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PEST DETECTION BASED LEAF DISEASE PREDICTION USING DEEP LEARNING TECHNIQUES

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Abstract

Agricultural productivity is something on which economy highly depends. This is the one of the reasons that disease detection in plants plays an important role in agriculture field, as having disease in plants are quite natural. If proper care is not taken in this area then it causes serious effects on plants and due to which respective product quality, quantity or productivity is affected. Plant diseases are extremely significant, as that can adversely affect both quality and quantity of crops in agriculture production. Plant disease diagnosis is very essential in earlier stage in order to cure and control them. Plant diseases can increase the cost of agricultural production and may extend to total economic disaster of a producer if not cured appropriately at early stages. Inspired by the deep learning breakthrough in image-based plant disease recognition, this work proposes deep learning models for image-based automatic diagnosis of plant disease severity. Deep learning algorithm in image can offer an alternative solution in plant monitoring and such an approach may anyway be controlled by a professional to offer his services with lower cost. It includes image segmentation which includes active contour method and image classification approach which includes neural network algorithm to predict various types of diseases. Back Propagation Neural Network (BPNN) is a multilayer neural network consisting of an input layer, minimum one hidden layer and an output layer. As the name of the algorithm implies, the errors (hence, learning) propagate backwards from the output layer to the input layer. Therefore, the process of back propagation is used to estimate weights which minimize the errors in reference with the network's modifiable weights. And also extend the approach to recommend the fertilizers based on severity analysis with measurements. Finally provide alert about fertilizer to farmers in the form of SMS alert.

I. Introduction

The production of crops is associate with many factors, for example, climate change, plant diseases, and insect pests. According to recent researches, about half of the crop yield in the world is lost to pest infestations and crop diseases [1]. Crop pests cause significant damage to crops and whether in developing countries. Hence, it is of great significance to identify insects in the crops at an early stage and select optimal treatments, which is an important prerequisite for reducing. The associate editor coordinating the review of this manuscript and approving it for publication was Chang-Hwan Son. crop loss and pesticide use. There are too many types of insects and the number of individuals which belongs to the same species is enormous. However, traditional pest identification of insects is typically time-consuming and inefficient. Therefore, in order to improve the efficiency of agricultural production, a new effective recognition method should be proposed. Nowadays, with the development of deep learning, many researchers apply this technology into different fields and many excellent approaches have been proposed. Because of the successful applications of deep learning in diverse areas, it also has been used in agriculture. Detection and recognition of plant diseases using machine learning are very efficient in providing symptoms of identifying diseases at its earliest. Plant pathologists can analyze the digital images using digital image processing for diagnosis of plant diseases. Application of computer vision and image processing strategies simply assist farmers in all of the regions of agriculture. Generally, the plant diseases are caused by the abnormal physiological functionalities of plants. Therefore, the characteristic symptoms are generated based on the differentiation between normal physiological functionalities and abnormal physiological functionalities of the plants

II. Literature Survey

CHARTERS, Z. WANG, Z. CHI, A. CSOI, AND D. D. FENG[1]

In this paper we utilize the widely used and proven Bag of Visual Words model to identify plant species from leaf images. In order to exploit the venation structure, we propose the novel EAGLE descriptor to characterize leaf edge patterns within a spatial context. In combination with SURF (Speeded-Up Robust Features), our descriptors are able to characterize both local gradient and venation patterns formed by surrounding edges to improve species identification.

Faithpraise et al. [2] demonstrated the combination of the k-means clustering algorithm and the correspondence filter to achieve pest detection and recognition. The detection used the relative filter to identify different types of pests, which is time-consuming and ineffective when the dataset is huge.

G. L. GRINBLAT, L. C. UZAL, M. G. LARESE, AND P. M. GRANITTO[3]

Nowadays, in many typical applications of machine vision there is a tendency to replace classical techniques with deep learning algorithms. The benefits are valuable: on one hand it avoids the need of specialized handcrafted features extractors and, on the other hand, results are not damaged, moreover they typically get improved. We propose using a deep convolutional neural network (CNN) for the problem of plant identification from leaf vein patterns. In particular, we consider classifying three different legume species: white bean, red bean and soybean. The introduction of a CNN avoids using handcrafted feature extractors as in state of the art pipeline. Furthermore, this deep learning approach significantly improves the accuracy of the referred pipeline. We also show that this accuracy is reached by increasing the depth of the model. Finally, by analysing the resulting models with a simple visualization technique, we are able to discover which vein patterns are relevant

A. JOLY, H. GOËAU, P. BONNET [4]

In this paper Since 2010, hundreds of thousands of geo-tagged and dated plant photographs were collected and revised by hundreds of novice, amateur and expert botanists of a specialized social network. An image-based identification tool – available as both a web and a mobile application – is synchronized with that growing data and allows any user to query or enrich the system with new observations. An important originality is that it works with up to five different organs contrarily to previous approaches that mainly relied on the leaf. This allows querying the system at any period of the year and with complementary images composing a plant observation. Extensive experiments of the visual search engine as well as system-oriented and user-oriented evaluations of the application show that it is already very helpful to determine a plant among hundreds or thousands of species.

