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Survey on Deep Learning for Plant Identification based on Leaf Image

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Abstract:

Today, there is an increasing interest in automating the process of species identification.Deep learning algorithms, in particular convolutional networks, have rapidly become a methodology of choice for analyzing plant images. This paper reviews the major deep learning concepts pertinent to various image analysis and summarizes .

Recent advances in machine learning, especially with regard to deep learning, are helping to identify, classify, and quantify patterns in plant leaf images. Deep learning has been widely applied in plant imaging for improved image analysis. This paper reviews the major deep learning techniques in this time of rapid evolution and summarizes some of its key contributions and state-of-the-art outcomes.

Keywords: deep learning, neural networks,Plants identification, Leaf Recognition,Survey.

I INTRODUCTION

Deep learning covers a set of artificial intelligence methods that use many interconnected units to fulfill complex tasks. Deep learning algorithms can automatically learn representations from large amounts of data rather than the use of a set of pre-programmed instructions. This paper reviews the major deep learning techniques.The remaining part of the paper is organized as follows: Section II involves the works related to the existing image texture and classification methods using deep learning . The paper is concluded in Section III.

II RELATED WORKS

Er-Yang Huan, Gui-Hua Wen ,2017proposed a body constitution recognition algorithm based on deep convolutional neural network, which can classify individual constitution types according to face images. the proposed model first uses the convolutional neural network to extract the features of face image and then combines the extracted features with the color features. Finally, the fusion features are input to the Softmax classifier to get the classification result. Finally, achieve the accuracy of 65.29% about the constitution classification

Subham Mukherjee , Pradeep Kumar,2017present a plant disease identi_cation methodology from their leaves using deep CNNs. For this, adopted GoogLeNet that is considered a powerful architecture of deep learning to identify

the disease types. Transfer learning has been used to fine tune the pre-trained model. An accuracy of 85.04% has been recorded in the identification of four disease class in Apple plant leaves.

Sue Han Lee a , Chee Seng Chan ,2017propose the use of deep learning (DL) for reverse engineering of leaf features. first employ one of the DL techniques – Convolutional Neural Networks (CNN) to learn arobust representation for images of leaves. Then, go deeper intoexploring, analyzing, and understanding the most important subsetof features through feature visualization techniques, then show thatour findings convey an important message about the extent andvariety of the features that are particularly useful and important inmodeling leaf data.

Danzi Wu,1 Xue Han,2 Guan Wang,2019 proposed method has two contributions ,first taxonomic loss encoded taxonomic tree into the objective function by simple group and sum operation, which was easy to implement and compatible with end-to-end training, then second The taxonomic loss facilitated the training of various deep neural networks, which further increased plant identification accuracies at species, genus, and family levels. Here, two different editions of PlantCLEF 2015 datasets and 2017 datasets were used to evaluate the performance of the proposed method, the images from which were collected from different locations by distinct contributors. Each image belongs to one of seven content-types

Guillermo L.GrinblatLucas C.Uzal ,2016,propose using a deep convolutional neural network (CNN) for the problem of plant identification from leaf vein patterns.here, three different legume species: white bean, red bean and soybean has been considerd . Furthermore, this deep learning approach significantly improves the accuracy of the referred pipeline. Finally, by analyzing the resulting models with a simple visualization technique, we are able to unveil relevant vein patterns.

MostafaMehdipour Ghazi ,2017 ,use deep convolutional neural networks to identify the plant species captured in a photograph and evaluate different factors affecting the performance of these networks. Three powerful and popular deep learning architectures, namely GoogLeNet, AlexNet, and VGGNet, were used for this purpose. Transfer learning is used to fine-tune the pre-trained models, using the plant task datasets of LifeCLEF 2015. To decrease the chance of overfitting, data augmentation techniques are applied based on image transforms such as

rotation, translation, reflection, and scaling. Furthermore, the networks' parameters are adjusted and different classifiers are fused to improve overall performance. the best combined system has achieved an overall accuracy of 80% on the validation set and an overall inverse rank score of 0.752 on the official test set.

