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Identification and Detection of Infected Glycine max (Soybean) Seed using Image Processing

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ABSTRACT: Soybean is an important commercial crop known as the "GOLDEN BEAN". Damage in soybean seed is an important quality factor for grading, marketing and end use of Soybean. Seed damage can be caused by weather, fungi, insects, artificial drying, and by mechanical damage during harvest, transportation, storage and handling. Seed-borne pathogen causes enormous losses to crops in the world as well as in India. The presence of pathogenic propagates in a seed lot is pivotal because infected seed may fail to germinate, causes infection to seedlings and growing plants. Main challenge here is without disintegration finding the defected seeds in big lot. Image processing helps to extract low level features such as colour, texture and shape to identify the diseases and classify them. The paper discusses detail study of diseases, causes and different techniques that can be used to identify and detect them. Proposed work has greater social impact by helping farmers to identify the seed borne diseases at early stage and thereby increasing yield.

KEYWORDS: Detection; Features; Identify; Image processing; Seed borne.

I. INTRODUCTION

The Soybean or Soya bean (Glycine max) is a legume species native to East Asia, which is highly cultivated for its edible seed. The plant has been classified under oil producing plant for its edible seed rather than for its pulse by the Food and Agricultural Organization (FAO). Soybean is an annual legume categorized under Fabaceae family. Soybean is one of the most important beans among all in the world which provides vegetable protein for millions of human and ingredients for thousands of chemical products. It is most nutritious and easily digested food of the bean family. The soybean is considered as one of the richest and cheapest sources of protein. It is a staple in the diet of humans and animals in different corners of world today. Close association with seeds facilitates the long-term survival, introduction into new areas and widespread dissemination of pathogens. The conventional method of disease detection in plants using naked eye observation method is cubersome and is non effective. Using computer vision toolbox the disease detection in plants is efficient and is not time consuming. Detection and recognition of diseases in plants using machine learning is very fruitful in providing symptoms of identifying diseases at its earliest.

This paper mainly addresses the issues related to the soybean. The issues include Identifying and detecting seed-borne diseases of soybean using image processing. Once the disease is detected then quantifying the effect of diseases in terms of percentage.

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II. LITERATURE REVIEW

"Soya" (or "Soy" in the United States), is a legume, Glycine max (L) Merrill. About 85 per cent of the world's soya beans are processed or "crushed", annually into soya bean meal and oil. Approximately, 98 per cent of the soya bean meal that is crushed further processed into animal feed with the balance used to make soy flour and proteins of the oil fraction. 95 per cent is consumed as edible oil; the rest is used for industrial products such as fatty acid, soaps and biodiesel. Soya bean is one of the few plants that provide a complete protein as it contains all eight amino acids essential for human health.

Why detection and identification of soybean seed diseases in necessary?
Detection means detecting of impairment of health or a condition of abnormal functioning or the action of identifying the presence of something concealed. Identifying the action or process of identifying something or the fact of being identified. By observing the signs and symptoms we come to the conclusion of particular disease. Some Agronomist are not so much aware about seed borne diseases which affects directly on the production of crop. So this detection and identification of seed borne diseases of soya bean crops which helps Agronomist to increase yield of crop.[International Journal of emerging tech. in Computer Science and Electronics (IJETCSE) ISSN, 0976-1353 Vol 14 issue to April 2015.]

III. RELATED WORK

It consists of two components database and processing unit. Database consists of collection of different types of disease images. Further, they are previously pre-processed so that having standard component. Pre-processing generally consists of remove noise. So that whenever matching process occurs noise is not to be problem. Before images are fed to database images firstly pre-processed with thresholding, resize, filtering etc. Such collection of image dumped into one group called as database. And all images are in the database called to be registered images. Then another set of image are given as an input to system to check whether they are disease free or having disease. Depending upon the matching % after applying matching algorithm the type disease and disease % we will get.

