SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE
PONDICHERRY

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INNOVATION NAME: **SOW**

INNOVATION THEME: **INNOVATE FOR THE SOCIETY**

TECHNOLOGY USED: **ARTIFICIAL INTELLIGENCE(MACHINE LEARNING & NEURAL NETWORKS)**

ABSTRACT:

The farmers suicide rate in India has ranged between 1.4 and 1.8 per 100,000 total population, over a 10-year period through 2005 because of huge amount of money loss. Money loss occurs due to lack of early identification weeds, diseases , pest damage and nutrient deficiency symptoms which lowers the yield rate drastically. Trees are radically identified by their leaves. Plant assimilation is very important in agronomics. Plant recognition had been studied using various laboratory methods. The morphological and genetical characteristics were employed to classify different leafs. However, the presence of wide morphological varieties through evolution among the various leaf cultivators made it more complex and difficult to classify them. Therefore manual identification as well as classification of these leaves becomes a tedious task. Diseases in plants results in economic losses. Naked eye observation of experts is the traditional approach adopted in practice for detection and identification of plant diseases and it is limited only to the farmers.

Contemporary methods in plant diseases detection has received increasing attention in monitoring large field of crops, doting early information on crop health and disease detection can facilitate the control of diseases through proper management strategies. In the project we facilitate the early detection of crop diseases by identifying a crop by pattern recognition algorithm to confer whether it is a diseased plant or not. Also during harvesting times, a notification is sent to the stakeholders that the crop is ripe. This technique will improve the productivity of crops on a voluminous extent.

PROBLEM STATEMENT:

Diseases in plants cause major production and economic losses as well as reduction in both quality and quantity of agricultural products. Real-time monitoring of agricultural crops is increasingly important because of the involved huge economic impact. The automatic identification of crops, as early as possible during the agricultural season, is an important issue supporting agricultural policies. Now a day's plant diseases detection has received increasing attention in monitoring large field of crops. This project enables the simple plant leaves disease detection system that would facilitate advancements in agriculture. Early information on crop health and disease detection can facilitate the control of diseases through proper management strategies.

The primary objective of the project is to develop an application for identification of crops, weeds, diseases and pest damage and nutrient deficiency symptoms. The application has user selection features like: Parameters to identify – Crop, Weed, Pest damage, disease damage and nutrient deficiency. The android application should have access to the device's camera. Prior to developing an extensive database of photos of Crops, weeds, other plants, trees, symptoms in the leaves that has been caused by pests, diseases and also typical examples of major and minor nutrient deficiency symptoms are needed. Algorithms for object detection, and Image classification, Pattern recognition algorithms are developed to provide a close match for all possible inputs and further get the most likely matching of the inputs.

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CURRENT ISSUES / CONSTRAINTS:

Nowadays farmers are struggling with the newer types of diseases, weeds and nutrient deficiencies with crops, they do not have an idea how to overcome those issues. As a result they meet with a huge amount of loss. Indian soils have been used for growing crops over thousands of years without caring much for replenishing. This has led to depletion and exhaustion of soils resulting in their low productivity. The average yields of almost all the crops are among the lowest in the world. This is a serious problem which can be solved by using more manures and fertilizers. Through this SOW application prediction of diseases that might manifest to the crop and provides information with the various diseases that might arise for that particular plant.

DISADVANTAGES IN THE EXISTING SYSTEM:

- The implementation still lacks in accuracy of the result in some cases. More optimization is needed.
- Prior information is needed for segmentation.
- Database extension is needed in order to reach the more accuracy.
- Very few diseases have been covered. So, work needs to be extended to cover more diseases.
- The possible reasons that can lead to misclassifications can be as follows: disease symptoms varies from one plant to another, features optimization is needed, more training samples are needed in order to cover more cases and to predict the disease more accurately.

FUTURE PROCESS FLOW DUE TO THIS SOLUTION:

- Basic knowledge about the new types of weeds, diseases and much more along with the extensive collection of images for each and every flaw and the solution for how to overcome. Thus the farmer can analyze more about the flaws. Genetic algorithm optimizes the crop searching process. It searches from a large sampling of the cost surface, with the help of image processing.
- It gives a number of optimum solutions, not a single solution. So different image segmentation results can be obtained at the same time

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ADDITIONAL FEATURES

- This application has many user selection features like crops, Weed, Pest damage, disease damage, nutrient deficiency that helps in the identification and classification of crops.

- The application has access to the device's camera. It has an extensive database of photos of Crops, weeds, other plants, trees, symptoms in the leaves that has been caused by pests, diseases and also typical examples of major and minor nutrient deficiency symptoms.

