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A Review on ML and DL Techniques in Detecting Plant Diseases

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Abstract: *In Our country, Agriculture is the main occupation of the people. Plant diseases are a major problem today as they affect the quality and production of agricultural production. Most plant-borne diseases are caused by viruses and fungi. Identifying the diseases in early stage by manual power is not possible in large sector of Area. Subsequent maintenance of plants conditions are major challenging task. To overcome this problem in Agriculture, we use Image Processing Technique to identify the disease in beginning stage . To Apply Image Processing Technique, we have to undergo certain Image concepts that deals with image acquisition, image pre-processing, image segmentation, feature extraction and classification of disease. This Methodology reduces the destruction of plants and make the crop production high. The digital Image Processing Technique is the main solution to solve the problems in Plant diseases by identifying the plant diseases in early stage. It is very much useful to the Farmers who are facing plant diseases problem in their Agriculture Area. Many techniques are used to identify the diseases in plants using classifiers such as , K-Nearest Neighbors ,Support Vector Machine methods etc. This paper gives the overview of available methods for plant disease detection*

Keywords: Image Processing, Plant Diseases, Segmentation, classification

I. INTRODUCTION

India is an agriculture country and most of its population will depends on agriculture because this is the main source of income as well as job employment. Majority of the Farmers facing the problems that affecting their crop.Traditional Method of Identifying the plant diseases done by experts with naked eye. But this method is not suitable for monitoring large farms and also identifying the diseases in early stages. Automatic detection of diseases in plants is important as it helps to overcome the drawbacks that occur in manual detection. Adding to this, earlier detection of diseases prevents huge losses in production.

II. APPROACH

Identifying the plant diseases in Image Processing Technique deals with certain Methodologies such as i) Image acquisition ii) Image Pre-processing iii)Image segmentation, Feature extraction and Classification. In image processing technology, Image Acquisition is examined using digital camera , image enhancement is used in image pre processing, Affected and healthy areas are segmented in image segmentation and also feature extraction helps in classifying the type of diseases.

A. Image Acquisition

Image Acquisition is the method of getting an picture from the source. It is the first method involved in Image Processing because our process starts from the images of the object.

B. Image Preprocessing

Preprocessing is the important step in detecting plant diseases.. It deals with Enhancement of an picture for further procedure. It also deals with geometric transformation.

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C. Image Segmentation

Image Segmentation is the important step in Processing. In Segmentation, Image is break in to several regions according to their bit per pixel Representation. Here Image is broken down in to small segments.

D. Feature Extraction

Feature extraction is used to avoid the similar set of data. It is also used to transform the raw data to numerical data.

III. TYPES OF DISEASES IN PLANTS

Identification of Plant diseases in Agriculture involves complicated task because of misunderstanding in identifying the type of diseases. Let us see about types of diseases..

A. *Red Rot*: The leaves become dry and shrinked and looks like red bright lesions on middle rib of leaves and the original color fades off. Red spots appear on the leaves and the pith becomes brown color in short period of time.
B. *Leaf Spot*: Leaf spot Infection caused by some type of bacteria. It starts as little spots in brown or black colour. Following this center of the leaf becomes dry and fall out.
C. *Sugarcane* Mosaic Virus: This infection is caused by virus and disease spreads rapidly to other parts of the plant. The number of days it takes to spread depends on the season.
D. *Yellow Spot*: The spot occurs in yellow color. It is fungal leaf disease. Yellow spot disease reduces the quality of the grain and also the quantity of crop by affecting the plants.
E. *Brown Spot*: Brown spot disease kills whole leaf. If it occurs in the seed part, the seed part becomes brown colour.

IV. LITERATURE SURVEY

In the past, many research works are done based on plant diseases.

Cristin et al. [2] proposed the Rider-Cuckoo Search Algorithm using ondeep learning to classify and detect the plant infections as well as 87.7%of accuracy in this method. Yousuf et al. [3] Authors and Affiliations identify the illness in plants by using the Ensemble model-based on K-Nearest Neighbor with accuracy of 96 percent. Hern´andez et al. [4] proposed the Probabilistic Programming method to recognize the disease in plantby Bayesian deep learning techniques and accuracy is93.02%. Udutalapally et al. [5] proposed the Internet of Agro-Things to predict the automated example of plant disease with 99.2% accuracy [10] proposed the Group method of Data Handling (GMDA)-Logistic model to split and diagnosis the plant disease with accuracy of 89.53%.In [2] cannot expanded the classification accuracy and [3] cannot predict the white mold plant illness. Similarly, [4] data labelling is expensive also [5]has not much more efficiency been increased as well as not covered the count of crops and severe infections and [6] data labeling itself cannotbe improved. Therefore, to conquer these difficulties of white mold a novelframework has to be propose.

