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Disease Prediction of Paddy Crops Using Data Mining and Image Processing Techniques

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ABSTRACT: Image processing is the analysis and manipulation of a digitized image especially in order to improve its quality. Data mining is the practice of examining large pre-existing databases to generate new information and it is process of selecting and exploringlarge amounts of data. This process has become an increasingly aggressive action in all areas of agricultural sciences and research. A large amount of scattered information about paddy crops is available. Here in this paper implements an innovative idea to identify diseases affected in paddy crops and provides the remedy/solution to farmers. The images of the diseased paddy crop are captured with the help of high pixel cameras or mobile phone like android or iPhone or wireless PDA. These images are then fed for application for identifying paddy diseases and suggest remedies to the farmer. This implementation provides better choice for every class of agriculture community especially in remote villages.

KEYWORDS: Data Mining, Paddy Crop, Diseases, Morphological Operators, Remedies.

I.INTRODUCTION

Image processing is the analysis and manipulation of a digitized image especially in order to improve its quality and it is form of signal processing for whichthe input is an image, such as a photograph; the output of image processing may be either an image or a set of characteristics or parameters related to that image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it. Digital image processing is the use of computer algorithms to perform image processing on digital images.

In our work, image processing starts with the digitized a colour image of paddy disease leaf. Then a method of mathematics morphology is used to segment these images. Erosion method has been used.
The following are the challenges that can be overcome in Image Processing for agricultural applications:

- To detect diseased leaf.
- To determine size & shape of paddy crop.
- To find shape of affected area.
- To determine colour of affected area
- To quantify affected area by disease.

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Data mining is the practice of examining large pre-existing databases to generate new information. It is computational process of discoveringpatterns in large data sets involving methods at the intersection of artificial intelligence, machine learning, statistics, and database systems. The goal is the extraction of patterns and knowledge from large amount of data, not the extraction of data itself. The overall goal of the data mining process in our implementation is to extract the information from a data set and transform it into an understandable structure called remedy. There are two forms of data analysis that can be used for extracting models describing important classes or to predict future data trends.

These two forms are as follows –

- Prediction
- Classification

Classification models predict definite labels in data analysis, while prediction models predict continuous-valued functions in data analysis.

Paddy Crops disease is caused by pathogen which is anyagent causing disease. In most of the cases diseases are seen on the leaves or stems of the plant. Therefore identification of plants, leaves, stems and finding out the diseases, percentage of the disease incidence, symptoms of the pest or disease attack, plays a key role in successful cultivation of paddy crops.Our team has three objectives: to process a diseased/healthy image of paddy crop leaf, to classify among diseases and finally provide the farmer with treatment possibilities for that particular disease.

II. PHASES AND METHODS

The block diagram constituting different phase is shown in below fig 1.

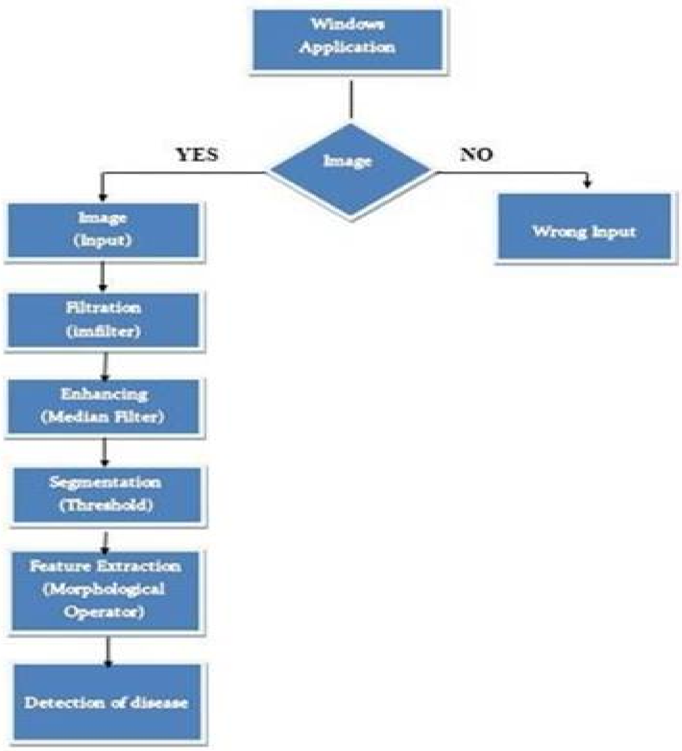

Fig (1): Different Phases.