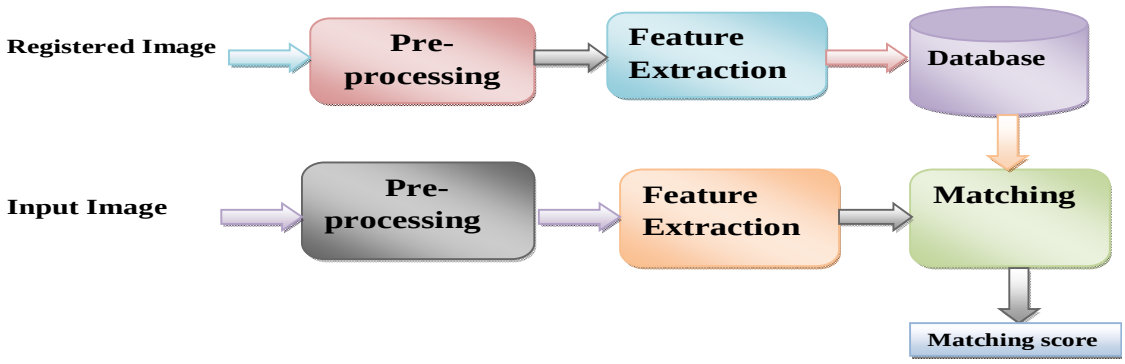

Fig 1: Block diagram of Identification of soybean seed disease using Image processing

A. Pre-processing: Data pre processing is an important step in the data mining process. The phrase"Garbage in, garbage out" is particularly applicable to data mining and machine learning projects. Data pre processing includes cleaning, normalization, transformation, feature extraction and selection, etc. Data preparation and filtering steps can take considerable amount of processing time. The product of data pre processing is the final training set.
B. Feature Extraction: In image processing, feature extraction starts from an initial set of measured data and builds derived values (features) intended to be informative and non-redundant, facilitating the subsequent learning and generalization steps, and in some cases leading to better human interpretation. Feature Extraction is related to dimensionality reduction. When the input data to the algorithm is too large to be processed and it is suspected to be redundant then it can be transformed into a reduced set of features. This process is called feature extraction. The extracted features are expected to content the relevant information from the input data, so that the desired task can b performed by using this reduced representation instead of the complete initial data.

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C. Database: A database is a collection of information that is organized so that it can easily be accessed, managed and updated. In one view, databases can be classified according to types of content: bibliographic, full text, numeric and images. Often abbreviated DB, a database is basically a collection of information organized in such a way that a computer program can quickly select desired pieces of data (as an electronic filing system). In relational database management systems, records are called tuples. Some programming languages allow defining a special data structure called a record. Generally, a record is a combination of other data objects.

