WEED DETECTION USING DEEP LEARNING

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ABSTRACT

Agriculture is the origins of human sustenance in this world. The detection and classification of weeds and disease of plants are one of the most important technical and economical importance in the agricultural industry. Rice is one of the major cultivated crops in India which is affected by various diseases at various stages of its cultivation. It is very difficult for the farmers to manually identify these diseases and weeds accurately with their limited knowledge. In order to control weeds on farms and to detect the type of disease for the plant this "Weed Detection using deep learning" system is proposed .Recent developments in Deep Learning show that Automatic Image Recognition systems using Convolutional Neural Network (CNN) with Transfer Learning (TL) and Support Vector Machine (SVM) models can be very beneficial in such problems. Since rice leaf disease image dataset is not easily available, we have created our own dataset which is small in size hence we have used Transfer Learning to develop our deep learning model. The proposed CNN architecture is based on MobileNet and is trained and tested on the dataset collected from rice fields and the internet.

Keywords: Convolutional Neural Network, Deep Learning, SVM, Rice Leaf Diseases, Transfer Learning.

INTRODUCTION

One of the major concerns of an economy is accelerating agricultural development. Weeds are unwanted plants that can survive and reproduce in agricultural fields.. They hinder agricultural development by disturbing production and quality through competing with crops for water, light, soil nutrients, and space. As a result, weed control strategies are critical to sustain crop productivity. As the world population increases, so does the demand for food. Taking into account that land, water, and labor are limited resources, it is estimated that the efficiency of agricultural productivity will increase by 25% by the year 2050.Therefore, it is crucial to focus on the problems faced by the agricultural industry. According to Wang average of 34% of production is lost because weeds directly compete for nutrients, water, and sunlight. Furthermore, weeds and disease plants are harder to detect due to their non-uniform presence and their overlap with other crops. Weeds and disease plants that try to grow everywhere in the crop fields which try to consume the necessary amount of nutrients as well of the water that are required by the crops by them .So by this reason the crops that are growing in the same field will not able to get the proper nutrients as well as the fertilizers or water that they need fromthe soil.

Rice is the staple source of food in India as well as across the world. It is attacked by a variety of diseases and pants containing weeds in various stages of its cultivation. Therefore, early detection and remedy of such diseases and weeds are beneficial to ensure high quantity and best quality but this is very difficult due to the huge expanse of land under individual farmers and the huge variety of diseases and weeds are harder o detect as they are uniformly grown with the plants as well as the occurrence of more than one disease in the same plant. Agricultural expert knowledge is not accessible in remote areas and it is a time taking process. Therefore, the Automated Systems are required. To aid the plight of the farmers and provide improved

accuracy of plant disease and weed detection, research work using various machine learning algorithms including Support Vector Machine(SVM), Artificial Neural Networks have been done.However, the accuracy of such systems is highly dependent on feature selection techniques.

Recent researches on convolutional neural networks have provided great breakthrough in image based recognition by eliminating the need for image preprocessing as well as providing inbuilt feature selection. Another challenge is that it is very difficult to obtain large sized dataset for such problems. For cases where size of the dataset is relatively small, it is more preferable to use a model which is pretrained on a large dataset.

This is called Transfer Learning and it can be utilized to create a model that can be used as a fixed feature extractor removing the last fully connected layer or by fine-tuning the last few layers that will work more specific to the concerned dataset. Nowadays, mobile phones are accessible to everyone and so we have come up with the idea of an automated system where the farmers can upload the diseased leaf image and post it to our server where the neural network will be used to identify the disease and the disease classification along with the remedy can be sent back to the farmer. In this work we have proposed the architecture for the disease classification part of the automated system. Inspired by the work on convolutional neural networks, in this work, we have developed the deep learning approach on our rice disease dataset that we have collected over past several months. We have used the pre-trained ResNet50 model (Trained on the huge ImageNet data) and using Transfer Learning we have finetuned the fully connected layers so that we can accommodate our own dataset and at the end we have done some error analysis and tried to explain the reasons for the error.

LITERATURE SURVEY

Literature survey is the most important step in the software development process. Before developing the tool it is necessary to determine the time factor, economy and company strength. Once these things are satisfied, then the next step is to determine which operating system and language can be used for developing the tool. Once the programmers start building the tool the programmers need a lot of external support. This support can be obtained from senior programmers, from books or from websites. Before building the system the above considerations are taken into account for developing the proposed system.