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The following are the different phases in our work.

- Filtering
- Enhancing
- Segmentation
- Feature Extraction
- Classification

2.1. FILTERING

The rgb2gray function converts RGB images to grayscale by eliminating the hue and saturation information while retaining the luminance.The*imfilter* function can perform filtering using either correlation or convolution. It uses correlation by default, because the filter design functions, described in Filter Design,and the *fspecial* function, described in using predefined filter types, produce correlation kernels.

2.2. ENHANCING

The principal objective of image enhancement is to process a given image so that the result is more suitable than the original image for a specific application. It accentuates or sharpens image features such as edges, boundaries, or contrast to make a graphic display more helpful for display and analysis.
If the main objective is to achieve noise reduction instead of blurring filtering method is suggested .The best filtering method **median filtering** method should be used. This method is useful when the noise pattern consists of strong, spike-like components and the characteristic to be preserved is edge sharpness.

The image with salt and pepper noise is shown in fig 2, we apply the median filter to the noisy image to get the enhanced image as shown in fig 3.

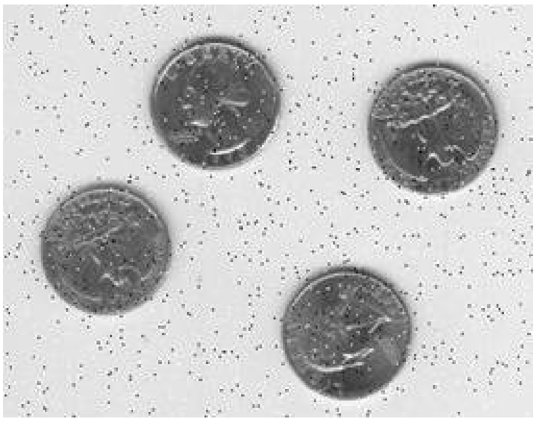

Fig (2): Image with Salt and Pepper Noise.

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Fig (3): Enhanced image using Median Filter.

2.3. SEGMENTATION

In thresholding method the pixels are partitioned depending on their intensity value. Thresholding methods replace each pixel in an image with a black pixel if the image intensity $I_{i,j}$ is lessthan some fixed constant T (that is, $I_{i,j}<T$), or a white pixel if the image intensity is greater than that constant.

2.4. FEATURE EXTRACTION

Morphological image processing is a collection of non-linearoperations related to the shape or morphology of features in an image. Morphological operations rely only on the relative ordering of pixel values, not on their numerical values, and therefore are especially suited to the processing of binary images.is a theory and technique for the analysis and processing of geometrical structures, based on set theory, lattice theory, topology and random functions. MM is most commonly applied to digital images, but it can be employed as well on graphs, surface meshes, solids, and many other spatial structures.Morphological operations can also be applied to grey scale images such that their light transfer functions are unknown and therefore their absolute pixel values are of no or minor interest.

In morphological techniques an image with a small shape or template called a **structuring element/mesh** is used. The structuring element is positioned at all possible locations in the image and it is compared with the corresponding neighborhood of pixels. Some operations test whether the element "fits" within the neighborhood, while others test whether it "hits" or intersects the neighborhood:

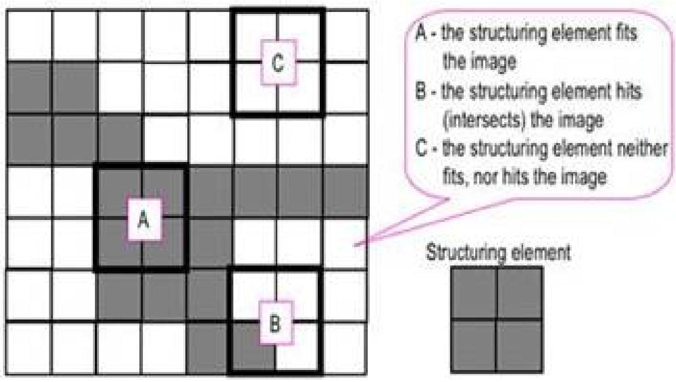

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Fig (5): Examples of simple structuring elements.

