PRODUCT RECOMMEDATION FOR PLANT LEAF DISEASE USING DEEP LEARNING: A SURVEY

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Abstract: Agriculture is the main activity in almost each and every part of the countries. Agriculture acts as a vital part and plays an important role in the economic system of every country. Agriculture supplies food and raw material as well as it is the main source of livelihood for farmers. But Plant Leaf Disease is very big issue nowadays. Agriculture is the important source for farmers' livelihood, and if plants get defected due to any disease, farmers' livelihood got in trouble. So, Plant Leaf Disease Detection and Pesticide Product Recommendation Technology will be very helpful. Therefore, plant leaf disease detection can be done by Convolutional Neural Network (CNN) which is one of the algorithms of Deep Learning. Also, pesticide product recommendation can be done by Collaborative Filtering and Deep Learning. Deep Learning is a branch of Artificial Intelligence. This study shows the current technologies and challenges for the Detection of Plant Leaf Disease using Convolutional Neural Network, Collaborative Filtering and Deep learning. In this paper, we present the current trends to get knowledge about the Accurate Pesticide Products for the Plant Leaf Disease.

Index Terms **- Plant Leaf Disease Detection, Deep Learning, image Processing, Product Recommendation.**

I. INTRODUCTION

Agriculture plays the most important role in the field of economy of every country. Therefore, agriculture is the main area that needs to be concentrated for the progress of the country. Farmers have to face many problems such as weather forecasting, climate change, soil fertility, etc. as well as the issues like Plant Leaf Disease Detection, phenology identification and crop harvesting. The field of agriculture needs an upgradation to survive the present as well as future condition. Plants are getting affecting by both bacterial and fungal diseases. To get maximum yield & profit, plants should be healthy. Detection of disease through our eyes is always a complicated process. For this, constant monitoring of farm is essential. This is so tedious and costly; area of farm is too large. Due to this complication, even agricultural experts are unable to identify and diagnose the plant leaf disease easily and find the solution of problem. An automated system will be able to identify diseases in plants and it will be very helpful for farmers in present situation. This system will inform farmers at right time and provide accurate solution. The occurrence of Plant Leaf Disease has a negative impact on agricultural production. Various parts of plants like leaves, flowers, seeds, fruits, etc. get affected by various diseases. These diseases are different on different parts of plants. Leaves are the most important parts of plants and they get mostly affected by the various diseases. If the plants get affected by diseases, whole plant life cycle gets disturbed. Hence, the early plant leaf disease detection is very complicated but very important and necessary. If the Plant Leaf Diseases are not identified and detected in time, it will become hard to get food. So, Detection of Plant Leaf Disease should be done earlier. It will result in the control and effective prevention of spreading of Plant Leaf Disease. It will play an important role in the management of agricultural progress. If the Detection of Plant Leaf Disease has done earlier, we can search the accurate pesticide product for that disease. So, there is a need to design the system and identify the Plant Leaf Disease and recommend the accurate pesticide for the detected disease. This Product Recommendation System for Plant Leaf Disease can be done using Deep Learning.

II. LITERATURE SURVEY

[1] The system has introduced the basic knowledge of deep learning and presented a comprehensive review of recent research work done in plant leaf disease recognition using deep learning. Provided sufficient data is available for training, deep learning techniques are capable of recognizing plant leaf diseases with high accuracy. Also, they present the current trends and challenges for the detection of plant leaf disease using deep learning and advanced imaging techniques. The occurrence of plant diseases has a negative impact on agricultural production. If plant diseases are not discovered in time, food insecurity will increase. Early detection is the basis for effective prevention and control of plant diseases, and they play a vital role in the management and decision making of agricultural production.

[2] The method designed is a model which is used to automate a method for the prediction of disease in the plants and intimating the farmers to take appropriate action beforehand. a deep learning model is proposed that accurately classifies any leaf images is having a disease or not, in addition to providing a type of disease. The images of tomato plants were drawn from the Plant Village dataset and trained using pretrained models like VGG16 and Dense Net using transfer learning.

