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AUTOMATIC RECOGNITION OF PLANT LEAVES USING MACHINE LEARNING ALGORITHMS

[1]S.S. Sahil Chakravarthy, [2]Dr. Prakash

UG Student, Dept of ECE, Saveetha School of Engineering, SIMATS, Chennai, India.

Assistant Professor, Dept of ECE, Saveetha School of Engineering, SIMATS, Chennai, India.

Abstract:

A fully automated method for the recognition of medicinal plants using computer vision and machine learning techniques has been presented. Leaves from 24 different medicinal plant species were collected and photographed using a smart phone in a laboratory setting. A large number of features were extracted from each leaf such as its length, width, perimeter, and 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 SVM classifier using a 10-fold cross-validation technique. With an accuracy of 90.1%, SVM classifier performed better than other machine learning approaches such as the k-nearest neighbour, Naïve Bayes, KNN and neural networks.

Keywords: Plant Diseases, Image segmentation, Convolution Neural Network, Medical application.

INTRODUCTION:

Computers have developed into a critical technology in a variety of applications such as defense, medicine, agriculture, engineering etc. with its ability to process visual information such as photographs taken from certain mobile devices. An picture contains valuable information that has developed into a crucial tool in a variety of applications such as defence, medicine, agriculture, engineering, etc. through its ability to process visual information such as images captured from other electronic devices. Any process of producing computations. The segmentation of images is a process of partitioning an image into smaller, more significant pieces.Interestingly, it can be stated as identification and classification of some region of interest. The segmentation is performed on the basis of some common properties of the objects present in an image such as colour, texture and shape etc. Image segmentation is a commonly performed pre-processing step for image processing using two methods (i)Traditional method and (ii) Soft computing method. Traditional system taxonomy mostly compromises soft thresholding, edge-, region-, and clustering approaches, and soft computation primarily compromising fuzzy logic, neural network, and genetic algorithm.

Nowadays, soft computing with the ability to solve ambiguity has been used most commonly for image segmentation. Soft computing methods are designed to mimic the human intellect by automatically learning from their ability to perform any complex function. The Soft Computing (SC) methods are a category of methods, primarily Fuzzy Logic (FL), Neural Network (NN), and Genetic Algorithm (GA), and Warm Intelligence methods, such as Particles Warm Optimization (PSO), Bacterial Foraging Optimization. Soft computing methods do not typically require human involvement to automatically perform the process of segmentation. In all the aspects so far, plants play an important part. They act as the foundation of environmental sustainability. Plants also suffer from diseases that affect the plants normal growth. These diseases affect complete plant including leaf, flower, fruit and stem. Detection of these plant diseases is an essential activity to undertake. The current approach for detecting and classifying diseases from a plant is performed using human intervention. Experts by naked eye make observations about a plant's diseases by continuous plant monitoring over a wide period of time. Such current approaches to detecting diseases are often time-consuming and cumbersome. The use of any automated system may be very useful to control the plant disease at an early stage. Soft computing technique with the capacity to simulate human thought is capable of automatically performing the task of detecting and classifying these plant diseases in less time and expense. In this article we presented an automated BRBFNN soft computing method to detect and classify disease from plant leaves. The proposed approach uses Bacterial Foraging Optimization(BFO) to assign optimal weight to the Radial Basis Neural Function Network (RBFNN) and to find the optimal region for the various diseases present on the plant leaves. RBFNN is a special linear feature with a specific competence in which the plant leaf images increase or decrease monotonously with distance from

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the center point capable of handling the nature of the area affected. The performance of the neural network Radial Basis Function is further improved for the region-widening approach using seed points and grouping them with related attributes that aid in the process of extraction of features. BFO with its mimicking functionality and multi-feature verifies that it is an effective and powerful device to initialize the RBFNN weight and train the network that can correctly recognize various regions with high convergence speed and accuracy on the plant leaf image. Identifying and classifying plant diseases using any artificial intelligence method may have the sense predicted, like

1) and metric design using other product-related criteria such as longevity, cost, potential needs and quality control, etc. 2) Pre-determination of plant usage on the basis of dangerous climatic conditions adverse to planting.

The arrangement of the paper is as follows: Section II presents the relevant work, Section III presents the methods of the proposed image segmentation algorithm, Section IV presents various plant diseases, Section VI presents the proposed method for disease recognition and classification, Section VI presents the outcomes of the proposed approach and Section VII ends the article with a future work followed by references.

