Grape Disease Detection Network Based On Multi Task Learning and Attention Features

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Abstract

In this procedure, we recommend the primary causes of a significant reduction in grape production are grape diseases. Therefore, it is critical to create a technique for diagnosing diseases of grape leaves. We use deep learning methods to identify grape diseases because they have recently demonstrated impressive success in a variety of computer vision problems. A Convolutional Neural Network (CNN) architecture built on an integrated approach is suggested in this procedure. The architecture of the suggested CNNs is intended to identify leaves that have common grape diseases. As a result, the performance of the suggested technique will yield better outcomes. The primary goal of this procedure is to use grape leaves to predict plant leaf disease on the other side, to improve the functionality of the procedure.

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1. INTRODUCTION

Because there are so many plant species in the world, it can be difficult and time-consuming to identify them, especially for non-expert users like land managers, agronomists, foresters, hobbyist gardeners, etc. Therefore, an automatic plant recognition tool ought to make the job of identifying plant types quicker. In this study, we concentrate on leaf form and shape-based methods for leaf identification. One can create a unique method or modify a general shape retrieval technique to the specific instance of leaves to characterise the shape of a leaf. This essay provides a summary of the ReVeS project's involvement in the 2012 Image CLEF Plant Identification assignment.As we attempt to develop a system for tree leaf identification on mobile devices, our approach is meant to cope with the challenges presented by complex nature photos and to enable a didactic contact with the user. The approach relies on a two-step model-driven segmentation process, evaluation of high-level attributes that support semantic meaning, and evaluation of broader form aspects. A random forest classification method is used to blend all of these descriptors, and its importance is assessed. Our team came in third on natural images and fourth overall, which is a very gratifying result in light of the project's goals.The ReVeS project aims to develop an interactive and instructional system that will assist users in identifying a tree in a natural setting from a picture of a leaf. Including prior information of the anticipated shape of the object we are searching for is a smart method to lower the possibility of error. The most pertinent information to depend on when attempting to approximate the outline of a leaf in possibly imperfect pictures appears to be colour.A true a priori color model for all leaves is not attainable because to the variety brought on by season, species, and illumination. However, in order to extract a color model from each image, we must first have a broad idea of where the leaf is located. We require the user's assistance to build a region inside the leaf, in the case of a complicated leaf, that has at least three components. We then rotated and cropped a few photographs so that they clearly only contained one important leaf, with its apex looking roughly to the top of the picture, in order to align them with our frame of work for a smartphone application. Only photographs are used for this one and only human involvement in the identification process. We attempt to guess a model of the leaf's colour based on this first, initial area, and to calculate the distance of each pixel to this model. This is done by combining, based

on the evidence, the dissimilarity to a global colour model computed by linear regression on the starting region and the dissimilarity to a local adaptive model constructed by changing an anticipated mean color while analyzing the picture.

2. LITERATURE SURVEY

The leaf vein and form are used in this article to suggest and build a leaf identification system that can be used to classify plants. 21 leaf features, such as distance, FFT magnitude, and phase, digital morphological features using four fundamental geometry features and 5 vein features, and the final feature recovered using the convex hull are all extracted using Fast Fourier Transform (FFT) techniques. Images of 1907 foliage were used to categorise 32 different types of plants in order to confirm the efficacy of the method. The suggested system outperformed the current leaf recognition technique, with an average recognition rate of 97.19%. Plants are important for food production, medicinal research, business, and environmental protection, but many plant species are in peril of extinction due to environmental pollution. The leaf vein and shape are used in this article to suggest a leaf identification method for classifying plants. Because the primary concern with automated plant categorization and recognition is whether chosen characteristics are stable and have an effective ability to distinguish between various types of leaves, this research is crucial for plant security. Color and shape, which can be determined by contrasting their colour histograms, are two characteristics used for plant identification based on leaf picture. However, the user's inability to explicitly define both ends of the leaves caused the recognition performance to be constrained. Leaf color is influenced by the seasons. Using leaf vein and frequency domain data, the suggested system can determine the orientation of a leaf based on the distance between its centroid and contour [1].