[3] The system has designed which is a very accurate artificial intelligence solution for detecting and classifying different plant leaf disease is presented which makes use of convolutional neural network for classification purpose. The presented model used the dataset that consists of more than 20,000 images with 19 total classes. The model then can be deployed on android and as well as iOS platform to reach out the farmers who can make the actual use of the proposed system.

[4] The system had worked on detection of plant diseases had explored the use of generalized image processing techniques and machine learning algorithms that can be applied at various stages of a plant's life cycle. Traditional disease detection methods adopted by farmers and experts are naked, continuous and obsolete as it is time consuming, costly and strenuous. Besides some countries do not have proper facilities for agriculture, therefore consulting an expert is beyond their reach.

[5] The system designed which is recognizing 32 different varieties of plant like apple, corn, grapes, potato, sugarcane, and tomato. and detecting the type of diseases the plant was infected. author used convolutional neural network for making of trained deep learning model, and this model can be used to test real-time images to detect and recognize plant diseases.

[6] This work has done survey on different plants disease and various advance techniques to detect these diseases. Also, they are gives importance of disease detection both to plants and to mankind. When plants are affected by heterogeneous diseases through their leaves that will affect on production of agriculture and profitable loss. Also, reduction in both quality and amount of agricultural production. Leaves are important for fast growing of plant and to increase production of crops. Identifying diseases in plants leave is challenging for farmers also for researchers.

[7] The system designed which detects and quantifies Neofabraea leaf spot in olive plants. For that the data has been collected from local olive farms and through online resources. Authors used two different methodology in this works Firstly they tried to apply thresholding technique on the Histogram values of the leaf image in the Lab color model; also used the k-means based color segmentation on the RGB color model. Quantification of the disease is also performed using the ratio of the infected region by the whole area of the leaf and verified using visual identification.

[8] The system designed for tomato leaf disease detection and classification; system recognizes four different types of tomato leaf diseases. For that they used the dataset contains 500 images of tomato leaves with four symptoms of diseases. author had made model using Convolutional Neural Network (CNN) and Learning Vector Quantization (LVQ) algorithm. CNN used for automatic feature extraction and classification and The LVQ has been fed with the output feature vector of convolution part for training the network.

[9] The system worked on identification and classification of plant leaf disease by using a novel method named as Bacterial foraging optimization based Radial Basis Function Neural Network (BRBFNN)) that is trained with the help of Bacterial Foraging Optimization (BFO), to find the affected region via different diseases present on plant leaves. RBFNN consists of three layers namely (i) input layer, (ii) hidden layer, and (iii) output layer. The network is are the feed-forward network for that they worked with only fungal diseases. The proposed method attains higher accuracy in identification and classification of diseases.

[10] The system designed which concentrates on disease detection and recognition which helpful for decision making system consists of four main phases are pre-processing, segmentation, feature extraction and classification. They focus on the image segmentation and different image classification techniques. image processing is applied for automatic leaf unhealthiest classification which establish on leaf image processing.

III. PROBLEM STATEMENT

Plant leaf disease detection is very important for production of good quality of crop. For that purpose, many technologies are used for detection and classification of disease but still the existing system is not satisfying the need of accurate pesticide recommendation for detected plant leaf disease. So, this system can detect disease of plant leaf and recommend pesticide information.