- It also provides general information about the crops including average profit, rainfall and much more in a simplified manner that a farmer with simple knowledge can understand.

- By fetching the farmers current location, a farmer can be made to communicate with the nearby available Researches provided by Krishi Vigyan Kendras(Agricultural extension centres created by ICAR and its affiliated institutions at district level to provide various types of farm support to the agricultural sector). The aim of KVKs portal is to transfer the technologies developed by the agricultural scientists to the farmers in a fast and effective manner.

- Usually in existing system authentication is provided by signing in with email id and password but in our application for more security purpose, the authentication is provided by scanning author's QR code, since it is unique to every individual user.

- Future enhancements like video suggestions, marketing of the seasoned crops, detecting the age of the plant can be added to the system.

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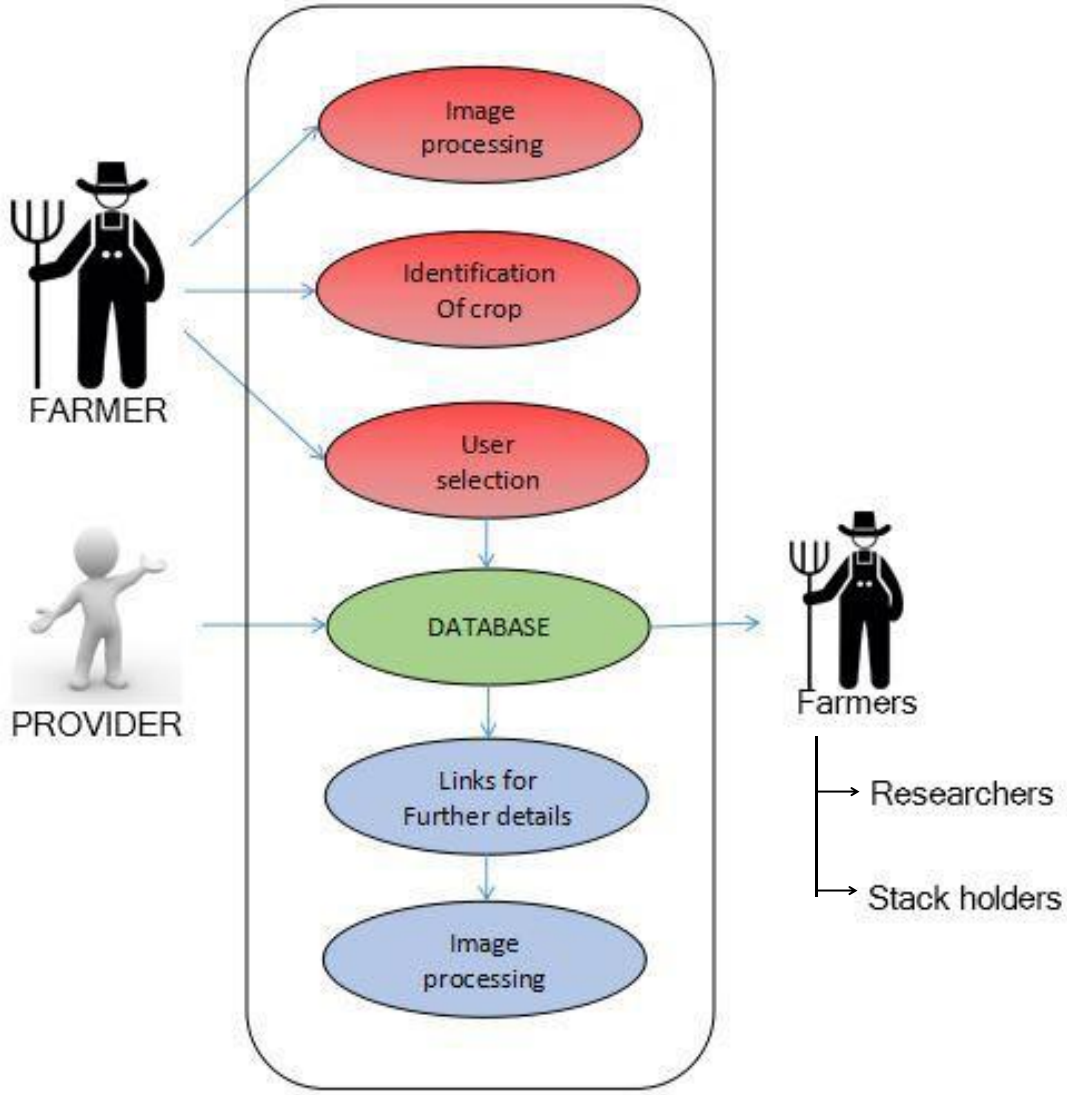
USE CASE DIAGRAM:



