, and Bagasse. The disease in the cultivation of sugar cane is not only the reduction in yield, but also the deterioration of the variety. Most of the time, the quality of sugar cane production depends on its robustness from the disease.

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Types of Sugarcane Disease:

Fig 1 shows some examples of sugarcane disease. Some diseases are discussed here:

1. Red rot disease:
   This type of disease firstly appeared as a red bright lesion on the midrib of sugarcane leaf and it shows itself as changing color and dropping of upper leaf. After that, the withering of leaf proceeds downwards. The later on brown and pith becomes red.
2. Leaf Spot Disease:
   This they of the disease characterized by it on the leaves as small lesions, which assure dark red to brown color and enlarge along the midrib. The leaves of crops become dry because of affecting of photosynthesis.
3. Sugarcane Mosaic Virus Disease:

   In this type of young-crown disease, leaves show a definite pattern of light green color and alternating with dark spots and variable sizes parallel to the central vein of the Leaf.
4. Yellow Spot disease:
   Two types of yellow spot disease, the first type is the yellow color and there are certain varieties of the sugarcane with the points shown as red and red stems. They are the wrong size and shape and it can range from tiny dots to spots reaching 1cm in diameter.
5. Brown Spot Disease:
   It causes from reddish-brown to dark brown spots on the leaves. These spots are oval in shape, surrounded by a yellow halo and are equally visible on both sides of the leaves. The long axis of the spot is parallel to the median vein, and spots often tend to become entangled annular spots.

Images form important information and data in biological science. Image analysis and digital image processing methodology based on computer and microelectronics has many applications in biology, and this new tool helps to improve the image from the microscope to telescope range and provides scale for analysis. Diseases of plants cause periodic outbreaks of the diseases that lead to massive death and famine. Machine

learning is nothing but it gives the ability to machine for learning from previous experience. There are mainly two types of machine learning approach used such as unsupervised and supervised learning in. A machine learning technique is shown in fig 2. Supervised learning is used to supervise a program that is trained by a training sample and can be used to find an accurateconclusion or prediction of new data.

