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Survey on: Crop Disease Detection and Prevention System Using Digital Image Processing and Machine Learning

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ABSTRACT

India is agricultural country and most of population depends on agribusiness. Farmers have broad range of selection in Fruit and Vegetable crops. The cultivation can be improved by technological support. Disease is caused by plant pathogens that can be fungal, bacterial, viral or nematodes and can damage plant parts above or below the ground at any environmental condition. It will result in high amount of loss in the yield and quantity of the agricultural product. In most of the cases diseases are seen on the leaves, fruits and stems of the plant, therefore detection of disease plays an important role in successful cultivation of crops. It is very complicated to monitor the plant diseases manually. Hence, image processing is cast-off for detection of plant diseases. Steps include for disease detection like image acquisition, image pre-processing, image segmentation, feature extraction and classification.

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I. INTRODUCTION

Sentimental Nowadays detection and recognition of plant disease is done by visual way which means observing the plant by naked eye by expert but it is more time consuming and less accurate, Though experts are available to detect diseases, still it may not correct every time by naked vision. Whereas if automatic plant disease detection technique is used it will take less effort, less time and become more accurate.

1.1 Signs and symptoms of plant disease

Most plant diseases – around eighty five percent are caused by plant or fungal-like organisms. However, different serious diseases of food and feed crops are caused by infectious agent and microorganism organisms. Certain nematodes also cause plant disease. Some plant diseases are classified as "abiotic," or diseases that are non-infectious and embody injury from pollution, organic process deficiencies or toxicities, and grow underneath but best conditions. For now, we'll explore diseases caused by the three main infective agent microbes: plant, bacterium and virus. Here are some samples of common signs and symptoms of plant life, microorganism and microorganism plant diseases:

1.1.1 Fungal disease signs and Symptoms:

Disease Sign:

1. Leaf rust (common leaf rust in corn)
2. Stem rust (wheat stem rust)
3. Sclerotinia (white mold)
4. Powdery mildew

Disease symptoms:

1. Birds-eye spot on berries (anthracnose)
2. Damping off of seedlings (phytophthora)
3. Leaf spot (septoria brown spot)
4. Chlorosis (yellowing of leaves)

Figure 1.Early blight lesion on infected tomato leaf with distinct concentric rings.

1.1.2 Bacterial disease signs and Symptoms:

Disease signs (difficult to observe, but can include):
1. Bacterial ooze
2. Water-soaked lesions
3. Bacterial streaming in water from a cut stem

Disease Symptoms:
1. Leaf spot with yellow halo
2. Fruit spot
3. Canker
4. Crown gall

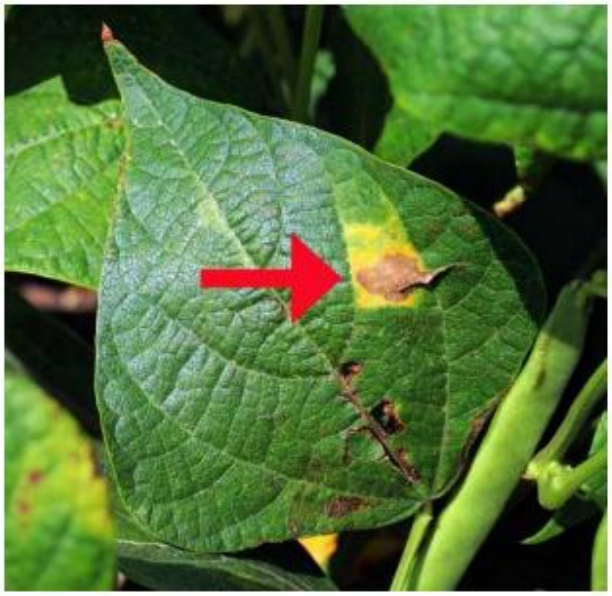

Figure 2.Dark red kidney bean leaf showing bacterial leaf spot symptom (brown leaf spot with yellow halo).

1.1.3 Viral disease signs and symptoms:

Disease Signs:
None – the viruses themselves can't be seen

Disease Symptoms:
1. Mosaic leaf pattern
2. Crinkled leaves
3. Yellowed leaves
4. Plant stunting

Figure 3.Symptoms of impatiens necrotic spot virus on pepper leaves

We can see that there is a lot of overlap between fungal, bacterial and viral disease symptoms. Also, abiotic diseases, weed killer injury Associate in Nursing roundworm issues should be thought-about prospects once an unknown plant downside seems. These lists are not complete or exhaustive, only examples stated by Michigan State University [17]. Even though research is done periodically to predict diseases in plants, accuracy in finding right diseases are not perfect. In this survey paper accuracy is main performance measure to be focused in detecting right type of disease in plant and information about that disease.