A. R. SFAR, N. BOUJEMAA, AND D. GEMAN[5]

This paper study fine-grained categorization, the task of distinguishing among sub-categories of a more basic category, such as an object or shape class, focusing on identifying botanical species from leaf images. Whereas people can usually immediately recognize instances from basic categories (trees, dogs, etc.), fine-grained categories (e.g., species of plants, breeds of dogs) are usually recognized only by experts. The difficulty arises because taxonomic categories often have very fine differences which are hard to notice for the common eye. Generally, the situation is the same in other domains of fine-grained categorization, and raises the question of what extent of semi-automation is required to provide useful results. To this end, we employ the user, with the goal of achieving something sensible between the two extremes of an inaccurate but fully automated identification and a very accurate but fully-manual identification. The baseline scenario is the standard one with no human intervention: given an image of a leaf, usually scanned against a flat background, the system automatically provides a single estimate of the true species. Even with scanned leaves, the utility of this approach is questionable due to relatively high error rates on large databases which contain very similar species and display high variability within the same species. This motivates the design of semi-automated systems. One natural possibility is to envision human participation at the end of the process in the sense of final disambiguation. The implementation exploits domain-specific knowledge about landmarks and taxonomy to automatically build the hierarchical representation of species based on purely foliar characteristics. As indicated earlier, we also introduce different identification scenarios and tackle the problem of the cluttered leaf images without using segmentation algorithms. State-of-the art results are obtained in all cases in which comparisons with previous work are possible.

Shijie et al. [6] proposed a detection algorithm on leaf images and constructed the convolution neural network model to detect tomato pests and diseases based on VGG16 [20] and transfer learning. The detection model achieved an average classification accuracy of 89%. In [21], an 8-layer CNN network was developed for the visual localization and classification of agricultural pest insects by computing a saliency map and applying deep convolutional neural network (DCNN) learning. And achieved a mean Accuracy Precision (mAP) of 0.951 for the classification of 12 important paddy insect species.

J. WÄLDCHEN AND P. MÄDER[7]

In a manual identification process, botanist use different plant characteristics as identification keys, which are examined sequentially and adaptively to identify plant species. In essence, a user of an identification key is answering a series of questions about one or more attributes of an unknown plant (e.g., shape, color, number of petals, existence of thorns or hairs) continuously focusing on the most discriminating characteristics and narrowing down the set of candidate species. This series of answered questions leads eventually to the desired species. However, the determination of plant species from field observation requires a substantial botanical expertise, which puts it beyond the reach of most nature enthusiasts.

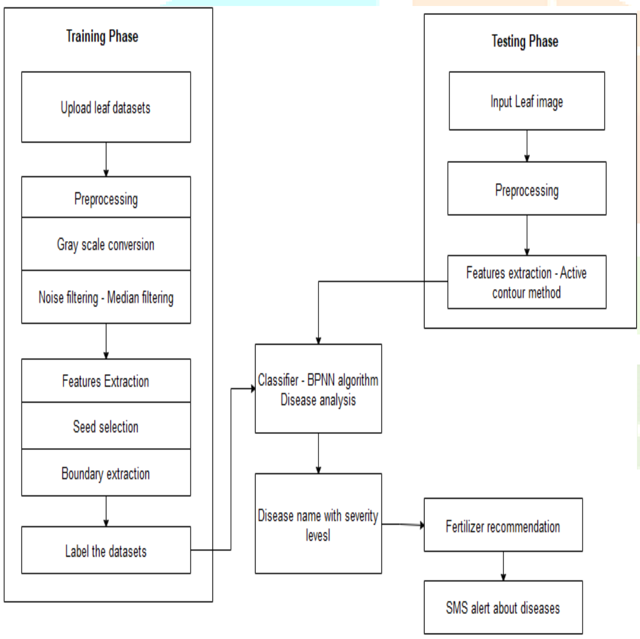
Wen et al. [8] proposed an effective feature-based insect automatical classification for orchard insects using six machine learning algorithms. And five common pest species in orchards were used To over if y the classification method. The maximum classification accuracy of 89.5% was observed.

Wang et al. [9] An automatic identification system designed to identify insect specimen images at the order level. The system adopted artificial neural networks (ANNs) and support vector machine

(SVM) as the pattern recognition methods for the identification tests and the system performed with good stability and accuracy reached 93%.

