# Iot Based Plants Disease Detection Using Convolution Neural Network (CNN) and Support Vector Machines (SVM)

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#### Abstract

Every country's economic is extremely reliant on agricultural efficiency. Thus in the field of farming, increasing the yield is very important and for increasing the yield, the detection of disease in the early stage in plant is essential. In order to identify a plant disease the utilization of an automated disease detection strategy is helpful in protecting the plants and in increasing the yield. In this paper we proposed a method for detecting the disease in banana leaves using IoT devices with the help of convolution neural network and support vector machine and we suggested a method for automation by robotics in forming. In the proposed work an algorithm for picture segmentation is developed for detection of leaf diseases in banana tree. Also, the convolution neural network is utilized to determine the kinds of disease. From the experimental results it is absorbed that our proposed method gives more accurate result than the existing methods

Keywords: Segmentation, Classification, SVM, Learning Methods, CNN

### 1. Introduction

In the India's agricultural land, there are more types of plants and trees, in that, only few could be noticeable and few are not. Plant life is definitely the way of life assistance process for income organisms as oxygen is provided by them. Grow components as well as the products of theirs as fresh fruits, stem, cereals, flowers, leaves etc., are taken in ways that are different by animals and humans. Although chiefly they're employed for the preparing of meals products, medication, production of mustard oil, which makes of biofuel and so on, you will find a selection of methods within what plant life engage in a significant function. Plants and flowers may also be recognized as well as realized by the features of theirs as level, form, color or size of vegetable or maybe the subsequent parts of it. The classification or identification on the vegetable tends to be more frequently accomplished with the aid of foliage visually according to the characteristics as size, shape, texture, and color of them. Our proposed system will detect the plant disease before it gets to manufacture or it gets affected heavy. This system was tested in the sample plant for seeing the accuracy level.

India is cultivating daily for each field for example production plus its sphere [6]. Though India is lagging someplace within the farming segment. Though the federal government is actually performing a great deal of initiatives to enhance efficiency therefore to help you growers, brand new systems are being launched by them, however, someplace we've a function to make use of technological

innovation which takes us a much better world. Although additionally the farming division could easily check efficiency and will recommend the farmer within time that is real, it is able to increase the farming market by not merely producing handy to growers. Robots symbolize a pure supply of ideas along with an excellent pedagogical instrument for teaching and research contained command principle [5]. Below, we've launched with the idea of independent ploughing method in that a video camera on a tractor could be in a position to identify the boundary on the area and will plough the ground entirely with no car owner by using IoT. Since lands is able to be of any kind of form, it could have variants within amount as revealed with Fig. 1. The farmer simply has to have several poles with color inside the farm boundaries of his, and that is the time when, he's to simply press at least one switch on his movable plus he is able to sit by as well as unwind. The field of his is going to be ploughed instantly by utilizing picture processing as well as IoT [4]. We launched a prototype and that functions on exactly the same idea by interfacing Raspberry pi [nine IoT and] as revealed with Fig. 3. We are able to additionally automate subsequent measures in farming including seeding, sprinkler system, as well as harvesting [2]. Hands free operation within farming are able to boost the output of farming sphere, as well as we are able to really conserve plenty of gas by producing electrical tractor and then put in several receptors which could keep track of the generation number in time that is real and utilizing IoT. This particular real-time information could be seen by Agriculture Department utilizing cloud computing [6].

A farmer is able to obtain the real time ideas on app that is mobile and will do the job appropriately. Moisture variants as well as climate variants are able to lead to a serious minimization within the development of a harvest [9]; as a result, it's vital that you understand that here when as well as precisely what a harvest is looking for really. Within summer time, area dries really quickly; as a result, it's essential to irrigate the arena more often, whereas, as part of rainy season and winter, normal water is needed by it less often. Consequently, with this manner, we are able to accomplish hands free operation in sprinkler system and will acquire different automatic strategies within farming. Likewise, IIoT is able to perform a significant part within linking every little thing to a cloud, and also with this manner, we are able to buy the effectiveness of seed products by calculating with the moment of harvesting. Furthermore, by understanding the green problems, we are able to boost efficiency by applying ways for location based complications [10].