Even now, a very small number of highly skilled workers painstakingly identify and categorise unidentified plant types. To recognise the leaf, shape, vein, color, and texture characteristics have been used, and a neural network method is used to categorise them. This is an intelligent device that can recognise different tree types from images of their leaves and gives precise findings more quickly. It is well known that plants are essential to keeping the ecosystem and environment of the earth by preserving a wholesome atmosphere and giving food and refuge to a wide variety of bug and animal species. The study of leaf picture retrieval is essential because the form of plant leaves is one of the key characteristics for clearly identifying different plants.The research of leaf picture retrieval methods will be a crucial step in creating a system for identifying plants because the shape of plant leaves is one of the key characteristics for visibly characterising different plants. A crucial step towards their protection and preservation is the creation of a plant database for the fast and accurate categorization and identification of various flora diversities. This is more crucial now that numerous plant species are in danger of going extinct. Recently, automated systems for classifying plants have effectively used computer vision methods and pattern recognition techniques. As form characteristics, we use the centroid-contour distance curve and the eccentricity of the foliage objects.However, extracting and transferring those characteristics to a computer instantly is not simple. In feature extraction, this work attempts to minimise human interference. There are 6 different vegetation types found. To identify the plant, they used the aspect ratio, the leaf divot, the leaf vein, and the invariant moment. The vein of a leaf (venation) is used to derive additional characteristics that are used to identify vegetation. For the recovery of various kinds of leaf pictures used as a database, shape and venation are used. To define a colour picture, colour moments serve as a representation of colour characteristics. In order to increase identification accuracy, this current study extracts color, vein, texture, and vein feature. This project will be done using MATLAB and uses a collection of various leaf pictures [2].

This study uses feature extraction, network training, and picture pre-processing to create a categorization system for agricultural and ayurvedic plants. The application of artificial neural networks to issues with pattern identification, classification, and picture analysis has been effective. In this study, 440 leaves from 16 distinct groups were evaluated, and the technique produced accuracy rates of over 90%. The most significant living forms on our world are plants, which not only support human existence and production but also balance the levels of O2 and CO2 in the atmosphere. Computerized plant recognition systems can make use of a variety of flora traits, ranging from basic to complicated. The categorization and identification of plants based on leaf form has received a lot of research. 12 frequently used digital morphological characteristics were extracted by Wu et al. and PCA was used to orthogonalize them into 5 main variables. Wang et al. used the eccentricity and angle code histogram (ACH), as well as the centroid contour distance (CCD) graph. Du et al. suggested an effective shape matching method for computer-aided plant species

identification (CAPSI) based on plant leaf pictures. Gu et al. made use of the segmented leaf structure that was obtained through the use of wavelet transform (WT) and Gaussian interpolation. Shape identification based on radial basis probabilistic neural network, taught by orthogonal least square algorithm (OLSA), and improved by recursive OLSA, was presented by Hu et al. [3].

A computer-based automated plant identification method is presented in this article. The leaf is chosen to acquire the characteristics of the plant out of all the possible plant organs. Digital picture processing methods are used to compute five geometrical factors. Six fundamental morphological characteristics are derived based on these geometrical factors. Leaf structure is used to obtain the vein feature, which is a derived feature. Digital scanners are used to capture foliage pictures at the initial stage. The extracted morphological characteristics are then used as input in the categorization step, which follows. The suggested algorithm's recognition efficiency is evaluated. This algorithm's accuracy has been tried against two distinct databases and contrasted. For both datasets, the false acceptance ratio and false denial ratio are computed.Plants are a crucial component of our ecology and are in danger of going extinct. Advanced computer vision methods are required to catalogue their identification, features, and valuable qualities. Numerous plant parts, including leaves, blossoms, fruits, and seeds, can be used to identify a plant. Sending leaf pictures to a machine allows for the extraction of leaf characteristics that help identify the plant. For plant recognition, a number of techniques have been developed, including form description, colour characteristics, texture features, vein structure, geometrical features, etc.Wang et al. suggest a shape descriptor technique for mobile platform-compatible online plant leaf recognition. Chaki et al. identified the plant genus using the Gabor Filter. main Component Analysis (PCA) and Probabilistic Neural Network were used by Wu et al. to extract 12 leaf characteristics and orthogonalize them into 5 main variables. (PNN). In this study, the foliage pictures were classified using a Euclidean classifier [4].

