

Agricultural Seed Disease Detection using Image Processing Technique

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Abstract – The main aim of this paper is to design and implement an image processing technique to detect and classify the seed diseases. As seeds are the main part of any cultivation, healthy seeds yields healthy crops. So it becomes necessary to provide the farmers healthy seeds. Most of the farmers find it difficult to describe the seed disease they just classify the seeds into healthy and unhealthy seeds. The system is based on SVM classifier which is used for classifying the diseases based on the values of the parameters that are used here in this system. This method provides a solution to detect and classify the diseases, to what extent the seeds are effected and depending upon the calculations and the value of the random variables the quality of the seeds can be detected to a nearest value as compared to the standard values.

Key Words: Image processing, Support vector machine, Random variables.

1. INTRODUCTION

India is an agricultural based country. But the farmers are facing a lot of problems in growing better quality crops, diseases as they lack knowledge of diseases regarding the seeds. Once the amount of disease is known the seeds can be classified into diseased, undiseased and poisonous seeds. Therefore farmers can be provided with better results by using image processing technique. This will help to visualize the diseased seeds that are being affected. This method is based on artificial neural network. In this method the color pixels are clustered by the SVM classifier.

Crop monitoring play an important role in successful cultivation. In some developing countries cultivation of best quality crops is becoming competitive. But for every best yield best seeds are the basic requirement. With this technique farmers are not only able to know about the various types of diseases but also to what extent the seeds are affected. Depending upon the value of parameters and comparing those values with standard values the quality of the seed can be detected. According to a survey most of the farmers are unable to identify the disease that are affecting the crops due to which they fail to gain the profit or even recover the amount they have spent on the crops. Farmers take loan from banks and in most of the times they suffer from loss due to diseased crops, bad weather, and other condition, not getting the exact market values for their crops and other natural calamities also.

1.1 Proposed Method

The method is based on image processing where the images of seeds are collected and then they are processed. The processing includes four steps: First step includes transformation of color. RGB structure of the seed image is applied to the device independent color space transformation. In the second step the segmentation of the images is done. In the third phase the texture features like mean, variance, correlation etc. are calculated for the infected seeds. Lastly in the fourth stage the features that are extracted are then given to a neural network which is pre-trained. For testing five types of seeds are taken like groundnut seeds, pumpkin seeds, peas among them the various diseases which effect the crops like fungal disease, viral disease, red spot etc. are classified. The seeds are classified into healthy seeds, unhealthy seeds, and poisonous seeds.

1.2 Karnataka State Seed Certification Agency (KSSCA)

This is an autonomous agency which certifies the quality of seeds depending on the sampling and testing of the seeds done in their laboratory. The various methods of sampling in seed testing laboratory includes:

1. Mixing and dividing of seeds
2. Mechanical dividing
3. Modified halving method
4. Hand halving method random cup method
5. Spoon method

1.3 Chemical Composition of a Seed

The chemical composition of any seed plays a very important. The seed quality can be defined depending on the chemical composition of the seed which includes the proteins, carbohydrates, nutrients, water content in the seed, They not only decide the size, shape, weight and quality of seeds but also the nutritional value of seed.

2. LITERATURE SURVEY

The seed testing method is more than 100 years old. It was implemented in the parts of Australia and Africa. But only simple and easiest methods were used. Later on seed testing laboratories were developed all over the world. Seed

pathogens may effect in different ways to crops .There are. There are many diseases that affect the crops the reason behind this is unhealthy seeds and other environmental factors. Seed disease may affect many parts of plants and crops .Many methods were proposed few among them included the parts like roots, leaves, stems, etc. Some features are shared by most methods presented in this section: The images can be taken by simple cameras and the format used for images is RGB quantized with 8 bits .Earlier papers were describing to detect mainly on aphids, white worms using various approaches suggesting the various implementation ways as discussed below.

A system that uses learning knowledge, image processing technique based. Earlier the plant diseases were detected and the images of the root, stem, and leaves were the main part of any system. They used 180 images as test for the purpose of dataset and among 180 images only 162 images were tested and giving the result and each image was having 0 to 5 white flies as bacteria. Then the False Negative Rate (FNR) and the False Positive Rate (FPR) were the images were divided as class 1 and class 2 like for clearance class1 with flies and class 2 without flies. Again in another project an algorithm was implemented which was used to detect the bio-aggresses which was limited to only two named as aphids and white flies. Here the detection was done at earlier stage like during the lower infestation stage of detecting the eggs of flies.

The algorithm was divided into four parts namely color conversion, reduction in noise, counting flies, and segmentation. Another different algorithm was developed which was named as Relative Difference in Pixel Intensity. This was developed only for pest detection which effected various seeds. Most of the pests which effected were white flies. This algorithm was developed to work both for agricultural field and also for green house based crops. This algorithm was used to test 100 images of white flies and the result was with an accuracy of 96%. Another adaptive image segmentation method having contextual parameters for the detection and classification of pest which caused damage to soya bean seeds. This was based on SVM classifier.

2.1 Detection

As the information gathered by image processing technique not only detects the disease but also estimating the severity of disease .The detection may be applied in two main conditions. In the partial detection type of classification the seeds are classified as healthy and unhealthy seeds depending on the external features like the shape and size of the seeds.

In the Internal detection method includes the study of parameters like the humidity of seeds, mean value, the shape of the seed before and after digging inside the soil.

This method is one of the most effective method in detection of diseases. As the seeds show better results after they are placed in the soil.

