Plant Monitoring and Leaf Disease Detection with Classification using Machine Learning-MATLAB

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Abstract India is an agricultural dependent country wherein most of the economic income comes from agriculture. Improper maintenance and protection of crops leads to more infections and affects the overall production. This technology helps the farmer to identify what type of diseases that the plant is being affected. The image has been processed in MATLAB and the status of the leaf has been identified with the help of neural network classification. Then the environment circumstances such as temperature, humidity and moisture has been monitored. After the image has been processed in the software it sends SMS to the user by using Global System for Mobile Communication (GSM). The SMS contains leaf status, particular solution and environmental conditions. If the environmental condition is abnormal, then the pump will automatically turn on. This proposed system presents an overview of the classification and detection of plant leaf diseases using machine learning. Within the area of machine learning, neural networks are a subcategory of algorithms built around a model of artificial neurons spread across three or more layers.

Keywords: Image processing, disease and healthy leaf, Future extraction, Classification Machine learning, neural networks and MATLAB

I. INTRODUCTION

The cutting edge innovations have enabled human culture to deliver adequate nourishment to satisfy the need. In any case, nourishment security remains threaten by various components including environmental change, plant sicknesses and others factors. Plant leaf illnesses are not just a danger to nourishment security at the world scale, yet can likewise have unfortunate effect for smallholder ranchers whose occupations rely upon sound plants.

So as to create impeccable image classifiers for the motivations behind plant malady recognizable proof, required an increasingly, checked dataset of images of sick and sound plants. Right now, server and portable based technique for sickness distinguishing proof has been utilized for infection identification. The AI for plant illness discovery and, such AI techniques being fake neural system, and Support Vector Machine (SVM), K-implies strategy, Convolutional neural systems and so on.

This proposed framework point is to structure and build up a control framework utilizing sensors in the yield field with information the executives by means of PDA and a web application. The three parts are equipment, web and versatile application. Besides, this framework speaks to driving agribusiness through computerized development.

II. LITERATURE REVIEW

[1] Ms.Nilam R.Thorat, Prof.Swati Nikam (2017), “Early disease detection and monitoring large field of crop by using IoT” the monitoring of diseases at early stage by using the sensors like temperature, humidity and soil moisture after that it will provide recommendation about disease and its fertilizers. With using above method it will train and test dataset. In train dataset there are number of images were taken for training and only few sample images are used for testing. After testing phase it will try to match the train dataset image with the tested sample images. After that disease images foreword to the pre-processing phase. In the Pre-processing phase k-means clustering is used for cluster the image into number of parts and then that parts will classified by using Support Vector Machine (SVM) classifiers. Edge detection is done by using the genetic algorithm and then it will give effective results. Proposed systems have evaluated three objectives of this dissertation work like monitoring, detection and quality of services.

[2] Budiarianto Suryo Kusumo, Ana Heryana(2018), “Machine Learning-based for automatic detection of corn-plant Diseases using image processing”, the system consists of Raspberry Pi- model B which is the main part of the system used for interfacing purpose. Initially, the input image is selected. According to selected image disease is detected with its name and remedies by using python or java and to be displayed on the App. After disease detection farmers take the necessary action i.e. Turn ON/OFF the sprinkler assembly by using app to spray pesticides or fertilizer by mixing it in water. Relay driver and single pole double throw relay is used to control the ON/OFF of external devices. Farmer can also check the soil condition and water level in the tank with the help of sensor. Four different types of sensors are used for measuring soil condition and level of water or pesticide tank. These sensors include LM 35 temperature sensor, DHT-22 Humidity Sensor, Water sensor and moisture Sensor. All these sensors are interfaced with Raspberry-Pi. The motor driver and DC motor are used for the movement of the overall system. The moving system helps to monitor soil condition at different place.
III. BLOCK DIAGRAM

The overall view of this project is shown in the Fig. 1. The input images are processed and the respective result is sent to PIC microcontroller. This takes the decision according to the input fed by the user and shows the SMS to the user via mobile.

![Block Diagram of the Proposed Design](image)

Fig. 1 Block Diagram of the Proposed Design

The different sensor blocks help in measuring the parameters of soil. The parameters such as temperature, humidity and soil moisture were displayed to the user. Finally, the information is sent to the user with the help of GSM.

IV. METHODOLOGY

A. Machine Learning: Machine learning is used to create an algorithm to model knowledge inside the data. It is also a data analytics technique that teaches computers to do what naturally humans and animals where learn from experience. In machine learning, Image processing is a method to convert an image into digital form and perform some operations on it. The four types of machine learning are Supervised Learning, Unsupervised Learning, Semi-Supervised Learning, and Reinforcement Learning.

