A Design and Implementation of Plant Leaf Disease using Image Processing Techniques

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ABSTRACT - One crucial element in averting a major outbreak is the detection of plant leaves. Plant disease detection algorithms are an important area of research. An essential plant for human life and welfare is the commitment. Like people and other organisms, plants can suffer from illnesses. There is the number of plant diseases that occur and impact a plant's normal development. These diseases affect the entire plant, including the leaf, stem, root system, organic matter, and flower. When a plant disease is not treated, it usually dies or may produce a decline in leaves, blooms, organic products, and other elements. For accurate identification and treatment, a suitable determination of such disorders is necessary various illnesses caused by plants. The study of plant diseases, their causes, and management and control techniques is known as plant pathology. However, the current approach includes human participation to maintain order and differentiate between disease proof. This tactic is costly and time-consuming. A more sensible approach than the current one could be the programmed division of illnesses from plant leaf photos using a delicate registering technique. This research presents a novel approach for the natural identification and characterisation of plant leaf diseases: the Bacterial Searching Improvement based Radial Basis Function Neural Network (BRBFNN). We use Bacterial Searching Streamlining (BFO) to assign the optimal weight to the Radial Basis Function Neural Network (RBFNN), which increases the system's speed and accuracy in identifying and classifying the districts contaminated by many diseases on the foliage of the plants. Through the search and collection of seed focuses with consistent characteristics for the highlight extraction method, the locale developing calculation increases the system's efficacy. chipped away at parasite diseases such as early curse, leaf twist, leaf spot, late scourge, and cedar apple rust. The suggested approach delivers increased accuracy in identifying and characterizing infections.

Keywords: RBFNN, BRBFNN, Disease prediction,

1. INTRODUCTION:

A large number of developing nations rely heavily on agriculture. This industry employs more than 60% of the people. The area of an economy that deals with cultivating plants and rearing fish and animals for commercial and domestic use is known as agriculture. The agricultural sector appears to be the most important part of the economy because it provides food, shelter made of wood, and clothing for human habitation. One aspect of human progress that contributed to the rise of immobile human growth was agribusiness [1]. The majority of African nations and a few Asian nations, such as Burma, Thailand, etc., rely heavily on agriculture [2]. The environment directly impacts the fisheries and agriculture. While it is necessary to understand these points of interest, soil moisture, water accessibility, and unique circumstances must also be met, the build-up of carbon dioxide in the atmosphere might boost some harvest yields in some places. Variations in the frequency and intensity of droughts and floods may provide challenges to farmers and agriculturists and weaken the security of food sources. Climate change often makes it more difficult to grow crops at similar locations to how they were previously done. Along with other progressive elements that impact agricultural output, such as modernization and adjustments to cultivation techniques, climate change is also a role [3]. The impact of the climate's increasing heat has led to the accumulation of diseases and pests that is impeding the plants' ability to blossom. Climate change affects availability, access, and absorption, according to a statement made by Shri B. Venkateshwarlu, a former director of the International Central Research Institute for Dryland Agriculture (CRIDA), in Hyderabad. Reduced output results in less food grains being available, which primarily affects the poor, who cannot afford to buy food, which has an adverse effect on their health.

2. LITERATURE REVIEW:

2.1 Joao Camargo Neto-Elliptic Fourier form properties of whole, isolated leaflets from plant canopies can be used to accurately identify different kinds of plants. Principal component analysis, linear discriminate models, and the EF approach worked incredibly well together. With an 88.3% classification rate, older plants from the third week had more developed leaves and offered the best leaf photos for identifying plant species. As leaves grow, their forms serve as a crucial species trademark. Throughout both weeks, the redroot pigweed plant had the lowest percentage of correctly recognized plants. Because the rounded leaf shape of redroot pigweed and the trifoliolate soybean leaflet at this growth stage are similar, they are mistakenly labeled as soybeans during the third week of growth. There were also a few smaller misclassifications involving sunflower. Combining the

second and third leaflet images An approximate 88.4% accuracy rate in species identification was achieved during the third weeks. Subsequent EF research ought to take into account better timing, illumination in the backdrop, better camerawork, and application to compound leaf identification. The EF analysis takes leaf orientation into consideration. As far as we know, no prior research on plant species imaging has addressed issue. In three-dimensional space, a leaf plane can be described by two angles. The ideal camera angles for full leaf exposure at the top of the canopy can be chosen because sunlit leaves of many species can show themselves heliotropically toward a light source, notwithstanding the difficulty of controlling or adapting to one of the leaf angles. It appears that the first leaf angle in the canopy plane is taken care of For rotationally invariant leaf texture or venation analysis, the EF harmonic is a crucial angle. To address categorization mistakes, more research on the orientation of leaves with respect to the camera lens may be necessary. Further research is required to ascertain the lowest digital image resolutions required to preserve the best performance in terms of species discrimination.

