A Survey of Image Processing Technique for Wheat Disease Detection

Varinderjit Kaur
Ph.D C.S.E, R.I.M.T University, India.

Dr.Ashish Oberoi
A.P, H.O.D (C.S.E), R.I.M.T University, India.

Abstract – There are many types of diseases which are present in plants. To detect these diseases pattern are required to recognize them. There are many types of pattern recognition algorithm which gives detection of disease with accuracy. In the existing work back propagation and principal component analysis are used to detect plant diseases. These algorithms are learned from training supervision in neural network. There is an issue of accuracy in these algorithms. These algorithms are able to detect diseases in plant but in accurate way. So to increase the accuracy for plant detection a new method will be proposed.

Index Terms – PCA ,B.P, SVD, 2-D,3-Dimages.

1. INTRODUCTION

1.1 What is an Image?

An Image may be defined as a two dimensional function, f (x,y), where x and y are spatial co-ordinates, and the amplitude of at any pair of co-ordinates (x,y) is called the intensity or gray level of that image at that point. When x,y, and the amplitude off are all finite, discrete quantities, we call the image a digital image. The field of digital image processing involves processing digital images by means of digital computer Image processing is composed of a finite number of elements, each of which has a particular location and value. These elements are referred to as picture elements, image elements and pixels. Image processing involves processing or altering an existing image in terms of pixels in a desired manner. [2]

An area of digital image processing applications includes:

• medical applications

• restorations and enhancements

• digital cinema

• image transmission and coding

• color processing

• remote sensing

• robot vision

• face smile

• pattern recognition

1.2 What is Digital Image?

Digital image processing is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Since images are defined over two dimensions, digital image processing may be modeled in the form of multidimensional systems Digital images can be divided into number of pixels. Each pixel represented by numerical value [1].

Image processing is used in a wide variety of applications to improve the visual appearance of images and to prepare images for measurement. Image processing usually refers digital Image processing but optical and analog image processing also are possible. This article is about general techniques that apply to all of them. The acquisition of images is referred to as imaging. Image processing is also known as digital image processing. Optical and analog image processing are also possible. There are different types of image processing fields like computer graphics where images are created, image processing where manipulation and enhancement of images are to be done and computer vision where analysis of images is done [17].

Image processing is also defined as the discipline in which input and output both are images. An image processing defines a new image y in terms of the existing image x. An image can be transformed in two ways. These ways are as follow:

1. Domain Transformation

2. Range Transformation

A pixel is a sample of continuous function. Modern digital technology has made it feasible to control multi-dimensional signals with systems ranges from simple digital circuits to advanced parallel computers. The goal of this manipulation can be divided into three categories

Image Processing (image in -> image out)

Image Analysis (image in -> measurements out)

Image Understanding (image in -> high-level description out)

An image may be considered to contain sub-images sometimes referred to as regions-of-interest. This concept reflects the reality that images commonly contain collections of objects which can be the basis for a region. In a sophisticated image processing system, it should be feasible to apply specific image processing operations to regions that are selected only. Thus, one part of an image might be processed to improve color rendition and other is to be processed to suppress motion blur.

The images should be available in digitized form is the most requirements for image processing of images, that is, arrays of finite length binary words. For digitization, first of all the given Image is sampled on a discrete grid and each sample or pixel is quantized using a finite number of bits. The digitized image is processed by a computer. To display a digital image, it is first converted into analog signal, which is scanned onto a display [18].

1.3. Operations on an Image with the help of Image Processing:

•Euclidean geometry transformations such as enlargement, reduction, and rotation

•Color corrections such as brightness and contrast adjustments

, color mapping, color balancing, quantization, or color translation to a different color space

•Digital compositing or optical compositing (combination of two or more images), which is used in film-making to make a "matte"

•Interpolation, demos icing, and recovery of a full image from a raw image format using a Bayer filter pattern

•Image registration, the alignment of two or more images

•Image differencing and morphing

•Image recognition, for example, may extract the text from the image using optical character recognition or checkbox and bubble values using optical mark recognition

•Image segmentation

•High dynamic range imaging by combining multiple images

•Geometric hashing for 2-D object recognition with affine Invariance.

1.4 Diseases Detection in Wheat [19]

Agriculture has become much more than simply a means to feed ever growing populations. 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 pathologist. 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 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. The naked eye observation method is generally used to decide diseases severity in the production practice but results are subjective and it is not possible to measure the disease extent precisely. Image processing technology in the agricultural research has made significant development. To recognize and classify fungi disease an automated system has been implemented using algorithm such as back propagation, pca and svd techniques of neural network.[14]

Fig.1: Naked eye Observation to Detect Diseases

Fig.2: Type of Diseases in Wheat

1.5 Artificial Neural Networks

Artificial Neural Networks are electronic models based on the neural structure of the brain. The brain basically learns from experience. It is natural proof that some problems that are beyond the scope of current computers are indeed solved by small energy efficient packages. This brain modeling also promises a less technical way to develop machine solutions.

