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Survey on detection and prediction of leaf diseases using CNN

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Abstract

Background: This study is to help reader to understand detection and prediction of leaf diseases using CNN.
Methods: The main purpose of the planned system is to grow an application which identifies cotton leaf diseases and be cooperative for the farmers. With help of image processing idea we can get a fully digitized colour image of a diseased leaf and then we can continue with applying CNN (Convolutional Neural Network) to forecast cotton leaf disease. System gears CNN to sense cotton leaf infections. Disease detection in early stages it very stimulating task for farmer but once the infection is detected he can take prior steps to cure them and save his crops from getting infected.
Findings: Farming is most important living in many countries. Indian economic system is reliant on agricultural production. The main good way towards food manufacture is necessary. While keeping path of infections in plants by specialists it becomes costly and cannot be inexpensive by normal farmers. As farming is main occupation in India and maximum farmers are average in economy. So there is a requirement for a structure which can mechanically sense the diseases and can tell about what pesticides to use so that suitable remedy can be taken after finding of diseases
Application:

- System can be implemented in agricultural farms.
- System can be use by agro service centers to help farmers.
- Provides efficient remedies for occurred disease on plants.
- System can be used by agro industries to prepare depending on the diseases occurred.

Keywords: CNN (Convolutional Neural Network), K-Means Clustering, SGLDM (Spatial Gray Level Difference Method).

1. Introduction

Cotton is the" The White Gold" or the "King of Fibers". As we know that most of the Indian land is used for farming purpose. It is also the back sustenance for Indian monetary state. There are several diseases which mass the growth of crops in fields which may cause vast loss in the power of products. Now image processing is used a lot for noticing such viruses, Vermin like the germ. Fungus and bacteria are main reason of the diseases to produces due to failure in superiority and degree of production. It is vast damage to the farmer. This paper is created on a scheme which tools Convolutional Neural Network to notice cotton leaf infections. It suggests more proficient ways to determine infection created by Bacteria and ecological effects. Disease unearthing at an early stage on crop is a exciting task for farmers where corporeal presence is a must. Disease finding and acknowledgment on the crop are very vital. There are several algorithms in image processing for disease acknowledgment by image organization like KNN, SVM, Random Forest, Artificial Neural Network and CNN. Each infection on crop has dissimilar features which are detached at each layer of the convolution network. The goal of this claim is to develop a system which differentiates crop infections. In this the user has to upload an image on the system, Image processing jerks with the digitized colour image of the diseased leaf. Finally by smearing the CNN plant infection can be forecasted.

1.1. Purpose of planned system

1. Emerging a user-friendly scheme for farmers
2. Identifying Cotton leaf infections exactly from input images
3. Providing remedial and defensive events for the detected diseases

1.2. Cotton leaf diseases focused

1. *Alternariamacrospora*
2. Bacterial Blight
3. Boll weevil
4. *Collectotrichum*
5. *Eremotheciumgossypii*
6. *Hoplolaimuscolumbus*
7. LeveillulaTaurica
8. *Meloidogyneincognita*
9. *Phakopsoragossypii*
10. *Phomaexigua*

1. The Image investigation in cultivation

The Image examination observes are broadly applied to farming knowledge and it has countless use especially in the plant protection field. Image examination can be practical for the next drives:

1. To sense unhealthy leaf, stem, fruit.
2. To compute pretentious area by infection.
3. To discover the limitations of the unnatural area.
4. To choose the dye of the pretentious zone
5. To control magnitude & figure of fruits.
6. To sort the Item appropriately.