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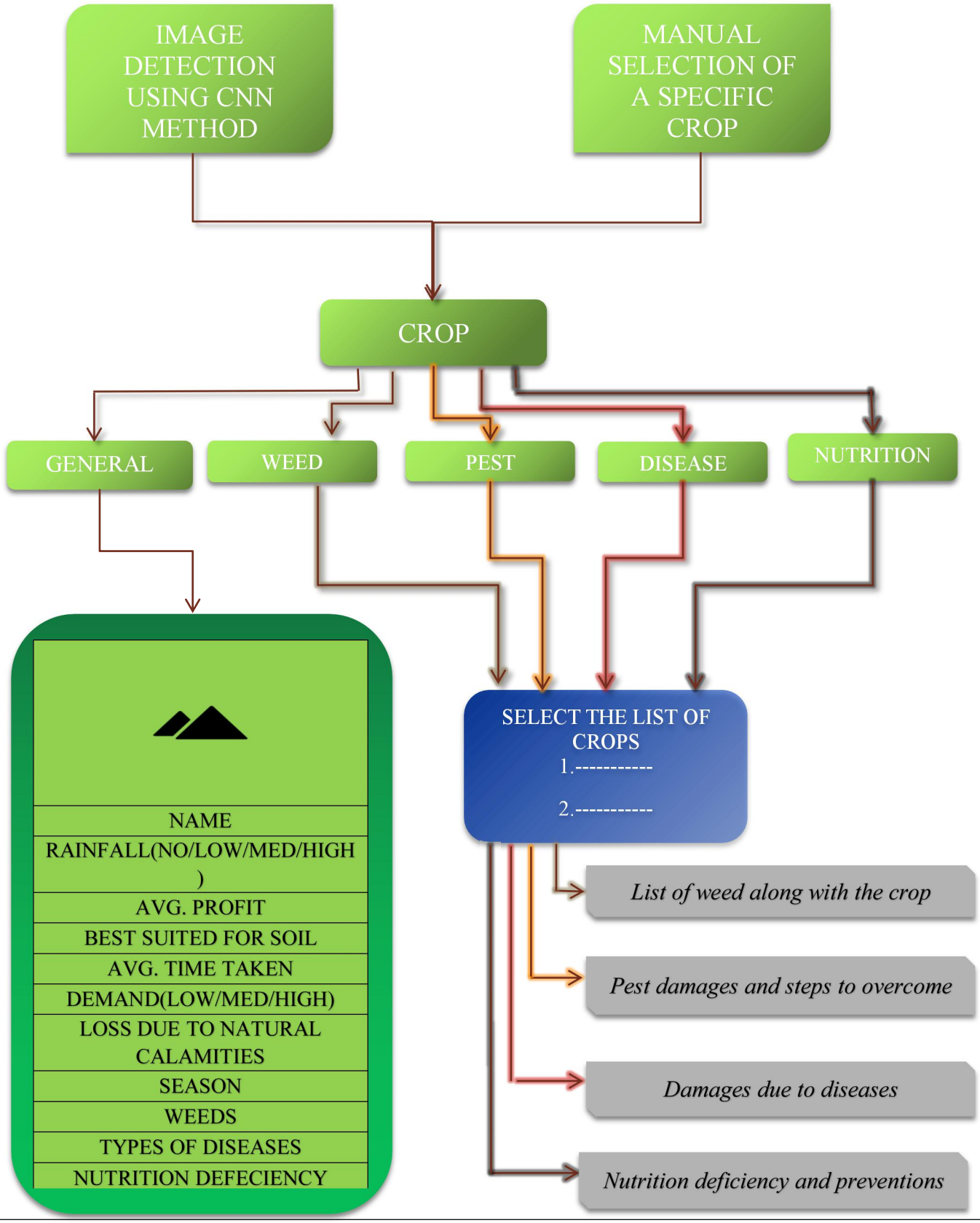
2.Solution overview and approach:

2.1. High level architecture diagram:



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WORKING FLOW:

The android app has two options on the screen

- Scanning
- Manual selection

SCANNING:

In scanning, With the help of the device camera we can identify the crop details by detecting the plant leaf.

CROP DETECTION:

Initially we have to scan the leaf with the help of the camera which gives you the full description about the plant like name of the plant, requirement of water, cultivation method etc.

MANUAL SELECTION:

In this, it displays a list of options like weeds, pest damage, disease, nutrient deficiency.

WEED:

A weed is any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Weeds are also known as invasive plants.