IV. COMPARISON BETWEEN EXISTING SYSTEM AND PROPOSED SYSTEM

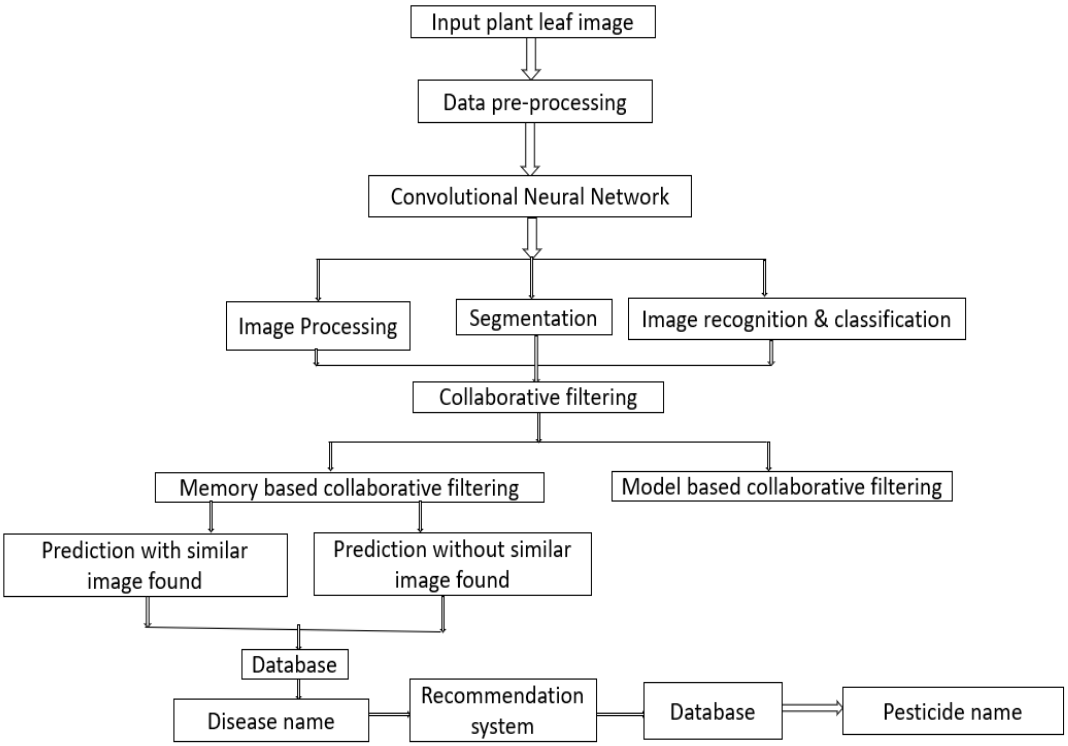
4.1. EXISTING SYSTEM

For detection and classification of various plant leaf disease many technologies used most used technology are image processing, machine learning, Deep Learning, Bacterial Foraging Optimization Based Radial Basis Function Neural Network (BRBFNN), CNN and Collaborative Filtering. In Machine Learning and Image Pre-processing Techniques performs steps like image collection, image pre-processing, segmentation and classification. The model is mainly divided into four steps or phases. In first one, collect the dataset of different plant leaves infected as well as healthy. These all images will be colour images. In second step, noise from the images is removed then we will create colour transformation structure for the images. In third step segment the images using clustering techniques available. This step is performed to easily extract the foreground that is leaf. Now the image set of leaves with black background is obtained. In final step, different machine learning and deep learning algorithms like logistic regression, KNN, SVM and CNN are trained and compared on the basis of accuracy and the algorithm that performs best in training as well as testing is taken in account. In deep learning techniques for detecting and classification of plant leaf disease approach used four major steps are Plant Village Dataset Image Acquisition, Image Pre-processing, Classification etc. in Image Acquisition Image dataset used for training the model was acquired in the Plant Village repository. A python script was used to download images of the plant diseases from the repository. The acquired dataset consists of approximately 35,000 images with 32 different classes plant varieties and diseases. Image Pre-processing Pre-processed images are reduced image size and image crop to a given input. It processes and enhances the image to its needed colour scale. The study uses coloured and resized images to 96x96 resolution for processing. Classification uses a fully connected layers and for feature extraction it uses convolutional and pooling layers. The classification process classifies the plant leaf if it is infected with the disease or not, identifies the type of plant disease and recognize the plant variety.