B. Pre-processing: Pre-processing have four different methods such as Contrast level, Intensity level, Histogram equalization.

C. Segmentation: It is the process of partitioning the pixels of an image into groups. The segmentation is to simplify or change the representation of an image into something more useful.

D. Feature Extraction: Feature extraction is a process in which the image can be analyzed by using different parameters such as size, colours, etc. The leaf disease detection system is shown in Fig. 2.

![Block Diagram for Disease Detection](image)

Fig. 2 Block Diagram for Disease Detection

E. Classification: The image processing classification system consists of a database that contains predefined patterns which are used to detect and classify in proper category. It is used to develop a statistical characterization of the reflectance in each information class. In this project, neural networks have been used to recognize the image. Neural networks are an interconnected collection of nodes that are called neurons or perceptron’s. Every neuron takes one piece as an input data, one pixel of the image has applied for simple computation. Some of the neural networks are Artificial Neuron, Radial basis function Neural Network, Convolutional Neural Network and etc.

F. Support-Vector Machines: SVM is a supervised machine learning models which is used for classification. The idea of SVM is simple and it can solve both linear and non-linear problems.

![SVM DATASETS](image)

Fig. 3 SVM

DATASETS

Images were collected for five crops, corn, paddy, turmeric, tomato and sugarcane different diseases were analysed for each crop, as well as the health status of each of these crops. Table 1 showing the diseases used for each of these crops and the number of samples.

<table>
<thead>
<tr>
<th>Name of Crop</th>
<th>Type of Case</th>
<th>Number of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>Healthy</td>
<td>20</td>
</tr>
<tr>
<td>Corn</td>
<td>Elongated Windows</td>
<td>19</td>
</tr>
<tr>
<td>Corn</td>
<td>Bore Hole</td>
<td>22</td>
</tr>
<tr>
<td>Corn</td>
<td>Dead Heart</td>
<td>17</td>
</tr>
<tr>
<td>Corn</td>
<td>Leaf Spot</td>
<td>25</td>
</tr>
<tr>
<td>Paddy</td>
<td>Healthy</td>
<td>25</td>
</tr>
<tr>
<td>Paddy</td>
<td>Blast</td>
<td>20</td>
</tr>
<tr>
<td>Paddy</td>
<td>Sheath Blight</td>
<td>15</td>
</tr>
<tr>
<td>Paddy</td>
<td>Sheath Rot</td>
<td>19</td>
</tr>
<tr>
<td>Paddy</td>
<td>Brown Spot</td>
<td>14</td>
</tr>
<tr>
<td>Turmeric</td>
<td>Healthy</td>
<td>24</td>
</tr>
<tr>
<td>Turmeric</td>
<td>Leaf Spot</td>
<td>17</td>
</tr>
<tr>
<td>Turmeric</td>
<td>Leaf Blotch</td>
<td>19</td>
</tr>
<tr>
<td>Turmeric</td>
<td>Rhizome Rot</td>
<td>15</td>
</tr>
<tr>
<td>Tomato</td>
<td>Healthy</td>
<td>24</td>
</tr>
<tr>
<td>Tomato</td>
<td>Xanthomonas Campestris</td>
<td>15</td>
</tr>
<tr>
<td>Tomato</td>
<td>Alternia Solani</td>
<td>19</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>Healthy</td>
<td>23</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>Red rot</td>
<td>22</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>Rust</td>
<td>18</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>Yellow Leaf disease</td>
<td>16</td>
</tr>
</tbody>
</table>
V. SIMULATION RESULT

The input image, as shown in Fig. 4, is loaded, and they are pre-processed. The contrast enhanced image of the leaf is shown in Fig. 5.

After that, three types of cluster images have shown in Fig. 8, which is helpful for classifying the disease. In those three, users have to select one model for verifying the segmented image status that is shown in Fig. 9.

Finally, a grayscale image has shown in Fig. 10, which is used to identify an affected image or not. After all these processes, a dialogue box is shown as an output in Fig. number 11, which will declare the status of the input image.

VI. HARDWARE OUTPUT

The overall agricultural system is mentioned in the Fig. 12. Temperature sensor, moisture sensor and humidity sensor are integrated in this system. If the temperature goes abnormal state the water pump will turn on automatically. In other way if the temperature reaches the normal state then it will turn off automatically.
humidity and moisture has been monitored. After the image has been processed in the software it sends SMS to the user by using Global System for Mobile Communication (GSM). The SMS contains leaf status, particular solution and environmental conditions. If the environmental condition is abnormal, then the pump will automatically turn on. If it is normal, it will remain turned off.

VIII. REFERENCES