2.2 Factors Effecting the Seed Diseases

1. Humidity
2. The physical structure of the seeds.
3. The swellingness of the seeds.

The diseases can be effected from two types externally and internally. Internal diseases are caused due to soil content, water content, and temperature, it occurs whenever the seeds are inside the soil. External diseases are caused due to the external features like the temperature, humidity, and other atmospheric conditions. Seed size indicate the quality of seeds, largest seeds have high seedlings survival growth and establishment. The seed quality gives the nutritional value of the seeds. Among the nutrients the protein, phosphorous, fat, are the major contents of any seed.

Tolerance capacity describes the capacity of seed to react on the surrounding conditions like the temperature, pressure and humidity.

2.3 Various Types of Diseases in Seeds

1. Yellow virus
2. Brown spot disease
3. Alternatae
4. Bacterial diseases
5. Aster yellow cytoplasm
6. Bacterial Blight

Planting disease free seeds is a smart way to minimize the possibility of the diseases and losses associated with them. The Regional Pulse Crop Laboratory (RPCDL). These above mentioned diseases are one of the major diseases that have been effecting the crops.

2.4 Characteristics of Good Quality Seeds

Quality seeds have the ability for efficient utilization of the input such as fertilizers, the internal content of the soil. The quality of a seed is defined as the variety of the seed, the purity of the seed with a high germination percentage free from diseases and with proper moisture and weight.

1. Higher physical purity for certification
2. Possession of good shape, size, color etc. according to the specification of variety
3. Higher physical soundness and weight
4. Higher germination depending on the crop

5. Higher physiological vigor and stamina

3. PROPOSED METHOD

The proposed system consists of various stages including collection of images of agricultural seeds for creation of database image segmentation is performed. Features of segmented images are stored in database with respect to image of seeds using support vector machine. The shape feature extraction is used to solidly extent minor axis length and eccentricity. This feature is taken in order to extract the shape feature of the diseased region. Eccentricity is used which and where the rust or the decay has occurred. Eccentricity is used to measure the area of the diseased region

3.1 Objectives of Seed Health Testing

The seed borne pathogens not only effect the market value but also the nutritional value of seeds

1. A test must give reliable information pertaining to field performance and quantity.
2. The results must be reproducible within statistical limits.
3. The time labor equipment for carrying through a test must be within economical limit.

3.2 Classification of Diseases Using Support Vector Machine.

The SVM is a classifier which uses input data and depending on the parameters the diseases are classified. A classifier is a system which classifies the input images of seeds according to the degree of presence of a disease in a leaf. And the classification is based on the features of the seeds.

The features include the color, shape, size which further are again classified using the various parameters like the mean, variance, skewness, kurtosis, etc. The most important parameter is mean time generation (MGT) which is defined as a measure of the rate and time spread of germination. SVM is a classifier based on kernel, linear separation is used for implementation which classifies data into two classes only.

SVM are support vector machine networks are supervised learning models with associated learning algorithms that analyses data used for classification and regression analysis. Extent implementation of image processing algorithm and technique to test disease. Proposed system includes four steps named as color conversion, segmentation, reduction in noise and classification.

A distinct algorithm named as relative difference in pixel intensity (RDI) was proposed for pest detection named as

white flies effecting various seeds. The algorithm not only works for green house based crops but also for agricultural based crops.

Texture feature identification is the angular moment (I1) is a measure of the image homogeneity and is defined as,

$$I1 = \sum [p(i, j)]^2$$

The mean intensity level I2 is the measure of image brightness and is derived from the co-occurrence matrix as follows,

$$I2 = \sum ip(i)$$

Variation of image intensity is identified by the variance texture feature and is defined as

$$\frac{\sum ij p(i, j) - I2^2}{I1}$$

4. FUTURE SCOPE

The seed testing and qualifying the seeds is one of the major part of agriculture. If the best quality seeds are provided then the usage of fertilizers can be reduced to some extent because the diseases are sometimes seed borne diseases. This image processing technique helps in detecting the quality of seeds based on the various parameters like the mean, standard deviation and others. This can further be used to improve the nutritional value of a seed. If this is done then India would become the largest producer of better quality seeds with highest nutritional value.

5. EXPERIMENTAL RESULTS

This system results in differentiating between the diseased seeds and the healthy seeds. Once the images of the seeds are given the various parameters are calculated these parameters are mean, standard deviation, skewness, entropy, IDM, and other parameters. Depending upon the value of the parameter the algorithm is designed in such a way that the values are compared with the standard values and a final result is given. So that the seeds can be classified as either .diseased or healthy seeds. The table below shows the comparison of the experimental results.

Table -1: Sample Table format

SEED SAMPLE (Name of the seed)	VALUES OBTAINED	TYPE OF CLASSIFICATION
Groundnut seed	Mean:83.1756 SD:54.8853 Entropy:7.60158 RMS:15.1125	Diseased Seed

Green peas	Mean:247.802 S.D:39.8445 Entropy:1.08235 RMS:15.9687	Healthy seed
Green gram seed	Mean:247.149 S.D:34.7104 Entropy:0.697832 RMS:15.9687	Diseased seed

Earlier algorithms were designed only for detecting the diseases of fruits, roots of the crops, leaves, stem of the crops. And the images that were taken was exceeding more than 100. The result accuracy was 90 to 96%. This project includes only the images of seeds and the images are limited to 10. The result accuracy is about 97%.

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