ISSN 2395-1621

Development of smart pesticide robot for detecting disease and pesticide spraying

Swanik Gehlot, Rajwender Singh, Chetan Bhoi, Namrata Suryawanshi

swanik3380@gmail.com,
rajwender24@gmail.com,
bhoichetan23@gmail.com,
suryawanshinamrata2@gmail.com

Department of Computer Engineering,
SKN Sinhgad institute of Technology and Science.

ABSTRACT

Plant diseases are square measure a motivating risk to sustenance security, but their fast distinguishing proof stays hard in numerous parts of the world because of the nonattendance of the necessary foundation. Emergence of correct techniques within the field of plant-based image classification has shown spectacular results. This paper makes use of CNN in distinguishing between healthy and diseased plant from the information sets created. Our proposed paper includes various phases of implementation specifically dataset creation, feature extraction, coaching the classifier and classification. The created datasets of diseased or unhealthy and healthy plants are jointly trained underneath CNN to classify the unhealthy and healthy pictures. For extracting options of a picture we have use Histogram of an Oriented Gradient (HOG). Overall, using machine learning to coach the big information sets offered publicly gives us a way to detect the disease present in plants in a large scale. Crop diseases square measure a motivating risk to sustenance security, but their fast characteristic proof stays hard in varied elements of the world due to the non-attendance of the necessary foundation. Emergence of correct techniques within the field of leaf-based image classification has shown spectacular results. This paper makes use of CNN in distinguishing between healthy and diseased leaf from the information sets created. Our proposed paper includes varied phases of implementation specifically dataset creation, feature extraction, coaching the classifier and classification. The created datasets of diseased and healthy leaves square measure jointly trained underneath CNN to classify the diseased and healthy images.

Keywords: Robotics, Leaf Disease, Disease Classification, CNN, Raspberry Pi

ARTICLE INFO

Article History

Received: 8th June 2021

Received in revised form :

8th June 2021

Accepted: 12th June 2021

Published online :

12th June 2021

I. INTRODUCTION

Machine Learning behaves like self-learning conception which will work with none interruption of a human. Currently self-driving cars, hand-writing recognition, Stock market are sample of the examples of Machine Learning ideas. Machine learning are going to be ready to predict the future based on the past or historical information. A computer program is alleged to be learned from expertise E with relevance some clause of task T and performance measure P, if its performance on T as measured by P improves with expertise E. Machine learning broadly uses 3 major learning algorithms supervised learning, unsupervised learning, Reinforcement learning.

The visible effects of disease can broadly speaking categorize in following types: -

Wilting, it's loss of state pressure during plant leading to temporary or permanent drooping of leaves, shoots, or entire plants from lack of water or infection by completely different pathogens.

Spot, could be a definite, localized, spherical to regular lesion, typically with a border of a unique color, characterized on location (leaf spot, fruit spot) and color (brown spot, black spot);

Powdery mildew, could be a plant fungal disease that affects a large vary of plants. Infected means diseased plants show white powdery spots on the leaves and stems. Because the plant disease progresses, the spots get larger and denser.

Galls, these square measure abnormal growths that occur on leaves, twigs, or branches. They may be simple lumps or difficult structures, plain brown or brightly colored.
Dryness, when traditional aging method usually leaf's get dry and drop down from the tree, however at other alternative times drying of leaves is also proof of fungal attacks. In disease diagnosis, information provided is little and a few of the values square measuring are missing that may need imputation of values we are going to replace all the null values with -1.
The proposed analysis work applies the conception of ensemble learning that's enforced through machine learning algorithms. When implementation the result's compare to induce the model has the very best accuracy.

II. LITERATURE SURVEY

[1] Autobot for Precision farming
Today's situation farmers are square measure hard to cultivate the land and yield the production. During this paper Robot runs with several elements as a multifunctioning robot. The many elements used are camera, spraying mechanism, sensors. The square measure are login module and selection and show module. Relevance in project: To spot diseases we have a tendency to sqare measure using image processing technique. Then spraying mechanism square measure used for Machine learning is employed in every and each routine task performed by creature. The analysis work deals with disease prediction with the assistance of machine learning. A disease could be a physiological abnormality. Once a plant suffers from any diseases it shows up bond symptoms. Crop diseases square measure a serious threat to food security, however their fast identification remains tough in several elements of the globe because of the dearth of the mandatory infrastructure. The mix of skyrocketing international smartphone penetration and up to date advances in laptop vision created doable by deep learning has sealed the method for smartphone-assisted disease diagnosis. Symptoms square measure the outward changes within the physical look that square measure step by step developed and may be witnessed by naked eyes. Illustrations of symptoms square measure wilt leaf spots, rots, cankers and plenty of a lot of spray pesticides within the affected space. Info of all the crops square measure hold on in information used by the farmer.

