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Analysis of Neural Network and Hybrid Techniques for Plants classification

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Review Article

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ABSTRACT

Today, computer science is increasingly involved in agricultural and food sciences. Various artificial intelligence and soft computing techniques are used to classify plants and detect defects to provide a better quality product to the final consumer. This article focuses on advances in automatic plant classification using soft computing techniques. Various ANN, CNN, PNN as well as Heuristic and meta heuristic optimization techniques are reviewed for plants classification. There are several meta-heuristic optimization algorithms developed on inspiration from nature. The review of Neural networks like ANN, CNN, PNN as well as some of the hybrid artificial neural networks with optimization methods like Genetic Algorithm (GA), Ant Bee Colony (ABC), Differential Evolution (DE), Group Search Particle Swarm Optimization (GSPSO), Firefly method, etc. are applied for benchmark data sets and to specific real-time experiments for plants classification are discussed.

INTRODUCTION

In the ecological, the main sources of energy for the animals are plants. Agriculture is a major contributor to the country's growth, but there has been a decline in crop production due to poor cultivation, lack of maintenance, manual control, ignorance of techniques conservation and features. Furthermore, rising labor costs, skilled workers lack, and the requirement to improve production processes have given the pressure on producers and processors for an inspection method.[1]Climate change is also a factor in plants that causes disease. Plant diseases are unavoidable, so leaf detection plays an important role because these diseases can spread throughout the farm and this will result in huge losses for both the farmer and the entire agricultural economy.[2] [3]Plants are also useful as food, as medicine, and also in many industries. The classification of plants can ensure the protection and survival of natural life. Plant recognition can be performed using different techniques on plant leaves. Traditionally, the most common method for classifying medicinal plants was manual identification. First, with the use of human organs, people were able to obtain characteristics such as shape, color, as well as texture of the entire plant or individual sections (bladder, fruit); therefore, they were able to determine plant species based on a reference or experience[4]. However, practice has shown that this method of identification is highly dependent on the level of competence and experience, not just heavy workload and low performance. This approach is difficult for non-experts due to lack of experience. This represents a formidable challenge for beginners who want to learn about organisms[5].

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In fact, automatic computer image recognition is widely used in image processing technologies and pattern detection development. The availability of related technologies such as digital cameras, mobile devices, remote data access, advanced image processing techniques, and pattern recognition have made automatic species identification a reality[5]. There is a great variety of plants such as fruits, flowers, vegetables, etc. For the identification of plants, leaves are considered. The sheets are easily collected; they can be purchased through any camera, mobile phone or scanner. Computer-based plant identification is used to classify the plant type. Initially, a database is created using sample images of all types of leaves. [6]Each image of the leaf is related to the relevant details of the plant.

ANN TECHNIQUES FOR PLANTS CLASSIFICATION

[7]Presented that from the rise of smart applications on different platforms such as desktop and mobile sheet recognition has gained importance. To correctly recognize the type of leaf, each leaf contains a unique distinct pattern that has been contained to provide efficient input for neural networks. Furthermore, using the back propagation neural network, an intelligent recognition system is presented to recognize and identify 27 different types of leaves and the results show that the developed system is excellent for recent research with an identification rate of 97.2%. [7][8]developed an identification method for leaf which is used to extract characteristics. All characteristics can be extracted from the digital image of the leaf plant. With one exception, all functions are extracted automatically. For classification once the captured image is pre-processed, extract the color consistency vector feature and heraldic features, and later send it to the ANN classifier. The main improvement relates to feature extraction and the classifier. To automate the detection of plant leaves, the artificial neural network (ANN) classifier is used. A neural network method for leaf identification is introduced. By re positioning the leaf images on the computer, the computer can automatically detect the leaf. ANN is presumed to have a fast training method to classify the leaf. The experimental result specifies that the method is effective with greater precision than the previous methods; this technique is quick to execute, skillful to identify, and simple to implement.