2. Categories of cotton leaf spot infections

The plentiful diseases distinguish on the cotton leaf spots are categorized as;

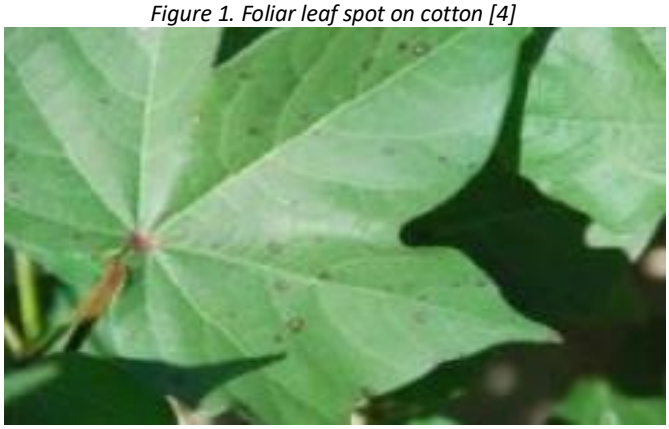
1. Grey mildew
2. Bacterial blight
3. Leaf curl
4. Fusarium wilt
5. Verticillium wilt
6. Alternaria Leaf Spot-*Alternariamacrospora*

3. Signs of cotton infections

1. Foliar frond spot on cotton

As exposed in above statistics then, the infection is identified as foliar virus ascends owing to potassium lack [1-3].

Figure 1. Foliar leaf spot on cotton [4]



The initial phase of this infection is as exposed in Figure 1, currently if the more spots of this infection consequences into the last step of this shrub where the shrub foliage is get reduction so it is named as Foliar infection of the cotton shrub as exposed in Figure 2. The leaf is having numerous no. of spots which clearly signifies more potassium lack in the shrub.

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Figure 2. Foliar leaf spot on cotton

2. Bacterial blight

Xanthomonas campestris Pv. *Malvacearum* Bacterial blight jumps out as Dark green, water saturated angular leaf spot of 1 to 5 mm through the greeneries and bracts, particularly on the below seeming of leaves with a red to brown edge;p0. The bony arrival is due to limit of the coiled by well veins of the cotton foliage. Spots on diseased plants may feast along the main leaf manners as infection developments, leaf petioles as shown in Figure 3. The angular leaf spot, conclusions in early defoliation and stalks may become diseased resulting in rash defoliation.

Figure 3. Bacterial blight

3. Alternaria Leaf Spot-*Alternariamacrospora*

This sources minor, gray, pale to brown, round or uneven spots gauging 0.5 - 3 mm in width and fractured centres seems on the pretentious greeneries of the shrub. Affected leaves become dehydrated and decrease off as shown in Figure 4.

Figure 4. Alternaria Leaf Spot-alternaria Macro Spora

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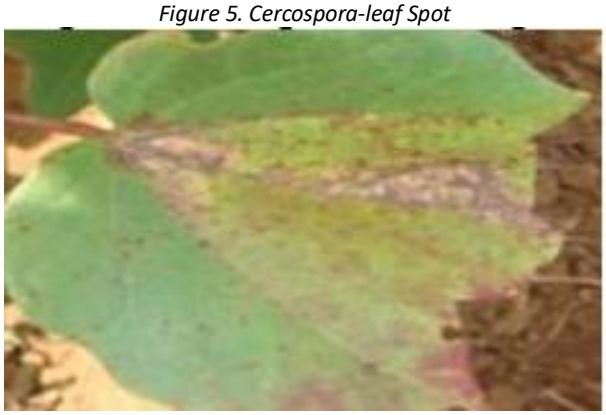
4. Grey mildew

This infection principally seems on older shrubberies as the plants reach central age, in the form of unevenly bony, pale spots, typically 3-4 mm in diameter and The grazes are light to yellowish green on the higher superficial. As the spots cultivate older, the leaf materials turn yellowish brown while a whitish frosty growth seems primarily on the under shallow but infrequently also on the higher external [5].

5. *Cercospora*-leaf Spot

The disease affects older leaves of established plants. The spots are round or asymmetrical in shape yellowish brown, with purple, dark brown or blackish limits and white centres pretentious leaves converted pale incolor and finally reduction as shown in Figure 5.