LITERATURE REVIEW :

[1] Many current crop disease-based image-recognition algorithms focus on extracting different kinds of features from diseased plant leaf images. They have a specific disadvantage because in the classification process, the features chosen for distinguishing leaf images are typically viewed as equally important. We suggest a innovative method for the identification of cucumber disease that consists of three pipeline procedures: segmentation of diseased leaf images by clustering K-means, extraction of shape and color features from knowledge about lesions, and classification of diseased leaf images using sparse representation (SR).A significant benefit of this strategy is that classification in SR space can easily reduce the expense of the calculation and increase the efficiency of the identification. Using a leaf picture dataset on cucumber diseases, we conduct a comparison with four other feature extraction based approaches. It is shown that the suggested solution is successful in identifying seven big cucumber diseases with an average identification rate of 85.7 percent, higher than the other approaches.

[2] In the field of agricultural knowledge, automated identification and diagnosis of rice diseases is highly desired. Deep learning is actually a hot subject of study in pattern recognition and machine learning, it can solve these problems successfully in vegetable pathology. In this analysis we suggest a novel method of detection of rice diseases based on the techniques of deep convolutionary neural networks (CNNs). The CNNs are trained to classify 10 common rice diseases using a dataset of 500 natural images of diseased and stable rice leaves and stems collected from the rice experimental sector.The suggested CNNs-based model achieves an accuracy of 95.48 per cent under the 10-fold cross-validation approach. The precision is much higher than the traditional model of machine learning. The findings of the simulation for rice disease identification demonstrate the effectiveness and utility of the proposed process.

[3] Considering the increasingly rising economic losses in the agriculture sector due to plant diseases, we have developed a real-time system capable of classifying plant diseases. In this context, we have proposed an image processing algorithm which transforms the image into three paces of colours which are processed at the same time. The algorithm executes in a sequence of intermediate steps including extending the comparison, including vector construction, and defining salient regions. We also suggested the underlying on-chip communication interface to allow successful interconnection between the three digital signal processing cores, each performing its own.The design was synthesized for both 90 nm process and an FPGA, reaching a 644 MHz post-layout operating frequency and a die area of 1208.9 μm2. In terms of precision and calculation time, we show that our device outperforms few current works in literature.

[4] This paper explores the methodology based on digital image processing, which has been used to diagnose and identify leaf disease present on different plants in agriculture. This will help plan specific approach for disease control which will be useful in the field of agriculture. Automatic disease diagnosis and examination are based on their particular symptoms, and the cost severity is of great benefit to farmers. This is a big problem in the agricultural science for the early identification of diseases. An agent such as fungus, bacteria, virus etc. is the main source of plant diseases and it is really important to develop the correct approach in certain areas.Both these research concentrate on the early identification and diagnosis of lesion diseases in plants.

[5] Agricultural production is what the economy relies heavily on. It is one of the reasons that plant disease identification plays an important role in the field of agriculture, because it is very common to have disease

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in plants. If due precaution is not taken in this field then it has harmful effects on plants and is influenced by the consistency, quantity or profitability of the corresponding commodity. A disease called little leaf disease, for example, is a dangerous disease found in US pine trees.Detection of plant disease by any automated procedure is helpful because it eliminates a huge surveillance function in huge crop farms, and it detects the signs of diseases at very early stages, i.e. when they occur on plant leaves. This paper introduces an image segmentation strategy algorithm which is used to automatically identify and recognize plant-leaf diseases. This also includes studies on different methods for classifying diseases that can be used to identify plant leaf diseases. Image segmentation is performed using genetic algorithm, which is an important feature for the identification of diseases in plant leaf disease.

METHODOLOGY :

In this study the detection and classification of plant leaf disease is carried out using Radial Basis Function Neural Network (BRBFNN) based on Bacterial foraging optimisation. The feature extraction process is performed by seeding and grouping points of similarity in some way using region-widening approach RBFNN training is performed using bacterial foraging optimization that proves to be an efficient and powerful method for initializing RBFNN weight and training the network that can correctly classify various affected regions on plant.Plants, including plants and wildlife, do suffer from diseases. These diseases affect a whole plant including the leaves, stem, fruit, root, and flora. There is the number of plant diseases that occur and this affects a plant's normal development. Many of the time where a plant's disease has not been taken care of, the plant dies which may cause falling of leaves, falling of flowers and fruit etc. Appropriate diagnosis of these diseases is required to diagnose and treat plant diseases correctly.Disease diagnosis relies on things like

1) Checking for signs or symptoms: the presence of any abnormal spots, dead areas etc. on the surface of the plant can be observed with naked eyes.

