**Plant Disease Detection and Classification by Deep Learning: A Review**

**Alternate Title:**

Different types of plant leaf disease detection in real time using Convolutional Neural Network

**Aim:**

 To detect the plant leaf diseases using convolutional neural network for high accuracy detection

**Synopsis:**

 Identification of leaf disease is very difficult in agriculture field. If identification is incorrect then there is a huge loss on the production of crop and economical value of market. Traditionally, visual examination by experts has been carried out to diagnose plant diseases and biological examination is the second option, if necessary. Leaf disease detection requires huge amount of work, knowledge in the plant diseases, and require the more processing time. Therefore, we can use image processing for identification of leaf disease.The system has been tested with the different numbers of test data set collected from different regions. This system has tested for different numbers of clusters to get the optimal number of cluster that can produce the best performance of the proposed leaf disease identification and control prediction system. In our approach, we use the technique of Convolutional Neural Network which uses the concept of hidden layers to classify the different diseases that affect the plants. The proposed deep-learning based approach can automatically identify the discriminative features of the diseased leaf images and detect the types of plant leaf diseases with high accuracy.

**Existing System:**

 Now a day, we regularly use digital camera and other electronic devices day today life. Then the automatic plant disease identification has been widely applied as a satisfactory alternative. Most of the cases following traditional machine learning approaches such as support vector machine (SVM), CNN and K-means clustering have complex image preprocessing and feature extraction steps, which reduce the efficiency of disease diagnosis.

**Proposed System:**

 Agriculture is one of the most significant occupations around the world. It plays a major role because food is a basic need for every living being on this planet. In this proposed system, deep learning approach Region Based Convolutional Neural Networks(R-CNN) for identification. They have two phases namely the training phase and testing phase. In the initial phase, they have carried out image acquisition, pre-processed the image and trained the images using R-CNN. In the second phase classification and identification of the Leaf disease. For training purposes, image is taken from the dataset whereas, for testing, real-time images can be used. The diagnosis of the leaf disease is done with the images that are uploaded in the system or present in the database. If the real-time input is taken from the surrounding, then the image needs to be preprocessed followed by the feature classification The Diagnosis of diseases is detected and the name of the disease is obtained.

**Modules:**

* **Feature Selection:**
* **Region Based Convolutional Neural Network**
* **Classification**

**Feature Selection:**

Image annotation is a vital step of which the objective is to label the positions and classes of object spots in the diseased images. For this stage, a convolution neural networks (CNN) algorithm that provides a frame selection function is developed in Python.

**Region Based Convolutional Neural Network**

 R-CNNs (Region-based Convolutional Neural Networks) are a family of machine learning models used in computer vision and image processing. Specially designed for object detection, the original goal of any R-CNN is to detect objects in any input image defining boundaries around them. An input image given to the R-CNN model goes through a mechanism called selective search to extract information about the region of interest. Region of interest can be represented by the rectangle boundaries. Depending on the scenario there can be over 2000 regions of interest. This region of interest goes through CNN to produce output features. When we are dealing with images, the data is generally huge and if it is fed as it is, the model becomes clumsy and the training will take a lot of time as well as the memory requirements will be huge. So, we will make use of a Region Convolutional neural network. The pre-processed data is fed into the input layer of the Convolutional neural network. At the time of reading the pre-processed data, a filter is applied which helps in decreasing the dimensions of the input data.

**Classification:**

 We detect the disease is affected in the plant leaf. Using the deep learning method, finally the disease will be labeled which types of disease are affected and it also says the remedy for the leaf disease.

**Software Requirements:**

* Operating System : Windows 10 (64 bit)
* Software : Python
* Tools : Python 3.7 IDLE and Spyder

**Hardware Requirements:**

* Hard Disk : 500GB and Above
* RAM : 4GB and Above
* Processor : I3 and Above

**Architecture Diagram:**

Capture Image

Image Preprocess

Testing Image

Convolutional neural network

Training images

Leaf disease Detection