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Research Article

CROP YIELD ENVISION AND LEAF DISEASE PREVENTION USINGDEEP LEARNING

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ABSTRACT
Nowadays, crop yield prediction is one of the most recent, interesting, and challenging tasks due to its dependence on various variable parameters like environmental, weather, soil, and climate factors. Deep Learning has become one of the important tools for predicting crop yields. This model is proposed that accurately classifies any leaf images is having a disease or not, in addition to providing an organic solution for the disease. The images of crops were drawn from the Plant Village dataset andtrained using pre-trained models. This project work can be enhanced to a higher level by availing it to the whole of India.

Keywords: *Crop yield prediction, Deep Learning, Convolutional Neural Network (CNN)*

INTRODUCTION
The main objective of this paper is to get the maximum yield rate of crops and detect the diseases of plants with a relevant organic solution in a specific region by using Deep Learning concepts. Many Deep Learning algorithms can help in improving crop yield production. For the crop yield prediction, foremost, we take some amount of soil from that specific region and test that soil in a laboratory to get the properties like mineral content, a temperature etc. and also collect the previous dataset of that soil. Then we detect the plant leaf disease by capturing the images of leaves and we give an organic solution also.
Our Inspection regarding this study are not only useful for researchers but also for practitioners who are all tending to develop the new crop yield prediction models. We are combining two concepts which mean Crop yield and Plant leaf disease detection, it will be useful for researchers and we are going to detect the specific leaf disease and got idea to detect much more leaves which useful for practitioner.

LITERATURE REVIEW
Here by we represent the review on Deep Learning based Plant disease detection and Crop yield prediction
K.Gangadhara Rao et.al. [2021] described the prediction of crop yield using various Machine Learning techniques. Crop Yield evaluates includes evaluating crop yields from available historical data such as precipitation data set, soil data, and historic crop yields. This prediction will help farmers to predict crop yield before farming. K-Nearest Neighbor (KNN) is applied on the training data set and are tested with the test data set, and the implementation of these algorithms is done using python programming and spyder tool.
Sonal Agarwal et.al. [2012] Analyzed present evidence related to this field includes a model which is incorporated with ML algorithms to determine best crop. It provides better accuracy than the existing model. The SVM is executed as a Machine Learning algorithm while LSTM and RNN are used as Deep Learning algorithms.
Kodimalar Palanivel et.al. [2019] Observed various Machine Learning techniques such as prediction, classification, regression and clustering are make use to forecast crop yield. Artificial Neural Network (ANN), Support Vector Machines (SVM), linear and logistic regression, decision trees, Naive Bayes are some algorithms used to implement prediction. An inspection has been performed on how various deep learning algorithms are useful in prediction of crop yield.
Martin Engen et.al. [2021] Studied Farm-scale crop yield prediction. Recent studies on crop yield production are restricted to regional-scale predictions. For this research, they identified the need to createa

large and reusable farm-scale crop yield production dataset, which could provide precise farm-scale ground-truth prediction targets.

Jalal Sadoon Hameed Al-bayati et.al. [2020] developed a method that can detect the disease of apple plant leaf using Deep Neural Network (DNN) algorithm. Plant Diseases Detection System (PDDS) architecture was designed. Speeded up robust feature (SURF) is used for feature extraction and Grasshopper Optimization Algorithm (GOA) for feature optimization, which helps to achieve better detection and classification accuracy.

Rinu R et.al. [2021] Determined to assure minimal loss to the cultivated crop, it is decisive to overlook its growth. Convolutional Neural Network is an algorithm used majorly for image classification and signal processing. VGG16 training model is used for detection and classification of plant diseases.

Pranesh Kulkarni et.al. [2019] Discussed plant disease using Image processing and Machine Learning. This paper achieves smart and efficient techniques for detection of crop disease which uses computer vision and machine learning techniques. This concept will be able to detect 20 different diseases of 5 common plants with 93% accuracy.

SK Mahmudul Haassan et.al. [2021] Examined Deep Convolutional Neural Network (CNN) to identify and diagnose diseases in plants from their leaves, since CNNs have achieved magnificent results in the field of machine vision. The accuracy results in the identification of diseases exhibited that the deep CNN model is promising, and can greatly impact the structured identification of the diseases, and may have ability in the detection of diseases in real-time agricultural systems.