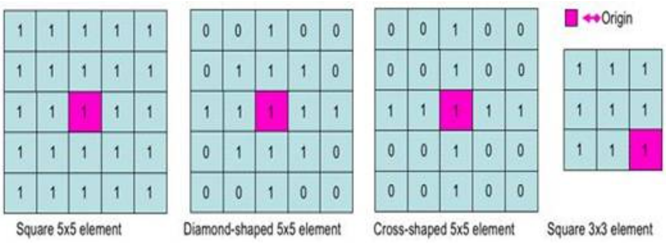

Fig (6). Fitting and hitting of a binary image with structuring elements s1 and s2.

A common practice is to have odd dimensions of the structuring matrix and the origin defined as the center of the matrix. Structuring elements play in morphological image processing the same role as convolution kernels in linear image filtering.

When a mesh is placed in a binary image, each of its pixels is associated with the corresponding pixel of the neighborhood under the structuring element. The mesh is said to **fit** the image if, for each of its pixels set to 1, the corresponding image pixel is also 1. Similarly, a mesh is said to **hit**, or intersect, an image if, at least for one of its pixels set to 1 the corresponding image pixel is also 1.

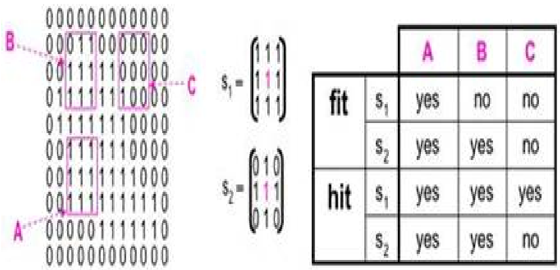

Fig (4):Probing of an image with a structuring element
(White and grey pixels have zero and non-zero values, respectively).

A morphological operation on a binary image creates a new binary image in which the pixel has a non-zero value only if the test is successful at that location in the input image.

The **structuring element/mesh** is a small binary image, i.e. a small matrix of pixels, each with a value of zero or one:

- The matrix dimensions specify the size of the mesh.
- The pattern of ones and zeros specifies the shape of the mesh.
- An origin of the structuring element is usually one of its pixels, although generally the origin can be outside the mesh.

Zero-valued pixels of the mesh are ignored, i.e. indicate points where the corresponding image pixel value is irrelevant.

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Erosion and dilation

The **erosion** is one of two fundamental operations in morphological image processing .erosion of a binary image f by a mesh s (denoted f s) produces a new binary image g = f s with ones in all locations (x,y) of a mesh's origin at which that mesh s fits the input image f, i.e. g(x,y) = 1 is s fits f and 0 otherwise, repeating for all pixel coordinates (x,y).

Erosion with small (e.g. 2×2 - 5×5) square mesh shrinks an image by stripping or cutting away a layer of pixels from both the inner and outer boundry regions. The holes and gaps between different regions become larger, and small details are eliminated:

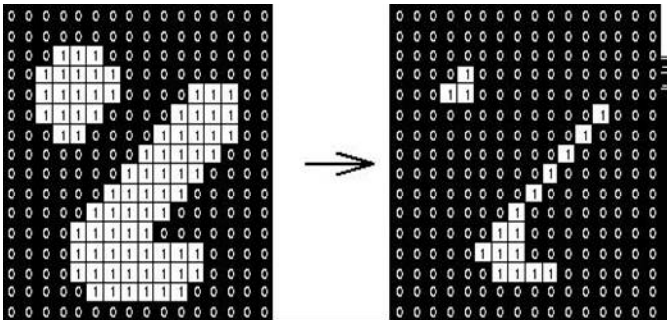

Fig (7): Erosion: a 3×3 square structuring element

Larger mesh have a more pronounced effect, the result of erosion with a large mesh being similar to the result obtained by iterated erosion using a smaller mesh of the same shape. If s1 and s2 are a pair of mesh identical in shape, with s2 twice the size of s1, then

$$f\ominus s_2 \approx (f \ominus s_1) \ominus s_1.$$

Erosion removes small-scale details from a binary image but simultaneously reduces the size of regions of interest, too. By subtracting the eroded image from the original image, boundaries of each region can be found: b = f − (f s) where f is an image of the regions, s is a 3×3 mesh, and b is an image of the region boundaries.