[9]Used the biometric feature to classify plant leaf images. The classification is facilitated by the biometric characteristics of the plant leaves, such as the vein. The biometric characteristics of the leaf are analyzed using a computer-based method, such as morphological characteristics analysis, and the classifier based on the artificial neural network take the input as a morphological characteristic of the leaf vein and classify them into four different species. In model training, the accuracy of this classification based on leaf rib is achieved 96.53% for the classification of leaves provide an accuracy of 91% in the tests to classify leaves images The classification of plants is obtained based on the morphology characteristics of the leaf vein with. The ANN-based classification model trained with 96.53% accuracy provides 91% accuracy in tests to classify leaf images with their biometric vein morphological characteristics.

[10]They proposed an algorithm to identify plants using three separate steps that are preprocessing the data set, and then applying the extraction of the characteristics that ultimately contribute to the classification of the plant. The authors used characteristics of the leaves for identification and classification, which are morphological characteristics, as well as Fourier descriptors and characteristics that define the shape. For the artificial neural network (ANN) the values obtain from these characteristics of the leaves are used as an input vector as well as the data set used for this research is based on training through 817 leaf samples from 14 different fruit trees. Moreover, the research has been proven effective on the Flavia and ICL data sets and provides 96% accuracy for both data sets. In this case, processing is the technique used to enhance data images prior to computational processing.

[11]Presented a new computationally efficient system that takes into account the combination of color, shape, morphological and characteristics of the tooth. The feature extraction step derives features based on the color and shape of the sheet image. Furthermore, the functionalities are used as input to the classifier for efficient

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classification and the results are then tested and compared using the artificial neural network (ANN) and Euclidean (KNN) classifiers. Furthermore, the proposed approach by using ANN classifier is 93.3% accurate, and the comparison of classifiers shows that ANN takes fewer mean times to execute than the Euclidean distance method. To identify a complex image, the proposed work can be further expanded with clustered petioles and leaves and real-time images of the leaf[12].

[12]to obtain data performance classification of leaf disease is presented by using the artificial neural network was successfully analyzed through image processing method and classified using neural network. The objective of classifying healthy or unhealthy leaves of medicinal plants was achieved by acquiring and analyzing data from leaf images using the image processing method. In addition, from the image processing method, the algorithm of contrast adjustment, segmentation and feature extraction is used to extract the image and obtain data. In the image processing method, all three methods are included. Using the artificial neural network, the results of the experiment were carried out. The multilayer feed forward neural networks are the multilayer perceptron and the radial basis function RBF the network structures used to classify healthy or unhealthy leave. Also, in the last experiment, the result shows that the RBF network performs better than the MLP network.

Automated baseline identification techniques of three Ficus species based on the collection of leaf images using the pattern recognition approach presented. Two machine learning algorithms were used, to build the identification model: ANN and SVM. Both models obtained a satisfactory result that proved their usefulness in identification tasks. The study showed that computerization classification of selected Ficus species that had similar leaf shapes is feasible based on leaf images. Furthermore, in the future, the robustness of the system could be improved by including more Ficus species[13] (Table 1).

[14]presented the plant morphology as well as features of domain-related visual plant leaf are analyzed and extracted. Moreover, for recognizing plant leaf using artificial neural network an approach is brought forward. A series of experiments are carried out to demonstrate the efficacy of the proposed methods. The result of the experiment demonstrates the efficacy and superiority of the methods.

Table 1: ANN technique with methods and result on plants Classification

Artificial Neural Network			
Goals	**Methods**	**Result**	**References**
To automate detection of leaf ANN Classifier is used for the plant classification.	Training as well as testing is the two phases. The input plant leaves are process by re sizing an image into 256x256 In the phase of training and apply the median filter to remove the noise. This image after processing is passed for features extracting by using haralick feature and color coherence vector technique as well as features are trained with ANN classifier and stored it in the knowledge base. Similarly in the phase of testing classifiers based on the knowledge base shows which class is present.	The result of experiment specifies that method is impressive with more accuracy more than the previous methods as well as quick in execution, proficient in identification and simple for implementation.	[15]