II. PROGRESS IN IMAGE PROCESSING FOR PLANT DISEASE DETECTION

2.1 Literature Survey

Sanjeev S Sannakki et al in 2011, [8] plant pathologists mainly rely on naked eye prediction and a disease scoring scale to grade the disease. It proposes a picture process primarily based approach to mechanically grade the illness unfold on plant leaves by using mathematical logic. The results area unit tested to be correct and satisfactory. Suhaili Beeran Kutty et al in 2013, [9] have considered an artificial neural network based system to classify the watermelon leaf diseases of Downney Mildew and Anthracnose. This classification relies on the colour feature extraction from RGB color model that is obtained from the known pixels within the region of interest. The true classification results conjointly depict the worth of 75.9%. P.R. Rothe et al in 2014, [10] have developed a graph cut based approach for segmentation of images of diseased cotton leaves. The mathematician filter was accustomed take away the noise gift within the pictures for segmentation. The color layout descriptor was used for content filtering and visual image. Mainly there area unit 3 diseases in cotton leaf like microorganism Blight, Myrothecium and Alternaria. Godliver Owomugisha et al in 2014, [11] has attempted to detect diseases in the banana plant such as banana bacterial wilt (BBW) and banana black sigatoka (BBS) that have caused a huge loss to many banana growers. There area unit numerous laptop vision techniques that light-emitting diode to the event of associate degree formula that consists of 3

main phases. 1) the pictures of banana leaves were nonheritable employing a normal digital camera; 2) It involves use of various feature extraction techniques to get relevant information to be used and 3) wherever pictures area unit classified as either healthy or unhealthy. Extremely irregular Trees performed best in distinguishing the diseases achieving zero.96 AUC for BBW and 0.91 for BBS. Sanjeev S Sannakki et al in 2015, [12] has used Back Propagation Neural Network (BPNN) classifier for detection of plant diseases based on visual symptoms occurring on leaves. Two diseases of pomegranate plant namely Bacterial Blight (BB) and Wilt Complex (WC). Images of healthy and unhealthy leaf samples area unit captured by photographic camera, enhanced and segmented to detect infected portions. Color and texture options area unit extracted and seasoned BPNN classifier that properly classifies the illness being occurred, thereby serving to farmers in effective deciding. The accuracy in classification was 97.30%. Aakanksha Rastogi et al in 2015, [13] have developed a Machine Vision Technology and Artificial Neural Network (ANN) is of nice use for mechanically police work the leaf plant as well as for leaf disease detection and grading. The projected system uses geometrician distance technique and K suggests that clump technique for phaseation of image to segment the leaf space, disease area and background area of the input leaf image so as to calculate the share infection of the illness within the leaf and to grade them into numerous categories. Then it helps to distinctive correct chemical and its amount to beat the matter in an efficient manner. Bhumika S.Prajapati, Vipul K.Dabhi& et al… [14] In this detection and classification of cotton leaf disease using image processing and machine learning techniques was carried out. Also the survey on background removal and segmentation techniques was mentioned. Through this survey, we tend to complete that for background removal color house conversion from RGB to HSV is helpful. We conjointly found that thresholding technique offers sensible result compared to alternative background removal techniques. We performed color segmentation by masking inexperienced pixels within the background removed image then applying thresholding on the obtained disguised image to induce binary image. This is helpful to extract correct options of illness. We found that SVM provides smart results, in terms of accuracy, for classification of diseases. There area unit 5 major steps in our projected work, out of that 3 steps are implemented: Image Acquisition, Image pre-processing, and Image segmentation. Durmus et al in 2017,[15] In this paper author used AlexNet and Squeeze pre-trained CNN models on tomato leaves from an open dataset to detect diseases. Lei He et al in 2018,[16] In this paper generalizes the IPFP method by a generalized graph matching model and some optimization tricks. Consequently, the generalized IPFP could be applied to the graph matching problem with outliers in both graphs. Experimental evaluations validate the effectiveness of the generalization. Besides IPFP, a similar generalization is also available for other graph matching algorithms with
graduated projection scheme.