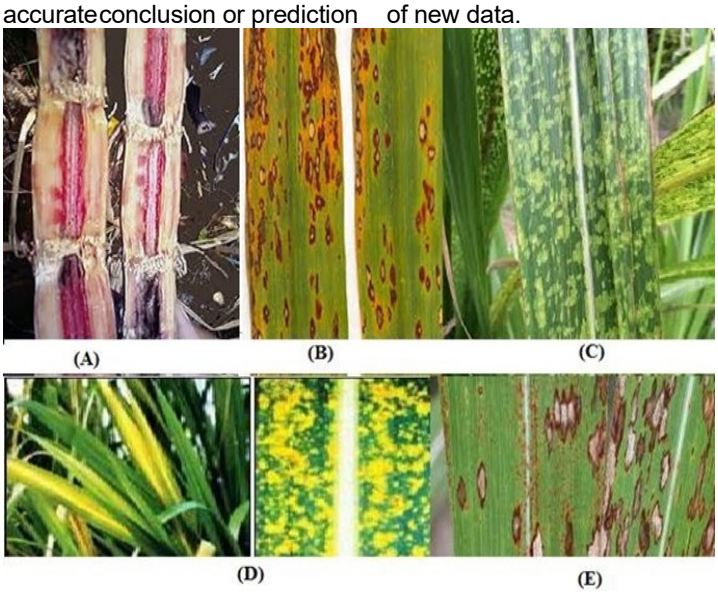

***Fig.1**. Types of Sugarcane Disease: A) Red Rot, B) Leaf Spot, C) Mosaic Virus, D) Yellow Spot and E) Brown Spot*

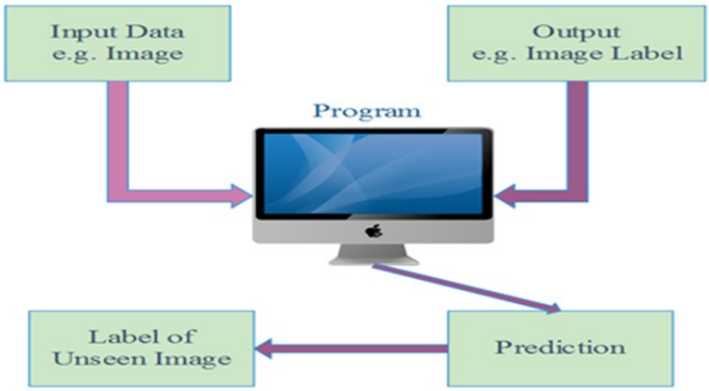

***Fig.2**. Machine Learning Approach*

Artificial neural network, Decision Tree, Bayesian Network, ID3, Support Vector Machines, K-Nearest Neighbor, Hidden Markov Model, etc. are some examples of supervised learning

2 LITERATURE REVIEW

The computer vision and machine vision techniques have been mainly used for the detection of leaf diseases analysis and grading of vegetables and fruits. This work summarize the review of the various work using different machine learning, image processing, and Artificial Neural Network such as Support Vector Machine and Convolution Neural Network, K-Means Clustering, Deep Learning, Image Processing, Neural Network and Binary Search Algorithm.

1. CNN (Convolution Neural Network):

S. Arivazhagan, and S. Vineth Ligi [1], they used deep learning based techniques to automatically identify plant of mango leaf diseases. Five type of varieties of leaf diseases are considered such as Alternaria leaf spots, anthracnose, leaf Webber, leaf gall, and leaf burn of mango and them consiered1200 images for this experiment. Raji. C, Kowsalya. J, and C. Gokul Prasad [2], they proposed automatically plant leaf disease detection techniques for this they used CNN. The system detects affected regions and it also finds out the accuracy level of leaf image. For the segmentation used canny edge detection. Itzhaky Yotam, Farjon Guy, and Shpigler Alon[3], they present two deep learning techniques for visual object counting task, demonstrating their efficiency on the CVPPP 2017 leaf counting challenge dataset. Firstly, counting performed using direct regression and after that used fusion technique for combining multi-scale predictions. Liu Tianyi, Fang Shuangsang, and Wang Peng [4], propose CCN for a face recognition problem.

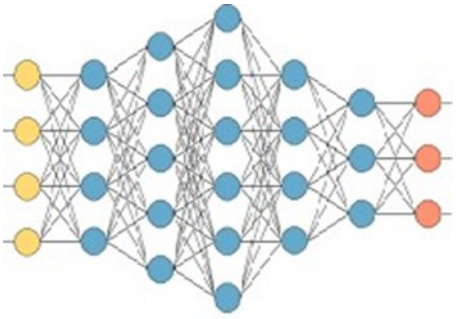

***Fig.3.** Convolution Neural Network*

Kaiming He, Shaoqing Ren, Jian Sun, and Ross Girshick[5], they present Re- gion Proposal Network techniques for sharing. Sue Han Lee, Paul Wilkin, Chee Seng Chan, and Paolo Remagnino [6], the present approach for deep learning in a top - down and bottom-up and the plant identification. To the plant classification, they learn leaf features using CNN. The CNN gives the 99.6% accuracy and of the drawbacks of this technique is that some class's misclassifications occurred. Jiang Lu, Guannan Zhao, Jie Hu, and Changshui Zhang [7], deep multiple instance learning (DMIL-WDDS) framework for the wheat disease diagnosis it aims to deal with the in-field wheat images without any technical preprocessing. Ronnel Atole, and Daechul Park [8]; they present the deep convolutional neural network (D-CNN) is applied on the pre-trained weights and biases for the classification of rice plants. Brahimi Mohammed, Arsenovic Marko, and Moussaoui Abdelouhab [9], the plant diseases classification and detection technique proposed and is based on CNN architectures (GoogleNet and AlexNet). Llorca Charmaine, and Maderazo Christian [10], they present CNN (Convolutional Neural Network) deep learning techniques to recognize the images by the using kernel convolutions for extracting and learning the relevant features in the images to recognize.