Yu Sun, Yuan Liu, Guan Wang, 2017, also studied a deep learning approach to automatically discover the representations needed for classification, allowing use of a unified end-to-end pipeline for recognizing plants in natural environment. The dataset BJFU100 has acquired by mobile phone in natural environment. The proposed dataset contains 10,000 images of 100 ornamental plant species in Beijing Forestry University campus. A 26-layer deep learning model consisting of 8 residual building blocks is designed for uncontrolled plant identification. The proposed model achieves a recognition rate of 91.78% on the BJFU100 dataset.

J. W. Lee and Y. Chan Yoon,2019, proposed a model to address the fine-grained plant image classification task by using the wide and deep learning framework which combines a linear model and a deep learning model. Proposed method sums the result of the wide and deep learning model using a logistic function so that discrete features can be considered simultaneously with continuous image content. The metadata such as the date of flowering and locational information for the wide model were used. the experiment shows that the proposed method gives better performance than a baseline method.

Adams Begue, Venitha Kowlessur, Fawzi Mahomoodally, Upasana Singh,2017, presented A fully automated method for the recognition of medicinal plants using computer vision and machine learning techniques. Leaves from 24 different medicinal plant species were collected and photographed using a smartphone in a laboratory setting. A large number of features were extracted from each leaf such as its length, width, perimeter, area, number of vertices, colour, perimeter and area of hull. Several derived features were then computed from these attributes. The best results were obtained from a random forest classifier using a 10-fold crossvalidation technique. With an accuracy of 90.1%, the random forest classifier performed better than other machine learning approaches such as the k-nearest neighbour, naïve Bayes, support vector machines and neural networks. These results are very encouraging and future work will be geared towards using a larger dataset and high-performance computing facilities to investigate the performance of deep learning neural networks

to identify medicinal plants used in primary health care

Margesh Keskar, Dhananjay Maktedar,2019 , proposed efficient accurate classifier for ayurvedic medical plant identification (EAC-AMP) utilizing using hybrid optimal machine learning techniques for ayurvedic medical plant identification .The spider optimization neural networks (SONN) were used to segmentation process. Then, we compute time and frequency domain features, by the help of symbolic accurate approximation (SAX) technique also we compute the color features and tooth features by the help of two dimensional binary phase encoding (2DBPE). the type of plants with higher efficiency and accuracy can characterized by the use of whale optimization with deep neural network (DNN) classifier,. the data set contains an aggregate of 928 ayurvedic plant leaf images. Here, 743 example ayurvedic pictures has utilized for training and 185 for testing.

Anfeng He, Xinmei Tian,2016, proposed an effective automatic plant identification algorithm with multiple organs by using multi-column deep convolutional neural networks .here develop the model to automatically identifying plants by combining multiple organs of plants. Specifically, proposed a multi-column deep convolutional neural networks (MCDCNN) model to combine multiple organs for efficient plant identification.

Aravindhan Venkataramanan et al presents a Deep Learning approach to detect and classify plant diseases by examining the leaf of a given plant. In this paper, the classification is performed in multiple stages to eliminate possibilities at every stage, hence providing better accuracy during predictions. A YOLOv3 object detector is used to extract a leaf from the input image. The extracted leaf is analyzed through a series of ResNet18 models. These ResNet18 models were trained using transfer learning. One layer identifies the type of leaf and the following layer checks for the possible diseases that could occur in the plant. PlantVillage Dataset was obtained from SP Mohanty's Git-Hub repository. The dataset comprised of raw images, data distribution for SVM and other useful data. The raw images consisted each of colour, grayscale and segmented images. Each category resulting close to 55k images which includes 38 different classes. Altogether there are 38 classes present in the dataset, our models were trained on 29 classes, and selection was done by selecting classes with atleast one disease and one healthy class each, so

that the model learns to distinguish the disease. the accuracy of the system to 96%

Xue J R, Fuentes S et al proposed new tools make the classification of Chinese medicinal plants easier, more efficient and cost effective. The comparative results between machine learningmodels obtained from two methods: i) a morpho-colorimetric method and ii) a visible (VIS)/NearInfrared (NIR) spectral analysis from sampled leaves of 20 different Chinese medicinal plants. Results showed that the ANN model developed using the morpho-colorimetric parameters asinputs (Model A) had an accuracy of 98.3% in the classification of leaves for the 20 medicinal plants studied.

