

Crop Disease Detection using Machine Learning: Indian Agriculture

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Abstract:-

Plant diseases are generally caused by pest, insects, pathogens and decrease the productivity to large scale if not controlled within time. Agriculturists are facing lose due to various crop diseases. It becomes tedious to the cultivators to monitor the crops regularly when the cultivated area is huge that is in acres. The proposed system provides the solution for regularly monitoring the cultivated area and provides the automated disease detection using remote sensing images. The proposed system intimates the agriculturist about the crop diseases to take further actions. The purpose of the proposed system is to detect diseases early, as soon as they start to spread to the outer layers of the leaves. The proposed system works in two stages: the first step involves training data set. This includes training on both healthy and as well as diseased data sets. The second step involves crop observation and disease detection using Canny's edge detection algorithm.

Key Words: Wheat Disease, Cotton Disease, Machine Learning Technique, Remote Sensing data, Canny's edge detection algorithm

1. Introduction

Agriculture gave rise to civilization. India is an agricultural country and its economy is mainly based on crop production. Agriculture is the backbone of any economy. Country such as India, where demand for food continues to increase due to population growth, requires development in the agriculture sector to meet this demand.

The agriculture sector is in need of a major modernization to survive the changing conditions of the Indian economy. Crops must be healthy for optimum yield, which requires advanced technology for monitor crops regularly. Crop disease is one of the major factors which indirectly influence the significant reduction of both quality and quantity of agricultural products. A number of varieties of pesticides are available to control diseases and increase the production. But finding the most current disease, appropriate and effective pesticide to control the infected disease is difficult and requires experts advise which is time consuming and expensive.

The presence of disease on the plant is mainly reflected by symptoms on leaves. So there is a need of an automatic, accurate and less expensive Machine Vision System for detection of diseases from the image and to suggest a proper pesticide as a solution.

1.1 Plant Diseases

(A) Wheat plant Diseases

The sicknesses which have an effect on Wheat plant are (1) Leaf Rust (2) Powdery mould (three) Stem Rust and (4) Yellow Rust. Leaf Rust causes small brown lesions on the leaves. This blister-like lesions are common on

leaves however can arise at the leaf sheath, which extends from the bottom of the leaf blade to the stem node. Lesions due to leaf rust are typically smaller, more round, and involve much less tearing of the leaf tissue than those caused by stem rust. Powdery mold causes white lesions on leaves and leaf sheaths. Glumes and awns additionally may be infected when the disorder is extreme. Fungal growth is largely restricted to outer plant surfaces and may be easily wiped away with the aid of rubbing a finger throughout affected areas. Mature lesions may additionally have dark, reproductive systems blended with the white, cottony increase of the fungus. Stem Rust causes blister-like lesions on leaves, leaf sheaths, and stems contamination of glumes and awns is likewise feasible. The reddish-brown spores of the fungus involve vast tearing as they burst through the outer layers of the plant tissues. Mature stem rust lesions are greater elongated than the ones of leaf rust. Yellow rust also known as stripe rust, is a fungal disease of wintry weather wheat. It produces leaf lesions (pustules), that are yellow in color and tend to be grouped in patches. Yellow rust often occurs in slender stripes, 2–3 mm extensive that run parallel to the leaf veins. Yellow rust is answerable for about 73-85% of recorded yield losses, and grain first-rate is also substantially reduced.

(B) Cotton Leaf Diseases

1) Bacterial Blight

Bacterial blight is bacterial disease particularly resulting from the microorganism “*Xanthomonas Campestris* sp. Malvacearum”. The signs and symptoms of Bacterial blight starts off evolved as dark inexperienced, water soaked angular spot of 1 to five mm on a leaf with purple to brown border. At the beginning, those angular leaf spots seem as water-soaked areas which afterward adjustments from darkish brown to black color. The spots at the lesion area of leaves may unfold over the major veins of leaf and in later petioles and stems get infected and untimely fall off of the leaves arise.