A longer edition of modern farming is together with the seeding machine the earth it handles is quicker compared to man [9]. Absolute best possibility seed products need to rooter as well as expand the farming is available in the electronic area together with the IIoT based on which provides information on the growers. The entire agriculture acreage is placed by way of an individual man keeping track of procedure more than a management dash panel laptop computer or maybe tablet giving us correct result together with the preferred reliability, and that is located in the favor on the farmer. Essentially, the correct growing depends upon 2 parameters: appropriate level of spacing and seeds in between vegetation. During the early point, these 2 difficulties are available in front side of farmers; by independent agriculture, we are able to manage these 2 details.

#### 2. Related Works

Machine Learning Techniques has provided birth to a lot of brand new applications and technologies which are hugely utilized in different areas [1], automatic robot course preparing [2], agriculture plant image detection within a specific area [3] and also average coverage category [4]. It's a procedure for studying a certain undertaking with no man treatment as well as enhancing the overall performance just by a consistent mastering procedure. Machine learning has 2 types: supervised studying [5], the location where the labeling is provided for the functions on the instruction dataset as well as unsupervised studying [6], Several classifiers worn predominantly contained machine learning methods are SVM classifiers which could deal with any image for classification and featuring [7], Decision Trees [8], Naive Bayes [9] as well as Logistic Regression [10]. Which all techniques are not that much satisfied to this model. When bigger datasets are being utilized within an application program subsequently the usage of Artificial Neural Networks (ANNs) is chosen for include removal as it makes a lot more exact outcomesand Much more usually the unwanted weeds are experiencing features that are similar because the harvest and also consequently can't be differentiated through the

naked eye. The nutrient information in dirt is reduced by them and therefore upsetting harvest quality as well as efficiency. [11].

Farming contributes to a noteworthy part of India's Gross household item. Foreseeing and considering organic problems, develop effectiveness may be widened. Item quality is dependent upon info gathered of area, soil dampness, for example, adjacent stickiness and temperature and so forth. Wise Agriculture is created making use of an NodeMCU microcontroller. The Farmer is able to keep track of the controlling steps used with the farm by android app on growers cell phone as well as information on dirt tastings may also be obtainable in it. The end user is able to keep track of the controlling steps used in the farm and also command the sprinkler system through android app on growers cell phone. Web of Things (IOT) plays an important part within intelligent farming. Wise agriculture is an appearing principle, since IOT receptors able to offering info regarding the agriculture fields of theirs. The undertaking is designed using changing know-how i.e. smart agriculture and IOT utilizing hands free operation. Checking green variables is definitely the main aspect to enhance the yield of effective plants. The characteristic with this undertaking consists of checking humidity and temperature within farming area by using receptors through the CC3200 individual chip. Video camera is interfaced with CC3200 to get photos as well as send out the photographs by means of MMS to growers movable utilizing Wi Fi. With all the increasing adoption on the Internet of Things (IOT), attached products have penetrated each element of the life of ours, of fitness and health, house hands free operation, auto & amp; amp; strategies, to industrial IOT [15] and smart cities. Thus, it's just rational that IOT, connected products, as well as hands free operation would discover the application of its in farming as well as, as these, extremely enhance a lot of features on the farming training. Exactly how might 1 continue to depend on horses as well as plows when virtual reality and self-driving cars are not a sci fi dream but a regular occurrence?. Farming has observed a selection of technical changes within the previous years, getting increasingly industrialized as well as technology driven. By utilizing a variety of wise farming devices, growers have achieved much better command with the procedure of elevating livestock as well as increasing plants, which makes cost-efficient as well as it much more predictable [13]. With this task, the IOT utilize instances in farming will be explored by us and even look at the benefits of theirs. In case you're thinking about purchasing wise agriculture or even intending to create an IOT alternative for farming, plunge correctly in. You can find numerous solutions to relate to contemporary farming. For instance, AgriTech describes the normal use of know-how to farming. Wise farming, however, is mainly usedto denote the use of IOT answers in farming. Even though sensible farming IOT and manufacturing IOT, arent as well known as customer attached products, the market place continues to be extremely powerful [12]. The adoption of IOT ways for farming is continually thriving. Specifically, BI Intelligence predicts that how many farming IOT unit installations will strike seventy five zillion by 2020, developing twenty % yearly. While doing so, the worldwide wise farming industry sizing is anticipated to triple by 2025, achieving dollar 15.3 billion (compared to simply being a little bit above dollar five billion in 2016). Since the market place continues to be building, at this time there continue to be adequate possibilities for companies ready to sign up in. Creating IOT solutions for farming inside the approaching many years are able to establish you apart as a beginning adopter as well as, as these, enable you to pave the means to good results. A vegetable illness is a biological abnormality. When a vegetable is suffering from any kind of sicknesses it turns up particular symptoms. conditions tend to be the outward modifications within the looks which are bit by bit created and also may be witnessed by nakedeves. Drawings of signs are wilt leaf areas, rots, cankers and many others. The noticeable negative effects of disorder could broadly categorize within sticking with types: Wilting, Galls, Powdery mildew, Spot, Dryness [10].