Yan Guo et al. [7], Introduced a plant disease ID is a cause in unpredictable weather. In rapid development of savvy plantings, plant disease IDs become digital and details are processed. It enable help assistance, sharp tests planning. This Article proposes a numerical method of the plant area infection and consent depend on in-depth awareness improves clarity, simplification, and technical preparation. First, a local proposal organization is used to detect and confine leaves to natural complexities. At the same time, pictures categorized depending on the results of the RPN calculation. It contained a part of the negative effects on the Chan-Vesecalculation. Finally, the separated leaves are a contribution to the learning curve method and are processed by a database of sick leaves under a particular basis. This model is also examined black rot, bacterial crust and produces accuracy of 83.57 percent that is greater than conventional method. Thus reducing the impact of infection on rural creation and the prospect of sustainable agricultural development. Therefore, the detailed reading calculations suggested on paper are very important .

Liu, J. et al. [8], proposed a plant disease and hardship are major influencing factors that determine the yield and environment of plants. Plant diseases can be treated with latest imaging processing techniques. Recently, deep study has made it more advanced in the field of image development, rather than conventional techniques. Effective way to use in-depth computational learning to diagnose plant diseases and practices is tangible evidence has become a problem for diagnosing more than professional concerns. This study provides an explanation for plant disease and excretion of

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irritants, improving the diagnosis of common plant diseases and bed bug infestation techniques. As indicated by the fragmentation of the organizational structure, this investigation follows plant infection testing and insect identification based on recent in-depth takeaways from the three parts of the organization.. General Datasets are distributed, and the presentation of existing research is considered. At this moment, this study notices the potential difficulties in the rational use of plant diseases and the recognition of irritants that depend on in-depth study.

Vijay Singh et al. [9] proposed, rural efficiency is the mainstay of the economy. This is one of the reasons why plant diseases are major factor in the agribusiness sector, as plant infections are common. In the event that proper consideration can be taken here, it causes significant impacts on plants .For example, a small leaf infection is a serious disease of pine trees in USA. The detection of plant disease through a systematic method is helpful as it reduces the visual activity of large harvest homes, and at the beginning of the stage itself detects signs of diseases for example when they appear on the leaves of plants. This paper provides a calculation of the image classification method used for systematic identification and classification of plant leaf diseases. It also includes reviews of a variety of disease planning methods that can be used to diagnose plant leaf infections. By applying hereditary calculation the fragmentation of images were done. Daniya et al. [10, 11] Reviewed about detecting plant diseases based on deep neural network.

V. PLANT DISEASE DETECTION AND CLASSIFICATION TECHNIQUES MACHINE LEARNING (ML) TECHNIQUES OR ALGORITHMS

A. The NB Strategy

It is a probabilistic classifier variety based on the NB classifier thought . It is expected that the examples' earlier probabilities are known to exist and that the class names are relegated their back probabilities. Considering this reason, the most extreme probability upsides of the information that have a place with a particular class mark are figured utilizing the back likelihood. It is determined by applying Baye's hypothesis to the result of each element's contingent likelihood. This hypothesis functions admirably in numerous order issues, despite the fact that it typically doesn't hold in a genuine setting.

B. Support Vector Machine

Support vector machine is an excellent Machine Learning Method . Supervised Learning is, already we have the set of classified data. It is used to predict the new values in data set. It uses different kinds of Algorithm to handle the data set. One of the important Algorithm is SVM.

SVM differs from other classification algorithms in how it chooses decision boundaries that maximize the distance from the closest data points for all classes. The decision boundary is referred as max-margin classifier or max-margin hyper plane.

Advantages in SVM are Effective for multi-function recording such as financial data and medical data. It is used where number of features are high. It uses support vector which is memory efficient and the decision function can be any number of core functions.

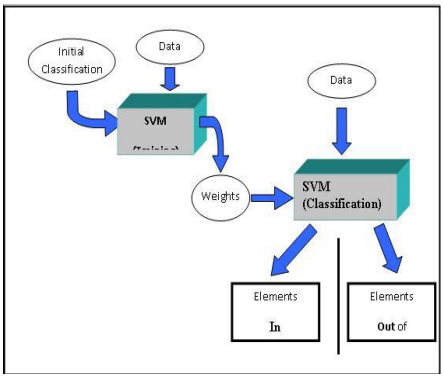

Fig.1.Example of a SVM

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Drawbacks of SVM are when the number of features is much larger than the number of data points, it is important to avoid over fitting when choosing kernel functions and regularization terms.SVM does not directly estimate probabilities. These are computed with an expensive 5-fold cross-validation. Because of its long training time, it works best when the sample set is small.