4.2. PROPOSED SYSTEM

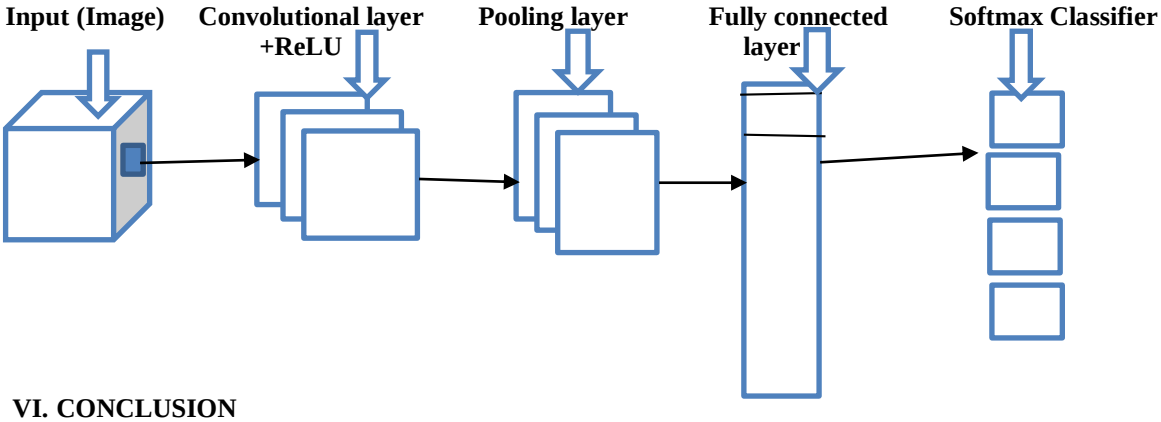
Proper pesticide for plant leaf disease is important for good quality and quantity of food. for that purpose, we use deep learning algorithms in proposed system for detection and classification of various plant leaf disease used deep learning approach contains image Acquisition, Image Pre-processing, Classification steps. and once disease detected on leaf of plant, we will use deep learning technology for recommendation of proper pesticide. image acquisition, image pre-processing and product recommendation techniques are being used extensively to reduce this additional overload and to recommend the product to the customer. Collaborative filtering, association rules and web mining recommendations are among the top techniques used for the technology. After identification, diagnosis and classification of plant leaf disease, pesticide product recommendation for disease will be done by using Convolutional Neural Network algorithm of Deep learning. Deep learning is a subsection of Artificial Intelligence and machine learning that uses artificial neural networks (ANN). Training the deep learning models divides the feature extraction and extracts its features for classification. There are several applications of deep learning which include computer vision, image classification, restoration, speech, video analysis, etc. CNN is used for training purpose and after that we get trained model. That CNN method is written with help of tensor flow. By using this model, we classify the image that system is getting after pre-processing of testing image. Then we get particular disease name or healthy leaf name if there is no disease on that leaf and that disease name is send to user and with the help of that disease name, we get particular pesticide name which help farmer to take respective action in order to decrease percentage of disease.

V. FLOW OF SYSTEM



5.1. ALGORITHM

The Convolutional Neural Network (CNN) algorithm which is one of the algorithms of Deep Learning is used for Detection and Classification of Plant Leaf Disease. The CNN algorithm is explained as follows:



VI. CONCLUSION

This survey paper has discussed about the various techniques such as Artificial intelligence, Machine Learning, Convolutional Neural Network, Collaborative Filtering and Deep Learning for Plant Leaf Disease Detection and Pesticide Product Recommendation. Deep learning is one of the branches of Artificial Intelligence. Convolutional Neural Network is used for Image Processing, Segmentation and Image Recognition and Classification. Collaborative Filtering and Deep Learning are used for Disease Detection as well as Prediction and Product Recommendation.

VII. ACKNOWLEDGEMENT

We express our sincere thanks to the Computer Engineering Department of Shahajirao Patil Vikas Pratishthan's S. B. Patil College of Engineering, our guide Prof. Salve. B. S. for giving us this wonderful opportunity to work on real-life project and enhance our skills. We would also like to express our heartfelt gratitude to the principal and head of the department Dr. Shirkande. S. T and project coordinator Prof. Gavali. A. B. for always being encouraging and supporting us with their timely analysis, constructive criticism and guidance.

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