Fertilizer Recommendation System For Disease Prediction

Introduction

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. Mostly, the plant leaf diseases are caused by Pathogens which are positioned on the stems of the plants. These different symptoms and diseases of leaves are predicted by different methods in image processing. These different methods include different fundamental processes like segmentation, feature extraction and classification and so on. Mostly, the prediction and diagnosis of leaf diseases are depending on the segmentation such as segmenting the healthy tissues from diseased tissues of leaves.

Literature Review

[1] Dos Santos Ferreiraet al.[2017] proposed a method to identify unwanted weeds in the soybean field. Unwanted weed includes unwanted grasses and broadleaf. Convolution neural network technique is applied in the process of identifying the weeds in the soybean field. For the purpose of capturing the image, drones were used in it. The database used for analysing purpose includes fifteen thousand pictures weeds, soil, soybean, grass weed, and broadleaf. SafeNet architecture is used for training the neural network. The cafe software includes Alex Net in it. Pynovisao algorithm is used to build a robust image database. The results are compared with Support Vector Machine, Ada Boost, and Random Forest. The accuracy of 99 % is achieved using the convolution neural network. Super pixel algorithm (Simple Linear Iterative Clustering (SLIC) Super pixel) mainly focus on object localization and segmentation of the image.

[2] Carranza-Rojaset al.[2017] proposed a technique for herbarium species identification using deep learning technique. It mainly focuses on how convolution neural networks help in automatic identification of plant species. Image-Net classification performs very well in convolution neural network process. TL is also used for domain related training. Results show a greater accuracy when it is trained and tested for a different set of species. It has been shown in it that by using herbarium dataset Transfer learning is possible to another region even when the species don’t match. Handwritten tags and noise can be removed by the pre-processing technique. The transfer learning from herbarium to non-dried plants are clearly listed in the table.

[3] Luet al.[2017b] proposed a technique for identifying the pathogen in the vegetable. Deep convolution neural network technique is used for the identification of the rice disease. Training and testing the model consist of 500 images of rice leaves and stem with 10 types of rice disease in it. Ten fold cross validation method is used for identification of rice disease. The proposed novel model provides an accuracy of 95.48 %. The structure of 10 cross field deep convolution network consist of input (3@512 * 512), convolution (362@244 * 224), stochastic pooling (32@112 * 1112), convolution (16@56 * 56), stochastic pooling(16@28 * 28), convolution (16@28 * 28), stochastic pooling (16@14 *14), and two fully connected one. In the pre-processing stage scale normalization and mean normalization is done for colour image and grey image and then PCA and whitening method is applied. Finally trained and tested feature map is plotted. Recognition accuracy for mean, max and stochastic pooling is as follows 92.11, 93.24,95.48 and the recognition accuracy for different filter (5*5, 9*9, 16*16, 32*32) are 93.15, 92.56, 93.29, 92.48. The proposed method is compared with BP, SVM, and PSO.

[4] Barbedo [2019] proposed a technique based on deep learning for the purpose of image classification. Data augmentation technique helps in the lack of a database for plant image. This paper mainly focuses on identifying the individual lesion and spot instead of considering the whole leaf for identification. While using only lesion and spot the accuracy is 12 % higher than using the entire leaf. The complete details about the recent architecture used for identifying the plant disease and where the data are collected for identifying the plant disease and its accuracy after identification is also mentioned clearly. The list of disorder found in the plant specimen is also listed out clearly in it. Google Net CNN was used in the experimental setup. In the experiment, three different types of images were used and they are 1. Image with-out any modification 2. Image with background removed 3. Expanded dataset. Accuracy for both original and expanded images are calculated.

[5] Barbedo [2018] the problems faced in the machine learning technique has been overcoming by the deep learning concepts such as Convolution Neural Networks (CNN). Large data sets are needed for processing this technique. This paper mainly focuses on how the size of data and its variety affects the performance of the deep learning concepts. 12 plant species with different samples, different disease, and different character are taken into consideration. This analysis describes the different CNN network used for disease classification along with where this large amount of data are collected for classification. Accuracy is also calculated for each deep learning concepts. The number of correctly classified sample divided by the total number of samples provides the accuracy value. List of different plant species and its disease are listed in it. Removing background from image improves the prediction accuracy. This analysis was performed mainly using dataset obtained from different sources.

[6] Tavakoli and Gebbers [2019] presented an analysis of winter wheat nitrogen and assessment of water in the field by using a camera. This experiment was conducted during a period of three years (2012,2013, and 2014). Nitrogen fertilization and different level of water are applied in the field for the purpose of the experiment. Two machine learning algorithm was developed for the purpose of analysis namely Random Forest (RF) and Partial Least Square Regression (PLSR). Specter radiometer was used for radial measurement. Separately Vegetation Index (VI) is also calculated. For analysing the nitrogen content R2(RMSE) model is used and it is calculated separately for both data type. Random forest algorithm performs better in combined-date data. Nitrogen estimation calculation performs better while using the digital camera. It can also be integrated with the smartphone. It has a limitation of accessing only these spectral bands so that the analysis of plant status is also limited.

[7] Grinblatet al.[2016] proposed a method used for the identification of plant using leaf vein pattern. The classification of white bean, red bean and soybean are also done in this. Referred pipeline accuracy is also improved in it. The vein pattern is obtained by analysing the visualization technique with the obtained results. The image processing is done in four different stages namely vein segmentation, central patch extraction, vein measure, and classification. Random forest, support vector machine, and penalized discriminant analysis algorithm are used for classification purpose. Central patch extraction and vein measure are replaced by the convolution neural network technique where it learns from the data set and solve this problem. In the proposed system of CNN, the depth of the model is increased from 2 layers to6 layers. While analysing the results it shows that the accuracy gets improved when we go deep into the layer at the 5th layer an accuracy of 92.6 is achieved.

[8] Ferentinos [2018b] proposed a technique on convolution neural network. For the purpose of training, the model 87,848 images of healthy and diseased plant leaves are taken which includes 25 plant variety. These plants are tested under two different condition namely laboratory and field condition. Alex Net, AlexNetOWTBn, Google Net, over feat and VGG architecture are used for identification of plant disease from the leaves. Its implementation is done using Torch7. It is a machine learning framework. Its training portion is implemented in the Linux environment. 80 % of training data and 20 % testing data for CNN.99.49 % success rate is achieved when using AlexNetOWTBn and 99.53 % of success rate is achieved using VGG model. The success rate for both the original image and the pre-processed image is analysed as well for all the five models. The success rate is more when the model is first trained for field condition and then laboratory condition. The success rate is low when it is tested under laboratory condition and thenfield condition. It can be integrated with the mobile device due to low computational power.

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