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The main purpose is to retrieve the leaf shape along with its fine serrations.	ANN with back propagation as a classifier is used in the planned algorithm as it is more extensive than PNN and less sensitive to noise than SVM. The algorithm has also been tested on Flavia, to verify its effectiveness. To recognize the type of the leaf, the algorithm uses different morphological features and Fourier descriptors.	The experimental results demonstrated the effectiveness and robustness of the proposed algorithm. It is applicable to any data set of leaf as well as we tested it on three different sets and achieved an accuracy of more than 96%.	[16]
The biometric feature of leaf are analyzed by using method of the computer based like morphological feature analysis and artificial neural network based classifier.	By applying canny edge detection and morphological feature extraction methods leaf Images are processed. By multi-layer perceptron based artificial neural network method, the results of the classification model are obtained.	Based on leaf venation the outcome of this classification is achieved 96.53% accurately in the training of the model for classification of leaves provide the 91% accuracy in testing to classify the leaf images.	[17]
By using Artificial Neural Network diseases of leaf classification has been successfully analyzed through image processing method as well as classified using Neural Network to get the performance of the data.	By using Back-propagation algorithm, the leaf health is classified. For training a multi-layer perceptron (MLP). To get the better result for accuracy of classification Back-propagation algorithm is systematic method. In this method, the categorization of health of leaf is done using MATLAB.	The 90.3% of leaves are classified right in the case where the test samples are more than the training samples.	[18]
By using Morphological Features as well as Zernike Moments Classification of Plant Leaves is done.	Leaf morphological features and Zernike moments are used in the proposed model, which are Self-reliant of leaf growth as well as image translation, rotation and scaling and then classified with several different classifiers to accomplish an optimal result.	Data set of Flavia which consist of 32 species as well as a medicinal plants data set of 6 species in the data set were tested. SVM as well as PNN have higher accuracy than k-NN and naive Bayes classifiers.	[19]
Medicinal Plant Leaves Using Image Features as well as ANN identification were selected.	The feature extraction based on shape of leaf, color of leaf, as well as texture of leaf images method utilized as well as training via ANN classifier for leaf classification of the system.	It was found optimal in terms of the complexity as it demands minimum input as well as it required less computational time. Against 63 leaf images in the data set, the accuracy of the system was 94.4%.	[20]

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CNN TECHNIQUES FOR PLANTS CLASSIFICATION

[21]Presented conventional neural network models to perform plant and disease detection and classification activities using simple images of healthy as well as diseased plant leaves, achieving a precision of 99.53%.

[22]propose the Convolution Neural Network (CNN) to classify the type of plants by collecting sequences of images from smart stations. First, lighting variations are depicted and smudges are removed with a few pre-processing steps. In addition, the convolutional neural network architecture is used to extract features from the image. The results obtained through the CNN model are compared with those acquired by the SVM classifier with different kernels, to evaluate the performance of the approach, as well as feature descriptors such as LBP and GIST. The outcome of the research on the TARBIL data set confirms that the designed method is quite impressive.

Presented an application which classifies the tree type based on leaves pictures. In an android mobile application to sort out natural images of leaves, the system developed for this research use a convolution neural network. For leaf classification, an application is represented by utilizing a convolution neural network. If an application of this type put on a mobile device, could be useful for Biology students learning about trees during their field work. It could also be helpful in using the leaves to recognize trees by researchers who are not experts. To learn more about the trees around them, the outdoor admirer also can get benefit from this application [23] (Table 2).