EXISTING SYSTEM

Due to the revolution in industrialization, the economic contribution of agriculture to India's GDP (Gross Domestic Product) is steadily declining with the country's economic growth. The problem that the Indian Agriculture sector is facing the integration of technology to bring the needed outputs. With the advent of new technologies and overuse of non-renewable energy resources patterns of rainfall and temperature are disturbed. The inconsistent trends advanced from the side effects of global warming make it cumbersome for the farmers to clearly predict the temperature and rainfall patterns thus affecting their crop yield productivity. In order to perform accurate prediction and handling inconsistent trends in temperature and rainfall various machine learning algorithms like RNN, LSTM, etc. This can be applied to get a pattern. It will complement the agricultural growth in India and all together augment the farmer's life easy. In past, many researchers have applied machine learning techniques to improve agricultural growth of the country.

The existing system makes use of Random Forest in identifying between healthy and unhealthy rice leaves from the data sets created. Random forests are learning methods for classification, regression and other operations that operate by constructing a forest of decision trees during the training time. It uses various aspect of implementation namely dataset creation, feature extraction, training the classifier and classification. The created datasets of unhealthy and healthy leaves are inclusively trained under Random Forest to classify the diseased and healthy images.

PROPOSED SYSTEM

This paper focuses on the practical application of Deep Learning algorithms and its quantification. The work presented here also takes into account the inconsistent data from soil property and temperature datasets to get a consistent trend. Crop yield prediction is determined by considering all the features in contrast with the usual trend of determining the prediction considering feature at a time.

The plant leaf disease detection will be done by scanning the diseased leaf with an organic solution. Both the concepts will be combination and final output as a mobile application.

It has to find the accuracy of the training dataset, accuracy of the testing dataset, Specification, False Positive rate, precision and recall by comparing algorithms using python programming code. The following involvement steps are,

- Define a problem

- Preparing data
- Evaluating algorithms
- Improving results
- Predicting results

Crop Yield Prediction

In this concept, we are going to use the Convolutional Neural Network (CNN) algorithm. We are going todo this concept for specific regions. Foremost, we need to test the soil of that specific region to get the parameters like mineral content, temperature etc., then also collect the previous dataset. The soil datasets are already available on government sites, we will access them Feature of this concept is to get maximum results.

Leaf Disease Detection

In this concept, we will take real-time leaf images as an input and compare them with pre-trained datasets. We will get the dataset through online websites like Kaggle etc. After detection of disease, we will give organic solutions. The feature of this concept is to increase the accuracy.

Applications

Final Output as we combined the Crop yield prediction and Plant leaf disease detection concepts as asingle android application.

BLOCK DIAGRAM

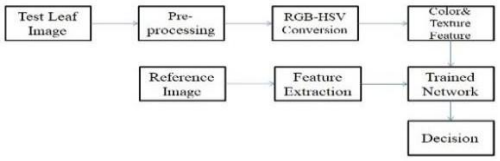

Figure 1: Leaf Disease Detection

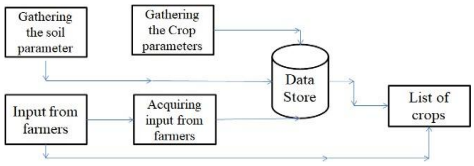

Figure 2: Crop Yield Prediction

MATERIALS AND METHODS

To implement a crop yield prediction system, we decided to go to Thanjavur district in Tamil Nadu state in India. As the climate and soil type were changing in different places, it was necessary to get data at district level. Particular region's historical data about soil and climate is needed to implement the system. This data was collected from Indian government websites. The data about the soil of each area of Tamil Nadu was collected from www.data.gov.in and the data about climate was collected from www.imd.gov.in. The climatic parameters are affecting the crop most are temperature, vapor pressure andetc. The data about the climate was collected in monthly level.

Plant disease detection is accomplished via the use of deep learning techniques. This model incorporates leaf retrieval, picture segmentation and identification with the use of a deep learning algorithm. Here, we use rice to detect the disease. The plant leaf images are extracted into numerous aspects that fall into three categories: color, shape and texture. The images of these plant leaves are shrunk to 256 x 256 pixels, to predict the presence of disease in the rice was detect in accurately.

Dataset collection

In crop yield prediction, we collected data from various sources and prepared datasets. This data is available from several online websites such as www.Data.gov.in. We are use a monthly summary of cropsfor at least 5 years. The datasets we used are soil, weather and plant datasets.