2) Understanding the usual features of the host plant: one would know the properties of the host plant, so the treatment of the plant disease is simpler for one.

3) Symptom timing: Depends on two variables 1. Condition, and Condition 2. Injuries. Disorders are caused by certain environmental issues, arise abruptly, as in a day or week, and do not extend through the areas of the plant.Whereas, it takes several days, weeks, months or even a year to develop, diseases are sluggish, having the property of affecting the other parts of plant.

4) Note the pattern of the diseases on the host plant: patterns may be standardized in nature and non-uniform. Uniform is known as abiotic, caused by non-living and non-uniform causes, which are biotic, caused by any illness or insect.

The plant diseases are classified into three categories 1. Bacteria 2. Fungus and 3. Virus.In this post, we concentrated on the detection of fungal diseases that affect the plant on a wide scale. Fungi is the disease which gets its energy from the plant on which they live. The fungal disease is responsible for considerable damage.Throughout our proposed research, we concentrate on recognizing and classifying plant diseases, using some approach to computational intelligence. The proposed approach uses the Radial Based Neural Function Network (RBFNN), which is learned with the aid of Bacterial Foraging Optimization (BFO), to identify the affected area via different diseases on plantleaves. RBFNN is a special linear feature with a particular skill in which the plant leaf photos increase or decrease monotonously with distance from the center point capable of managing the nature of the area affected.The efficiency of the Radial Based Neural Function Network is further improved by using region-widening method searching for seed points and grouping them with similar attributes that aid in the process of extraction of features. BFO with its mimicking functionality and multi-optimal function verifies that it is an effective and versatile method for initializing the RBFNN weight and training the network that can correctly classify various regions with high convergence speed and accuracy on the plant leaf picture.

RGA is a simple approach that begins with the collection of seed points and grows by using those seed points to shape a area by adding the adjacent pixels to each seed, providing analogous characteristics to the seed such as intensity level, color or scalar properties for gray scale pictures. The RGA approach has the benefit of taking multiple steps to pick a seed point. In this strategy there are two main schemes, called 4-neighborhood and 8-neighborhood. The 4-neighborhood leaving diagonally related regions choose adjacent regions while the 8-neighborhood chooses diagonal regions as well as adjacent regions as the practice expands.BFO is Kevin Passino's first new, nature-inspired optimisation algorithms in 2002. The community that forages bacterial activity such as M. Xanthus et E. Coli. Has inspired BFO growth. BFO algorithm is inspired by simulated bacteria's chemotaxis activity going towards (in the direction of) or away

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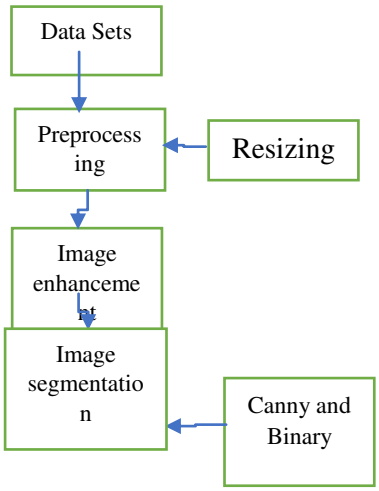
from (not in the direction of) different signals taking small steps when looking for nutrients in problem search space is another core principle for BFOs. BFO has proved to be an efficient and powerful optimization technique that provides fast convergence speed and precision implemented in the number of applications in the real world.There is the variety of causes that may influence the natural ecosystem which that cause variations in the population of bacteria where they are found. The increase in temperature causes a high concentration of nutrient gradients or events which kills or transfers all the bacteria in a region to another area. The latest substitutes are loaded uniformly over the quest space to tackle this scenario of other bacteria being liquidated at random with a very low chance.



The above figure is the block diagram that

represents the functioning of the project

RESULT :

The first set of 6 different images with 6 different diseases is selected from the natural planet and the second dataset consists of approximately 270 images from crowdAI.org (PlantVillage Disease).The resulting part is divided into two categories (A) To properly segment / identify the infected area for a disease on the plant leaf and (B) To classify the type of leaf disease. Two quantitative evaluation parameters based on the statistical performance of the ground-truth image and segmented image are used to evaluate the performance of the proposed work to correctly identify the affected area or disease on the plant leaf.