Table 2: CNN technique with methods and result on plants Classification

Convolution Neural Network			
Goals	**Methods**	**Results**	**References**
To extract the feature from raw images, is main goal of the image classification. Therefore, the proposed system uses CNN for implementation. Similar to ordinary Neural Networks, convolution Neural Networks is used which is, that is made up of neurons that have Learn-able weights and biases.	The System present Convolution Neural Network (CNN) a learning algorithm of the machine being used for automatic classification the images.	Data sets used for both training as well as testing purpose Using CNN. Accuracy rate of 98% is provided.	[24]
To those of our CNN based approach, the classification rate of these methods is compared. On the experimental data, the algorithms were tested which were acquired under natural outdoor illumination.	The type of plants from the image sequences is classified from smart agro-stations. Convolution Neural Network (CNN) architecture is used.	With an accuracy about 97.47% on 16 kinds of plants, experimental results indicate that CNN based approach is significantly effective.	[22]
If put on a mobile device, could be used by Biology students who are learning about trees during their field work as well as it could also be used by researchers who may not be experts in using the leaves to	The research utilizes, the system which is developed to utilizes a convolution neural network based the approach in an android application of the mobile to classify natural images of leaves.	The result of this approach is 89.65% accurate on the 29 species of leaves.	[23]

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recognize trees are the main goal of an application of this type.			
Leaves classification is the motive of this research, which makes dramatic contributions to endangered plants protection	Using data augmentation, a seven-layer CNN is proposed for recognition of leaves.	Our algorithm is workable with an accuracy greater than 94.6% on 32 kinds of plants is indicated by an experiment results.	[25]
To perform detection of diseases of plant as well as diagnosis using simple leaves images of healthy and diseased plants, through deep learning methodologies, the CNN models were developed.	Based on the specific convolution neural networks, Deep learning models were developed, for the recognition of plant diseases through simple leaves images of healthy as well as diseased plants. In both laboratory conditions as well as real conditions in cultivation fields, by using an openly available database of 87,848 photographs for the training of the models was performed. The data comprised of 25 plant species including some healthy plants in 58 distinct classes of combinations.	The accuracy rate of 99.53% is achieved.	[21]

PNN TECHNIQUES FOR PLANTS CLASSIFICATION

Represented for fast speed on training and simple structure PNN is adopted which implements a leaf recognition algorithm using easy-to-extract features as well as high efficient recognition algorithm. On feature extraction and the classifier, is the main improvements are. From digital leaf image, all features are extracted. To form the input vector of PNN, 12 features are extracted and processed by PCA. By 1800 leaves to classify 32 kinds of plants, the PNN is trained with an accuracy greater than 90% [31] (Tables 3 and 4).

Table 3: PNN technique with methods and result on plants Classification

PROBABILISTIC NEURAL NETWORK			
Goals	**Methods**	**Results**	**References**
It is used for general purpose automated leaf recognition as well as plants classification.	For fast speed on Training, PNN is adopted 12 features are extracted to form the input vector of PNN and processed by PCA, as we sample structure.	To achieve an accuracy greater than 90%, the PNN is trained by 1800 leaves to classify 32 kinds of plants.	[26]
For Indonesian Medicinal Plants Identification using Fuzzy Local Binary Pattern as well as Fuzzy Color Histogram in Mobile Application	By Histogram in order to identify the medicinal plants found, the combined methods of Fuzzy Local Binary Pattern (FLBP) as well as the Fuzzy Color is utilized. The Combination was done via Product Decision Rule (PDR) method, as well as for extracting leaf image texture and color. PNN classifier was utilized to achieve to propose the system.	For increasing the overall accuracy of plant identification methods FCH has shown an accuracy of 74.51%. for FCH feature respectively.	[27]

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Table 4: Comparison between advantages and disadvantages of classifiers

Techniques	Advantages	Disadvantages
ANN	1. Artificial neural networks learn events as well as take decisions by commenting on similar type of events. 2. Simplistic statistical training.	1. The continuance of the network is unknown: The network is decreased to a certain value of the error on the sample means that the training has been completed. Optimum result is not provided by this value. 2. Bigger computational load.
CNN	1. CNN can automatically detect the important features without any human supervision as well as used for image classification and recognition because of its advanced accuracy. 2. Multiple features can be extracted simultaneously.	1. CNN do not encode the position and location of the object into their formulation. 2. High computation level
PNN	1. PNNs can be more faithful than multilayer perceptron networks as well as bring forth accurate predicted target score of probability. 2. The specimen can be classified into multiple outputs.	1. At classification new cases PNN are slower than multilayer perceptron networks and PNN require more memory space to store the model. 2. Have the tendency for the over fitting with too many traits.