[2] Smart Leaf Infection Identification and Fertilizer Spray
In this paper an automated system has been developed to see whether the plant is diseased or not. This paper makes an attempt to develop an automated system that detects the presence of disease within the plants. An automated disease detection system is developed using mistreatment sensors like temperature, wetness and color supported variation in plant leaf health condition.

[3]AgRobots (A combination of image processing and data analytics for precision pesticide use)
India is especially an agricultural country. This paper principally deals with mechanism that uses image process technique to investigate the sick part of the plant and supply pesticide to that part of the plant. During this proposed system openCV is interfaced with the python for image process . Pesticide spraying mechanism is administrated by autonomous robot.

[4] Design and Development of Agrobot for Pesticide Spraying Using Grading System
India is a country where bigger than 70% of individuals depends on agriculture. Agriculture is that the column of Indian economic wealth. Our farmers work twenty four hours to count over 1.20 billion. In India agriculture contributes about 16.1 % of full GDP and 10% of total transport. More than 60% land zone is cultivate building. Hence farmers would like well-founded system which might observe the infected crops. It's straightforward to use Agrobot to look at farms observe the diseases and automatically sprinkling.

III. PROPOSED SYSTEM

The main aim of the proposed system is to observe plant diseases exploitation IoT with Machine Learning. Hence, within the proposed work we've thought of detection of disease present on leaves. The discrimination of normal and affected plant leaf is measured supported variation in colour, Blight Spot, Rust, and Fungi. Image process module (called as IP-module) with robotic setup can move over the land. Initial the camera is enabled then its begin to capturing the plant leafs. Then these pictures area unit processed in order to Pre-processing, Feature Extraction, Segmentation and Classification with Machine Learning rule. The ip-modules details more further forward through web to endusers for analysis if any. Once finishing the identification method, a spray fertilizer module will spray & alert the enduser if illness known otherwise it moves to different plants. During this project we tend to area unit style the automatic robot module and leaf disease identification using image processing here.

Our operating step method is following modules.

- Robot Modules
- Camera

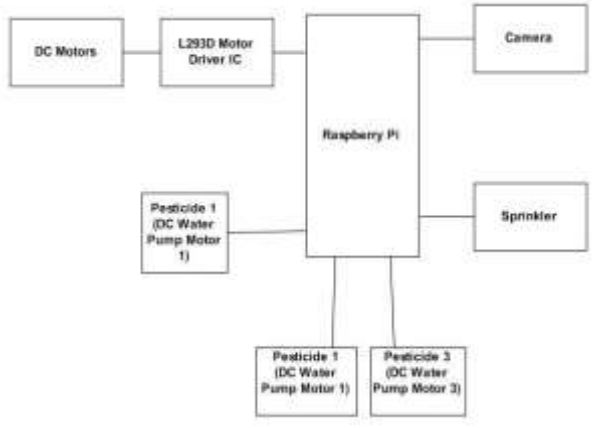


Fig.1:- System Architecture

IV. METHODOLOGY (CNN):

Convolutional neural network (CNN, or ConvNet) could be a kind of deep learning and most typically applied to analyzing visual mental imagery. CNNs use a variation of multilayer perceptrons designed to want minimal pre-processing. They are conjointly referred to as shift invariant or area invariant artificial neural networks (SIANN), supported on their sharedweights architecture and translation `unchangeable characteristics. Convolutional networks were galvanized by biological processes in this the connect pattern between neurons resembles the organization of the animal visual cortex. Individual animal tissue neurons reply to stimuli only in a exceedingly restricted region of the sight view field referred as the receptive field.

The receptive fields of various neurons partly overlap such they cover the complete visual field. CNNs use comparatively very little pre-processing compared to different image classification algorithms. This implies that the network learns the filters that in ancient algorithms were handengineered. This independence from previous information and human effort in feature style could be a major advantage. They need applications in image and video recognition, recommender systems, image classification, medical image analysis, and natural language processing. A CNN consists of associate in nursing input associate in an output layer, as well as additionally multiple hidden layers. The hidden layers of a CNN generally carries with it convolutional layers, pooling layers, fully connected layers and normalization layers**.**