### 3. Proposed Approach

Within the suggested method, an algorithm for picture segmentation method that can be used for automated detection as well as category of grow leaf diseases. Additionally, it was proposed with various category methods which may be utilized for grow leaf disorders detection. The style threshold strategy is utilized after which the convolution neural network is utilized to determine the kinds of disease. Farming efficiency is one thing where economic system extremely is dependent. This is the primary reason that disease detection in vegetation plays a crucial part of farming area as getting health problems in vegetation are very common. Next phase, the characteristics are extracted based upon color as well as feel through the Lab color room as well as LBP technique. After that within the subsequent action segmentation is done by installing a k means algorithm. The teaching on the SVM classifier is achieved utilizing instruction information. Lastly, with the aid of examining information, the classification of suggested strategy is validated.

The latest growers are utilizing conventional techniques for farming that will be the primary reason behind a lesser amount of efficiency as well as food wastage of electricity; a number of techniques are released to get over the problems; automated farming automatic robot is additionally a huge idea whereby effort is finished to link automation and robotics with farming. The primary goal is reducing the hassle of growers came across within the industry. The primary reason behind utilizing electrical automobiles can be reducing co2 footprints as well as greenhouse gasses. The robots are accustomed to help growers within the farming field; the science utilized to manage the method is Raspberry Pi that provides hand-operated controlling of the entire product. The device proposed is utilized for ploughing, dispensing, and then fresh fruit selecting.