OPTIMIZATION TECHNIQUES

Soft computing techniques are increasingly important, as the power of computer processing devices increases. To make a complex system you need intelligent systems by choosing the best results from many possibilities, using complex algorithms. This requires fast processing power and large storage space that is recently become available in latest years to many research centers, universities as well as technical institutes at a very less cost. In the real world to enable solutions, the fusion of engineering methodologies is soft computing as well as a consortium of methodologies that works in synergy and provides, in one way or another, flexible information processing capabilities for management. [28] The guiding principle is to invent calculation methods that lead to an acceptable solution at low cost, seeking an approximate solution to a problem formulated inaccurately or precisely (Figure 1).

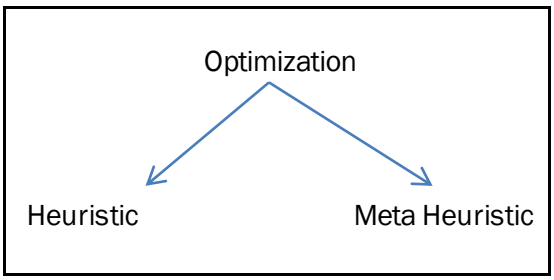

Figure 1: OPTIMIZATION TECHNIQUES

In general there are two kinds of optimization techniques such as Heuristic and Meta heuristic. Generally, heuristics means to "find" or find out by trial and error. These algorithms can be expected to work for most, but not all time. A further development of heuristic algorithms is the so-called Meta heuristic algorithm. Here, Meta means "beyond" or "higher level" and these algorithms in general work better than simple heuristics. Furthermore, all Meta heuristic algorithms use certain offsets from randomization and local search. It should be noted that it was not agreed there

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are definitions of heuristics and Meta heuristics in the literature; some use the terms heuristics and Meta heuristics interchangeably. However, the recent trend tends to give it a name all stochastic algorithms with randomization and local search as Meta heuristics. Heuristic optimization techniques such as swarm intelligence, taboo search, simulated annealing, genetic algorithm, etc. and Meta heuristics can be classified in many ways. One way is to classify based on population or trajectory. For example, genetic algorithms are population based because they use a set of strings; so are the optimization of the particle swarm (PSO), the firefly algorithm (FA), and the search for the cuckoo, which use multiple agents or particles.

HYBRID OPTIMIZATION TECHNIQUES FOR PLANTS CLASSIFICATION

Optimization means choosing the 'best' strategy among the multiple options. Depending upon the situation, the best path is chosen. In optimization the main objective could be simply to minimize the production cost as well as maximize the production efficiency. The process of optimization algorithm executed repeatedly by comparing various solutions till an optimum or a satisfactory solution is found. The two main types of optimization algorithm which are widely used today (a) Deterministic algorithm (b) Stochastic algorithm. Deterministic as name implies use specific rule for moving one solution to other where stochastic algorithm are random in nature. The reviews of some of these hybrid artificial neural networks with optimization methods like Genetic Algorithm (GA), Ant Bee Colony (ABC), Differential Evolution (DE), Group Search Particle Swarm Optimization (GSPSO), Firefly method, etc. are applied for benchmark data sets and to specific real-time experiments for plants classification are discussed.
To optimize feature selection by combining the characteristics of Ant Colony and Artificial Bee Colony (ABC) algorithms;a new Swarm based hybrid algorithm AC-ABC Hybrid is proposed. Eliminate stagnation behavior of the ants as well as for time consuming global search is the initial solutions, the employed bees algorithms are hybridized. In the proposed algorithm, to determine the best Ant and best feature subset, Ants use exploitation by the Bees; bees change the feature subsets generated by the Ants as their food sources. For the evaluation purpose, the algorithm consists of thirteen UCI (University of California, Irvine) benchmark data sets have been used. By the experimental results, the behavior of the proposed method of increasing the classification accuracy and optimal selection of features is shown[29].