2. SVM (Support Vector Machine):

Arivazhagan S., Newlin R. Shebiah, Ananthi S. and, Vishnu S. Varthini [11], the present techniques for automatic classification and detections of leaf diseases. Firstly, they create RGB image, then it marks the green pixels and it removes using segmentation techniques. Fig 4 shows that the samples images of leaves with various diseases like yellow spots, early scorch, late scorch, brown spots, fungal diseases, and bacteria. Zarreen Reza, Nuzhat Faiza, and Nuzhat Mahsa [12],

they present Android based application for the detection of stem diseases of jute plants and to the classification and identification of disease they used Multi-SVM classifiers. It provides farmers a reliable and automated approach for the detection of crop disease detection; it is helpful to insurgency for the agricultural industry. Qiao Xi Yang Rui, Huang Wenshan and Huang Tisen, [13], they present an SVM algorithm for recognizing disease of sugarcane seed. Samples of Yuetang 159 and GuangXi sugarcane 42 selected from the NanBei and Chongzuo Qujiu village and its length is 300 mm. To select the parameter used cross-validation technique. Jagadeesh Pujari, Yakkundimath Rajesh and Byadgi Syedhusain [14] in this they present the approach to the early detection of plant disease which is affected on agriculture/horticulture crops. This work is used in preprocessing of images, image acquisition, and feature selection. In this, they used two machine learning approach such as SVM and ANN and SVM gives good accuracy as compared to ANN.

Fig.4. *Sample Infected Image of Leafs*

3. K-Means Clustering Algorithm:

Dhivya Elavarasan, and Vishal Sharma; they present a supervised and unsu- pervised machine learning approach for the prediction of crop yield based on the climatic parameters. Trimi Tete and Sushma Kamlu, they propose an method for image processing, it's used for classification and detection of leaf disease in different agriculture plants.

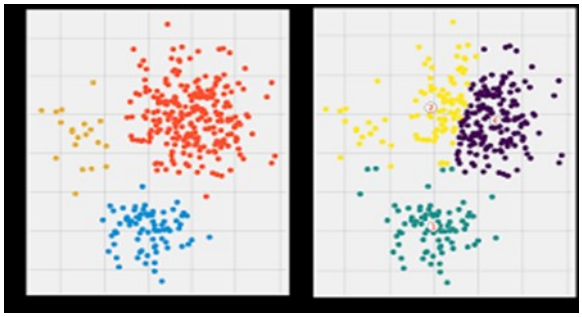

Fig.5. *K-Means Algorithm*

4. Deep Learning Algorithm:

Guan Wang, Jianxin Wang and Yu Sun [18], deep learning approach for automatic diagnosis of plant disease severity. The performance of fine-tuned VGG16 technique is best and it achieves 90.4% accuracy on the test set. Fuentes Alvaro, Yoon Sook, and Dong Park [19] present a deep learning approach for the detection of pests and diseases in the tomato plants using images. The experimental result of this approach shows that this technique is effectively recognizing nine different types of pests and disease. Konstantinos Ferentinos [20]; the CNN (Convolutional Neural Network) approach for the detection of plant disease detection and diagnosis for that they used simple healthy leaves images and diseased plants using deep learning technique and this experiment conducted on the 87,848 images of 25 different plants in the set of 58 distinct classes. This technique improves the classification perfor- mance. Belal Ashqar, and Samy Abu-Naser [21], deep convolutional neural networks for the classification of plant diseases. The division procedure de- pends on the distinctive highlights found in the picture. Rudraraju Pravallika, and Vineela Sravya [22]; the k-nearest neighbors (k-NN) algorithm is used to the plant leaf disease classification and the division of picture is performed utilizing Fuzzy C-Means calculation. Ashwini Sapkal and Uday Kulkarni [23]; they considered different features such as shape, color, texture, SURF, SIFT features, and HOG. Back propagation neural network (BPNN) approach is used to the classification purpose.