When to use a BP Neural Network[22]

Here are some situations where a BP NN is a good idea:

•A large amount of input/output data is available, but you're not sure how to relate it to the output.

•The problem appears to have overwhelming complexity, but there is clearly a solution.

•It is easy to create a number of examples of the correct behavior.

•The solution to the problem may change over time, within the bounds of the given input and output parameters (i.e., today 2+2=4, but in the future, we may find that 2+2=3.8).

•Outputs can be fuzzy, or non-numeric. [20]

One of the most common applications of NNs is in image processing. Some examples would be: identifying hand-written characters; matching a photograph of a person's face with a different photo in a database; performing data compression on an image with minimal loss of content. Other applications could be: voice recognition, RADAR signature analysis, stock market prediction. All of these problems involve large amounts of data, and complex relationships between the different parameters.

2. RELATED WORK

All the related works that have been done by other researchers that are related to the current research problem should be summarized in this section.

Savita N. Ghaiwat, Parul Arora, [1] They present survey on different classification techniques that can be used for plant leaf diseases classification. A classification technique deals with classifying each pattern in one of the distinct classes. A classification is a technique where leaf is classified based on its different morphological features. There are so many classification techniques such as k-Nearest Neighbor Classifier, Probabilistic Neural Network, Genetic Algorithm, Support Vector Machine, and Principal Component Analysis, Artificial neural network, Fuzzy logic. Selecting a classification method is always a difficult task because the quality of result can vary for different input data. Plant leaf disease classifications have wide applications in various fields such as in biological research, in Agriculture etc. This paper provides an overview of different classification techniques used for plant leaf disease classification. The k-nearest-neighbor method is perhaps the simplest of all algorithms for predicting the class of a test example. An obvious disadvantage of the k-NN method is the time complexity of making predictions.

Prof. Sanjay B. Dhaygude and Mr. Nitin P. Kumbhar, [2] In this paper they introduced the detection of plant leaf is a very important factor to prevent serious outbreak. Automatic detection of plant disease is essential research topic. Most plant diseases are caused by fungi, bacteria, and viruses. Fungi are identified primarily from their morphology, with emphasis placed on their reproductive structures. Bacteria are considered more primitive than fungi and generally have simpler life cycles. With few exceptions, bacteria exist as single cells and increase in numbers by dividing into two cells during a process called binary fission Viruses are extremely tiny particles consisting of protein and genetic material with no associated protein.

Mr. Pramod S. la ndge, [3] The Author proposed and experimentally evaluate a software solution for automatic detection and classification of plant diseases through Image Processing. Farmers in rural India have minimal access to agricultural experts, who can inspect crop images and render advice. Delayed expert responses to queries often reach farmers too late. This paper addresses this problem with the objective of developing image processing algorithms that can recognize problems in crops from images, based on color, texture and shape to automatically detect diseases or other conditions that might affect crops and give the fast and accurate solutions to the farmer with the help of SMS. The design and implementation of these technologies will greatly aid in selective chemical application, reducing costs and thus leading to improved productivity, as well as improved produce.

Anand.H.Kulkarni and Ashwin Patil R. K, [4] They introduced a methodology for detecting plant diseases early and accurately, using diverse image processing techniques and artificial neural network (ANN). Farmers experience great difficulties in changing from one disease control policy to another. Relying on pure naked-eye observation to detect and classify diseases can be expensive various plant diseases pose a great threat to the agricultural sector by reducing the life of the plants. the present work is aimed to develop a simple disease detection system for plant diseases. The work begins with capturing the images. Filtered and segmented using Gabor filter. Then, texture and color features are extracted from the result of segmentation and Artificial neural network (ANN) is then trained by choosing the feature values that could distinguish the healthy and diseased samples appropriately. Experimental results showed that classification performance by ANN taking feature set is better with an accuracy of 91

Haiguang Wang, Guanlin Li, Zhanhong Ma, Xiaolong Li, [5] In this paper they proposed to achieve automatic diagnosis of plant diseases and improve the image recognition accuracy of plant diseases, two kinds of grape diseases (grape downy mildew and grape powdery mildew) and two kinds of wheat diseases (wheat stripe rust and wheat leaf rust) were selected as research objects, and the image recognition of the diseases was conducted based on image processing and pattern recognition. After image preprocessing including image compression, image cropping and image denoising, K_means clustering algorithm was used to segment the disease images, and then 21 color features, 4 shape features and 25 texture features were extracted from the images. Backpropagation (BP) networks were used as the classifiers to identify grape diseases and wheat diseases, respectively. The results showed that identification of