C. S. Sumathi proposed using Genetic Algorithm to optimize the weight of the network during training, Digital Evaluation is optimized. By using NPD-dimensional, Differential Evolution (DE) is a parallel direct search method of parameter vectors. Differential Evolutionary Mutation, Crossover and Selection. To maintain a population of structures which are candidate solutions for specific domain challenges, a genetic Algorithm is an iterative procedure. With specific genetic operators like reproduction, crossover, and mutation, a new candidate solutions-population is formed. Using MATLAB, the features were extracted. To train the classification algorithms, the features extracted method were adopted. The proposed hybrid algorithm based on DE and GA improves the classification accuracy of the neural network is shown by an experimental result. The percentage of classification accuracy is determined by a proposed optimized Differential Evolution as well as GA optimization algorithms. [28] For the purpose of better classification accuracy Genetic weight optimization-based neural network systems of diseased plant leaf classification is proposed. As features five attributes, such as contrast, correlation, energy, homogeneous and area of the leaf was used. Initially, from the segmented image after prepossessing the features of leaves were extracted. By Genetic algorithm for specified iterations, the weight of the neural network is updated. In the end the performance is analyzed in different classes (class 2, class 3 and class 6) of diseased plant leaves by using classification accuracy. For better classification accuracy, Genetic weight optimization-based neural network systems of diseased plant leaf is classified [30].

[31]Presented a new hybrid approach of PSO (Particle swarm optimization) and IWD (intelligent water drop) as hybrid IWD-PSO approach for the optimization of ANN for Iris classification as well as compared its execution with the individual approaches PSO and IWD. The outcomes of the model clarify the better performance of the hybrid IWD-PSO approach in terms of accuracy and SSE as compared to IWD and PSO stand alone with reference to the number of hidden layers as well as hidden nodes. By using this hybrid algorithm, a better search results can be

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received. As optimization the IWD, PSO, and IWD-PSO are utilized approaches for Ann. The result of comparison represented that IWD-PSO-ANN accomplished IWD-ANN and PSO-ANN in terms of SSE and accuracy rate. It can be concluded that the proposed hybrid IWD-PSO approach is suitable for use as an optimization approach for ANNs. The outcomes of the study also show the fact that in enhancing the performance of a neural network a comparative analysis of different optimization approaches is always supportive. Moreover, this hybrid IWD-PSO approach can be applied to deal with more optimization problems in future scope.

[32] Presented a hybrid algorithm known as the Group Search Particle Swarm Optimization (GSPSO) which is based upon Particle Swarm Optimization (PSO) and here the GSO has been proposed wherein a PSO model along with the GSO model is made use of. PSO and the good performance is done in the GSO. Form of the many-valued logic the Fuzzy classifier is derived from the theory of a fuzzy set. Moreover, for classification, a Multilayer Perceptron Neural Network (MLPNN) concept is used. Such type of techniques is selected as they can provide a training that is faster to solve the problems of pattern recognition by using the technique of numerical optimization. Therefore, in this work, an optimal and deterministic feature subset has been chosen by using a technique of a hybrid GSO. This algorithm has been inspired by the social search behavior of the animals in the global performance of which has been now proved to be very competitive. In case of the GSPSO algorithm, any PSO model can be used for identifying one good search space where a point of global optimization has been contained having a very high degree of probability. For this technique, the GSO is used to make a search within its local search space and rangers used for revising the space simultaneously.

