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DESIGN AND IMPLEMENTATION OF PLANT LEAF DISEASE DETECTION AND CLASSIFICATION USING CNN

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ABSTRACT: The detection of plant leaf is a very important factor to prevent serious outbreak. Automatic detection of plant disease is essential research topic. The commitment of a plant is very imperative for both human life and condition. Plants do experience the ill effects of ailments, similar to people and creatures. There is the quantity of plant maladies that happen and influences the typical development of a plant. These ailments influence finish plant including leaf, stem, organic product, root, and blossom. More often than not when the illness of a plant has not been dealt with, the plant bites the dust or may cause leaves drop, blossoms and organic products drop and so on. Suitable determination of such illnesses is required for precise ID and treatment of plant sicknesses. Plant pathology is the investigation of plant infections, their causes, methodology for controlling and overseeing them. Yet, the current strategy incorporates human inclusion for order and distinguishing proof of maladies. This strategy is tedious and expensive. Programmed division of illnesses from plant leaf pictures utilizing delicate registering approach can be sensibly valuable than the current one. In this paper, we have presented a strategy named as Bacterial searching improvement based Radial Basis Function Neural Network (BRBFNN) for recognizable proof and characterization of plant leaf illnesses naturally. For doling out ideal weight to Radial Basis Function Neural Network (RBFNN) we utilize bacterial searching streamlining (BFO) that further expands the speed and exactness of the system to recognize and arrange the districts tainted of various infections on the plant leafs. The locale developing calculation expands the effectiveness of the system via looking and gathering of seed focuses having regular characteristics for highlight extraction process. To chip away at parasitic maladies like basic rust, cedar apple rust, late scourge, leaf twist, leaf spot, and early curse. The proposed strategy achieves higher precision in recognizable proof and characterization of infections.

Keywords: Cnn,Bfo,Knn, Rbfn, disease prediction

I. INTRODUCTION

A. IMAGE PROCESSING

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. Usually Image Processing system includes treating images as two dimensional signals while applying already set signal processing methods to them. It is among rapidly growing technologies today, with its applications in various aspects of a business. Image Processing forms core research area within engineering and computer science disciplines too. Image processing basically includes the following three steps.Importing the image with optical scanner or by digital photography. Analyzing and manipulating the image which includes data compression and image enhancement and spotting patterns that are not to human eyes like satellite photographs. Output is the last stage in which result can be altered image or report that is based on image analysis.

II. EXISTING SYSTEM

Precision Botany (PB) refers to the application of new technologies in plant identification. Computer vision can be used in PB to distinguish plants from its species level, so that an identification can be applied on the size and number of plants detected for the classification purpose. Automatic plant identification tasks have gained recent popularity due

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to its use in quick characterization of plant species without requiring the expertise of botanists. Leaf-based features are preferred over flowers, fruits, etc. due to the seasonal nature of the later and also the abundance of leaves (except may be for the winter season). The current electronic devices for capturing images have been developed to a point where there is little or no difference between the target and its digital counterpart. The success of machine learning for image recognition also suggests applications in the area of identification of plant by herbarium specimens. Once the image of a target is captured digitally, a myriad of image processing algorithms can be used to extract features from it.

Drawbacks:

The diseases mostly on leaves and on stem of plant. The diseases are viral, bacterial, fungal, diseases due to insects, rust, nematodes etc. on plant. It is important task for farmers to find out these diseases as early as possible. Following example shows that how diseases on cotton plant reduces the productivity. There is 20 to 25% of cotton loss due to diseases on plan Accurate, automatic and rapid method for detecting the diseases is required. Diseases decrease the productivity of plant. Which restrict the growth of plant and quality and quantity of plant also reduces. Image processing is best way for detecting and diagnosis the diseases. In which initially the infected region is found then different features are extracted such as colour, texture and shape. Finally classification technique is used for detecting the diseases. There are different feature extraction techniques for extracting the colour, texture, shape features and classification technique SVM can implement with radial basis function.

III.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.

Advantages:

- ✓ Tolerant to noisy Inputs.
- ✓ Instances Classified to many Output
- ✓ adaptiveTo change data, Easy to implement,
- ✓ Applicable to wide range Of Problems,
- ✓ Able to form Arbitrarily Complex non-linear Mapping.

IV. SYSTEM IMPLEMENTATION

Module Split up

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

Modules Description

IMAGE ACQUSITION

Plants have become an important source of energy, and are a fundamental piece in the puzzle to solve the problem of global warming. There are several diseases that affect plants with the potential to cause devastating economic, social and ecological losses. In this context, diagnosing diseases in an accurate and timely way is of the utmost importance. There are several ways to detect plant pathologies. Some diseases do not have any visible symptoms associated, or those appear only when it is too late to act. In those cases, normally some kind of sophisticated analysis, usually by means of powerful microscopes, is necessary. In other cases, the signs can only be detected in parts of the electromagnetic spectrum that are not visible to humans. A common approach in this case is the use of remote sensing

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techniques that explore multi and hyper spectral image captures. The methods that adopt this approach often employ digital image processing tools to achieve their goals.