In plant leaf disease detection, we are collected datasets from several websites such as www.Kaggle.com. We are collected all healthy, mild diseased and heavily diseased images.

Dataset Partitioning

This step has input data of training and testing images. These loaded data is divided into two sets, they are

training datasets and test datasets, with the ratio of 80% and 20%.

Preprocessing step

In crop yield prediction, this is the very important step. Preprocessing consists of inserting the missing values, appropriate data range and extracting the functionality. This kind of dataset is very critical to the analysis process.

In Plant leaf disease detection, the plant leaves images are taken in RGB format. These RGB images are converted to color space representations in the HSV color space. The hue and saturation components are used to evaluate the images. The RGB model is based on a Cartesian coordinate system. In segmentation method, it was divided into two stages. They are, masking and threshold segmentation. In masking segmentation, masking the image is when the pixel value of the image is set to zero or a different value. The green region of plant leaves is the healthiest. If the intensity of the green pixels is greater than the default value, all of those values are set to zero. After masking, the pixels with zero values are discarded. In Threshold segmentation, the image is segmented using equivalent segmentation, which is based on the grey scale or intensity of the image. The threshold method is selects an appropriate threshold T for segmenting the image pixels into a several categories.

Applying Machine earning modules

In our project we have used Convolutional Neural Network (CNN) algorithm. In crop yield prediction, they are specialized to handle grid like gsfdata. Such data are images or rows of multi-column data. Compare to traditional feed forward neural networks, CNNs possess some special features making them efficient to find salient features within the data.

In plant leaf disease detection, CNNs have achieved the great success in the various types of image recognition, plant disease diagnosis and can improve the accuracy of the plant disease diagnosis. During the recognition and classification, the CNN can directly input the original leaf images to extract the features; it was reducing a lot of preprocessing.

Feature selection

In crop yield prediction, it should simplify the amount of the data involved to represent a large dataset. The soil and weather characteristics are extracted from the pre-trained phase constitute the final set of training. These characteristics include the physical and chemical properties of the soil.

Table 1: Dataset Description

	Precision	**Recall**	**F-1score**
Class A	0.8222	0.8604	0.8408
Class B	0.6666	0.1000	0.1738
Class C	0.1000	0.1764	0.1273

Table 2: Structured 3x3 Confusion Matrix

	Train	**Validation**
Bacterial Leaf Blight	108 Images	43 Images
Blast	90 Images	24 Images
Brown spot	123 Images	17 Images

Table 3: Evaluation of Metrics

		PREDICTEDVALUES		
		Class A	Class B	Class C
ACTUALVALUES	Class A	37	6	0
	Class B	0	24	0
	Class C	8	6	3