[33] purposed a hybrid approach, is used in classification which consists of artificial neural networks and particle swarm optimization algorithm (PSO). According to research, in four farms of Agria potato mixture; under controlled lighting conditions using white LED lamps, image capture was presented. A decision tree is used in terms of difference between potato plants and weeds, to select the 6 most significant features. The database was divided into two groups to evaluate the proposed model :(1) training data, which is used to train the hybrid ANN PSO and (2) test and validation data to evaluate the network. In conclusion, to classify the inputs as potato plants or weeds, ANN-PSO method is applied. Moreover, a comparison is presented by using a Bayesian classifier.

A novel fruit-classification tool is offered. The methodology which is presented consists of different processes: First of all, a four-step pre-processing was performed, followed by the color, shape, texture features were combined. Later, for feature reduction, principal component analysis was employed. Furthermore, method with the combination of "Hybridization of PSO and ABC (HPA)" and "single-hidden layer feed forward neural-network (SLFN)", this was termed as HPA-SLFN is presented as a novel classification. The research results demonstrated that the in compared to existing method, proposed HPA-SLFN achieved an accuracy of 89.5%. The proposed HPA-SLFN was effective [34] (Table 5).

Table 5: Optimization technique with methods and result on plants Classification

Optimization Techniques				
Research Paper	**Classification based upon**	**Optimization Technique**	**Accuracy**	**References**
The potato plant and three types of weed are classified by using video processing as well as hybrid of artificial neural network and particle swarm algorithm	Potato plants and three common types of weeds are located and identify.	The Hybrid approach, consisting of the artificial neural network (ANN) and Particle Swarm Optimization algorithm (PSO) is used.	98.1%	[35]
An algorithm which is hybrid by using Ant and Bee Colony optimization for feature selection as	In reduced size of the feature subset increased classification accuracy, low computational complexity as well as quick	To optimize feature selection Ant Colony as well as Artificial Bee Colony (ABC) algorithms	96%	[36]

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well as classification.	convergence, the proposed algorithm is used.	is used.		
For Plant Leaf classification, Hybrid optimization is proposed.	With specific genetic operators like reproduction, crossover, and mutation, a new candidate solutions population is formed. By using Matlab, the features were extracted. To train the classification algorithms, the features extracted were used.	With GA optimization, Differential Evolution algorithm is optimized.	95.56%	[28]
For plant leaf classification, Hybrid feature selection using group search particle swarm optimizer is proposed.	Multi-layer Perceptron Neural Network (MLPNN) concept is used for classification. Selected techniques can provide a training that is faster to solve the problems of pattern recognition by making use of the technique of numerical optimization.	Based upon Particle Swarm Optimization (PSO) Group Search Particle Swarm Optimization (GSPSO) is used.	92.88%	[37]
By a Hybrid IWD-PSO Approach for Iris classification, Artificial Neural Network Optimization technique is used.	Initially, the extraction of features was done from the segmented image after pre-processing. For the classification of diseased plant leaf, as well as the weight of the neural network is updated by Genetic algorithm. Genetic-based Feed Forward Neural network architecture is constructed for specified iterations. In conclusion, the performance is analyzed in different classes of diseased plant leaves using classification accuracy.	PSO (Particle swarm optimization) and IWD (intelligent water drop) as hybrid IWD-PSO is used.	97.7%	[31]

CONCLUSION

On the basis of the study carried out, it was derived that soft computing models have shown extraordinary performance in the plants leaf classification. While a number of promising technologies exist, non-destructive evaluation of plants. Using computer vision systems and flexible computer models, the classification is carried out. For plants classification, various ANN, CNN, PNN as well as Heuristic and Meta heuristic optimization techniques are reviewed. Algorithms must be selected and combined to form hybrid optimization techniques, to maintain good compensation. To form hybrid approaches, the algorithm are chosen, that should be in the category of one asset with an exploration rate and the other with a good exploitation rate. Consequently, details of some hybrid classifiers developed by combining ANN, with different Meta heuristic optimization techniques (MHOA) in the literature are briefly provided. There are still many ongoing experiments with ANN optimized in different domains to determine solutions for everyday problems. In the future, the plants industry should get big benefits by using more robust software computer models.

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