III. MACHINE LEARNING METHODS

Machine learning is the subfield of computer science. It evolved from the study of pattern recognition and machine learning theory in AI, machine learning explores the study and construction of algorithms which is able to learn from and build predictions on data. Machine learning methods are:

3.1 Digital Image Processing
In computing, digital image process is that the use of computer algorithms to perform image process on digital pictures.
There are two categories of steps involved in Image Processing:
1. Methods whose outputs are input are images.
2 Strategies whose outputs are attributes extracted from those pictures

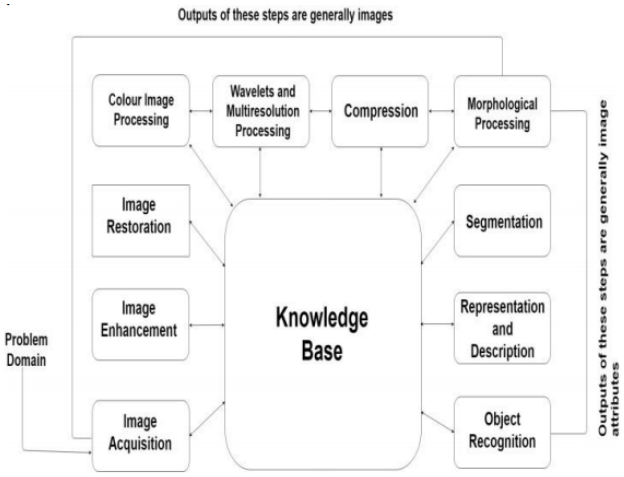

Figure 4.Fundamental Steps in Digital Image Processing

3.1.1 Image Acquisition:
It may be as easy as being given a picture that's already in digital type. Generally the image acquisition stage involves process such scaling.

3.1.2 Image Enhancement:
It is among the only and most appealing areas of digital image process. The idea behind this is often to bring out details that area unit obscured or just to focus on bound options of interest in image. Image Improvement could be a terribly subjective space of image process.

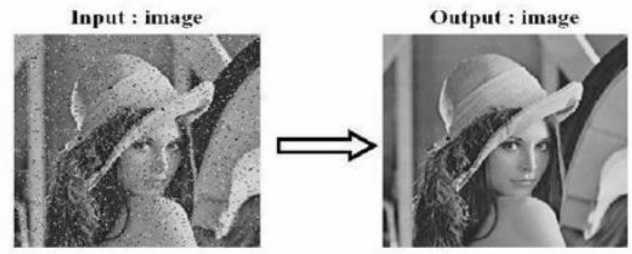

Figure 5.Processing in Image Enhancement

3.1.3 Image Restoration: It deals with improving the appearance of an image. It is Associate in nursing objective approach, within the sense that restoration techniques tend to be supported mathematical or probabilistic models of image process. Enhancement, on the opposite hand relies on

human subjective preferences relating to what constitutes a "good" sweetening result.

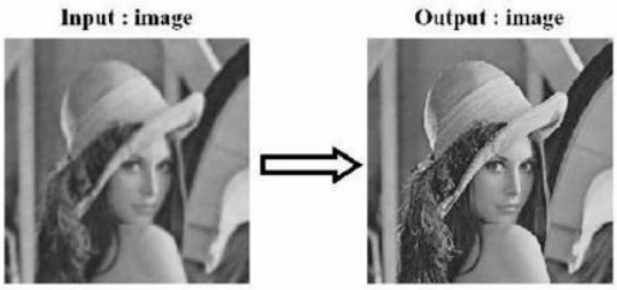

Figure 6.Image Restoration

3.1.4 Color image processing: It is a part that's been gaining importance attributable to the employment of digital pictures over the web. Color image process deals with primarily color models and their implementation in image process applications.

3.1.5 Wavelets and Multiresolution Processing: These are the foundation for representing image in various degrees of resolution.

3.1.6 Compression: It deals with techniques reducing the storage required to save an image, or the bandwidth required to transmit it over the network. It has to major approaches a) lossless Compression b) lossy Compression.

3.1.7 Morphological processing: It deals with tools for extracting image components that are useful in the representation and description of hape and boundary of objects. It is majorly used in automated inspection applications.

3.1.8 Illustration and Description: It invariably follows the output of segmentation step that's, raw picture element knowledge, constituting either the boundary of a picture or points within the region itself. In either case changing the information to a type appropriate for computer process is critical.

3.1.9 Recognition: It is the process that assigns label to an object based on its descriptors. It is the last step of image process that use computing of computer code.

3.1.10 Knowledge base: Knowledge about a problem domain is coded into an image processing system in the form of a knowledge base. This knowledge is also as easy as particularization regions of a picture wherever the knowledge of the interest in celebrated to be set. Thus limiting search that has got to be conducted in seeking the knowledge. The cognitive content can also be quite complicated such reticulate list of all major doable defects during a materials examination issues or a picture information containing high resolution satellite images of a section in reference to amendment detection application.

3.2 Support Vector Machine:

Support Vector machine (SVM) is a Supervised Classifier. It falls under the umbrella of machine learning, which is used in many pattern recognition problems, including texture classification. In SVM, the input data is non -linearly mapped to linearly separated data in some high dimensional space providing good classification performance. Multiclass categorification is additionally applicable and is largely engineered up by varied two class SVMs to unravel the matter, either by using one-versus-all or one versus-one. The winning category is then determined by the best output operate or the most votes severally. Figure below shows the support vector machines concept [7].