[1].Detection of Weed Plants Using Image Processing and Deep Learning Techniques: P. L. Charitha, M. Mydhili, N. Khyathi, P. Pavithra ,G. Anuradha This paper centers around distinguishing the weeds in the crop utilizing convolutional neural organization, Image preparing utilizing yolo. Painting network model is first prepared by giving huge images of weed and crop. This prepared model is conveyed. Images from dataset Machine learning framework. Proposed model performs Image division, by separating the image into little fragments and makes the annotation for each image. Each image highlights aregone to Trained model for ordering as weed or crop.

[2].Y.Lu,S.Yi,N. Zeng,Y. Liu, and Y. Zhang, “Identification of Rice Diseases Using Deep Convolutional Neural Networks,” Neurocomputing, 267, pp. 378-384,2017. An accurate and timely detection of diseases and pests in rice plants can help to reduce economic losses substantially. It can help farmers in applying timely treatment. Recent developments in deep learning based convolutional neural networks (CNN) have allowed researchers to greatly improve the accuracy of image classification. In this paper, we present a deep learning based approach to detect diseases and pests in rice plants using images captured in real life scenario with heterogeneous background. We have experimented with various stateof-the-art convolutional neural networks on our large dataset of rice diseases and pests, which contain both inter-class and intra-class variations. 8 The results show that we can effectively detect and recognize nine classes of rice diseases and pests including healthy plant class using a deep convolutional neural network, with the best accuracyof

99.53% on test set.

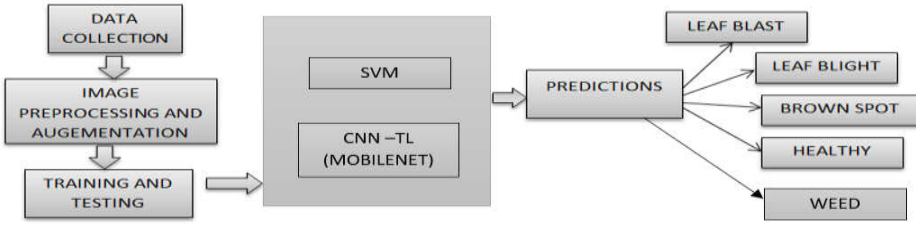
[3].R. R. Atole, D. Park, "A Multiclass Deep Convolutional Neural Network Classifier for Detection of Common Rice Plant Anomalies,"International Journal Of Advanced Computer Science And Applications,vol. 9,no. 1,pp. 67–70,2018. This study examines the use of deep convolutional neural network in the classification of rice plants according to health status based on images of its leaves. A three-class classifier was implemented representing normal, unhealthy, and snail infested plants via transfer learning from an AlexNet deep network. The network achieved an accuracy of 91.23%, using stochastic gradient descent with mini batch size of thirty (30) and initial learning rate of 0.0001. Six hundred (600) images of rice plants representing the classes were used in the training. The training and testing dataset-images were captured from rice fields around the district and validated bytechnicians in the field of agriculture.

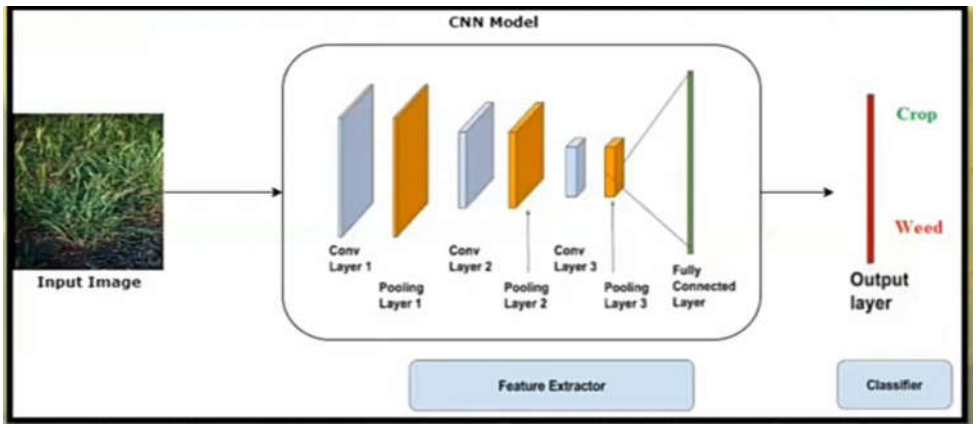
[4].Deep Learning Techniques for In-Crop Weed Identification: Kun Hu, Zhiyong Wang, Guy Coleman, Asher Bender, Tingting Yao, Shan Zeng, Dezhen Song, Arnold Schumann, Michael Walsh. This paper reviews the developments of deep learning techniques in the field of image based weed detection. The review begins with an introduction to the fundamentals of deep learning related to weed detection. Next, recent progresses on deep weed detection are reviewed with the discussion of the research materials including public weed datasets. Finally, the challenges of developing practically deploy-able weed detection methods are summarized, together with the discussions of the opportunities for future research.We hope that this review will provide a timely survey of the field and attract more researchers to address this inter-disciplinary research problem. 9