Xie et al. [10] developed an insect recognition system using advanced multiple-task sparse representation and multiple-kernel learning(MKL) techniques, which could combine multiple features of insect species to enhance the recognition performance. And their experimental results on 24 common pest species they collected outperformed other state-of-the-art methods of the generic insect categorization. Traditional machine learning algorithms [14]– [18] were proved to perform well when the number of pest species was small, but they cannot match the accuracy provided by deep learning methods when multiple features need to be extracted manually.

III. Proposed Architecture with Module Explanations



MODULES DESCRIPTION :

<u>Leaf Image Acquisition</u>

- Tree leave is snap shot of the whole plant
- User can upload the leave images as Leaf images
- Image can be any size and any resolution
- This image is in RGB (Red, Green and Blue) form.
- Color transformation structure for the RGB leaf image is created

<u>Pre-processing</u>

- Convert RGB image into gray scale image
- Using median filter algorithm to eliminate the noises in images
- The median filter is a nonlinear digital filtering technique, often used to remove noise.
- Such noise reduction is a typical pre-processing step to improve the results of later processing

<u>Image Segmentation:</u>

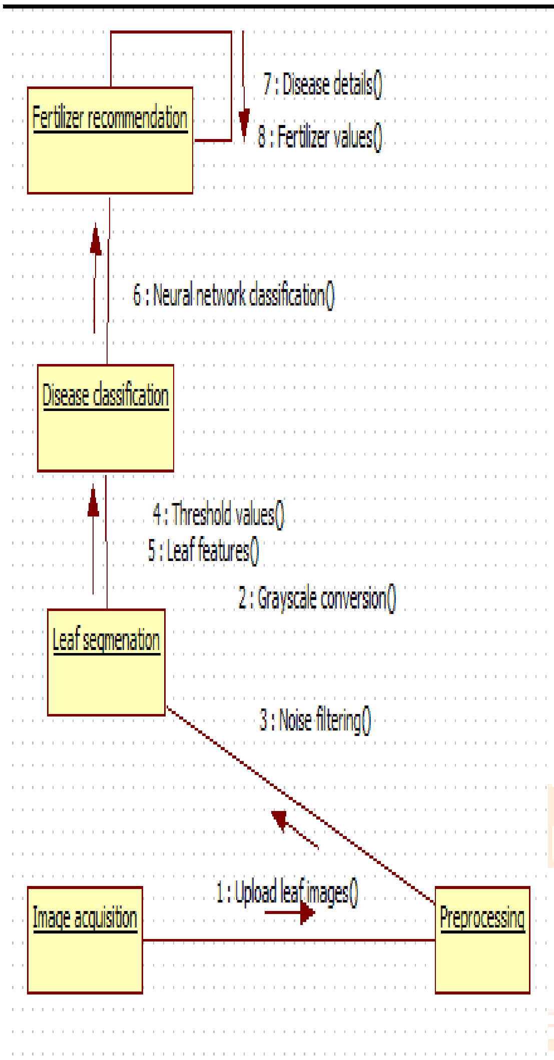
- Implement guided active contour method to segment the tree leaves
- At first leaves features are tracked and pointed as high level features
- Based on feature values, foreground leaves part is detected using contour method algorithm

<u>Disease prediction</u>:

- Track the features and calculate affected part features
- Implement Neural classification algorithm to predict the diseases
- Predict diseases as bacteria, fungi and other diseases

<u>Fertilizer Recommendation</u>

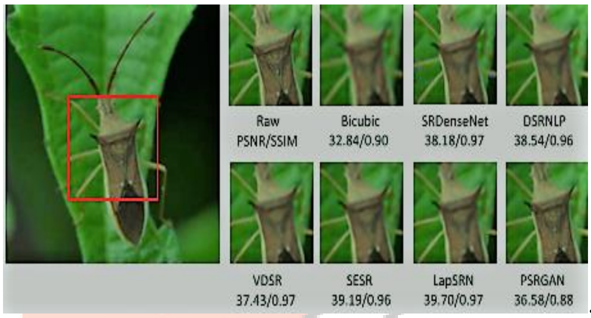
- Predict the diseases based on trained features
- Based on disease name, recommend the fertilizers that are added in trained side
- Provide improved classification rate based on severity levels



In this project contains two phases. They are Training phase and Testing phase, we trained convert RGB into GRAYSCALE image for reduce noise use median filter techniques and also update the datasets.

First, Admin upload the datasets. The uploaded datasets contain images. Next, Admin trains the feature using Back Propagation Neural Network (BPNN) is a multilayer neural network consisting of an input layer, minimum one hidden layer and an output layer. back propagation is used to estimate weights which minimize the errors in reference with the network's modifiable weights and also to recommend the fertilizers based on severity analysis with measurements.