C. K-Nearest Neighbor(KNN) Algorithm

K-Nearest Neighbor is also a supervised learning Algorithm used in Machine Learning. K-NN algorithm deals with both classification and Regression. It assumes the data points that are similar are near to each other.K-NN Algorithm first loads the data and initialise K for number of neighbors. Next it calculate the distance for the datas available and sort the ordered collection of distances from smallest to largest.

Most of the time relevant data are closer to each other. So KNN added this Assumption as true enough for the Algorithm used. Similarity of data is achieved by calculating the distance between two points like we calculate in graph that we generally used in Mathematics. Method for Calculating distance between two points depends on the solution of the problem.

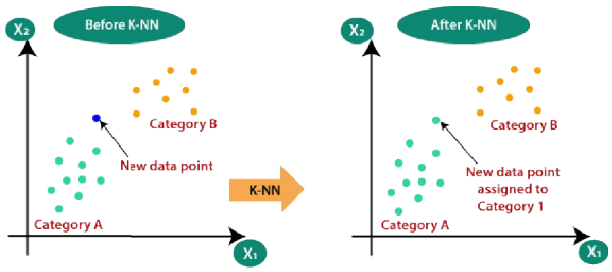

Fig.2.Example of a KNN Algorithm

To calculate the Straight line distance between two points, Euclidean distance Method is familiar and popular.

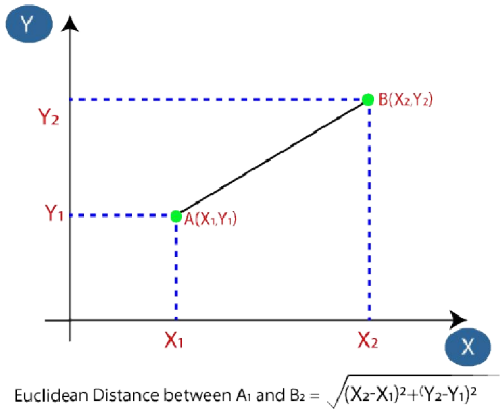

Fig.3. Calculating Euclidean Distance.

D. DT Methodology

The DT Methodology In oversaw learning, a managed request and backslide estimation makes classifiers by partitioning the data into various more unassuming social events (tree structure) according to which division makes the more imperative irregularity [15,16]. One of the habitually utilized trademark assurance estimations that are once in a while used as uniqueness assessments is the Gini list, generally called entropy. One benefit of this method is that it could work on it for individuals to unravel the results. If the tree could have arranged without being confined by its significance, a DT could create close to no planning botch. A couple of DT assortments, including ID3, C4.5, and Truck, are extensively used in various data mining and ML applications.

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E. RF Methodology

The RF Procedure It is an assortment of learning methods for randomized DT classifiers [15,16]. During preparing, it is controlled by building a few DTs. In view of every grouping tree's vote, the class marks of the testing dataset are determined. The class marks with the most noteworthy votes by the grouping trees decide the classifier's eventual outcome. This approach endeavors to deliver an uncorrelated woodland of trees that will foresee execution more precisely than that of the singular tree by utilizing stowing and haphazardness of highlights during the structure of each tree.

VI. DEEP LEARNING (DL) TECHNIQUES OR ALGORITHMS

A. The CNN Technique

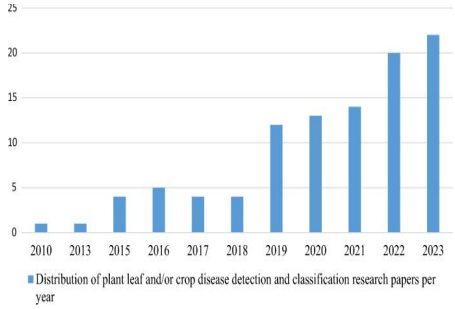
Significant feed-forward cerebrum networks are used by the CNN to analyze complex data. The CNN learns channels that are started after it portrays a particular element at some spatial arranging information .The amount of ages utilized in the execution of various convolution channels with parts of 2 × 2 and 3 × 3 chooses their accuracy. This is reliant upon the channel's angles. A couple of pre-arranged plans, including VGG16, VGG19, ResNet50, ResNet152, InceptionV3, Inception Net, andDenseNet121, are open for use with the CNN approach.

B. The ANN Technique

A brain network is a model that imitates the data handling capacities of an organic framework, for example, the cerebrum [15,16]. Coefficients connect fake neurons, otherwise called handling components (PEs), to make an organization structure. Experience prompts the revelation of information examples and linkages as opposed to their programming. Since ANNs can grasp complex information, they can be used to separate examples from it.

VII. PERFORMANCE EVALUATION OF PLANT DISEASE DETECTION AND CLASSIFICATION

The appropriation of applicable papers throughout the long term has been portrayed in Fig. The Figure shows an expansion in plant leaf or potentially crop illness recognition and grouping throughout the long term.



