ABHAY KISAAN: Aiding Farmers with AI

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***Abstract*—Abhay Kisaan is a project aimed at protecting the integrity of farmers by developing three modules for their benevolence. The first module is a crop recommender system which recommends crops based on climate and soil conditions. The second module is a weed detection system which detects the exact location and presence of weed in an image of a top view crop field. Weed growth can hamper crop development and hence must be detected and removed at once. The third module is Prediction of various crop diseases using images and analyzing its cause to present it as evidence for a faulty fertilizer or inclement weather. Accuracy of the models are 95will be presented as an android application.**

***Index Terms*—Tensorflow, Scikit-learn, Convolutional Neural Network (CNN), Object-Detection, FRCNN V2,weed, crop, accu- racy.**

I. INTRODUCTION

India is one of the established nations that has agriculture as its primary source of income. Agriculture is one such domain that contributes only around 14on the Indian economy. The conventional agricultural practices and techniques are posing a lot of issues in terms of efficiency, cost-effectiveness and resource utilization. There is a necessity of better techniques that can improve the standard of living of the farmers too. Over the years due to globalization, agriculture has evolved by adapting the latest technologies and techniques for a better standard of living. Among the technologies and techniques, precision agriculture is one budding technology in the field of agriculture. Precision agriculture mainly focuses on site-specific farming The major and serious setback in the crop productivity is that the farmers do not choose the right crop for cultivation. There are many different issues regarding farming that still need to be resolved because they create a major impact on agriculture. These issues need to be solved efficiently so that productivity will increase and that will be beneficial for farmers.

Many farmers generally follow their traditional approach towards farming that sometimes ended by choosing the wrong type of crop for farming. Traditional farming is not always effective and it does not lead to proper choice of the crop for farming. Due to extreme weather changes and disturbance of the seasonal weather, particular crops may not be the right choice. This mainly happens because the type of crop for farming is not suitable according to conditions. Particular crops for the farming should be chosen on basis of the weather conditions, location of the farm, ph value of the soil and other factors. These all factors are not considered mainly so that choice of the crop is not proper. Many times crop affected by the particular disease are not identified by farmers and that leads to more destruction of the crop. Due to various factors the crop gets affected by various diseases and not all diseases are common to farmers and hence they face difficulty to identify the diseases. If a particular disease is not identified in the meantime there will be more destruction of the crop. High Percentage of weed on the farm leads to less productivity in the farm, hence to detect the weed in the farm is a challenge for the farmers. Weed is the mostly unwanted part in the farm and over excess of that reduces the productivity of the crop. Since it is difficult to identify the weed farmers face this issue many times and hence there is a need for a solution for this problem.

II. OBJECTIVES

The Following are the main objectives :

- Recommendation of multiple crops to farmers according to various parameters.
- Detection of weed in the crop field.
- Disease identification of different crops.

III. LITERATURE SURVEY

In the paper S. Pudumular have finalized features for the crop recommendation system but their model generated is prone to overfitting [1]. Author Rohit Rajak has combined datasets from different geographical regions and has performed evaluation of feed forward networks but has limited the use of ensembing [2]. T Hariharan's paper provides insights about evaluation of dataset but the use of Image Segmentation seems irrelevant [3]. It was important to select an appropriate model for weed detection among the likes of FRCNN, YOLO, SSD and gather information about implementation of the weed detection system [4]. The paper is used for getting an idea of how the final module will be implemented with a seamless application [5].

IV. DATASET DESCRIPTION

For the crop recommendation system, the dataset consists of 4 features namely Temperature, Humidity, Soil pH value and Rainfall. There are a total of 31 classes including crops like Rice, wheat, maize etc. and the size of the dataset is over 3100 rows. For Crop Disease Identification, the dataset consists of images of 38 classes of crop diseases and the dataset size is close to 50,000 images. For the weed detection module the image dataset of 100 unlabelled images of weed in crop fields are first labelled using LabelImg. The labelled info is then converted from xml to csv. The csv information

is again converted into a tf records file. After this procedure training of the model is to be done.

temperature	humidity	ph	rainfall	label
20.87974371	82.00274423	6.502985292	202.9355362	rice
21.77046169	80.31964408	7.038096361	226.6555374	rice
23.00445915	82.3207629	7.840207144	263.9642476	rice
26.49109635	80.15836264	6.980400905	242.8640342	rice
20.13017482	81.60487287	7.628472891	262.7173405	rice
23.05804872	83.37011772	7.073453503	251.0549998	rice
22.70883798	82.63941394	5.70080568	271.3248604	rice
20.27774362	82.89408619	5.718627178	241.9741949	rice
24.51588066	83.5352163	6.685346424	230.4462359	rice
23.22397386	83.03322691	6.336253525	221.2091958	rice
26.52723513	81.41753846	5.386167768	264.6148697	rice
23.97898217	81.45061596	7.50283396	250.0832336	rice