[5].Y. Es-saady,T. El Massi,M. El Yassa,D. Mammass, and A. Benazoun, "Automatic recognition of plant leaves diseases based on serial combination of two SVM classifiers," International Conference on Electrical and Information Technologies (ICEIT) pp. 561- 566, 2016. This paper presents a machine vision system for automatic recognition of plant leaves diseases from images. The proposed system is based on serial combination technique of two SVM classifiers. The first classifier uses the color to classify the images; it considers, at this phase, that the diseases with similar or nearest color belonging to the same class. Then, the second classifier is used to differentiate between the classes with similar color according to the shape and texture features. The tests of this study are carried out on six classes of diseases including three types of pest insects damages (Leaf miners, Thrips and Tuta absoluta) and three forms of pathogens symptoms.

PROPOSEDSYSTEM

In proposed system we are collecting dataset of weeds and plants for training purpose.
Data set is pre-processed, tested, trained and spitted and CNN is used to train dataset and model is saved to system.
Flask web application is developed for uploading weeds and plants image and classification is predicted.





A convolutional neural network is a type of artificial neural network used in deep learning to evaluate visual information.

The CNN networks can handle a wide range of tasks involving images, sounds, texts, videos, and other media.

You can load a pretrained version of the network trained on more than a million images from the ImageNet database.

As a result, the network has learned rich feature representations for a wide range of images. The network has an image input size of 224-by-224.

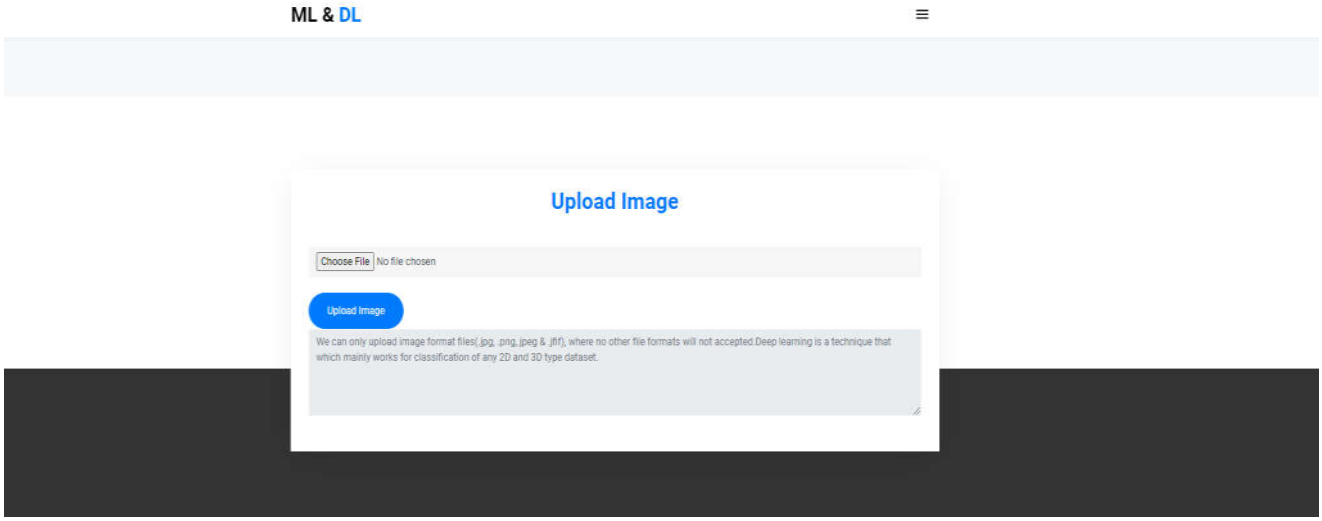
Proposed model gives the accuracy for identification of weeds and the crop.