Figure 1: False Smut

Figure 2
Yellow Stem Borer

Figure 3
Yellow Stripe Rust

Figure – 4
Septoria Tritici Blotch

Figure – 5
Bacterial Panicle Blight

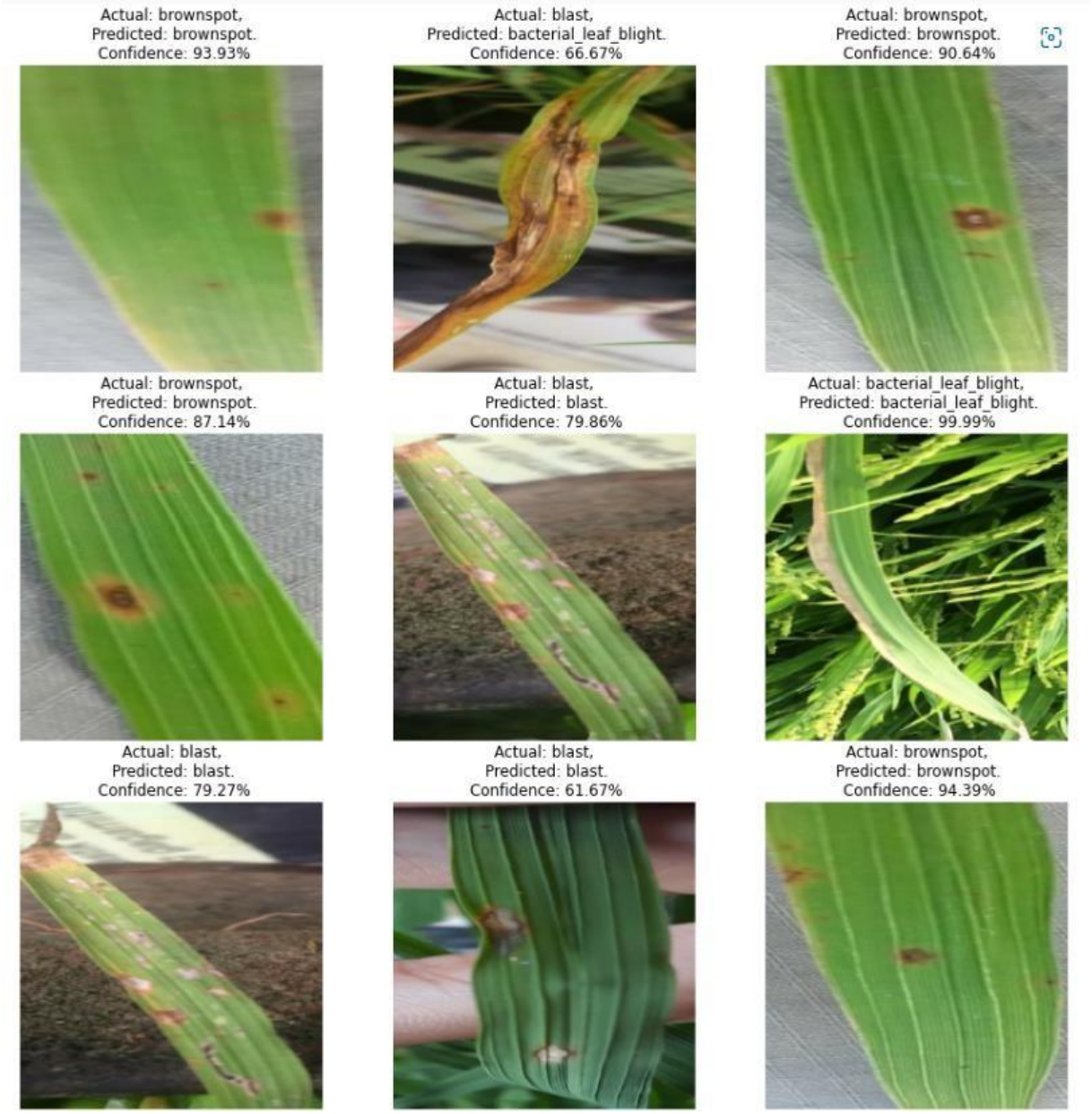

Figure – 6 *Simulated Output*

CONCLUSION

In agriculture field, fast and accurate disease prediction of crops plays a very important role. The algorithm separates sign color, leaf color and illumination from different color channels. Many existing segmentations cannot propose such approach as this paper proposes an intelligent approach. So newly developed but widely used methodology will play an important role in recognition of diseases of rice leaves. The result indicates that an algorithm was made the fact for final feature analysis. A novel method for disease prediction of plants based on classification techniques is proposed with an accuracy rate of 95.46%.Our proposed model is created by using AI algorithms to reduce the problems of the former's making losses on their farms due to lack of knowledge of cultivation in different soil and weather conditions. The model predicts the best crops that should be grown on land with less expense among the number of crops

available after analyzing the prediction parameters.
From a future perspective, we might propose the methodology of identification of various diseases from rice leaf. There are many diseases which rice leaves contain, such as, Rice Blast, Brown Spot of Rice, Sheath blight of Rice, Bacterial leaf blight, Sheath rot of Rice etc.,. It's necessary for early detection of particular disease which plants have and start taking care of plants according to disease before wilting. Future features for crop yield prediction we expand the area of region into whole India.

RESULT AND DISCUSSION

Our experimental research and its results in particular, we will focus in depth on Deep Learning. On CNN, the algorithm will first take an input image, which is in RGB form. We get the part of the disease with this algorithm. We took two sets of data called train data and validation data. The train data set contains images which have already been processed, and diseases and feature releases have been detected. Another with validation data includes images which need to be processed to Diagnosis diseases. One image from the validation data set is taken and its features are matched to images in the training database. The key to this work is that the total area infected with the disease will be calculated as a percentage and hence diseases are detected.
The soil dataset that is used to predict the name and yield of the crop is fed into classification and regression algorithms. Experiments were conducted on Indian government datasets and it has been established that Random Forest Regressor gives the highest yield prediction accuracy.

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