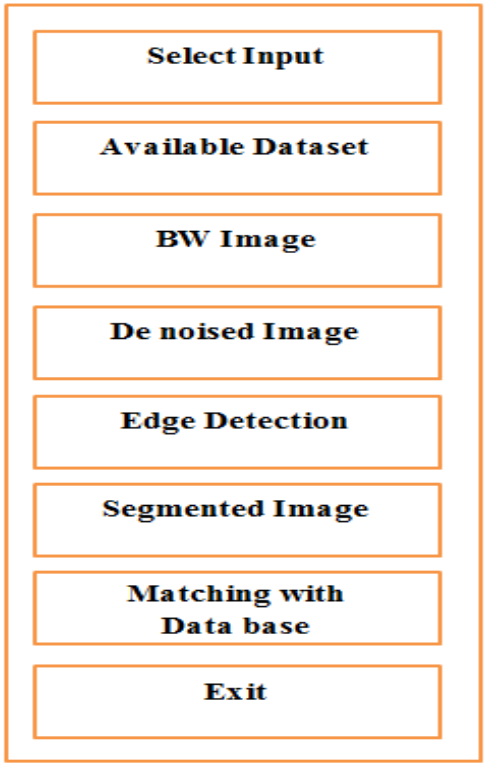

Fig 2: Steps of Algorithm

D. Matching: The matching block estimates motion between two images or two video frames using "blocks" of pixels .The matching block matches the block of pixels in frame k to a block of pixels in frame k+1 by moving the block of pixels over a search region. This matching block matches the external input image to the image which is stored in database, and if external input image matches with database image then the desired output is given otherwise error occurs.[International Journal of Emerging Technology in computer Science and electronics(IJETCSE) ISSH;0976-1353 Volume 14 Issue 2-April 2015]

IV. ALGORITHM

In mathematics and computer science an algorithm is a finite set of well-defined instructions for accomplishing some task which, given an initial state, will terminate in a corresponding recognizable end-state. Algorithms can be implemented by computer programs, although often in restricted forms; mistakes in implementation and limitations of the computer can prevent a computer program from correctly executing its intended algorithm. Correctly performing an algorithm will not solve a problem if the algorithm is flawed or not appropriate to the problem. Algorithms are essential to the way computers process information, because a computer program is essentially an algorithm that tells the computer what specific steps to perform in order to carry out a specified task.

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Select input: Selected input is the input image which is to be matched with the available dataset. On the basis of which we can detect and identify the infected area of the seed and display it in the form of segmented image with the message on the result side.

Available dataset: An available dataset also called standard test image which is a digital image file used across different institutions to test image processing and image compression algorithms. By using the same available dataset or standard test images, different labs are able to compare results, both visually and quantitatively. The images are in many cases chosen to represent natural or typical images that a class of processing techniques would need to deal with. Other test images are chosen because they present a range of challenges to image reconstruction algorithms, such as the reproduction of fine detail and textures, sharp transitions and edges, and uniform regions.

Black and white image: In photography and computing a grayscale or grayscale digital images is an image in which the value of each pixel is a single sample, that is, it carries only intensity information. Images of this sort, also known as Black and White, are composed exclusively of shades of grey, varying from black at the weakest intensity to white at the strongest. Grayscale images are distinct from one-bit bi-tonal black and white images, which in the context of computer imaging are images with only the two colours, black and white. Grayscale images have many shades of grey in between. Grayscale images are often the result of measuring the intensity of light at each pixel in a single band of the electromagnetic spectrum. And in such cases they are monochromatic property the only a given frequency is captured. But also they can be synthesized from a full colour image. The intensity of a pixel is expressed within a given range between a minimum and maximum, inclusive. The range is represented in an abstract way as a range from 0 (total absence, black) and 1 (total presence, white), with any fractional values in between. This notation is used in academic papers, but this doesn't define what "black" or "white" is in terms of colorimetric.

De-noised image: Image de-noising is an important image processing task, both as a process itself, and as a component in other processes. There are many ways to de-noise an image or a set of data exists. The main property of a good image de-noising model is that it will remove noise while preserving edges. Traditionally, linear models have been used. One big advantage of linear noise removal models is the speed. But a drawback of linear models is that they are not able to preserve edges in a good manner: edges, which are recognized discontinuities in the image. Nonlinear models on the other hand can handle edges in a much better way than linear models can.

Edge detection: Edge detection is the name for a set of mathematical methods which aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. The points at which image brightness changes sharply are typically organized into a set of curved line segments termed edges. Edge detection is a fundamental tool in image processing, machine vision and computer vision, particularly in the areas of feature detection and feature extraction. The purpose of detecting sharp changes in image brightness is to capture important image and changes in properties of the world.

Segmented Image: In image processing, image segmentation is the process of partitioning a digital image into multiple segments. The goal of segmentation is to simplify and change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries in images. More accurately, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics. The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image.