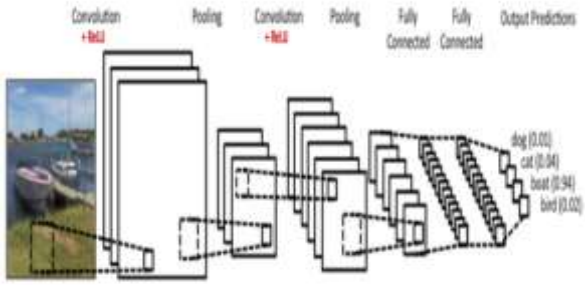


Fig2. Simple ConvNet

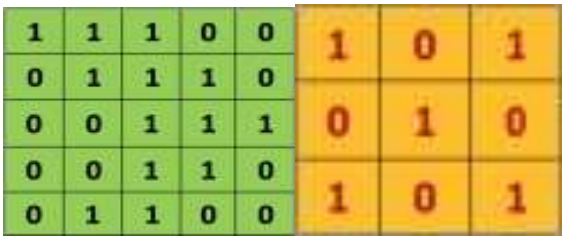
The Convolutional Neural Network in Fig. is similar in design to the forst LeNet and classifies an input image into four categories: dog, cat, boat or bird. There area unit four main operations within the ConvNet shown in fig. above:

1. Convolution
2. Non Linearity (ReLU)
3. Pooling or Sub Sampling
4. Classification (Fully Connected Layer)

An Image could be a matrix of picture element values. Primarily, each image is represented as a matrix of pixel value Channel is a conventional term used to refer to a certain component of an image. An image from a standard digital camera will have three channels – red, green and blue – you can imagine those as 3, 2d-matrices stacked over each other (one for each color), each having pixel values in the range zero to 255.

The Convolution Step:

ConvNets derive their name from the "convolution" operator. The first purpose of Convolution just in case of a ConvNet is to extract options from the input image. Convolution preserves the abstraction relationship between pixels by learning image options exploitation little squares of input file. We'll not come in the mathematical details of Convolution here, however can attempt to perceive however it works over pictures As we mentioned above, each image can be considered as a matrix of pixel values. Take a five x five image whose pixel values are only 0 and 1 (note that for a grayscale image, pixel values range from 0 to 255, the green matrix below could be special case where pixel values are only zero and one.



Also, take another three x three matrix as shown. Then, theConvolution of the five x five image and therefore the 3 x 3 matrix is computed as shown in the animation in Fig below:

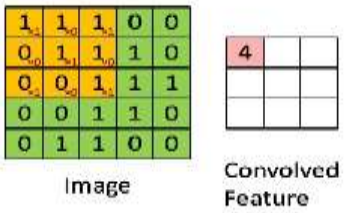


Fig3. The Convolution operation

The output matrix is termed Convolved Feature or Feature Map. Take a flash to grasp to understand how the computation above is being done. We tend to slide the orange matrix over our original image (green) by one pixel (also known as 'stride') and for each position, we tend to work out part wise multiplication (between the 2 matrices) and add the multiplication outputs to introduce the ultimate whole number integer which forms a single element of the output matrix (pink). Note that the three×three matrix "sees" only a part of the input image in every stride. In CNN terminology, the three×three matrix is termed a 'filter' or 'kernel' or 'feature detector' and therefore the matrix shaped by slippy the filter over the image and computing the dot product is termed the 'Convolved Feature' or 'Activation Map' or the 'Feature Map'. It is necessary to notice that filters acts as feature detectors from the first input image.

It is evident from the animation on top of that different values of the filter matrix will manufacture different Feature Maps for the similar input image. As an example, consider the following input image: It's evident from the animation on top of that different values of the filter matrix will produce different Feature Maps for the same input image. As an example, consider the following input image:

In the table below, we will see the results of convolution of the above image with totally different filters. As shown, we will perform operations like Edge Detection, Sharpen and Blur simply by ever-changing the numeric values of our filter matrix before the convolution operation– this suggests that different filters will discover different features from an picture, as an example edges, curves etc.

Operation	Filter	Convolved Image
Identity	$\begin{bmatrix}0&0&0\\0&1&0\\0&0&0\end{bmatrix}$	
Edge detection	$\begin{bmatrix}1&0&-1\\0&0&0\\-1&0&1\end{bmatrix}$	
	$\begin{bmatrix}0&1&0\\1&-4&1\\0&1&0\end{bmatrix}$	
	$\begin{bmatrix}-1&-1&-1\\-1&8&-1\\-1&-1&-1\end{bmatrix}$	
Sharpen	$\begin{bmatrix}0&-1&0\\-1&5&-1\\0&-1&0\end{bmatrix}$	
Box blur (normalized)	$\frac{1}{9}\begin{bmatrix}1&1&1\\1&1&1\\1&1&1\end{bmatrix}$	
Gaussian blur (approximation)	$\frac{1}{16}\begin{bmatrix}1&2&1\\2&4&2\\1&2&1\end{bmatrix}$	

Introducing Non Linearity (ReLU):

An additional operation known ReLU has been used when each Convolution operation in Figure above. ReLU stands for Rectified Linear Unit and is a non-linear operation.

