Assignment 6

Abstraction

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PSYC 315 Computational Thinking

**How the nature of your problem decided the Abstraction?**

* Agricultural productivity is something on which economy highly depends. This is the one of the reasons that disease detection in plants plays an important role in agriculture field, as having disease in plants are quite natural. If proper care is not taken in this area, then it causes serious effects on plants and due to which respective product quality, quantity or productivity is affected.
* Detection of plant disease through some automatic technique is beneficial as it reduces a large work of monitoring in big farms of crops, and at very early stage itself it detects the symptoms of diseases i.e. when they appear on plant leaves.
* Visual identification of diseases in these plants can be less accurate and time-consuming, relying in naked-eye observation of experts which is the primary approach for observation can be prohibitively expensive, one of the drawbacks is that a severe disease in some cases may lead to severe side effects for the plants and the crop of the farmer.

**What are the General Characteristics of an abstracted algorithm? Factor out details from common pattern?**

* Compared with the definite classification, detection and segmentation tasks in computer vision [[9](https://plantmethods.biomedcentral.com/articles/10.1186/s13007-021-00722-9#ref-CR9)], the requirements of plant diseases and pests detection is very general. In fact, its requirements can be divided into three different levels: what, where and how [[10](https://plantmethods.biomedcentral.com/articles/10.1186/s13007-021-00722-9#ref-CR10)].
* “what” corresponds to the classification task in computer vision, “where” corresponds to the location task in computer vision, and the positioning of this stage is the rigorous sense of detection. This stage not only acquires what types of diseases and pests exist in the image, but also gives their specific locations. “how” corresponds to the segmentation task in computer vision.
* Classification describes the image globally through feature expression, and then determines whether there is a certain kind of object in the image by means of classification operation; while object detection focuses on local description, that is, answering what object exists in what position in an image, so in addition to feature expression, object structure is the most obvious feature that object detection differs from object classification. That is, feature expression is the main research line of object classification, while structure learning is the research focus of object detection. Although the function requirements and objectives of the three stages of plant diseases and pests detection are different, yet in fact, the three stages are mutually inclusive and can be converted.

All of the proposed techniques for Plant Leaf disease detection goes through the system consists of several steps like

Physical characteristics such as decolorization of leaves can be used to identify several diseases that may affect the crop. Earlier methods of classifying diseased plant images such as rule-based classifiers relied on a fixed set of rules to segment the leaf into affected and unaffected regions.

Some of the rules to extract features involve observing the change in the mean and standard deviation between the color of the affected and unaffected regions. Rules to extract shape features involve individually placing several primitive shapes on top of the affected region and identifying the shape that covers the maximum area of the affected region. Once the features are extracted from the images, a set of fixed rules are used to classify the images depending upon the disease that may have affected the plant.

The overall concept that is the framework for any vision related algorithm of image classification is almost the same. First, the digital images are acquired from the environment using a digital camera. Then image-processing techniques are applied to the acquired images to extract useful features that are necessary for further analysis. After that, several analytical discriminating techniques are used to classify the images according to the specific problem at hand. Figure 1 depicts the basic procedure of the proposed vision-based detection algorithm in this research.

However differences can be found in specific instances in a way the image segmentation and recognition processes occur.

Segmentation is the process that is carried out to extract the diseased region and the plant diseases are graded by calculating the quotient of disease spot and leaf areas. An optimal threshold value for segmentation can be obtained using weighted Parzen-window (Jun and Wang, 2008). This reduces the computational burden and storage requirements without degrading the final segmentation results.

**Color Texture Feature Analysis** texture features are calculated from the Spatial Gray-level Dependence Matrices (SGDM) and the classification is done using squared distance technique. Grapefruit peel might be infected by several diseases like canker, copper burn, greasy spot, melanose and wind scar (Kim et al., 2009).

Hue Saturation Intensity (HIS) - transformation is applied to the input image, then it is segmented using Fuzzy C-mean algorithm. Feature extraction stage deals with the color, size and shape of the spot and finally classification is done using neural networks (Helly et al., 2003).

Al-Bashish et al. (2011) developed a fast and accurate method in which the leaf diseases are detected and classified using k-means based segmentation and neural networks based classification. Automatic classification of leaf diseases is done based on high resolution multispectral and stereo images (Bauer et al., 2011). Sugar beet leaves are used in this approach.

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