2) Alternaria

It's miles a fungal sickness mainly caused by *A. Alternata* or *Alternaria macrospora*. The disorder is maximum excessive at the decrease a part of leaves as compared to the upper element and may get harassed with the spots of bacterial leaf blight because the symptoms are almost similar. At the start, brown, grey-brown to tan colored small circular spots appears on leaves and range from 1-10mm in length which in a while turn out to be dry, lifeless with grey facilities which crack and fall out. on occasion, antique spots integrate together and create irregular useless regions.

3) Cercospora

Cercospora is brought approximately with the aid of the *Cercospora Gossypina*. The contaminated leaf has red spot blemishes at the leaves which amplify in distance across to around 2 cm. The spots are round or unpredictable in shape with yellowish, crimson, dark brown or blackish fringes with white focuses. The rakish leaf spot suggests up because of the predicament of the lesion area by pleasant veins of the leaf. This malady influences greater seasoned leaves of increase flora.

4) Grey Mildew

It's miles fungal disease commonly resulting from the *Ramularia Areola* Atk. in imperfect stage and *Mycosphaerella areola* in ideal stage. at the initial stage, the contamination seems as triangular, square or irregularly round whitish spots of three–four mm length on leaves. This disease on the whole seems as irregular angular and pale translucent spots of diameter 1-10mm on older leaves of matured plant. The inflamed areas are mild to yellowish green in color on the higher floor. As disorder contamination will increase, the small spots merge together forming larger spots and the leaf tissues flip yellowish brown at the same time as whitish frosty boom appears on a decrease surface but every so often on the higher floor.

5) Fusarium Wilt

It is the fungal disease largely as a result of *Fusarium oxysporum*. The organism can attack cotton seedlings, however the illness for the maximum element shows up while the vegetation are greater matured. The inspired plants first get to be especially darker inexperienced and hindered. Latterly, the yellowing of the leaves and loss of foliage is determined. in

the beginning, the manifestations display up on decrease leaves around the season of first blossom and the leaf edges cut back, flip yellow first of all observed via brown with inward motion.

2. Literature survey

Huang et al, studied the spectral traits of wheat and tested a technique to expand new spectral indices (NSIs) the use of alleviation-F setoffrules.This method did not contain periodic tracking of the plants.

Chenghai yang proposed a machine describes the design and checking out of an airborne multispectral digital imaging machine for faroff sensing packages. The gadget consists of 4 excessive resolution rate coupled tool (CCD) digital cameras,this machine involved huge maintenance value.

Wenjiang Huang framed a scientific method for canopy spectral traits of wheat infested by using aphid, however this methodology involved calculations.

DavoudAshourloo, proposed the gadget studying techniques for Wheat Leaf Rust disease detection in addition to compare the education pattern size and influence of sickness symptoms outcomes at the strategies of predictions. This paper compares the overall performance of PLSR, v-SVR, and GPR with the PRI and NBNDVI. The mixtures of ailment signs and symptoms at each ailment severity stage results in complicated spectra which declined the accuracies of PRI and NBNDVI at the same time as they do not have damaging impacts on PLSR, V-SVR, and GPR performances. The GPR's performance the use of smaller training facts set results in better accuracy than different methods.

P. Revathi, proposed stages to pick out the lesion area of the ailment. First side detection technique is used for segmentation after which photo analysis and class of diseases is done the usage of the proposed HPCCDD set of rules. This paper proposed RGB feature based techniques in which, the captured pics are processed first after which colour photograph segmentation is executed to get disorder spots. the edge capabilities are extracted to pick out the disease spots the use of Sobel and Canny filter.

3. Proposed approach

The proposed device has two phases,first phase deals with training data sets both wholesome and diseased leaf photographs are accrued as soon as the dataset is prepared with healthful and inflamed photograph samples, the edge is extracted for each getting old and for sicknesses.

Periodically photographs are acquired by means of remote sensing. RGB values of the monitored photographs are extracted and as compared with threshold pix.If the brink is more or much less than given price, histogram evaluation and side detection techniques are used to identify particular plant diseases.