METHODOLOGY

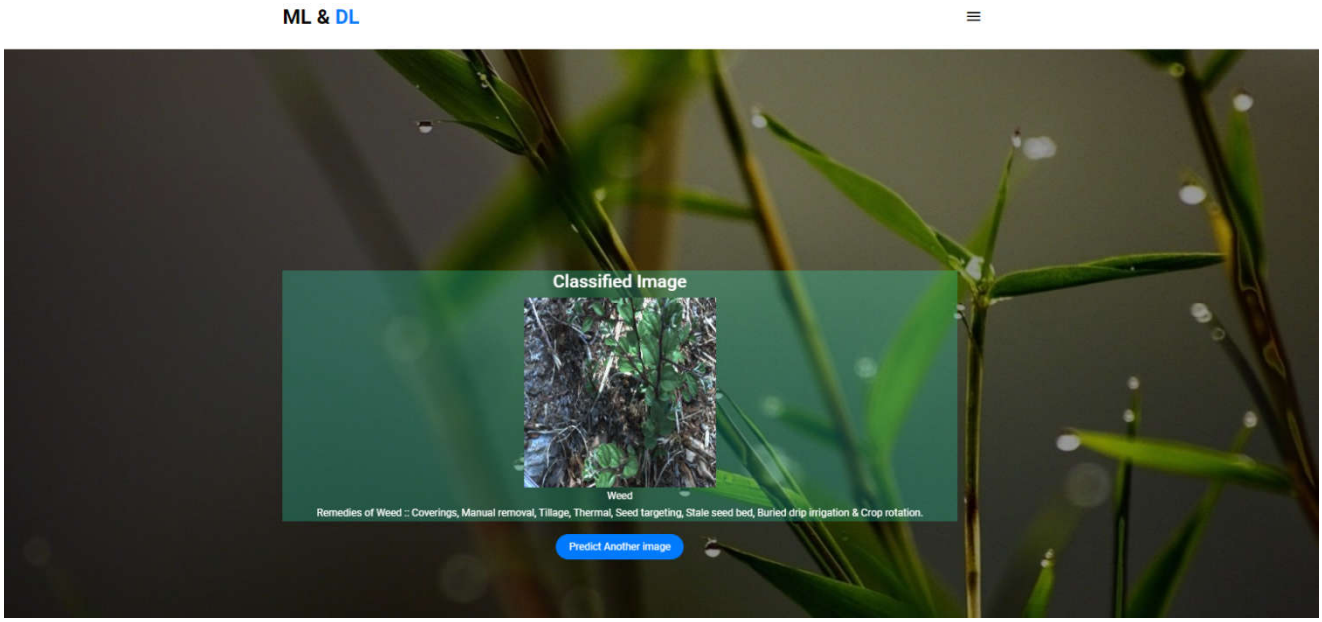
One of the objective is to remove the weeds and disease plants by reducing the human effort and to reduce use of herbicides used, the risk of pollution of crop and water and to improve the accuracy of the model and to evaluate the model with other parameter. The image of crop field is given as input training examples. Using the CNN model of deep learning, a system that can classify disease plants,weeds and crops are developed. CNN classification model is used to extract the important features. In order to predict weeds and plants data set is collected and traines.