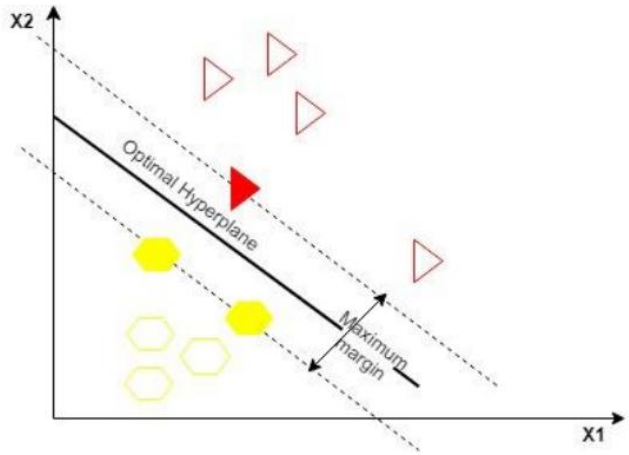

Figure 7.Support Vector Machine

3.3 Neural Network (NN):

The NN could be a system created from easy, extremely interconnected process parts, that method their data victimization states to external inputs.Limitation of NN is, in backpropogation neural network a user almost does not know about what procedure is going on into the classifier to classify the dataset. Backpropogation networks are slower to train compared to other type of NN [6].

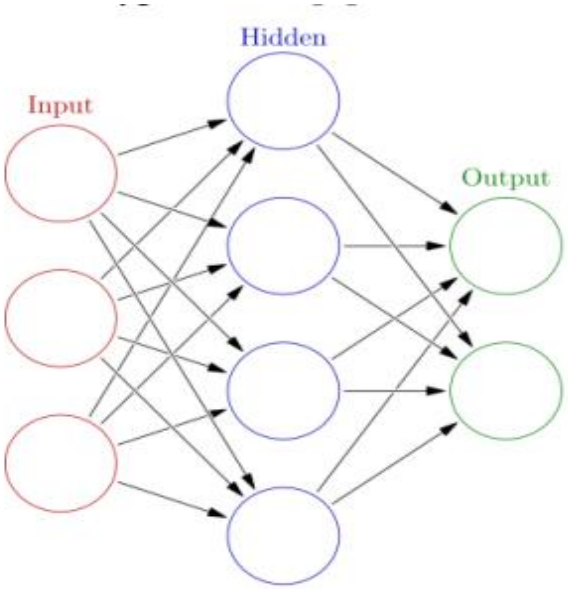

Figure 8.Artificial Neural Network

3.4 Principal Component Analysis(PCA):

Principal component analysis (PCA) is a statistical procedure that reduces data by geometrically projecting them onto lower dimensions called principal components (PCs), with the goal of finding the best summary of the info

employing a restricted range of PCs. Principal Component Analysis
Algorithm
Step: 1. Find the mean vector.
2. Assemble all the data samples in a mean adjusted matrix.
3. Create the covariance matrix.
4. Compute the Eigen vectors and Eigen values.
5. Compute the basis vectors.
6. Represent each sample as a linear combination of basis vectors.

3.5 Graph Matching:

Graph matching is that the downside of finding a similarity between graphs [1].Graphs area unit ordinarily accustomed inscribe structural info in several fields, as well as computer vision and pattern recognition, and graph matching is a crucial tool in these areas [2]. In these areas it's usually assumed that the comparison is between the info graph and also the model graph. The case of tangible graph matching is understood because the graph similarity problem [1]. The drawback of tangible matching of a graph to a region of another graph is termed subgraph similarity problem. The inexact graph matching refers to matching issues once precise matching is not possible, e.g., once the numbers of vertices within the 2 graphs square measure totally different. In this case it's needed to seek out the simplest potential match. For example, in image recognition applications, the results of image segmentation in image technique usually produces information graphs with the numbers of vertices swarming larger than among the model graphs data expected to match against. In the case of attributed graphs, even though the numbers of vertices and edges square measure a similar, the matching still is also solely inexact [1].Two categories of search methods are the ones based on identification of possible and impossible pairings of vertices between the two graphs and methods which formulate graph matching as an optimization drawback [3].Graph edit distance is one in all similarity measures urged for graph matching [4][5].The class of algorithms is termed error-tolerant graph matching [5].

IV. CONCLUSION

The surveys of different papers studied have given different identification and classification techniques which have been summarized above. As per the survey, this paper has created an endeavor to check machine learning ways that area unit utilized by researchers for illness identification and classification of. These machine learning methods help agricultural experts and Farmers in detection of disease in the plant in timely fashion. So that farmer will give the treatment for the diseased plant in a timely manner which will increase th e crop yield.

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