Matching with database: The infected sample images which are already stored in database are compared with the externally taken input images and if the particular image gets matched with one of the sample image then it displays message as an output. Otherwise, the message is displayed as image is not matched.[Zhao DT, Chai YH, Zhang CL Research on detection technology of soybean Frogeye based on Image processing technology. Journal of Northest Agricultural University 2014; 41(4): 119-123]

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RGB Colour Representation

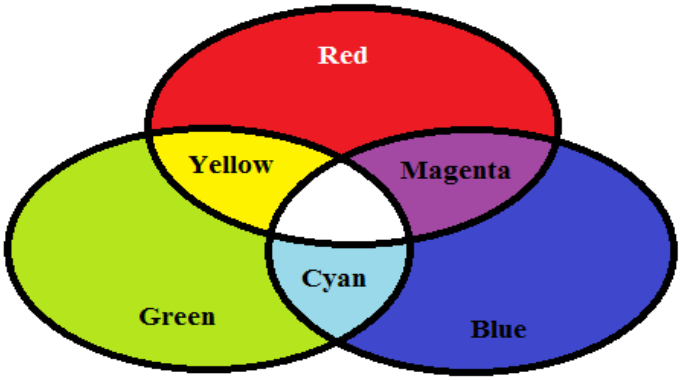

Fig 3:- RGB Colour Representation.

The input image is converted into black and white image and after that by segmentation process, we get the segmented image. The red colour represent the highly infected area.

Sr. No.	Disease Name	Symptoms and Sign	Management	Images
1	Phonopsis	Black, raised specks that appear in linear rows on mature soya bean stems.	Can be treated with fungicide. Timely harvest will help to reduce the risk of seed decay and preserve seed quality.	
2	Aspergillus	In both grains and legumes, infection is minimized to small areas and discolouration and dullness of affected areas is often seen. Growth is rapid and colonies appear downy or powdery in texture.	To avoid this aeration system is used. Moisture level should be kept below 11.5%.Temperature in storage units should be kept as low as possible since the pathogen is unable to grow below 5 degree Celsius.	
3	R. Bactaticola	It can kill and rot seeds before germination or cause seedling death. The soybean seeds become colourless and powdery.	Accurate diagnosis can help in managing disease. Disease can be reduced by planting good quality seed in well drained, non-compact fields. Fungicidal seed treatments may reduce seed and seedling diseases.	

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4	Penicillium	Powdery green or blue fungal growth is observed. Discolouration of embryo takes place at high moisture condition.	Proper sanitation and careful handling, chemical treatment with chlorine bath, addition to fungicides can reduce severity of the disease.	
5	Fusari	Causes seed decay and damping of soybean, wilting, clhlorosis, necrosis, premature leaf drop, browning of the vascular system, stunting.	To improve soil condition planting resistant verity, removing plant tissue to prevent overwintering of the disease, using soil and systematic fungicides.	
6	Cercospora	Upper leaves turning yellow, purple-red lesions are present on leaves and coalesce to give the leaves a bronzed appearance and severe infections give leaves a blighted appearance and cause them to drop from the plants.	No soya bean varieties are immune to the disease but some have more resistance than others and can give some degree of control; crop debris should be plowed into soil following harvest to reduce built up of inoculum.	

[www.extension.umn.edu/agriculture/crop-diseases/soybean/soybeandisease.html]

Table 1. Brief Discussion of Diseases

V. SIMULATION AND RESULT

The figure 4 shows the black and white infected image of Glycine max seed whose disease is to be identified. Binary images are produced from colour images by segmentation. This is the first step our research paper.

