Crop Disease Analysis Using Machine Learning

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Abstract- *India is agrarian country. Agriculture is the main backbone of the Indian economy. Total 60% of India's land comes under the agriculture. 70 % of population are directly or indirectly depend on agriculture in India. Agriculture not only play the important role in large industries but also each and every person of the society are depend on it. So crop monitoring is crucial task to know the crop health. As we know agriculture is backbone of economy so productivity and quality is key points in agriculture sector. To grow the high quality product and maximize the yield production proper and in time "Crop Disease Detection" is very much needed. Disease in crop is natural or very common but to identify is in timely manner is essential in agriculture sector. This paper presents the crop disease analysis using the machine learning algorithm which usages the crop images. Convolutional Neural Network used for crop disease analysis. Images are preprocessed and essential feature are extracted from image then crop disease are classified using the machine learning classification algorithm. Proposed systems application would be useful to the farmer to detect the disease of crop just by capturing the photo of crop and submit to the application. Convolutional Neural Network has better ability to dealing with images and have greater accuracy in more amount of data.*

Keywords- Feature Extraction, Machine Learning (ML), Convolutional Neural Network (CNN), Crop Disease, Agriculture, Sugarcane, Wheat, Accuracy, Classification.

I. INTRODUCTION

Now-a-days, even India is cultivated country and 70% of population are depend directly or indirectly on agriculture, India's farmer are facing lots of problems in their life. Two major reasons are there behind it. First uncertain rain water because of more industrialization and Second one is Not good system available for crop disease detection. So first issue is not in our hand that's why we are try to cover the second one. Crop Disease is something which causes the unhealthy crop and it tends to the overall outcome from the crop. Crop Disease Restrict the crop to produce the lesser amount of product than their ability and also the low quality yield. Using the proposed system farmer can easily detect the crop disease at early stage and can take the proper action which directly results in yield production and and quality of the product.

With drastic change in environment number of diseases are also increased. Modern technologies used for crop cultivation and also various kinds of fertilizers and pesticides are used for increase the productivity. But farmer have not know about the actual contents and proper knowledge of the fertilizer this increased and improper use of this fertilizer and pesticide also coz the various different disease on the crop. In this paper I covered two types of crop and 8 different disease. 4 disease of each crop. I consider the most common crop and common disease of them as follows.

Sugarcane Disease- Red Rot, Grassy Shoot, Leaf Scald, Yellow Leaf Disease these are the common disease found in sugarcane and our proposed system detect correctly these disease of sugarcane.

Wheat Disease- Brown Rust, Loose Smut, Flag Smut, Foot Rot these are the common disease found in wheat and our proposed system detect correctly these disease of wheat.

Table 1-Types of crop and Disease

Type of Crop	Sugarcane	Wheat
	Red Rot	Brown Rust
Type of Disease	Grassy Shoot	Loose Smut
	Leaf Scald	Flag Smut
	Yellow Leaf Disease	Foot Rot

II. RELATED WORK

1. As there are many novel technologies like Image Processing, Machine Learning, Neural Network, Deep Learning and may other approaches are available but they have less accuracy.

2. There are many methods available who gives goods accuracy also but they are limited for the small amount of dataset.

3. For the feature extraction lots very good feature extraction methods work fine but the combination of feature extraction and classification not works great.

4. That's the reason i am using CNN algorithm which has own ability of feature extraction which work pixel by pixel on image and CNN is also a classifier so no need of

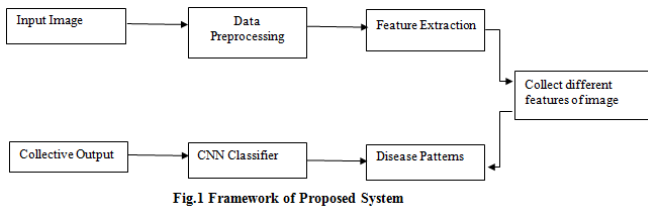more combination of feature extraction and classification algorithm.

III. METHODOLOGY

Fig.1 Framework of Proposed System

Steps involve in Crop Disease Analysis:

1. Data Acquisition: No standard Data available for this specified disease i have collected different image of Disease from the internet, from the few dataset of available for particular disease. I have also took some real time image from my farm and have created large number of images of crop disease.

2. Data Pre-Processing: After collecting images from different source they are different from each of in properties like image type image size and some other features. So i have preprocess them and made all of the same type as image extension and pixel resolution.

3. Feature Extraction: CNNs compare images piece by piece. The pieces that it looks for are called features. By finding rough feature matches in roughly the same positions in two images, CNNs get a lot better at seeing similarity than whole-image matching schemes.
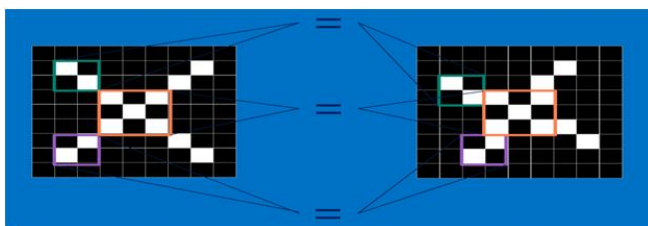
        Each feature is like a mini-image a small two-dimensional array of values. Features match common aspects of the images. In the case of X images, features consisting of diagonal lines and a crossing capture all the important characteristics of most X's. These features will probably match up to the arms and center of any image of an X.