RESULTS AND DISCUSSIONS

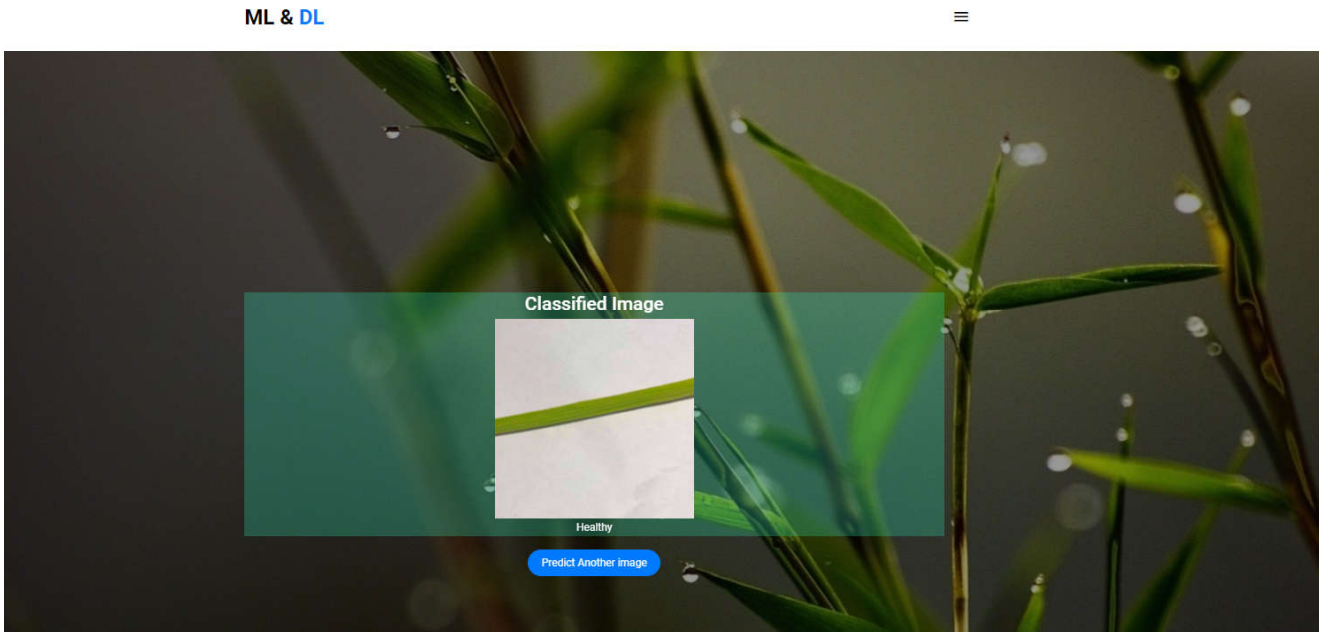
Uploading an image



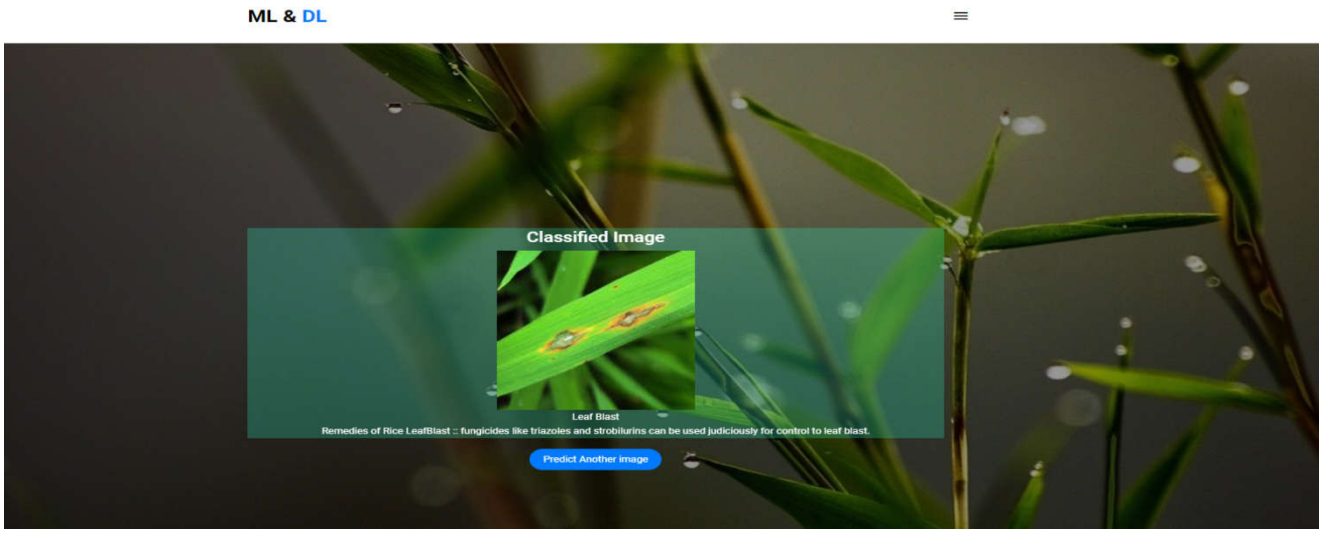
Upload an image and predict the results as weed



Upload an image and predict the results as Healthy



Upload an image and predict the results as Leaf Blast



CONCLUSION:

In this project we have successfully developed an application, that which can detect and recognize the paddy crop disease and weed. Here we developed the methods by using CNN with transfer learning (Mobile Net) algorithm and SVM algorithm. The features are extracted from the input images using convolutional layer. Pooling layer is used to downsizing the image. Finally, dense layer is used for classification. Further,we have considered the dataset of paddy leaf images which will be of 3 different types (Brown Spot, Healthy, Leaf Blight) and one weed image. Once after trained the dataset results were tested by uploading image and classifies the image according to the paddy leaf diseases and weeds with more accurate. So, it will be easier to find any the paddy leaf diseases and weeds with less human efforts and it will give remedies for that disease.

FUTURE SCOPE:

In future work, we would like to collect more images from agricultural fields and Agricultural Research institutes so that we can improve the accuracy further. We would like to add cross-validation process in future in order to validate our results. We would also like to use better deep learning models and other state-of the art works and compare it with the results obtained. The developed model can be used in future to detect other plant leaf diseases, which are important crops in India.

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