Guillermo L. Grinblat , Lucas C. Uzal , et al ,2016 proposed a novel framework and an effective data augmentation method to address the task of realistic recognition. As deep convolutional neural networks (CNNs) used for large-scale image classification basing on deep learning.The operation attention cropping (AC) used to crop the image. An extensive comparative experiments are carried out on different types of datasets including Oxford flower which is a traditional dataset and PlantCLEF which is a specific dataset for real-world identification.

M. Akila, P. Deepan,2018 proposed a deep-learning-based approach to detect leaf diseases in many different plants using images of plant leaves. consider three main families of detectors: Faster Region-based Convolutional Neural Network (Faster R-CNN), Region-based Fully Convolutional Network (R-FCN), and Single Shot Multibox Detector (SSD), which was used for the purpose of this work. The proposed system can effectively identified different types of diseases with the ability to deal with complex scenarios from a plant's area. Dataset contains images with several diseases in many different plants. In this System we consider some of the commercial/cash crops, cereal crops, and vegetable crops and fruit plants such as sugarcane, cotton, potato, carrot, chilly, brinjal, rice, wheat, banana and guava. Diseased leaves, healthy leaves all of them were collected for those above crops from different sources like images download from Internet, or simply taking pictures using any camera devices or any else

Lu, Jiang & Hu, Jie & Zhao, Guannan & Mei, Fenghua & Zhang, Changshui. (2017)This paper presents an in-field automatic wheat disease diagnosis system based on a weakly super- vised deep learning framework, i.e. deep multiple instance learning, which achieves an integration of identification for wheat diseases and localization for disease areas with only image-level annotation

for training images in wild conditions. Furthermore, a new in-field image dataset for wheat disease, Wheat Disease Database 2017 (WDD2017), is collected to verify the effectiveness of our system. Under two different architectures, i.e. VGG-FCN-VD16 and VGG-FCN-S, our system achieves the mean recognition accuracies of 97.95% and 95.12% respectively over 5-fold cross-validation on WDD2017, exceeding the results of 93.27% and 73.00% by two conventional CNN frameworks, i.e. VGG-CNN-VD16 and VGG-CNN-S. Experimental results demonstrate that the proposed system outperforms conventional CNN architectures on recognition accuracy under the same amount of parameters, meanwhile main- taining accurate localization for corresponding disease areas. Moreover, the proposed system has been packed into a real-time mobile app to provide support for agricultural disease diagnosis.

Alexander Johannes , Artzai Picón , Aitor Alvarez-Gila et al,2017 ,A novel image processing algorithm based on candidate hot-spot detection in combination with statistical inference methods is proposed to tackle disease identification in wild conditions. This work analyses the performance of early identification of three European endemic wheat diseases septoria, rust and tan spot. The analysis was done using 7 mobile devices and more than 3500 images captured in two pilot sites in Spain and Germany during 2014, 2015 and 2016. Obtained results reveal AuC (Area under the Receiver Operating CharacteristicROCCurve) metrics higher than 0.80 for all the analyzed diseases on the pilot tests under real conditions.

Prema K, Carmel Mary Belinda,2019 proposed methodology aims to create an approach for plant leaf disease detection based on deep neural network. This approach combines IoT and image processing which runs preprocessing and feature extraction techniques by considering different features such as color, texture, size and performs classification using deep learning model that expands to help identification of plant leaf disease. we have used around 20000 images for training the web application using the Django for GUI purpose where we provide the option of uploading the image if the user upload image it will processed by the Deep Learning and predict the results of the various crop diseases our application is more accurate and complete its work within less time it predicts correctly most of the time.

III. CONCLUSION

Developments in deep learning algorithms in recent years have occupied a major part in our lives by automating most of the processes. They have shown improvement over the traditional machine learning algorithms. In this paper

highlighted the issues, which act as barrier in the growth of deep learning in the plant identification industry. We have also discussed the application areas of deep learning in plant image analysis. Although, the list of application area is never complete but the paper provides indication of large list of application areas of deep learning in plant imaging and lastly it can be concluded that the application of deep learning in plant imaging is limited.

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