2.2 Gaurav Agarwal-The goal of this study is to build electronic field guides prototypes for the plant species found in the United States National Herbarium (US) collection held by the Smithsonian. In producing these field guides, we take into account three important factors. First, we are building a digital library where we will store textual and visual records of every specimen. Our initial focus was on type specimens, which comprise over 85,000 vascular plant specimens in the United States. These collections are crucial, and symbolize clear-cut species identification. The digital type specimen collections at other significant international herbaria, like the Harvard University Herbaria, the Missouri Botanical Garden, and the New York Botanical Garden, can then be connected and combined with this Smithsonian digital collection. But we soon discovered that type specimens are often not the finest representations of variation within a species, therefore we have expanded our usage of non-type collections in the process of building the image library. Secondly, in order to compare and rank the visual similarity in the captured photographs of different plant species, we are creating plant recognition algorithms. These recognition algorithms will be combined with traditional methods to search the image section of the digital library of plant species search techniques in the digital collection's textual section. Third, we are creating a series of test and field-use prototype devices with mobile user interfaces. We will discuss our work in creating a digital library of Smithsonian type specimens, creating algorithms for leaf recognition that can identify the type of plant from which an image of a leaf is taken, and creating user interfaces for electronic field guides in this paper.

2.3 David Knight-In the past, recognizing an unidentified plant species necessitated consulting a large field guide, which required the user to make occasionally hazy observations of the plant's characteristics and work through a challenging decision tree. Even for experienced botanists, the procedure was challenging, and taking the guides into the field was frequently unfeasible, especially for hikers and other casual users. The emergence of highly portable, computationally powerful smartphones with large storage capacity offers a chance to replace and enhance the field guide's database and decision tree features as well as develop automatic leaf classification apps based on popular image processing techniques that are currently standardizing on mobile platforms. A user-friendly app that can identify a large number of plant species on a well-known mobile platform like Android might be widely adopted and raise people's awareness of and appreciation for their surroundings. In this case, the complexity of the background complicates the task of picture segmentation, but the knowledge of one or two desired crops among undesirable weeds simplifies the challenge species. Unlike in more broad applications where many shape properties need to be learned, color and texture information is typically enough to make this differentiation. A number of teams have taken on the task of automatic leaf classification more recently. There is a lot of variance in the ways that these metrics are integrated and applied in the classification process, even if the groups frequently use similar digital morphological traits, such as eccentricity, sphericity, and rectangularity.

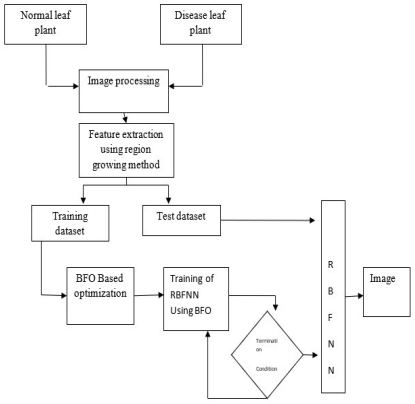
3. EXISTING SYSTEM:

India is an agricultural nation with over 65% of the people dependent on the sector. Disease-related crop losses range from 10% to 30%. Farmers often make inaccurate and improper judgments about diseases based on their personal experience. Farmers occasionally consult specialists to identify ailments, although this method is also time-consuming. The illnesses primarily affect the plant's stem and leaves. Plant diseases can be caused by viruses, bacteria, fungi, insects, rust, nematodes, etc. Farmers have a crucial responsibility to identify these illnesses as soon as feasible. The example that follows demonstrates how diseases affect cotton plants and lower yield. Diseases account for 20 to 25 percent of cotton losses on plan. Quick, automatic, and accurate technique for It is essential to identify the illnesses. Diseases reduce a plant's productivity. which limit plant growth and cause a decrease in plant quantity and quality. The most effective method for identifying and diagnosing diseases is image processing. wherein the affected area is first discovered, and then several characteristics, including color, texture, and shape, are extracted. Lastly, a classification technique is employed to identify the illnesses. SVM with radial basis function can be used with various feature extraction techniques to extract color, texture, and form features as well as classification algorithms.