The **dilation** is one of the basic operations in mathematical morphology. The dilation operation usually uses a mesh for probing and expanding the shapes contained in the input image .Dilation of an image f by a mesh s (denoted f s) produces a new binary image g = f s with ones in all locations (x,y) of a mesh's origin at which that mesh shifts the the input image f, i.e. g(x,y) = 1 if s hits f and 0 otherwise, repeating for all pixel coordinates (x,y). Dilation has the opposite effect to erosion -- it adds a layer of pixels to both the inner and outer boundaries of regions. The holes enclosed by a single region and gaps between different regions become smaller, and small intrusions into boundaries of a region are filled in:

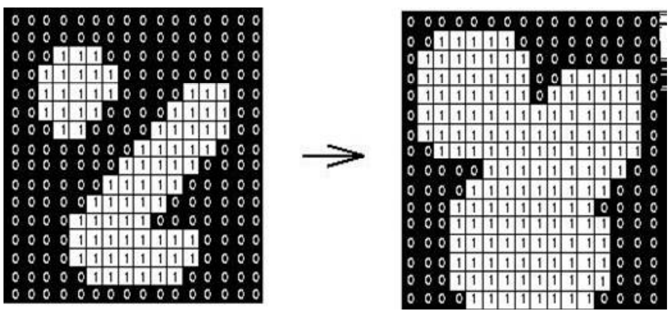

Fig (8). Dilation: a 3×3 square structuring element

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Size and shape of the structuring element influences on results of dilation or erosion. Dilation and erosion l operations have opposite effects. Let f c denote the complement of an image f, i.e., the image produced by replacing 1 with 0 and vice versa. Formally, the duality is
written as

$$f \oplus s = f^{c} \ominus s_{rot}$$

Where Srot is the mesh s rotated by 180 . If mesh is symmetrical with respect to rotation, then Srot does not differ from s. If a binary image is a digital image that has only two possible values for each pixel. Typically, the two colors used for a binary image are black and white, though any two colors can be usedis considered to be a collection of connected regions of pixels set to 1 on a background of pixels set to 0, then erosion is the fitting of a mesh to these regions and dilation is the fitting of a structuring element (rotated if necessary) into the background, followed by inversion of the result.

III. EXPERIMENTAL RESULTS

The application was deployed and tested on various systems. The following images were obtained from our implemented work, which processes the paddy crop image to identify diseases.

Fig (9):. Input image.

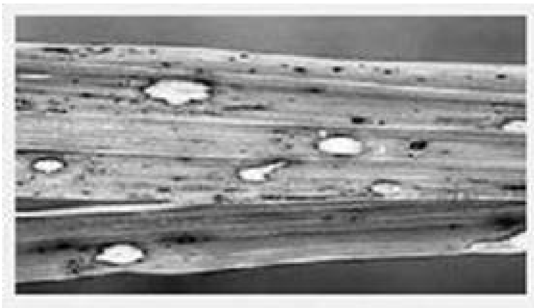

Fig (10): Filtration 1.

Fig (11): Filtration 2.

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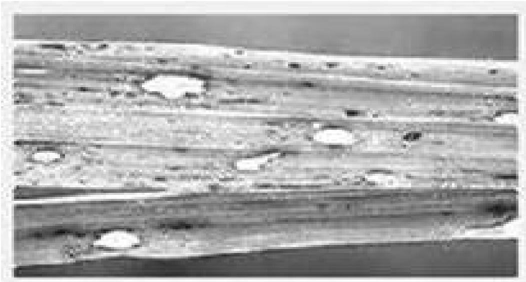

Fig (12): Enhanced.

Fig (13): Segmentation.

Fig (14).(a)

Fig (14). (b)
Morphological Operation 1. (a) Erosion. (b) Dilation.

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Fig (15). (a)

Fig (15). (b).
Morphological Operation 2. (a) Erosion. (b) Dilation.

IV. CONCLUSION

This paper implements an innovative idea to identify diseases affected in paddy crops and provides the remedy/solution to farmers. The images are then fed to our application for identification of paddy diseases and the remedies are suggested to the farmer. Thisimplementation provides better choice for every class of agriculture community particularly in remote villages.

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