And in Testing phase, in this database, we can implement the implement multiclass classifier; we can predict diseases in leaf images with improved accuracy.



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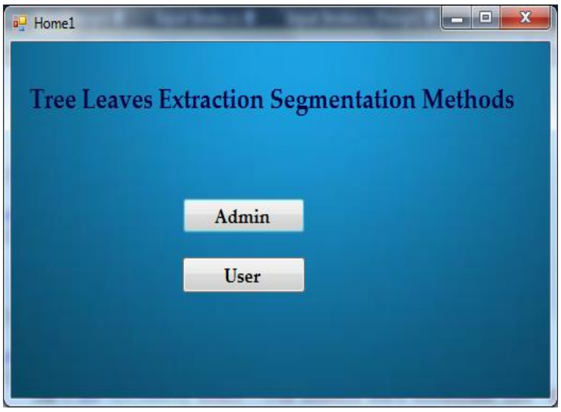
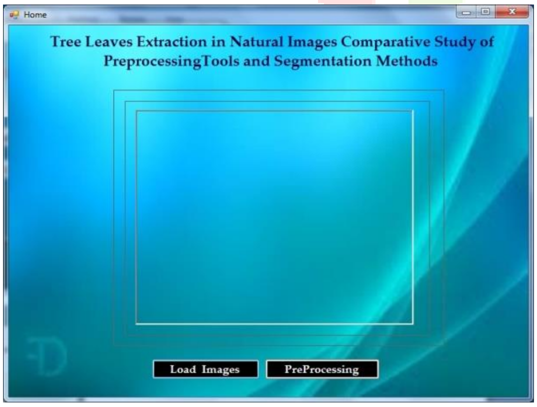
Experimental Results:

Home Page:



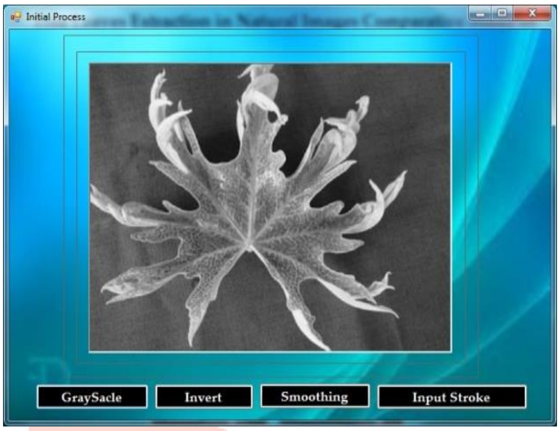
ADMIN Page:

LEAFIMAGE ACQUISATION



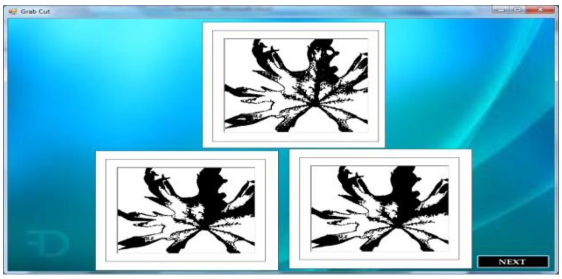
UPLOAD IMAGE

PREPROCESSING



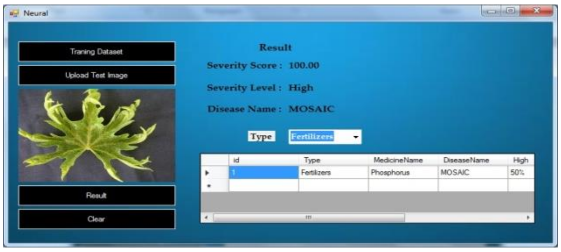
NOISE REMOVING

IMAGE SEGMENTATION



DISEASE PREDICITON

FERTILIZER RECOMMANDTION



VI. Conclusion:

In this project, we overview the various techniques and algorithms are proposed for segmentation and classification methods for improve the quality of segmentation. But the result shows that segmentation algorithms do not work properly and can't implement in large datasets rather than proposed graph cut model. We have presented a method designed to perform the segmentation of a leaf in a natural scene, based on the optimization of a polygonal leaf model used as a shape prior for an exact active contour segmentation. It also provides a set of global geometric descriptors that, later combined with local curvature-based features extracted on the final contour, make the classification into tree species possible. The segmentation process is based on a color model that is robust to uncontrolled lighting conditions. But a global color model for a whole image may sometimes not be enough, for leaves that are not well defined by color only. The use of an additional texture model or of an adaptive color model could lead to a good improvement. Finally implement neural network classification algorithm to classify the leaf diseases as bacteria, fungi and virus. Then recommend the fertilizers to affected leaves based on measurements

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