In the further study of the project, the result can be seen in few snapshots for referring the project. The result shows the status of the plant and remedies for taking care of the leaf.

In these pictures, we can clearly see the status of the plant leaf. For example, for the disease name LATE BLIGHT, remedies that are given are **monitor the field, hand pick diseased plants and bury them.**

The area rising method is used to search for seed points and group them with similar attributes which aid in the process of extraction of features. The original image was processed and converted to a grayscale segmented image. The mask creation of the grayscale image was done to improve the results finally obtaining the affected region on a diseased plant leaf.

The maximum precision in segmentation with a specificity value of 0.8897 is obtained via the algorithm suggested for accurate detection of early blight. From the results it is seen that if the network is properly trained then the probability of finding the disease region increases.

There is the variety of causes that may influence the natural ecosystem which that cause variations in the population of bacteria where they are found. The rise in temperature causes a high concentration of nutrient gradients or events which kills or moves all the bacteria in a region to another region. The new replacements are initialized randomly over the search space to handle this situation with certain bacteria being liquidated at random with a very small probability.

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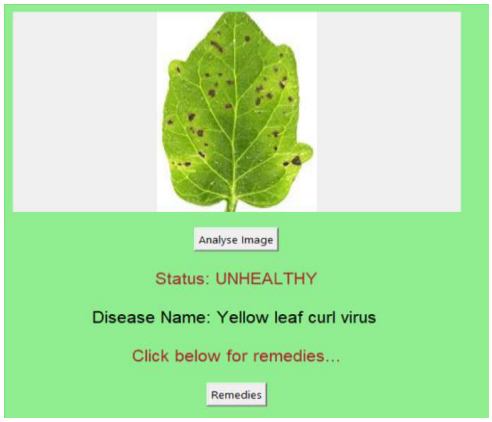

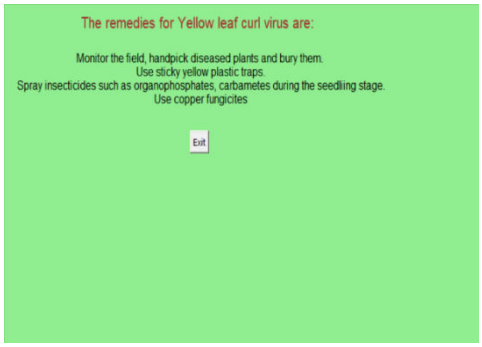

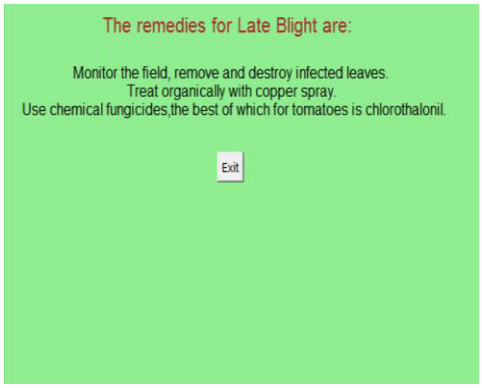

CONCLUSION :

The plant acts as the basic requirement for every living organism. They embody the most important and vital part of our world. Just like a human or other living organism, plants do suffer from various types of diseases. These diseases are detrimental to planting in a variety of ways, such as to damage plant production, bulbs, fruits, and leaves etc. due to which even a plant can die. In this work, we proposed a new approach called Bacterial foraging optimization based Radial Basis Function Neural Network (BRBFNN) to recognize and classify plant leaf diseases. Compared with other methods, the results show that the method proposed achieves higher performance both in terms of identifying and classifying plant leaf diseases. BRBFNN 's segmentation test based on precision and sensitivity for the first set of images was found to be 0.8558 and 0.8705, and 0.8231 and 0.8357 respectively for the second set of images. The results of the classification for BRBFNN based on Vpc and Vpe for the first set of images are 0.8621 and 0.1118, and for the second set of images were Vpc = 0.8307 and Vpe = 0.1527.The system proposed for the detection and diagnosis of diseases is also superior in terms of statistical efficiency. We have dealt with only fungal diseases for this research, in future this study can be expanded by dealing with multiple repositories of dissimilar diseases such as bacteria or viruses.

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