A. CNN

The simple supervised-machine-learning algorithm used in classification problems, and it uses similarity measurements particularly CNNs, are the most promising approach for automatically learning decisive and discriminative features. Plant-disease detection can be accomplished using a CNN model as it requires large amounts of data to train the network. If an available dataset does not contain enough images, performance is worse. The inception module can extract more specific and relevant features as it allows for simultaneous multilevel feature extraction. the implemented CNN achieved impressive results and better performance in comparison with those of state-of-the-art machine-learning techniques.. Illustrates the literature related to the detection of plant diseases. presents the CNN models and the details of the datasets that are used in the experiments

B. (BFO) FOR TRAINING THE NETWORK

BFO is new nature-inspired optimization algorithms proposed by Kevin Passino in 2002. The group foraging behavior of bacteria such as M. Xanthus and E. Coli. motivated the development of BFO. BFO algorithm is inspired by the chemotaxis behavior of virtual bacteria that move towards (in the direction of) or away (not in the direction of) from the specific signals taking small steps while searching for nutrients in the problem search space is another key concept for BFO. BFO has turned out to be an effective and influential optimization tool that provides high convergence speed and accuracy applied in the number of the real world applications.

C. RADIAL BASIS FUNCTION NEURAL NETWORK (RBFNN)

RBFNN consists of three layers namely (i) input layer, (ii) hidden layer, and (iii) output layer. The network is are the feed-forward network. The functionalities of the input layer are the same as for other networks i.e. for taking input and providing output; the major difference for any network is lies within the working of hidden layer. In this network the hidden layer contains the specific activation functions known as Radial Basis Function (RBF). Other than that the hidden layer also comprises of radial kernel functions and output layer comprises of linear neurons. The network compromises of neurons with “local” or “tuned” receptive fields that can be biologically motivated with somatosensory cells reactive to precise body regions or orientation-selective cells in visual cortex. RBF termed as to be a special class of linear function having a unique feature, of which response decreases or increases monotonically with distance from a centre point. The hidden layer is responsible for carrying out non-linear transformation of input and output layer performing linear regression to envision the anticipated outputs. RBF is different from the other networks having multiple hidden layers active at a time. Although there are many radial kernels available to be used for RBF, the Gaussian and Multi quadric are frequently used. A Gaussian RBF having the property of monotonically decreasing with the distance from the centre and Multiquadric RBF having the property of monotonically increasing with the distance from the centre.

D. DISEASE PREDICTION

Support vector machines (RBFNNs) are a set of related supervised learning methods used for classification and regression. Supervised learning involves analyzing a given set of labeled observations (the training set) so as to predict the labels of unlabelled future data (the test set). Specifically, the goal is to learn some function that describes the relationship between observations and their labels. Multiclass RBFNN aims to assign labels to instances by using support vector machines, where the labels are drawn from a finite set of several elements. The dominant approach for doing so is to reduce the single multiclass problem into multiple binary classification problems. Common methods for such reduction include: building binary classifiers which distinguish between (i) one of the labels and the rest (one-versus-all) or (ii) between every pair of classes (one-versus-one). Classification of new instances for the one-versus-all case is done by a winner-takes-all strategy, in which the classifier with the highest output function assigns the class. Based on the multiclass classifier, we can predict diseases in leaf images.

E. EVALUATION CRITERIA

The proposed work was implemented on MATLAB 2012b working on a system with an i3 processor having 4GB RAM. For validating the effectiveness of this work we have taken two sets of images. The first set consisted of 6 different images with 6 different diseases is selected from planet natural and second dataset consists of about 270 images are selected from crowdAI.org (Plant Village Disease Classification Challenge) categorizing among the same 6 set of diseases. The result part is divided into two categories (A) To correctly segment/identify the infected area on plant leaf for a disease and (B) To classify the type of leaf disease. The performance evaluation of the proposed work for correctly identifying the affected area or disease on the plant leaf is evaluated using two quantitative evaluation parameters that are based on the statistical performance of the ground truth image and segmented image. The parameters are specificity and sensitivity Refer to (9) and (10). The most critical part is the classification of diseases based on some attributes associated with them. The performance of the proposed work for correctly classifying diseases is done by using two entropy functions known as Validation evaluation partition coefficient Vpc and Validation evaluation partition entropy Vpe

$$Specificity = TNTN + FP$$

$$Sensitivity = TPTP + FN$$

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where True Positive (TP) = no. of pixels exactly classified, False Positive (FP) = no. of pixels incorrectly classified, True Negative (TN) = no. of pixels exactly misclassified, and False Negative (FN) = no. of pixels incorrectly misclassified. The value of specificity and sensitivity lies between 0 and 1 when result is equal to 1 means perfect segmentation.

