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Classification of Diseased Plants using Separation of Points by Planes

C. Kavya Reddy
Altech power and energy systems pvt. Ltd.

D. Hiranmayi
Altech power and energy systems pvt. Ltd.

K. Eswaran
Altech power and energy systems pvt. Ltd.
Sreenidhi Institute of Science and Technology

G. Gayatri Likhita
Altech power and energy systems pvt. Ltd.

B.Saritha
MVSR Engineering college

ABSTRACT:

A person easily cannot identify a diseased tree by mere eyesight. Different trees are exposed to different diseases. In this paper, our aim is to solve this problem using our algorithm. To serve this purpose, a dataset was taken from an online repository named UCI. It is Wilt dataset that consists of some diseased trees along with other land cover that are fed to the algorithm to identify whether the tree is diseased or not. There are training and testing samples for the 'diseased trees' and for 'other land cover'. The data comprises of numerical values related to the texture information, generated by segmenting a Pan-sharpened image and also the segments contain spectral information and texture information from the Quickbird multispectral image bands and the panchromatic image band respectively.

INTRODUCTION:

The Diagnosis of Plant diseases play a significant role mostly in the agricultural sector and forestry. In olden days plant diseases were identified by manual procedures, which were time taking and were not successful to such a great extent and leads to loss of nutritional food. However, we can overcome such problems with the latest Artificial Intelligence and Image processing techniques. In this paper, a new algorithm is described and is used to classify diseased plants from the large number of other land cover. Now-a-days artificial intelligence and machine learning methods are used to detect plant or crop diseases. Therefore, Research in the field of agriculture is intended towards the raise in quality and efficient productivity. Plant diseases are generally caused by bacteria, viruses and fungi. The occurrence of plant diseases also depend on environmental conditions. Disease can occur in any part of the tree like fruit, leaves, vegetable and stem or trunk etc. Detecting disease in a plant plays a major role in the agricultural sector. It is difficult for the farmers to detect the disease through their mere eye sight which requires constant monitoring. There is a chance of inaccurate result in all this manual process of identification and is costly and time consuming. In every situation it is not possible to call experts for opinion or conclusion of disease. Thus, Automatic detection of plant disease is vital research topic in the agricultural sector.

We here used a newly discovered algorithm [2, 3] which is capable of classifying and identifying plant disease data. The algorithm uses mathematical approach to separate N data points, assumed to be d-dimensional, by a certain number of hyper-planes. The number of hyper-planes actually required (say q), varies from one problem to another. The best part corresponding to this algorithm is that it is non-iterative; with a computational complexity of approximately $O(d.N.\log_2(N)) + (d^3\log_2(N))$, where N is the given number of points and d is the dimension of space. Thus, automatic detection of plant diseases with the help of image processing technique provides more accurate result which helps in disease supervision. Detection of a disease depends upon many factors like, parameters that are to be considered for disease detection. In this paper, a new algorithm is used to classify the given data. The data set named WILT is taken from UCI Machine Learning repository. The wilt data set has got five features or attributes.

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LITERATURE SURVEY:

In paper [11], authors **Muhammed Fahri Unlersen, Kadar Sabanci** has considered the Wilt Data Set which was obtained from UCI machine learning repository database [12]. The WEKA software tool was used for classification. Two classification methods have been performed named MLP neural networks and KNN method.

Vaibhavi S. Bharwad1, Kruti J. Dangarwala, Author of [14] have given brief overview of methodology based on reviews made on recent research trends to recognize disease in the plant which is based on image processing techniques. In the conclusion authors suggested the major techniques used for detection purpose with some limitation.

Revathi and Hemalatha [7] used canny and sobel edge detection homogenous techniques segmentation, while Homogeneous pixel counting technique for cotton disease detection (HPCCDD) algorithm has been used for analysis and classification.

Rastogi et.al [15] has conducted an image processing and machine vision based methods for leaf disease detection and grading. Artificial neural network has been used for the classification of diseased area (AD). After calculating the percentage of infection, grading has been applied by using fuzzy logic. For grading, infection percentage was calculated by using total leaf area (AT) and logic.

DATASET DESCRIPTION:

In this paper, a new algorithm is applied in order to classify the disease plants from the large number of other land cover. ”WILT DATA SET” is considered from UCI Machine learning repository. The data set has the following five attributes.

Attribute Information:

1. GLCM_Pan: GLCM mean texture (Pan band)
2. Mean_G: Mean green value
3. Mean_R: Mean red value
4. Mean_NIR: Mean NIR value
5. SD_Pan: Standard deviation (Pan band)

The classes of disease are specified as : 'w' for diseased trees, 'n' for all other land cover.

The machine learns the training set with 4339 records. Test data has 500 records. This paper describes a new method proposed in [4] & [5] , which includes the concept of Orientation Vectors to train the model. This is the fundamental algorithm which separates a given set of points by planes in such a way that each point is seperated from the other by atleast one plane.