Figure 5. Cercospora-leaf Spot



2. Literature survey

The foremost drive of farming is to produce fit crops without any disease current. It is very problematic to visually believe the fitness of cotton leaf. To overwhelm this problem, a machine learning based approach is planned which can measure the image of the leaf of the plant and notices the disease and the class of the cotton plant using machine learning approach [5]. Agricultural science is one of the imperative professions in many countries counting India. As most part of the Indian monetary system is needful on cultivation making, the deep care to the anxiety of food Assembly is needed. There is a basic for a organisation which can robotically sense the diseases as it can bring uprising in nurture large arenas of collect and then plant leaves can be busy cure as soon as probable after recognition of virus. The aim of the scheduled system is to ripen an application which distinguishes cotton leaf infections [1]. Opportune and correct discovery and organization of plant diseases are the vital factors in plant manufacture and the reduction of victims in crop yield. This paper proposes an tactic for leaf disease uncovering and society on plants using image dispensation [5].

Agriculturalists have great snags in altering from one disease control strategy to another. Trusting on pure naked-eye remark to detect and categorize diseases can be classy. Many plant bugs pose a great threat to the farming sector by dipping the life of the plants. The contemporary work is aimed to mature a simple illness discovery system for cotton diseases. The signs of the attacks are usually well-known complete the shrubberies, stems or fruit check. This proposed system converses the operative way used in performance finding of plant infections through leaf feature examination. Leaf image is taken and suggested to control the health rank of cotton shrub [3].

3. Proposed system

We projected a system which helps in perceiving the diseases of cotton leaves which will help the growers to detect disease and take proper deterrence to augment the making of cotton. We took the images of unwell cotton leaves and achieved countless pre-processing performs on them for eliminating the borderline of the leaf. The main goal is to recognise the infection in the leaf spot of the cotton crops.

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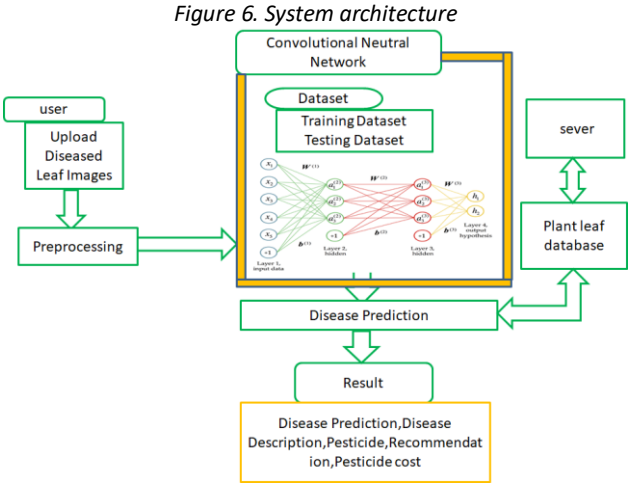
In this regard, it is deliberated that approximately 80 to 90% infections on the Cotton crops are on its leaf spot. Subsequently areas of notice are that classifying the foil of the cotton somewhat than entire cotton. We used CNN as the classifier for challenging the input test image with the catalogue image so that good infection can be sensed. The main impartial of the planned work is to wisdom bugs in cotton leaves. It is very essential to perceive the infections in cotton leaves. Gratitude of cotton leaf infections can be done primary and correctly using Convolutional neural network as shown in Figure 6.

Figure 6. System architecture

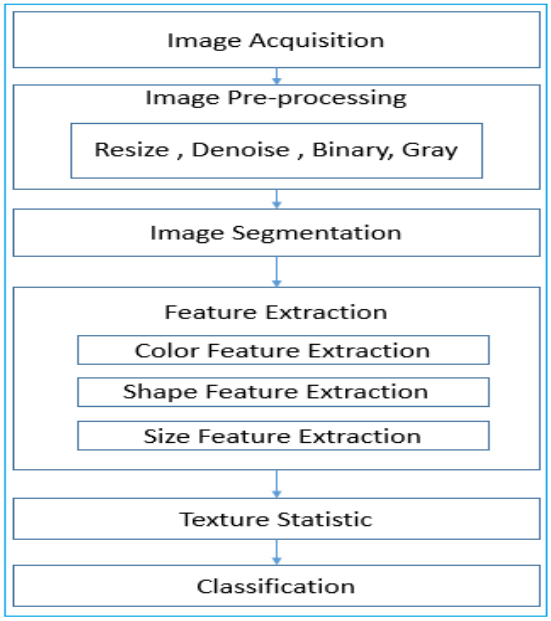


1. Proposed algorithm

The strategic algorithm comprises the some of the image dispensation steps.