Fig. 1. Crop Recommendation System Dataset

V. PROPOSED SYSTEM

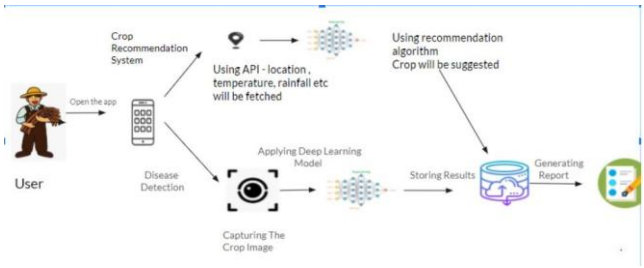

Fig. 2. The proposed system for integrated modules of crop recommender and crop disease prediction

A. Crop Recommendation System

This module will be presented as an android application. The feature values for prediction will be taken by gaining the user's gps coordinates and then scraping details according to these coordinates.

B. Weed Detection System

All the top view images of the crop field taken using drones or a camera will be stitched together and the algorithm will be applied on every image. In output the detected images will be stitched similarly. Due to this the user can find out where exactly the weed is.

C. Crop Disease Prediction System

This module will also be presented as an android application. The user will then upload the image of the infected crop/leaf. With the help of Image Recognition the exact disease will be predicted. Also the user will know about the cause of this disease by comparing similar information in the database.

VI. ALGORITHMS USED

A. Crop Recommendation System

Algorithms	Accuracy (In Percentage)
1. NaiveBayes(GaussianNB)	93.9
2. SVM	83.3
3. Random Forest	95.5
4. XGBoost	94.08
5. Decision Tree	92.3
6. Voting Classifier	95.4
7. Stacking Classifier	95.4

Fig. 3. Algorithms and their accuracy (In Percentage

From the above table we can infer that the ensembling tech- niques like Random Forest, Voting and Stacking Classifiers yield the highest accuracy

B. Weed Detection System

The technique used for detecting weed in crop fields is Object-Detection. It is implemented using Tensorflow 1.15 along with an Object-Detection directory containing necessary files. The model used for actual detection is Faster RCNN Inception V2. The IoU score goes as high as 0.98. The no. of boxes to be detected is kept 1 and threshold is kept 0.85

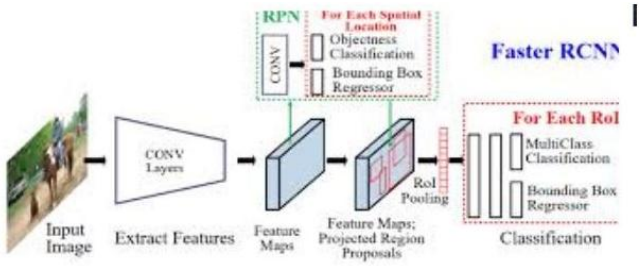

Fig. 4. Image explaining the architecture of Faster RCNN

C. Crop Disease Prediction

Used Convolutional Neural Network (CNN) and transfer learning network called Resnet50. Transfer Learning plays a significant role in boosting the accuracy of the model since the no. of classes are 38 and the dataset size is over 50,000 images.

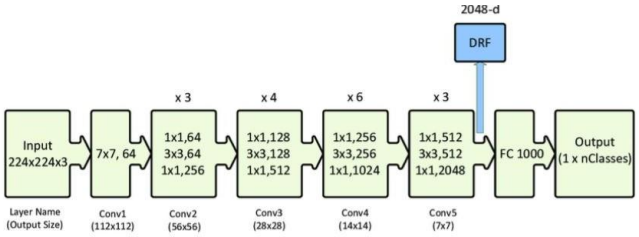

Fig. 5. Architecture of Resnet50

VII. RESULTS

A. Crop Recommendation System

According to Fig 3, since Random Forest technique gives the highest accuracy and being an ensembling technique it is preferred over all other techniques [7].

B. Weed Detection System

The weed detection along with the accuracy percentage is obtained as results

Fig. 6. Weed is detected in above top view images with very high IoU scores

C. Crop Disease Prediction

The accuracy obtained with Resnet50 is close to 91

Fig. 7. Disease Predication Results

VIII. CONCLUSION

Protecting the integrity of the farmers is very important in a country where the primary occupation is Agriculture. This project and its implementation thus has made remarkable progress over the existing projects. The ability of crop disease prediction module to provide evidence about the cause of diseases due to deleterious fertilizers, Insecticides or inclement weather has been a huge problem in India for decades. Thus we have successfully used Artificial Intelligence in developing products that will aid the farmers in producing a better harvest.

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