4. Feature Classification: For the feature classification we here use the classifier CNN. **Convolutional neural networks model:**

i.   Convolution
ii. ReLU Layer
iii. Pooling
iv. Fully Connected
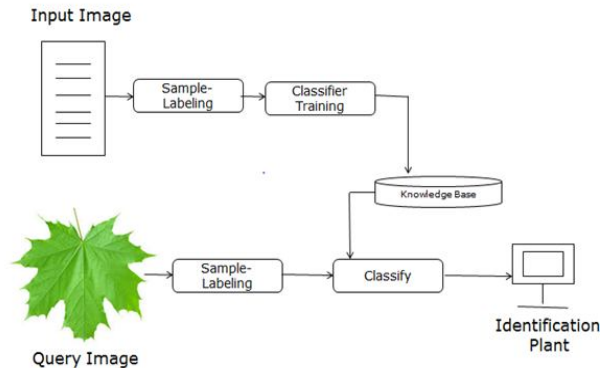
- **INPUT [32x32x3]** will hold the raw pixel values of the image, in this case an image of width 32, height 32, and with three channels R,G,B.

- **CONV layer** will compute the output of neurons that are connected to local regions in the input, each computing a dot product between their weights and a small region they are connected to in the input volume. This may result in volume such as [32x32x12] if we decided to use 12 filters.

$$\sum Input\ feature * Training\ image$$

$$\sum each\ pixel\ / \text{ total number of pixel}$$

- **RELU layer** will apply an element wise activation function, max(0,x). This leaves the size of the volume unchanged ([32x32x12]).

Activate Function f(x) $= \begin{cases} 0\ if\ x < 0 \\ x\ if\ x >= 0 \end{cases}$

- **POOL layer** will perform a down-sampling along the spatial dimensions (width, height), resulting in volume such as [16x16x12].

- **FC (i.e. fully-connected) layer** will compute the class scores, resulting in volume of size [1x1x10], where each of the 10 numbers correspond to a class score, such as among the 10 categories of CIFAR-10. Each neuron in this layer will be connected to all the numbers in the previous volume.

Pros and Cons of Classifiers:

Convolutional Neural Network:-

Pros-
1. Gives higher accuracy as 95% in image reorganization.
2. CNN are more useful in large dataset, large number of features and complex classification task.
3. Training of data again and again is not essential.
4. For Crop Disease application those contain noise in date still gives better results.
5. Low error rate.
6. CNN is designed to work better in image dada.

Cons-

1. High Complexity.
2. CNN require more training data.
3. Because of Complex Structure More powerful hardware require.

IV. RESULTS AND DISCUSSION

In this proposed work, we captured different crop disease of sugarcane and wheat preprocess them for same properties then extract the features and classify them using very strong classifier as Convolutional Neural Network, Which detect the accurate crop Disease.

Dataset:-

The dataset of Crop Disease images used for this system is collected from UCI repository, CrowdaAI and from other internet source as well as some real time captured images, which are by normal student and PD person. This dataset contain total 8 different disease of sugarcane and wheat 4 for each crop and each Disease contains 200 images so total dataset have 1600 images.

Performance Analysis Of classifiers:-

Table 2-Performance of classifier

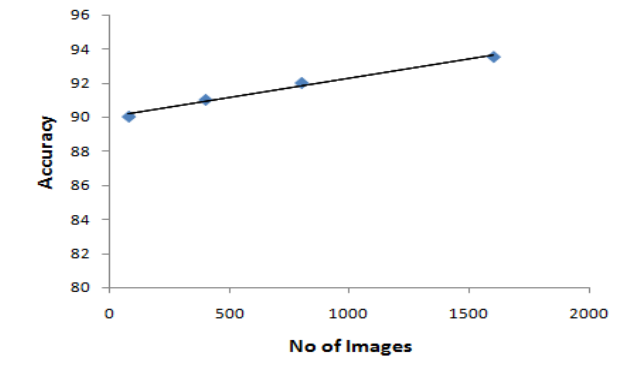| No. of disease Images	Accuracy
80	90%
400	91%
800	92%
1600	93.55%

Fig.4 Classifier Analysis

Table 3-Evaluation of classifier

No. of trained Images	No. of tested Images	Correctly classified	Misclassified	Accuracy
80	80	79	1	93.55%

Analysis of Classifiers:

It can be easily represent Convolutional Neural Network achieve highest accuracy (93.55%).Convolutional Neural Network gives balanced classification.
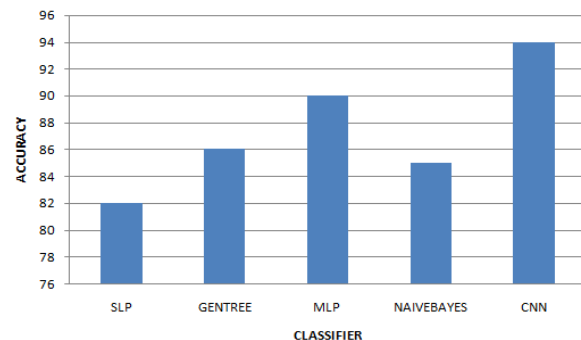

Fig. 5 Classifier Performance

V. FUTURE SCOPE

In proposed work, we tested results for detection of crop Disease for two types of crop by Convolutional Neural Network.

In this proposed work,8 different crop disease are detection is done. But in future using the same system can detect more number of disease for more number different of crop and also possible to make one android application for the user.

VI. CONCLUSION

Crop Disease analysis using Convolutional Neural Network is useful technique to detect the disease of various crop. This detection of disease is very helpful to the farmer as well as whole society because it result into more productivity and high quality yield production. The proposed system will detect the 8 different types of crop disease of the sugarcane and wheat disease with higher accuracy. Proposed system is very useful as per farmer point of view and indirectly it also beneficiary to the economy because it helps to produce the more and good quality product. Proposed system used the Convolutional Neural Network for feature extraction and image classification.

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