the diseases could be effectively achieved using BP networks. Accuracy and the prediction accuracy were both 100%.
Piyush Chaudhary, Anand K. Chaudhari, Dr. A. N. Cheeranand Sharda Godara [6] They proposed an algorithm for disease spot segmentation using image processing techniques in plant leaf is implemented. This is the first and important phase for automatic detection and classification of plant diseases. Disease spots are different in color but not in intensity, in comparison with plant leaf color. So, we color transform of RGB image can be used for better segmentation of disease spots. In this paper, a comparison of the effect of CIELAB, HSI and YCbCr color space in the process of disease spot detection is done. Median filter is used for image smoothing. Finally, threshold can be calculated by applying Otsu method on color component to detect the disease spot. An algorithm which is independent of background noise, plant type and disease spot color was developed and experiments were carried out on different ".

3. PROPOSED MODELLING

3.1 Problem Formulation

The machine leaning is the technique which is applied for the plant disease detection. The machine learning algorithms lean from the previous values and drive new values on the basis of current situations. In the base paper, [19] following are the techniques of machine learning are applied for plant disease detection: -

1. The algorithm of partial least square is applied which utilize or learn the parameters of the plant from the disease need to be detected and also derive the values of the disease symptoms

2. The Gaussian process regression algorithm is being applied which learn the symptoms of the wheat leaf diseases for the disease detection

3. The algorithm of SVD is been applied which take the input of the train dataset which are the symptoms of the disease and test dataset from which disease need to be detected. The algorithm will mark the disease from the test dataset. [6] Pattern recognition aims to classify data (patterns) based on either a priori knowledge or on statistical information extracted from the patterns. The patterns to be classified are usually groups of measurements or observations, defining points in an appropriate multidimensional space. A complete pattern recognition system consists of a sensor that gathers the observations to be classified or described; a feature extraction mechanism that computes numeric or symbolic information from the observations and a classification or description scheme that does the actual job of classifying or describing observations, relying on the extracted features. The classification or description scheme is usually based on the availability of a set of patterns that have already been classified or described. This set of patterns is termed the training set and the resulting learning strategy is characterized as supervised. Learning can also be unsupervised, in the sense that the system is not given an a priori labeling of patterns, instead it establishes the classes itself based on the statistical regularities of the patterns. The classification or description scheme usually uses one of the following approaches: statistical syntactic and structural or neural. Statistical pattern recognition is based on statistical characterizations of patterns, assuming that the patterns are generated by a probabilistic system. Structural pattern recognition is based on the structural interrelationships of features. Neural pattern recognition employs the neural computing paradigm that has emerged with neural networks. [5] There is problem of accuracy in existing methods. To overcome this problem a method will be proposed with SVD algorithm to enhance its accuracy.

3.2 Objectives and Scope of Study

1. To analysis the performance of existing image processing techniques for wheat disease detection.

2. To develop improved image enhancement techniques for better wheat disease detection.

3. To propose and implement a technique for wheat disease detection.

4. To test and validate the proposed techniques both Quantitatively and Qualitatively.

4. EXPECTED OUTCOME

Following are the various expected outcomes of this research

1. This research is based on to detect the diseases from the wheat. The proposed algorithm will detect the diseases in the minimum amount of time

2. The proposed algorithm will detect the area of fraction in which disease is spread and also the type of disease

3. To improve performance of PLSR, SVR and GPA algorithm for the wheat disease detection and compare with the existing system

4. Apply improved technique for the wheat disease detection

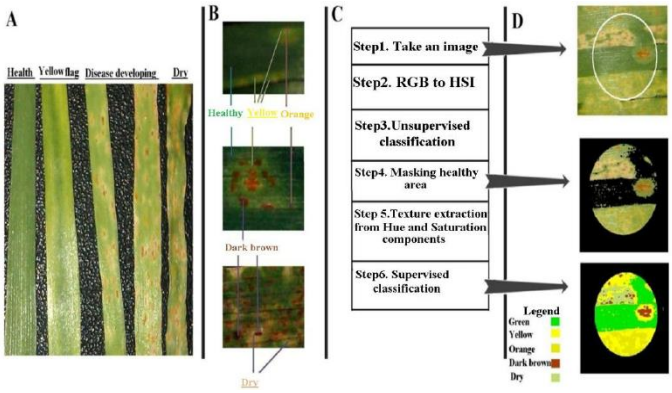

Fig.3: Steps to Detect Disease in Wheat Leaf [12]

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Authors

Miss Varinderjit kaur received B.Tech degree from P.T.U. M.Tech from L.P.U in Wireless Sensor Network. Pursuing Ph.D. from R.I.M.T University in Digital Image processing.

Dr Ashish Oberoi working as H.O.D in R.I.M.T University and expert in D.I.P .He Completed Ph.d from M.M University.