4. PROPOSED SYSTEM:

Plant diseases have turned into a big problem as it can cause significant reduction in both quality and quantity of agricultural products. In our proposed work, we center around distinguishing proof and characterization of plant illnesses utilizing some computational knowledge approach. The proposed strategy utilizes Radial Basis Function Neural Network (RBFNN) that is prepared with the assistance of Bacterial Foraging Optimization (BFO), to locate the influenced district by means of various illnesses present on plant clears out. RBFNN is the extraordinary direct capacity having a novel ability of which increments or reductions monotonically with separation from the middle point fit for taking care of the multifaceted nature of the influenced district exists on the plant leaf pictures. The productivity of the Radial Basis Function Neural Network is additionally improved by utilizing district developing strategy hunting down seed focuses and gathering them having comparable properties that assistance in highlight extraction process. BFO with its imitating ability and multi-ideal capacity confirms to be a productive and ground-breaking instrument for instating the heaviness of RBFNN and preparing the system that can accurately distinguish diverse areas on plant leaf picture with high union speed and exactness is further enhanced by employing the district development approach to find seed focuses and collect them with similar features that aid in the highlight extraction process. With its ability to mimic and multi-ideal capacity, BFO has proven to be an effective and revolutionary tool for establishing the weight of RBFNN and setting up a system that can precisely and quickly discern between various places on a plant leaf picture.

4.1 SYSTEM ARCHITECTURE:



5.MODULES DESCRIPTION:

- Image acquisition
- Preprocessing
- Image segmentation
- Radial basis function neural network (RBFNN)
- Disease prediction
- Evaluation criteria

5.1 IMAGE ACQUSITION:

In addition to becoming a vital source of energy, plants are a key component in the solution to the global warming dilemma. Numerous plant diseases have the potential to cause enormous damage in terms of the economy, society, and environment. It is crucial to diagnose illnesses accurately and promptly in this situation. Plant diseases can be found in several methods. Certain illnesses exhibit no outward signs at all, or if they do, they do so when it is too late to treat them. In those situations, a more in-depth study is typically required, typically involving the use of powerful microscopes. In other situations, the indications are only visible in portions of the electromagnetic spectrum that are opaque to the human eye. A typical In this instance, the strategy involves utilizing remote sensing methods to investigate multi- and hyperspectral picture acquisitions. Techniques that use this strategy frequently use digital image processing capabilities to accomplish their objectives.

5.2 PREPROCESSING:

This module allows us to apply preprocessing techniques that reduce noise from photos and convert RGB images to grayscale. The goal of preprocessing is

• Enhance the visual appearance of images.

• Improve the manipulation of datasets.

employing picture resampling to alter the dataset's pixel count and brighten the dataset to enhance visualization. This technique starts with converting the obtained color image to a grayscale image. After that, background and leaf pixels are identified by picture segmentation. The segmented image is converted to binary and the inside of

the leaf is subtracted, leaving an image of the leaf's outline and contour, after holes have been filled in and small areas have been eliminated.

5.3 IMAGE SEGMENTATION:

A. REGION GROWING ALGORITHM (RGA) FOR FEATURE EXTRACTION

RGA is a straightforward method that begins with a set of seed points and expands by using these points to construct an area by appending neighboring pixels to each seed that have similar qualities to the seed, such as color, intensity level, or scalar properties for grayscale images. The benefit of picking many metrics for a seed point selection is provided by the RGA approach. This approach has two fundamental schemes called 4-neighborhood and 8-neighborhood. While the 8-neighborhood selects both diagonal regions and neighboring regions during the growth operation, the 4-neighborhood that leaves diagonally associated regions chooses nearby regions.