In this article, we build a general-purpose automatic leaf identification system using multilayer perceptrons, image and data processing methods, and neural networks. It is inexpensive and easy to sample foliage and take pictures of them. The leaf picture can be quickly transferred to a computer, which can then autonomously extract characteristics using image processing methods. Utilizing simple-to-extract features and a highly effective identification algorithm, this article uses a leaf recognition algorithm. The classification and feature extraction are where we make the most gains. The digital picture of a leaf has all of its characteristics removed. All characteristics can be mechanically extracted, with one exception.Plants are vital to human civilization but are in danger of going extinct. A plant protection database must be put up in order to safeguard them. The use of classification based on foliage images is preferable due to its affordability and practicality. Extracting and transferring features to a computer instantly is difficult, though. In feature extraction, this work attempts to minimise human interference.Several strategies have been put forth, including artificial neural networks and k-nearest neighbour (k-NN) classifications. (ANN). A form identification method based on radial basis probabilistic neural network that is trained using the orthogonal least square algorithm (OLSA) and optimised using the recursive OLSA was proposed by Du et al. Using simple-to-extract features and a highly effective identification algorithm, this article uses a leaf recognition algorithm. While ANN classifiers improve other classifiers' accuracy, they run quicker than k-NN (k=1, 4) and MMC hyper sphere classifiers (MLPN, BPNN, RBFNN, and RBPNN). All characteristics are extracted mechanically from the digital image of a leaf, with just one exception. A feed-forward artificial neural network model called a multilayer perceptron (MLP) translates sets of raw data to sets of suitable output [5].

3. PROPOSED SYSTEM

The health of a plant's growth has a significant impact on both the ecosystem and human existence. However, a variety of plant illnesses caused by viruses, fungi, and microorganisms can hinder a plant's development and ability to produce farming goods. Multiple symptoms are present in grape esca, black rot, and isariopsis, three soil-borne illnesses. These illnesses frequently result in leaf loss or even the disappearance of the plant or plants nearby. For improved grape development and output, early discovery and prevention become essential, and they must be handled promptly.

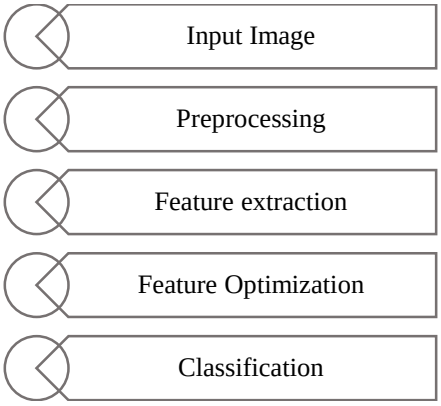

Fig 1: System Architechture

The state-of-the-art either uses regression-based object identification on UAV pictures or traditional computer vision methods like edge detection and segmentation. Furthermore, until detected leaves are evaluated for real disease/symptoms, the therapy is not effective. As a consequence, more effort and money are spent.

Advantages:

When compared to the current technique, the process is more accurate.

Due to the few datasets used, the process' dependability is at its highest point.

Following section explains several stages that are involved in putting the suggested technique into practice:

Input Image:

The fundamental data structure in MATLAB is an array, which is an organised collection of simple or real components. Images and real-valued, organised collections of colour or intensity data are best represented using arrays. For pictures with complicated values, an array is appropriate.The majority of pictures are depicted in the MATLAB workspace as two-dimensional arrays (matrices), where each member of the matrix represents a single pixel in the visible image. An illustration would be a 200-by-300 grid containing 200 rows and 300 columns of variously coloured spots.A three-dimensional matrix is necessary for some pictures, such as RGB, where the first plane in the third dimension represents the intensity of the red pixels, the second plane represents the intensity of the green pixels, and the third plane represents the intensity of the blue pixels.

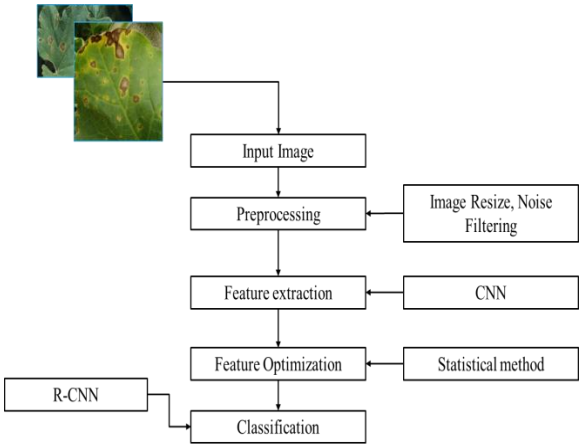

Fig 2: Flow Diagram

Pre-processing:-

Picture scaling in computer graphics and digital photography refers to resizing a digital picture. In video technology, upscaling or density increase are terms used to describe the enlargement of digital content. A vector graphic picture can be scaled without sacrificing image clarity by using geometric changes on the graphic primitives that make up the image. Raster graphics images must be scaled by creating a new picture with more or fewer pixels. When the number of pixels is reduced (scaling down), there is typically a noticeable clarity loss.Raster graphics scaling is a two-dimensional illustration of sample-rate conversion from the perspective of digital signal processing, which is the translation of a discrete signal from one sampling rate (in this instance, the local sampling rate) to the other.