Evaluation Metrics

The utilization of DL ways of managing distinguish and arrange plant contaminations can avoid the deterrents of fake assurance of infection spot features, causing plant ailment to incorporate extraction more objective, and extending research shows and advancement change speed [17]. The examiners in the composing have assessed their proposed systems by using different execution evaluation estimations like precision, mean ordinary exactness (Guide), survey, precision, Getting point over Affiliation (IoU), mindfulness, and distinction.

Evaluating the performance of plant disease detection involves:

A. *Accuracy* The precision score of a model, regularly known as precision, is a portrayal estimation in DL and ML systems that tends to the degree of right gauges made by the model.

B. *Map* when the Combination over Affiliation (IOU) is more noticeable than or comparable to the edge, Guide is the precision. It is the extent of a legitimate and expected locale of interests' intersection guide district toward the relationship of the same. At different edges, area execution is assessed in constraints of Guide.

C. *Review* A model's review is characterized as the model's capacity to distinguish Genuine Up-sides accurately. It is characterized as the proportion of accurately ordered positive results to accurately arranged yields.

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A. D Exactness is portrayed as the ability to perceive simply pertinent articles. It is portrayed as the extent of precisely requested positive outcomes to amount to positive outcomes.

D. F1-score The f1 score is likewise acquainted with survey the model's precision. The f1-score thinks about both the model's accuracy and review

VIII. RESULTS AND DISCUSSIONS

A close to review of different assessment works done in different plant leaf disorder area and gathering using DL and ML techniques has been investigated by various researchers. Similarly, when sufficient data is free for getting ready, DL systems are good for perceiving and portraying plant leaf disorders with high accuracy. As shown in Figs. particular investigators have made plant leave contamination acknowledgment and portrayal structures by using plant leave pictures. Here, most of the experts have given their proposed structures a shot different plant leaves. They have handled the evaluation estimations like precision, exactness, survey, f1-score, Guide, IoU, mindfulness, disposition, and Matthews association coefficient (MCC) for planning and testing purposes. Similarly, for this particular relative audit, the maker has contemplated recently the accuracy of the composition. In addition, the best accuracy (including multiclass level correctnesses in this way) result has been seen as in plant leaf ailment distinguishing proof and course of action research work that has been taken a stab at different plant leaves in the composition.

IX. CONCLUSION AND FUTURE WORK

The composing gave various techniques that have been made and made available to help the achievement of huge accomplishments in the fields of ML, DL, and picture dealing with. The assessment in like manner communicated that the rate accuracy can be improved by means of getting ready and testing the models with progressively more datasets to help the request and ID precision. To determine the issue of plant leaf or yield disease, new and better DL computations that can give higher precision in perceiving and orchestrating plant leaf or gather afflictions ought to continually be made and applied. A couple of methods for requesting plant leaf diseases have been made and used beforehand. Nevertheless, cerebrum associations, as CNN, appear, apparently, to be the best methodology for gathering plant sicknesses as a result of their versatility and component extractor property, which licenses them to isolate features normally. Unlike prior models like NB, KNN, SVM, RFC, and others, CNN could propel extra components from pictures to make predominant results. Because of their intricacy in acquiring and isolating information from pictures for trustworthy outcome, mind associations, for instance, CNN are suitable for research work in the space of PC vision and picture dealing with. Similarly, from the DL and ML procedures that have been associated with this particular audit, CNNs are much of the time the inclined toward choice for picture disclosure and request due to their inherent capacity to acquire suitable picture components and handle spatial moderate frameworks freely. Anyway, the decision between standard ML and DL turns upon the particular issue, the accessibility of data, and the computational limits open. Properly, in different significant level picture acknowledgment and request endeavors, DL, predominantly through CNNs, is leaned toward when above and beyond data and computational resources are available and show extraordinary ID and portrayal ramifications for their datasets, but not on other datasets.

Finally, future Research work includes

- Making DL models for ailment acknowledgment and portrayal in different bits of plants.
- To deal with the goodness of hand made datasets in puzzled settings, a robotized limit filter procedure for the environment data extension method should be made.
- Data development, colossal datasets with basic variability, and various philosophies might increase at any point plant ailment distinguishing proof and gathering exactnesses.
- Developing the recommended strategies will achieve a basic obligation to legitimate cultivating, affecting harvest quality for individuals later on.
- Using preprocessing methodology on the dataset, for instance, resizing and increment.
- DL models for consistent contamination area are being made.
- Improvement of an Android application that recognizes the presence of diseases on different plants using a DL model.

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- Encourage such plant leave disclosure and request structures by joining DL and ML systems, for instance, DCCN and CNN features with SVM techniques.

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