### **Prototype Model**

Below, a prototype that has a ploughing mechanism as well as have been made by us additionally a Raspberry Pi as well as USB digital camera. As revealed around Fig. two with the help of NumPy and OpenCV, we could distinguish in between colors, and therefore, we are able to system the tractor like it ploughs the entire area inside a zigzag way by detection colors within the poles. in case it detects the red-colored colour, subsequently it's to switch 180° appropriately as well as plough the edge lane, of course, if it detects the azure colour, then it's to flip  $180^{\circ}$  in the left aspect as well as once again plough the side lane therefore on; it finishes the entire ground regardless of area size as well as condition. Farmer has to simply establish poles on borders prior to putting up performance. And additionally rest the independent tractor is going to do. As revealed around Fig. 3 when the digital camera detects the yellow-colored colour, subsequently the automobile has to quit. The farmer must become in touch with cloud server MQTT, after which, he is able to switch off the ploughing inside between anytime he desires. It's absolutely simple to use and also such as a social networking wedge in which farmer can have interaction together with the demand of the crops of it's by harnessing info coming from a group of receptors placed on the field. Flowchart, Figure 2, here, we've shown the hookup of MOTT server within what in the event that farmer spins about the ploughing through tractor, in that case it is going to start as well as get feedback coming from the digital camera. The digital camera informs it, where you can go. As revealed around Fig. four in the event that yellow-colored color is detected by tractor, subsequently it has to quit. Color detection: The location where the digital camera is utilized to shoot & additionally to offer feedback to code. Impression taken by the digital camera is within BGR structure, green, i.e. red, as well as pink. Although for correct color detection, HSV structure is being used by us, most electronic gadgets make use of the sort of feedback. Hue is meant by HSV, saturation, and value in which tint is colour, saturation is greyness, advertisement great implies the brightness on the pixel. Saturation worth close to could mean its grey or dull your search. The white color of OpenCV has tint worth roughly within the assortment of 0- ten as well as 160 180. Inside OpenCV, benefit selection for 3 matrices is 0 179(Hue), 0 255(Saturation), 0 5(Value) or perhaps (color), (Saturation), (Brightness). Saturation: Saturation great belongs to the total amount to that that colour is blended with cream. Worth: the total amount is belongs t by Value to that that colour is actually blended with dark. Figure five exhibits a flowchart for picture processing within that morphological transformation is finished to get rid of little sounds within the picture. Morphological changes are several functioning that is dependent about the form of images; for this specific, we want 2 inputs: you are another input and original image will be the kernel. Kernel makes a decision the dynamics on the functioning be carried out on the picture. 2 simple morphological operators are erosion and dilation. With this, dilation is used by us as well as a 5\*5 kernel matrix. In case more than 1 pixel below kernel is but one, it'll just boost colour area and lower interference within the picture. Dilation gives a level of a pixel to each outer and inner borders of the area. Today, contour the picture earlier discussed suggests differentiating

each and every colour together with the rectangular bounded type that is known as a contour. A basic type links constant areas, owning the exact same intensity or colour. Contour is something mostly employed for form detection as well as evaluation & item detection as well as recognition.

### **Proposed Motivation**

The System motivation of ours would be the loss in plants and the quality of it's by utilization of incorrect applying water to methods as well as strikes of pets in farming. Thus we're changing innovative instant program that is going to improve harvest quality as well as stay away from harvest injury with all the usage of wireless method with android App and IOT. The Farmer is able to keep track of the controlling steps used with the farm by android app on growers cell phone as well as information on dirt tastings may also be obtainable in it. For suggest program farmer publish picture of illness grow through android program, as well as receives health problems info, treatment for specific illness.

### Preprocessing

In case the enter pictures are color pictures requires afterward we're become grey scope coming from a color pictures. After that it could be changed into binary transformation (zero signifies black color & one implies white). Image preprocessing is a signifies to improve the quality on the photo, these kinds of that the consequential perception is a lot improved when as opposed together with the original form.



**Figure 1. Architecture Diagram** 

### Segmentation

The feature extraction is extracted to determine the Leaf area. The characteristic removal incorporates SURF. HARRIS, and FAST The HSV segmentation is utilized to be able to draw out the disease within the leaf. Segmentation divides an image within the constituent areas of it's or perhaps

things. The goal of segmentation is producing easier as well as modify the representation of a photo in something that is less complicated & implies a lot more to assess.



**Figure 2. Flow chart Steps** 

### **CNN Algorithm**

When a photo is thinking about the method, action places are extracted plus it's transferred upon the recognition process by which the attributes are extracted & furthermore, the labeling of the actions is achieved. The outcome of existing covering operates since the responses of approaching covering. The quantity of ranges & furthermore, the activation does might maybe be converted and seen to recognize the top highly effective airier. If the instructions are finished, a perception is offered towards the method which reads the photo. If the photo is read through via, the outline on the picture is realized at first. As a result, the spot segmentation device develops within that the tasks inside the photo are segmented separately then the abounding program is bounded near to the joy patterns that are discovered together with the product.