The Pooling Step:

Spatial Pooling (also called subsampling or downsampling) reduces the spatiality of every feature map however retains the foremost necessary data. Spatial Pooling are often of various types: Max, Average, Sum etc.

In case of Max Pooling, we tend to outline a spatial neighborhood (for example, a 2×2 window) and take the biggest part from the corrected feature map at intervals that window. Rather than taking the biggest part we tend to may also take the average (Average Pooling) or sum of all elements in that window. In apply, Max Pooling has been shown to work better. shows associate degree example of Max Pooling operation on a Rectified Feature map (obtained after convolution + ReLU operation) by using a 2×2 window.

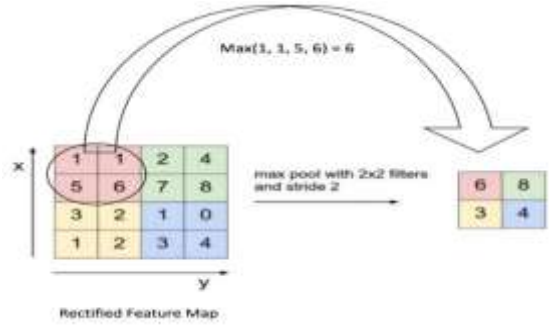


Fig 5. Max Pooling

We slide our pair of 2 x 2 window by 2 cells (also known as 'stride') and take the utmost worth in each region. As shown in Figure, this reduces the spatility of our feature map.

V. ACKNOWLEDGEMENT

I would like to precise my profound thanks to all who helped us directly or indirectly in creating this paper. Finally I would like to thank to all our friends and well-wishers who supported us in finishing this paper with success. I am especially grateful to our guide Prof. Prashant Karkalle for her time to time, very much needed, and valuable guidance. Without the full support and cheerful encouragement of my guide, the paper would not have been completed on time

VI. CONCLUSION

The smart agriculture using IOT has been experimentally established to figure satisfactorily by observance the leaf diseases in the agricultural field. principally identification and curing of plant disease are going to be done manually. Then also disease will be identified at the severe stages only. The most objective of the paper is to automatically discover and cure the disease by spraying pesticides through IoT. In agricultural field, the disease plays a significant role to cause loss economically. The disease is known as image processing using the convolutional neural network (CNN) algorithm. Then the severity of the unwellness is known by comparing value with the trained dataset and provides pesticides accordingly. During this proposed system the detection and curing of plant disease going to be done automatically. Hence saving the loss and helps in agricultural field efficiently.

REFERENCE

[1]Kala HS, Mr.Ramachandra Hebbar,Anjali singh, Deepak Kamble, Mr. P V Vinod"AgRobots(A combination of image processing and data analytics for precision pesticide use)"2018 International Conference on Design Innovations for 3Cs Compute Communicate Control

[2]Mohammed Abu Basim, Abhishek Hariharan, Nishanth Solomon, Deva Dharshini "Autobot for Precision Farming " 2017 IEEE ISBN No.978-1-5090-4527-3.

[3] Aakanksha Rastogi, Ritika Arora, Shanu Sharma, "Leaf Disease Detection and Grading using Computer Vision Technology &Fuzzy Logic"

Haiguang Wang, Guanlin Li, Zhanhong Ma, Xiaolong Li, "Image Recognition of Plant Diseases Based on Back propagation Networks"

[4] Sai Kirthi Pilli1, Bharathiraja Nallathambi, Smith Jessy George, Vivek Diwanji , "eAGROBOT- A Robot for Early Crop Disease Detection using Image Processing"

[5] Fritz Brugger, "Mobile Applications in Agriculture", Syngenta Foundation, Basel,Swit zerland, 2011

[6] Pierre SibiryTraoré, "The view from above" in ICT Update, a remote sensing scientist and GIS head at the (ICRISAT), 23 February 2010

[7] Komal Sharma, Akwinder Kaur and Shruti Gujral, "Brain Tumor Detection based on Machine Learning Algorithms" International Journal of Computer Applications (0975 – 8887) Volume 103 – No.1, 2014 .