SEPERATION OF POINTS BY PLANES (ALGORITHM):

Imagine N number of points in M-dimensional space. Basically the algorithm generates planes in M-dimensional space such that the planes can separate all the N points, such that every point is separated from every other point by at least one plane.

Assume a set of N points in space each of M-dimensional space. Create another M-dimensional space X with some initial planes. Start transferring points from G space to X space, such that each point should separate from the other point in X space. Transfer the points until each point is separated from the other by at least one plane. We call two points as neighbors, if they are not separated by a plane. Collect such pairs until the count is equal to dimension of points (n) in X [2]. Once we collect the pairs a new plane is drawn through midpoints of those pairs. If a point in G falls in the same quadrant, or be a part of a “pair”, we put it back in G and choose the next point [2]. Repeat the process until all the points are transferred.

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Start the testing process, after all the train points are separated by hyper planes. Test points are taken and orientation vectors of them are calculated by using plane equations. Each test point has a different Orientation vector.

Once the Orientation vectors of all the test points are calculated, compute the dot products of each test point with all the train points. Collect n maximum values of dot products and find the Euclidean distance of those test points with all the train points [3]. Classify the test point by assigning the class label of the train point to which it is near.

The algorithm has the property of restarting; if any new points are to be separated, the algorithm can continue from where it has left off. The Algorithm tackle the new data points which are of a higher dimension, after some minor modifications [2].

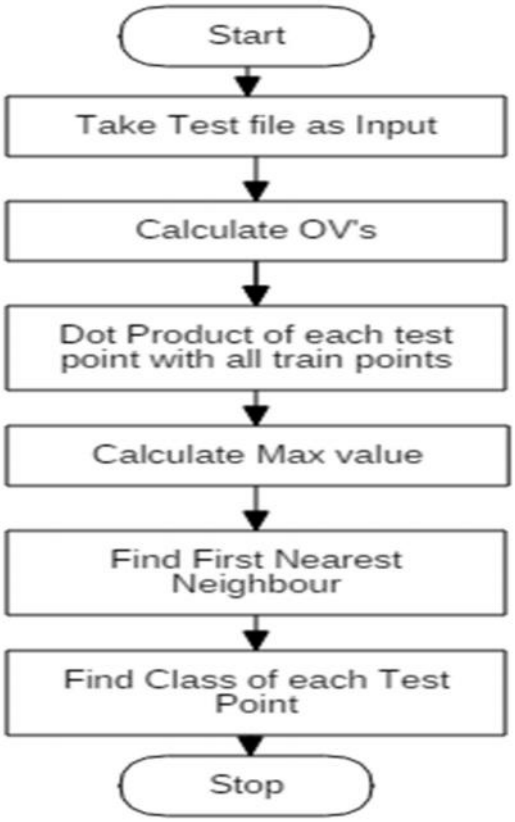

Fig 1: System flow chart

RESULT ANALYSIS:

As mentioned in the previous section , data set is taken from UCI machine learning repository. The data set is having training set of 4339 records and testing set of 500 records. The algorithm "the separation of n points using q planes in m dimensional space" is used in this paper to obtain following results.

- Initially 2 planes are considered randomly.
- Totally 91 planes were required to separate all train data.
- Time taken for training was 5 seconds.
- First we calculated the OV's (orientation vectors) for train and test points.
- Now the dot product is calculated for each test point with minimum 10% sampling from trained data.

- Now the highest dot product value and a 4 nearest neighbor is considered to find the class of the test point.
- Total time taken for the completion of testing is 1 second with 90.4% pf Accuracy.

In Table 1, the performance of the separation of algorithm was compared with other methods mentioned in [11]. Our algorithm could diagnose plant disease with the accuracy of 90.4% in very less time of 1 second when compared to other methods like K-Nearest Neighbor, MLP-Neural Networks.

Table 1: Accuracy comparisons of approaches used in this work and in paper [11].

Methods and Parameters	Accuracy performance	Ref. paper	Time taken for testing
Separation of points by Planes	90.4 %	This paper	1second
MLP Neural Network	86.4%	11	-
K Nearest Neighbor	72%		-

CONCLUSION:

In this paper a new algorithm "separating a given set of points by q planes in m-dimensional space" is applied on Wilt dataset which is fetched from UCI Machine Learning repository. The accuracy obtained using this algorithm is 90.4% in the very less time span of 1 second. This method achieved high accuracy when compared to the accuracy obtained using MLP Neural Network and K Nearest Neighbour methods. During our literature survey it is acknowledged that the major techniques for detection of plant diseases are: Neural network, fuzzy logic, WEKA tool and SVM for classification and K-means for clustering. Now, through this paper we have proved that, "separation of N points by planes in m-dimensional space" is the best and fastest algorithm in classifying the diseased plants from the others as shown in above table. Therefore, there may be scope for improving the existing methodology.

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