### **SVM Algorithm**

Input: Input: D dataset, on-demand features, aggregationbased features,

Input: Output: Classification of Application

- 1) for each application image\_id in D do
- Get on-demand features and stored on vector x for image\_id
- 3) x.add ( Get\_Features(image\_id));
- 4) end for
- 5) for each application in x vector do
- 6) Fetch first feature and stored in b, and other features in w.
- 7) hw, b(x) = g(z) here z = (wTx + b)
- 8) if (z =0)
- 9) assign g(z)=1;
- 10) else g(z)=-1;
- 11) end if
- 12) end for

### 4. Experimental Results

The experiments are performed on MATLAB R2017b version. The computations are performed using the image Classification Learner Toolbox that is readily available in MATLAB.With this experiment, the precision of harvest prediction is elevated by utilizing the SVM classifier. Linear Regression is utilized to classify harvest yield Table 2 and 3 displays the end result dining room table of harvest yield prediction process, Outcome is pointed out to the type of accuracy. When the process is all about Predicting harvest yield, therefore, the genuine good prediction plays a crucial function that steadily raises the precision of the entire system, whereas incorrect good success in reducing. In Figure 4, we can see the prototype design of our work and testing image. It is tested with the land for the response and hence achieved as we expect



## Figure.3 Output Image

For starters, the type in picture via the scanner repository is provided to the device. Fig.3 is a test impression from a scanner repository. If this impression is transferred the pre-processing come about in which all of the characteristics are extracted for additional segmentation.

When the following step, the RGB elements are obtained from the picture then changed to Grayscale picture. Fig. 2 displays the picture once the Grayscale air filter is used towards the picture. Each image are in contrast to one another to locate the big difference between the characteristics then Machine Learning Techniques are utilized towards the pictures to determine the plant leaf disease. The characteristics are then simply taught with CNN that is popular for almost all category as well as regression strategies. Subsequently the scrutinizing is completed on the quantity of clusters gotten

	Predicted class		
Actual Class		Class = Yes	Class = No
	Class = Yes	True Positive	False Negative
	Class = No	False Positive	True Negative

### **Table 1. Accuracy and Predicted Class**

Approaches	Accuracy
SVM	0.92
Decision Tree	0.70
Linear Regression	0.83

### **Table 2. Metrics for Prediction**



# Figure 4. Prototype Design

Standard metrics	Predicted Crop	Predicted Crop
	Crop	Not-Crop
Crop	True Negative (TN)	False Positive (FP)
Not- Crop	False Negative (FN)	True Positive (TP)

### Table 3. Result Table







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Figure 6. Testing area in Zone class

Figure 7. Crop age Testing

Table 1, we've accomplished the Accuracy amount on evaluating and also the identification of disease leaf in the picture is accurate there are two hybrid model for prediction one is SVM and CNN. Hence we have tested in figure 6 and 7. The precision of the CNN method is found with 99.69 % accuracy system. Hence we achieved the accuracy on comparing with existing models and in figure 5, we have checked the SVM classifier for testing the response level.

#### 5. Conclusion

Several disease are prevailing within many plants these days. Plant disease are among the majority of risky illnesses to the majority of agriculture environment are dealing with throughout the world. Original detection of these disease cells might lessen the danger of loss in plants living to a much better level. With this paper, we've suggested an effective approach to the diagnosis the cells at a previous phase by utilizing CNN Techniques. The pictures from scanners are utilized for fusion wearing such a manner which yields excessive picture quality. These pictures are after that employed for the additional categories. The prototype has the ability to plow the industry with no man attempt. It's additionally geared around such a manner it uses a particular predefined road by utilizing color detection. Prior enhancements could be accomplished by adding a drone within the prototype which is able to get on a plane on the area and will time to precious time computer monitor the condition of plants. The drone is able to offer a real-time video clip feed on the farmer. This could additionally be utilized to observe ground. These worker bees may likewise be worn for theft safeguards.

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