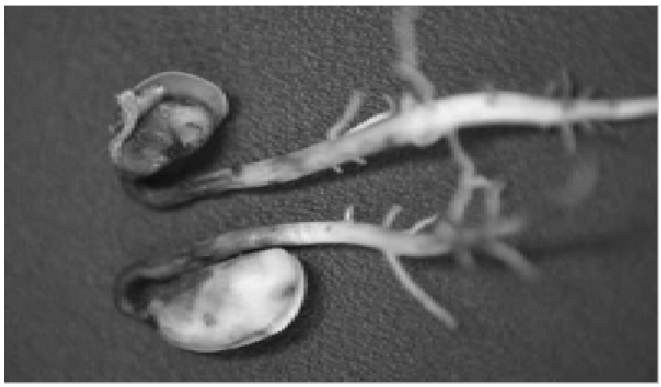

Fig 4: Binary Input Image

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Figure 5 is the segmented image which shows different segments of image. Segmentation is the process of assigning each pixel in the source image two or more classes and here we have used three classes to assign pixels. And the reddish-yellow coloured area shows the more infected part of the seed.

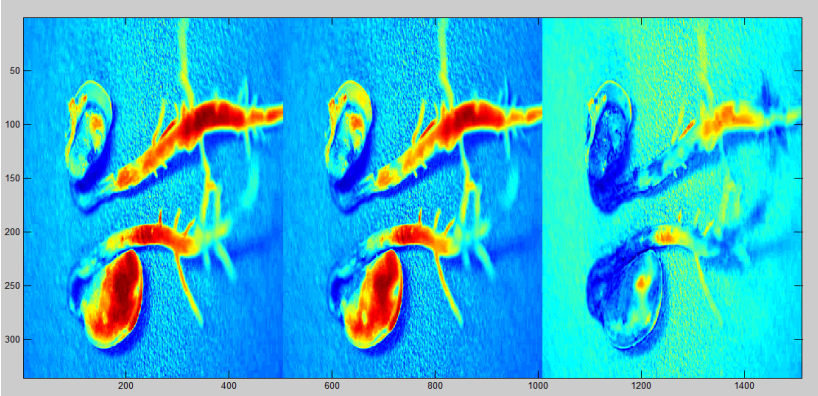

Fig 5: Segmented Image

The figure 6 shows the result containing the edge detected image obtained from segmented image. Edge detected image creates a binary image with some pixels assigned to edge pixels which is further used to get the message. The fourth block shows that the infected image is infected with penecillium due to moisture.

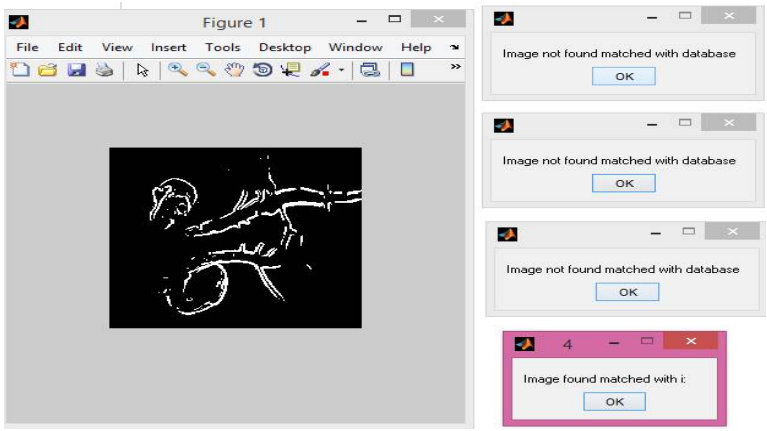

Fig 6: Image Showing Final Result

VI. CONCLUSION

Commercial production of soybean is potential source of income to farmers, traders and government. Reliable detection of seed borne diseases in early stages is essential for economic, production and agricultural benefits. Key contribution to the paper is to identify the issues related to seed borne diseases. An image processing based approach is proposed in this paper for seed borne disease, identification and detection problem. The proposed approach is composed of mainly three steps. In first step edge detection is done, second step contains +
segmentation and finally third step is if identification and detection of diseases. We have used different types of seed borne soybean diseases as a case study. Proposed work has greater social impact by helping researcher and farmers to identify the seed borne diseases at early stage and there by increases in yield.

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