1. Captured image accomplishment
2. Resizing an image into standard resolve
3. Adapting RGB image into Grayscale image
4. Detecting the edges of the diseased spot of leaf
5. Segmentation of an image
6. Colour, shape and texture features are extracted
7. Convolutional Neural Network classifier is used to train and test the image.
8. Compare the result with trained dataset
9. Image result outputted

Figure 7. Phases for organization of cotton leaf spot infections



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4. Methodology

In new agriculture system, the Advance computing skill has been industrialized to nursing the proper growth of crops in the fields. But in the early agricultural system, the comment of crops by farmer itself is puzzling task. Without having the good knowledge about infection indicators discovery the disease by ruling opinion may lead to the loss of crops. Even to refer the capacity is too cost and time intense. So that here suggesting the progressive method for empathy and ordering of cotton leaf spot impurities as shown in Figure 7.

1. Image acquisition

The images are taken for the discovery in the first step. Then it is practical to dispensation stage. In this any image of the cotton leaves in or outdoor of the record can be showed by the CNN that we have skilled.

2. Image processing

The pre-processing task contains some events to make the images enhancement .Cotton leaf double is in RGB color setup. The RGB duplicate is rehabilitated to a grayscale image, next the image division established on gray-level edge segmentation is modified and the dual image is added. Camera flash can act as noise and interrupts the image brilliance. Hence, median filter and morphological workers are practical to remove needless spots

Image pre-processing is the term aimed at processes on images at the lowermost level of concept whose goal is an enhancement of the copy data that conquer undesired biases or augments some image topographies important for further processing and analysis it task does not growth image information gratified.

RGB to Gray scaled Adaptation Traverse finished entire input image array. Read separate pixel colour value (24-bit). Split the color value into discrete R, G and B. Calculate the grayscale module (8-bit) for given R, G and B pixels using a change formula. Compose a 24-bit pixel value from 8-bit Gray scale value. Store the new worth at same location in output Image.

3. Thresholding

Negotiate through entire input image array. Read distinct pixel colour value (24-bit) and convert it into gray scale Calculate the binary output pixel value (black or white) based on current threshold. Store the new value at same site in output image.

RGB to HSV Color objects in images can be easily labelled by its hue, saturation, and glare. The HSV model decouples the intensity constituent from the colour-carrying indication in a color image. This model is an ideal tool for evolving color image handing out algorithms. The hue, saturation, and intensity values can be added from the RGB color cube. We can convert any RGB point to a constant point in the HSV colour model by working out the geometrical plans. For the images in the database for each image be around is done for hue saturation and value and these are features are removed by this method and the output is acquired concurrently.

4. Image segmentation

The leaf spot in the capture image usually covers replication from cause, which forms some strong spot in the cotton leaf, but pixel value within the cotton leaf is over a precise edge then it is replaced by pixel value of some area pixel. This act fills all strong leaf spot current in cotton leaf area

5. Feature abstraction

The penalty area of this stage is to find and extract features that can be charity to oversee the meaning of a given sample. In our scheme we are sighted color as wanted feature. We will modernize RGB image in hue saturation and value for getting features.

6. Texture statistic

Arithmetical study tasks are ended to choose the best structures that signify the feasible image, thus dropping feature redundancy.

7. Classification

Classifier will relate the input image with unhealthy leaves current in store. We are using CNN as our classifier.

5. Algorithm

1. CNN

Old-style feature learning means trust on semantic labels of reports as management. They typically accept that the identifiers are steadily high-class and thus do not opinion out to the trouble of labels. The educated features award clear semantic families with words. We also develop a innovative cross-model article that can in cooperation make visual and written fillings. CNN him is a method of classifying imageries as a chunk of deep knowledge. In which we smear solo neural link to the full paired.