$Vpc = \Sigma\Sigma uik2NNi=1Kk=1$

$Vpe = -\Sigma\Sigma uik\log(uik)=1Kk=1$

Where uik is the membership value of pixel i belonging to the k-th cluster, K is the number of clusters and N is the total number of image pixels. Both functions value lies between 0 and 1, when Vpc is high and Vpe is low, it implies the membership values are less in segmentation results and the tissues are classified correctly..

V. CONCLUSION

The plant serves as the bas ic need for any living organisms. They are the most important and integral part of our surroundings. Just like a human or other living organism does plant do suffer from different kind of diseases. Such diseases are harmful to plant in a number of ways like can affect the growth of the plant, flowers, fruits, and leaves etc. due to which a plant may even die. So in this work, we have proposed a novel method named as Bacterial foraging optimization based Radial Basis Function Neural Network (BRBFNN) for identification and classification of plant leaf diseases. The results, when compared with other methods, show that the proposed method achieves higher performance both in terms of identification and classification of plant leaf diseases. Future enhancement In future work, we can extend our approach to improve the accuracy using neural network classification algorithms in order to increase the recognition rate and severity of the detected disease.

VI. REFERENCES

[1]Neto, J.C., Meyer, G.E., Jones, D.D., Samal, A.K.: Plant species identification using elliptic Fourier\leaf shape analysis. Comput. Electron. Agric. 50(2), 121–134 (2006)

[2]Agarwal, G., Belhumeur, P., Feiner, S., Jacobs, D., Kress, J.W.R., Ramamoorthi, N.B., Dixit, N., Ling, H., Russell, D., Mahajan, R., Shirdhonkar, S., Sunkavalli, K., White, S.: First steps toward an electronic field guide for plants.Taxon 55(3), 597–610 (2006)

[3] Knight, D., Painter, J., Potter, M.: Automatic plant leaf classification for a mobile field guide (2010)

[4] Du, J.X.,Wang, X.-F., Zhang, G.-J.: Leaf shape based plant species recognition. Appl. Math. Comput. 185(2), 883–893 (2007)

[5] White, S.M., Marino, D., Feiner, S.: Designing a mobile user interface for automated species identification. In:Conference on Human Factors in Computing Systems, pp. 291–294, San Jose (2007)

[6]Park, J., Hwang, E., Nam, Y.: Utilizing venation features for efficient leaf image retrieval. J. Syst. Softw. 81(1), 71–82 (2008)

[7] Wang, X.-F., Huang, D.-S., Du, J.-X., Xu, H., Heutte, L.: Classification of plant leaf images with complicated background. Appl. Math. Comput. 205(2), 916–926 (2008)

[8] Teng, C.H., Kuo, Y.T., Chen, Y.S.: Leaf segmentation, its 3d position estimation and leaf classification from a few images with very close viewpoints. In: International Conference on Image Analysis and Recognition, pp. 937–946, Halifax (2009)

[9] Villena-Román, J., Lana-Serrano, S., González-Cristóbal, J.C.: In: Proceeding of CLEF 2011 Labs and Workshop, Notebook Papers. Amsterdam, The Netherlands (2011)

[10] Paris, S., Halkias, X., Glotin, H.: Participation of LSIS/DYNI to ImageCLEF 2012 plant images classification task. In: Proceeding of CLEF 2012 Labs andWorkshop, Notebook Papers. Rome, Italy (2012)

[11] Chen, S.Y., Lee, C.L.: Classification of leaf images. Int. J. Imaging Syst. Technol. 16(1), 15–23 (2006)

[12]Hossain, J., Amin,M.A.: Leaf shape identification based plant biometrics. In: InternationalConference on Computer and Information Technology, pp. 458–463, Dhaka (2010)

[13]Du, J.X.,Wang, X.-F., Zhang, G.-J.: Leaf shape based plant species recognition. Appl. Math. Comput. 185(2), 883–893 (2007)

[14] Backes, A.R., Bruno, O.M.: Shape classification using complex network and multi-scale fractal dimension. Pattern Recogn. Lett. 31(1), 44–51 (2010)

[15]Casanova, D., Florindo, J.B., Gonçalves, W.N., Bruno, O.M.:IFSC/USP at ImageCLEF 2012: plant identification task. In: Proceeding of CLEF 2012 Labs and Workshop, Notebook Papers. Rome, Italy (2012)