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A NOVEL APPROACH FOR LEAF DISEASE DETECTION USING CNN

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ABSTRACT: In this paper, we proposed "Leaf disease detection uses convolutional network" is concerned with a new approach to the development of plant disease recognition model, based on leaf image classification, by the use of deep convolutional networks. The developed model will be able to recognize different types of plant diseases out of healthy leaves, with the ability to distinguish plant leaves from their surroundings.

CNN is a Deep Learning algorithm which can take in an input image, assign importance to various aspects/objects in the image and be able to differentiate one from the other images. This Deep Learning algorithm will be trained and fine-tuned to fit accurately to the database of a plant's leaves which is the dataset "New Plant Diseases Dataset" consists of about 87K RGB images of healthy and diseased crop leaves which is categorized into 38 different classes.

When plants and crops are affected by pests it affects the agricultural production of the country. Usually, farmers or experts observe the plants with naked eye for detection and identification of disease. But this method can be time consuming, expensive and inaccurate. By using CNN to detect diseases in leaves, the detection of diseased leaf can be easily done. It produces accurate results and it takes less time. With that we can take care of the diseased plant by taking necessary precautions to help increase its growth.

INTRODUCTION

The automated identification of diseases by imaging has the potential to solve all of these problems using tools for automated or expert assistance. Determining the healthiness of a plant through an image is a quite difficult task. The crops are rich and complex environments. Their evolution is constant, with leaves, flowers, and fruits changing throughout the season every season. Their appearance also slightly changes during the day. Since 2012, Deep Neural Networks (DNNs) and in

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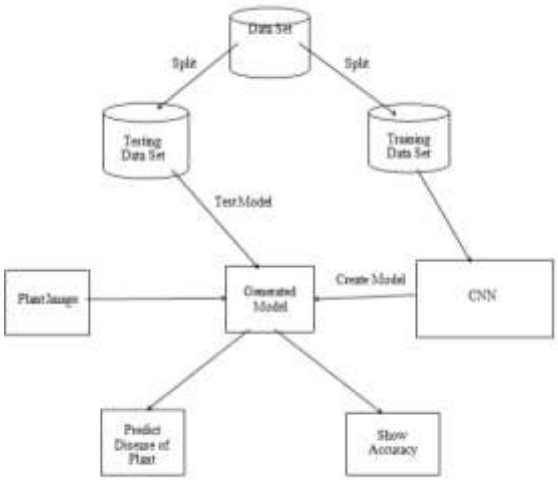
particular Convolutional Neural Networks (CNNs) have been very successful in various computer vision tasks, such as object detection and recognition, classification, and biometry. The convolution layers of a CNN can be seen as matching filters that are derived directly from the data. CNNs thus produce a hierarchy of visual representations that are optimized for a specific task.



LITERATURE SURVEY

Brahimi, M., Arsenovic, M., Laraba, S., Sladojevic, S., Boukhalfa, K., Moussaoui, A., 2018. Deep learning for plant diseases: Detection and saliency map visualisation

Recently, many researchers inspired from the success of deep learning in computer vision to improve the performance of plant diseases detection systems. Unfortunately, most of these studies did not leverage the recent deep architectures and based essentially on AlexNet, GoogleNet or similar architectures. Moreover, the deep learning visualization methods are not taken advantage of, which makes these deep classifiers not transparent and qualified as black boxes. In this chapter, we have tested multiple state-of-the-art Convolutional Neural Network (CNN) architectures using three learning strategies on a public dataset for plant diseases classification. These new architectures outperform the state-of-the-art results of plant diseases classification with an accuracy that reached 99.76%. Furthermore, we have proposed the use of saliency maps as visualization method to understand and interpret the CNN classification mechanism. This visualization method increases the transparency of deep learning models and gives more insight about the symptoms of plant diseases.