Feature extraction:

Convolutional neural networks (CNNs) are built utilizing a variety of building blocks, such as pooling, convolution, and fully connected layers, to automatically and adaptively learn spatial hierarchies of feature sets by back-propagation. This review article provides insight into CNN's fundamental ideas and how they apply to various radiological jobs. It also analyzes its difficulties and potential applications in the future of radiology. This paper will also discuss methods to reduce the problems of short dataset and over-fitting when using CNN for radiological jobs. To fully utilize CNN's potential in diagnostic radiology and enhance radiologists' performance while enhancing patient care, it is crucial to be aware of its principles, benefits, and limits.

Classification:

Deep Learning trains machines or computers to learn from experience, categorize, and identify data or pictures in a similar way to how a human brain does. Deep Learning has become a successful method for analyzing massive data. CNNs are a class of artificial neural networks used in deep learning and are often used for classifying and identifying objects in images. As a result, Deep Learning employs a CNN to recognize objects in an image.

4. RESULT

This procedure uses deep learning methods to identify grape diseases, using a Convolutional Neural Network architecture built on an integrated approach. The goal is to use grape leaves to predict plant leaf disease on the other side, to improve the functionality of the procedure. The ReVeS project aims to develop an interactive and instructional system that will assist users in identifying a tree in a natural setting from a picture of a leaf. The method is based on two-step model-driven segmentation, evaluation of high-level properties, and evaluation of more general form features. A random forest classification method is used to blend all of these descriptors, and its importance is assessed. This study introduces a novel method based on faster R-CNN called GLDDN for categorizing grape leaves as healthy or sick. It combines object detection and classification with attention-based multilevel feature map synthesis and achieves a 99.93% recognition rate. Multitask learning involves pooling by cropping the region suggestion. The provided model is straightforward, accurate, and computationally efficient, and it might replace on-site identification by experts.

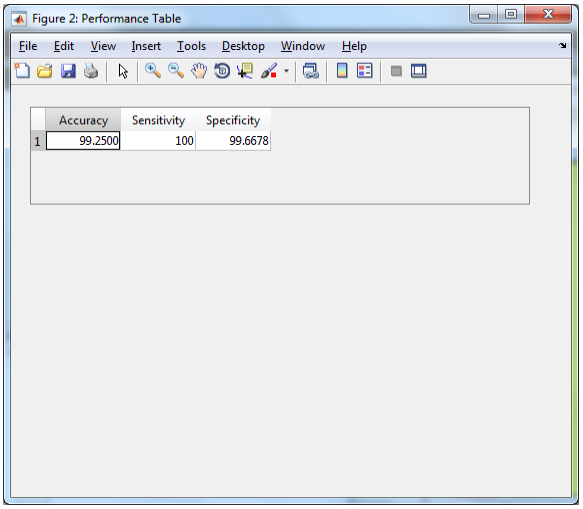

Fig 3: Performance Measure

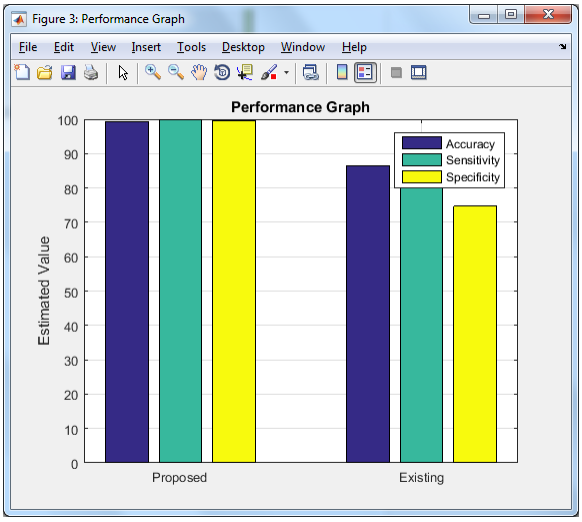

Fig 4: Performance Analysis

5. CONCLUSION

In this study, we introduce a novel method based on faster R-CNN called GLDDN for categorizing grape leaves as healthy or sick (esca, black rot, and isariopsis). In order to classify and identify the sick region in leaves, RPN receives the feature map that was produced from the concatenated attention mechanism. To recognize the object and categorize it to determine whether it is infected, multitask learning involves pooling by cropping the region suggestion. The uniqueness of the study resides in the integrated framework that combines object detection and classification with attention-based multilevel feature map synthesis. The experiment shows the effectiveness of the suggested technique because it achieves a 99.93% recognition rate for the dataset. The provided model is straightforward, accurate, and computationally efficient, and it might replace on-site identification by experts.

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