Receives a capacity of sizeW1×H1×D1

Needs four hyper parameters:

Amount of filters K

Their three-dimensional degree F

The step S

The quantity of zero stuffing P

Products a volume of size W2×H2×D2 wherever:

W2=(W1-F+2P)/S+1

H2=(H1−F+2P)/S+1(i.e. width and stature are calculated correspondingly by symmetry)

D2=K

With restraint distribution, it hosts F*F*D1 masses per filter, for a total of (F*F*D1)*K masses and K partialities. In the production capacity, the dthdepth slice (of size W2*H2) is the result of accomplishment a legal effort of the dthriddle over the effort size with a step of S, and then balance by dthfavouritism.

A shared situation of the hyper parameters is F=3, S=1, P=1 However, near are public bonds and rules of thumb that motivate these restless limitations.

2. K-means clustering

The process for K-Means Clustering is given below:

1. Categorize the pictures into K number of groups where K should be known.
2. Mark K points at arbitrarily in cluster centroid.
3. Mapping stuffs to their closest group centroid.
4. Calculate the mean, centroid or perimeter of all pictures in each cluster.
5. Recap steps 2, 3 and 4 until the equal points are plotted to each group.

3. SGLDM (Spatial Gray Level Difference Method)

SGLDM is founded on second order provisional probability thickness function. SGLDM is an arithmetical technique which builds co-occurrence media to reflect the 3-D distribution of gray levels in the region of notice. SGLDM is centred on the approximation of the second order restricted chance density g (i, j, d, Ɵ). It means that an component at site (i, j) of the SGLD Matrix suggests the likelihood that two changed resolve cells which are in a quantified arrangement Ɵ from the flat and stated expanse d from each other ,it will have gray level values i and j individually. An angle is used to presumption the direction of surface, and the claim of several distance values can provide a telling report of the size of the periodicity texture. Thus for diverse Ɵ and d standards, diverse SGLD Environments consequence. The angle Ɵ is usually delimited values of 0, 45, 90, and 135°, and the distance d is limited to values limited to integral multiples of pixel size. The SGLDM matrix is formed by calculating the number of incidences of each pixel with gray level i that are away by distance d from any pixel with gray level j in a direction clear by angle θ. The excellent of distance and viewpoint grouping, as well as the quantization equal, is slightly random.

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6. Result

The objective of this claim is to advance a system which knows crop infections and shows user the results as sensed disease, pesticides optional and rate of insecticides optional and for that operator must to give an image then, Image indulgence jumps with the digitized color appearance of the unhealthy leaf. Finally by smearing the CNN plant bug can be forecast. The dataset covers types of diseased leaf images and also Fit Leaf images. The training dataset trains the data whereas testing dataset matches the images. The correctness of teaching is 80% while the exactness of testing is 89%.

7. Conclusion

A System has been positively applied for crop disease finding for cotton leaves by Convolutional Neural Network. Well leaf set of pictures is also used for noting healthy images of leaf. Convolutional neural complex has been well-known with three unseen coats to categorize the cotton leaf infection images. System absolutely takes appearance effort from user and conveys input in the form of infection sensed, cautious actions, remedial measures, insecticides obligatory. Scheme can be lengthy to any other harvests taking handiness of adequate huge dataset for that gather. Number of other infections can be involved for discovery. Scheme also cans device hardware using IOT for Image seizing in grounds.

8. Reference

1. S. Kumbhar, A. Nilawar. Farmer buddy-web based cotton leaf disease detection using CNN. *International Journal of Applied Engineering Research*. 2019; 14(11), 1-5.
2. V. Ramya, M. Anthuvan Lydia. Leaf disease detection and classification using neural networks. *International Journal of Advanced Research in Computer and Communication Engineering*. 2016; 5(11), 1-4.
3. M. Ranjan, M.R. Weginwar, N. Joshi, A.B. Ingole. Detection and classification of leaf disease using artificial neural network. *International Journal of Technical Research and Applications*. 2015; 3(3), 331-333
4. S.P. Patil, R.S. Zambre. Classification of cotton leaf spot diseases using support vector machine. *International Journal of Engineering Research and Application*. 2014; 4(5), 92-97.
5. N. Shah, S. Jain. Detection of disease in cotton leaf using artificial neural network. Amity International Conference on Artificial. 2019.

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