B. BACTERIAL FORAGING OPTIMIZATION (BFO) FOR TRAINING THE NETWORK

Kevin Passino introduced BFO, a novel class of nature-inspired optimization techniques, in 2002. The collective feeding habits of microorganisms like The creation of BFO was driven by M. Xanthus and E. Coli. The chemotaxis behavior of virtual bacteria, which travels either toward or away from particular signals, served as the model for the BFO algorithm. Another important idea for BFO is to move slowly when looking for nutrients in the problem search region. With its high convergence speed and accuracy, BFO has proven to be a powerful and useful optimization technique that is used in many real-world applications.

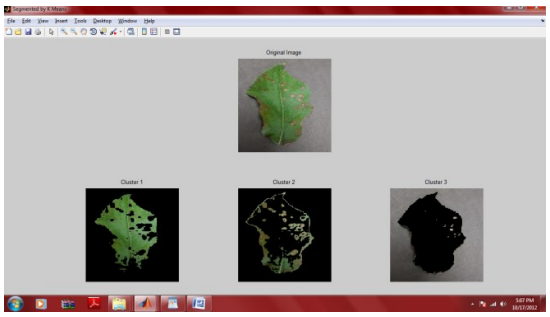
5.4 RADIAL BASIS FUNCTION NEURAL NETWORK (RBFNN)

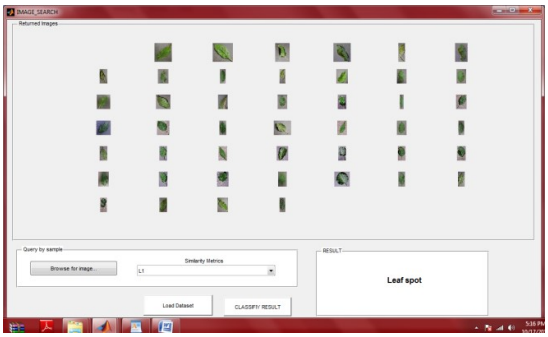
Three layers make up an RBFNN: an input layer, a hidden layer, and an output layer. The feed-forward network is the one in question. The input layer functions in the same ways as other networks, that is, for accepting The functioning of the hidden layer is what makes a significant difference in any network when it comes to input and output. The buried layer of this network has particular activation functions called Radial Basis Functions (RBFs). Aside from that, linear neurons make up the output layer and radial kernel functions make up the hidden layer. The network is made up of neurons with "local" or "tuned" receptive fields, which can be biologically driven by orientation-selective cells in the visual cortex or somatosensory cells that respond to specific body areas. The response of an RBF is said to drop or rise monotonically with distance from a central point, making it a special type of linear function with a distinctive property. The hidden layer is in charge of doing non-linear input transformation and output layer that uses linear regression to visualize the desired results. Unlike other networks, RBF has numerous hidden layers that are operational at the same time. The Gaussian and Multiquadric are widely used radial kernels for RBF, while there are many others available. The characteristics of a multiquadric RBF are monotonically growing with distance from the center, whereas the properties of a Gaussian RBF are monotonically decreasing.

5.5 DISEASE PREDICTION:

A group of related supervised learning techniques used for regression and classification are called support vector machines (RBFNNs). Analyzing a predetermined collection of labeled observations (the training set) in order to forecast the labels of future unlabeled data (the test set) is known as supervised learning. The objective is to specifically learn a function that explains how observations and their labels relate to one another. Support vector machines are used in multiclass RBFNN to assign labels to instances; these labels are selected from a finite set of multiple elements. Reducing the single multiclass problem into many binary classification problems is the prevalent method for accomplishing this. Creating binary classifiers that can differentiate between (i) one label and the rest (one-versus-all) or (ii) between each pair of classes (one-versus-one) are common techniques for this kind of reduction. In the winner-take-all technique, the classifier with the highest output function assigns the class to new examples in the one-versus-all scenario. We are able to forecast illnesses in leaf photos by using the multiclass classifier

SCREEN SHOT





7.CONCLUSION:

Any living thing's basic requirement is met by plants. They are the most significant and essential component of our environment. Plants can get a variety of diseases, much like people or other living things. These illnesses can damage plants in many ways, including by impairing their ability to grow, produce flowers, fruits, leaves, and other parts of the plant, and even perhaps causing them to die. Therefore, for the purpose of identifying and categorizing plant leaf illnesses, we have developed a novel technique in this study called the Bacterial Foraging Optimization based Radial Basis Function Neural Network (BRBFNN). When compared to alternative approaches, the results demonstrate that the suggested strategy performs better in terms of both identification and classification of plant leaf diseases.

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