Brahimi, M., Boukhalfa, K., Moussaoui, A., 2017. Deep learning for tomato diseases: classification and symptoms visualization

Several studies have invested in machine learning classifiers to protect plants from diseases by processing leaf images. Most of the proposed classifiers

are trained and evaluated with small datasets, focusing on the extraction of hand-crafted features from image to classify the leaves. In this study, we have used a large dataset compared to the state-of-the art. Here, the dataset contains 14,828 images of tomato leaves infected with nine diseases. To train our classifier, we have introduced the Convolutional Neural Network (CNN) as a learning algorithm. One of the biggest advantages of CNN is the automatic extraction of features by processing directly the raw images. To analyze the proposed deep model, we have used visualization methods to understand symptoms and to localize disease regions in leaf. The obtained results are encouraging, reaching 99.18% of accuracy, which out performs dramatically shallow models, and they can be used as a practical tool for farmers to protect leaves against disease.

PROPOSED SYSTEM

Usually, farmers or experts observe the plants with naked eye for detection and identification of disease. But this method can be time processing, expensive and inaccurate. Existing systems use expert system that contains many rules (business) which leads much time and much coding. May not give more effective results. Most of machine learning algorithms are on statistical approach. These statistical approaches are used for textual and numerical data. They may not work heavy or large no of image inputs.

- **Disadvantages of existing system:**
    - Inaccuracy in generating maps results in decrease in accuracy
    - Expensive to train and generate maps
    - Time eating procedure
    - It is difficult to code
    - Inaccurate training

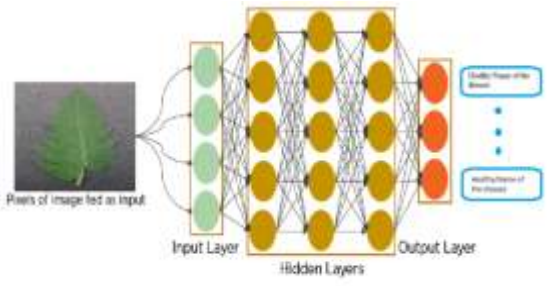
Implementing this disease recognition model are, starts from gathering images in order to create a database, assessed by agricultural experts, a deep learning framework to perform the deep CNN training. The dataset “New Plant Diseases Dataset” consists of about 87K RGB images of healthy and diseased crop leaves which is categorized into 38 different classes. This approach, detecting plant diseases using the deep convolutional neural network trained and fine -tuned to fit accurately to the database of a plant’s leaves that was gathered independently for diverse plant diseases. The working of model is healthy leaves and background images are in line

with other classes, enabling the model to distinguish between diseased leaves and healthy ones or from the environment by using deep CNN.

- **Advantages of proposed system:**
  - Higher accuracy and more efficient
  - Time consumption is less when training or while using the model
  - Meant for Image data
  - It is in-expensive

IMPLEMENTATION

Machine Learning, Artificial Neural Networks perform really well. Artificial Neural Networks are used in various classification tasks like image, audio, words. Different types of Neural Networks are used for different purposes, for example for predicting the sequence of words we use Recurrent Neural Networks more precisely an LSTM, similarly for image classification we use Convolution Neural networks.



Input Layers: It's the layer in which we give input to our model. The number of neurons in this layer is equal to the total number of features in our data (number of pixels in the case of an image).

Hidden Layers: The input from the Input layer is then feed into the hidden layer. There can be many hidden layers depending upon our model and data size. Each hidden layer can have different numbers of neurons which are generally greater than the number of features. The output from each layer is computed by matrix multiplication of output of the previous layer with learnable weights of that layer and then by the addition of learnable biases followed by activation function which makes the network nonlinear.

Output Layers: The output from the hidden layer is then fed into a logistic function like sigmoid or softmax which converts the output of each class into the probability score of each class.

Algorithm Steps:

- Step 1: Choose a Dataset
- Step 2: Pre-Process Dataset for Training
- Step 3: Split the Dataset into training dataset and testing dataset

- Step 4: Assigning Labels and Features
- Step5: Define, compile and train the CNN Model (Adds conv layers, pooling layers, activation, batch noramlization and flatten the image)
- Step 6: If after testing then show accuracy of the model otherwise show the prediction of the unknown test case

CONCLUSION

This project has proposed a detection approach that is based on improved convolutional neural networks for leaf diseases. The deep-learning-based approach can automatically extract the discriminative features of the diseased leaf images and detect the common types of leaf diseases with high accuracy.

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