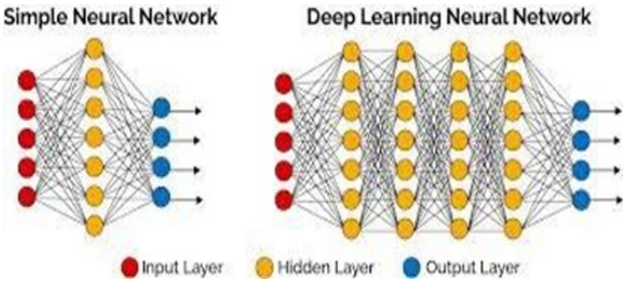

Fig.6. *Deep Learning Algorithm*

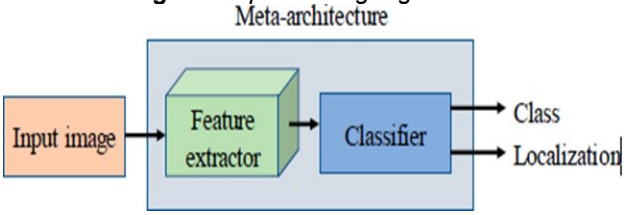

Fig.7. *Flow Chart of Deep Learning Approach*

5. Image Processing Technique:

Lihua Zheng, Wei Liao, Ronghua Ji, Minzan Li [24], the present approach of world coordinates of apples which are based on the information fusion. This technique helps for getting identification apple in world. Sanjay Patil and Dr. Shrikant Bodhe [25] triangle thresholding and simple threshold two techniques are used for segmentation of lesion region and leaf area. Chaudhary Piyush, Anand Chaudhari and A. Cheeran [26] they compared different image processing technique effect of the HIS, YCbCr, and CIELAB color space for processing of disease spot detection. This experiment is carried upon different "Dicot" and "Monocot" family plant leaves with both of noisy background and noise free (i.e. white). A disease of a plant is classified based on dimensions of disease spot. Viraj Gulhane and Ajay Gurjar [27]; diagnosing and identifying a technique for cotton disease and for this experiment they considered the different pattern of disease. Viraj Gulhane and Ajay Gurjar [28]; they used different image processing techniques for the detection of disease such as for smoothing the image they used the median filter, disease spot is detected used thresholding. H. Al-Hiary, M. Reyalat, S. Bani Ahmad, and Z. AL. Ra- hamneh [29]; a neural networks approach is used to

automatic disease detection of plant leaves and Otsu's techniques of image segmentation are used to the identification of green colored. Singh Vijai, and A. Misra [30]; diseases classification approach is used to plant leaves disease detection and image segmentation approach used for automatic detection as well as classification of leaf diseases.

3 CONCLUSION

This paper focuses on the various sugarcane disease detection techniques. This survey of work should be very useful for the researcher in this area. Most of the paper, for the disease detection different machine learning and image processing technique, are used such as CNN, NN, SVM, and K-nearest. From the whole review, we have concluded that CNN and SVM is a very effective technique for the detection of various types of sugarcane diseases. This paper reviews the developments of machine vision for the agricultural industry. Machine vision approach is increasingly used in industry for quality evaluation purposes and inspection. However, many difficulties still exist, evident from the relatively slow commercial uptake of machine vision approaches in all sectors. But among all, algorithms convolution neural network (CNN) and support vector machine (SVM) approach are gives better accuracy compared to other machine learning approach. The main objective of this research is to describe an overview of the technical concepts used in the method existing in literature review and the main focus of this research on the early and accurate detection of sugarcane diseases and increases the productivity of sugarcane crop.

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