3.1 Training Model



Fig 1: Trained Model

Extraordinary types of crops given as the input to the schooling model. For every crop, lots of wholesome and defected crop pictures are considered. Set the edge value for each crop. train the version in a any such way that it should take the proper decision for all kinds of crops Fig.1 indicates that healthy crop pics, infected crop pix, unique sicknesses of various crops and pesticides for that illnesses are all considered to get skilled model.

Extraordinary spatial decision photographs are acquired from distinct agricultural satellites including NASA's TERRA satellite, RESAT-1, PSLV-C16 and PSLV-C36

3.2 Disease Detection

Reference picture is given as input to DSS. This device makes use of trained version to take the further choicetrained model makes use of the dataset to offer a right concept.

If there's a large trade within the threshold of the Reference photo, then check whether it's because of growing old. if so, no want of intimating to the farmer but if the trade is due to sickness this is deformities in leaves and color trade in leaves could be diagnosed then area detection and histogram evaluation may be finished to provide the right solution. Fig.2 indicates the choice aid device for solution.

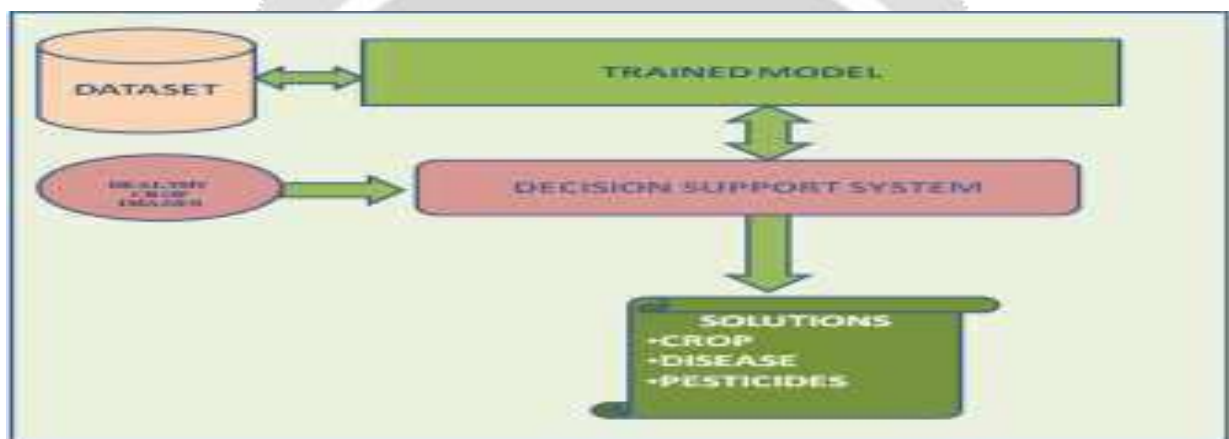


Fig. 2: Decision Support System

3.3 Canny Edge Detection Algorithm

The Process of Canny edge detection algorithm can be broken down to 5 different steps:

- 1- Apply Gaussian filter to smooth the image in order to remove the noise
- 2- Find the intensity gradients of the image
- 3- Apply non-maximum suppression to get rid of spurious response to edge detection
- 4- Apply double threshold to determine potential edges
- 5- Track edge by hysteresis: Finalize the detection of edges by suppressing all the other edges that are weak and not connected to strong edges.

3.4 Algorithm for Disease Detection

1. Start
2. Read the reference image
3. Check the threshold
4. If change in threshold due to aging then goto step 7.
5. Else

- a. Convert the image into grayscale.
- b. Apply Canny edge detection algorithm
- c. Get the histogram value.
6. Identify the particular disease for the reference image.
7. Stop

4. Conclusion

The proposed device periodically video display units the cultivated area. Crop diseases are detected in early stage by way of the usage of aspect detection and histogram matching device studying techniques are used to teach the version which facilitates to take a right choice regarding the diseases. The pesticide as a treatment is usually recommended to the farmer for infected illnesses to govern it.

In destiny proposed system maybe implemented through adding greater services like close government shops, rate listing for the insecticides, near with the aid of open market and lots of greater.

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