WEED INFO AND CONTROL:

- Cultural weed control
- Chemical weed control
- Natural weed control

PEST DAMAGE:

The agricultural entomologist has a distinct advantage over his colleagues in nematology and plant pathology in that the damaging organisms with which he is concerned are relatively large and usually to be found in the vicinity of the damage on the crop plant. This helps to make the identification of insect pests a relatively simple matter, at least to the level of family and genus.

DISEASE:

Disease fungi take their energy from the plants on which they live. They are responsible for a great deal of damage and are characterized by wilting, scabs, moldy coatings, rusts, and blotches and rotted tissue.

NUTRITION DEFICIENCY:

If plants do not receive adequate proportion of essential minerals or they fail to thrive despite of proper growing conditions it signifies they are suffering from malnutrition. There are various minerals required for proper growth and health of a plant. Excess of these nutrients can be harmful as well and may show toxicity symptoms. This implies you need to be very careful while feeding plants with essential minerals and nutrients, as both excess and lack of them can be a cause of adverse effects.

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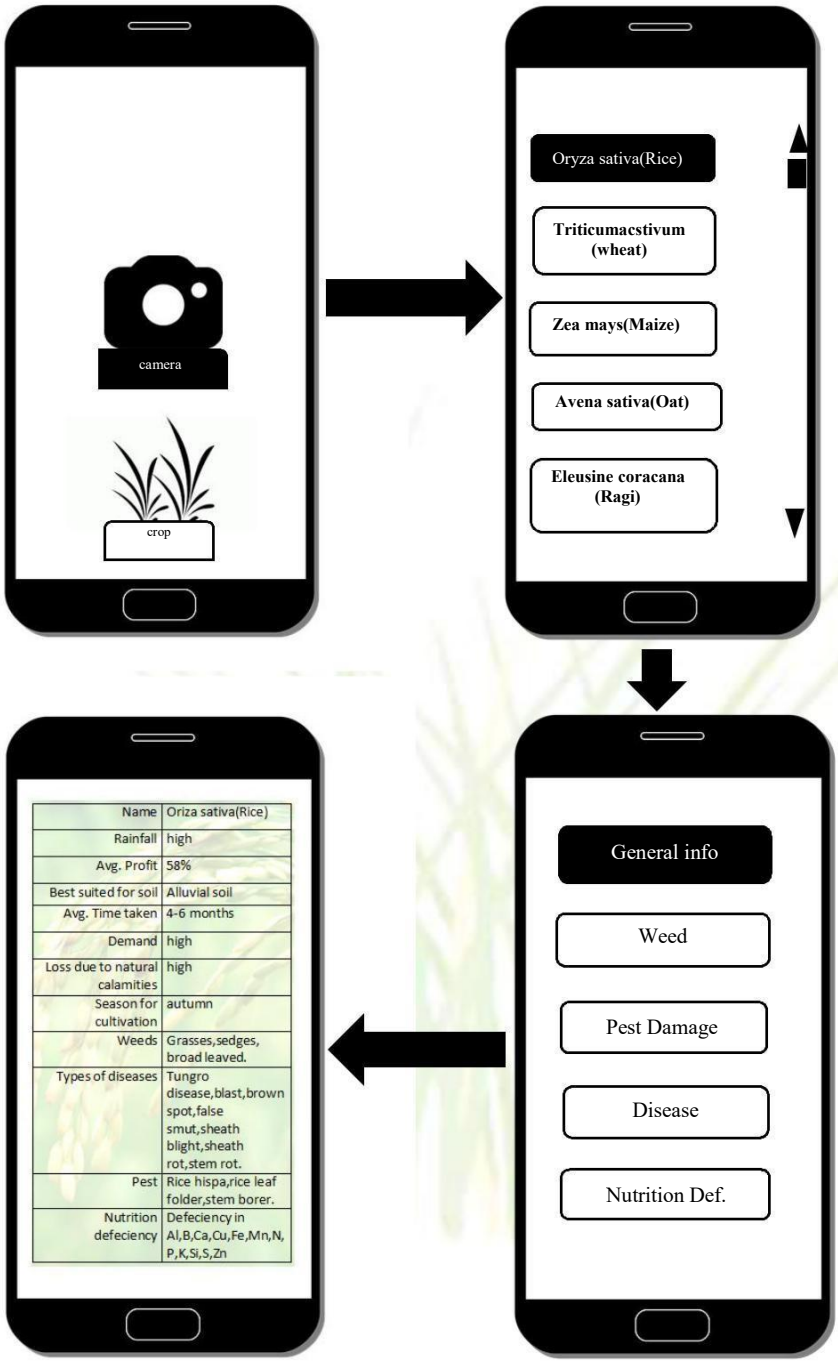
IMPLEMENTATION ARCHITECTURE:

The step by step process about SOW has been descripted below,



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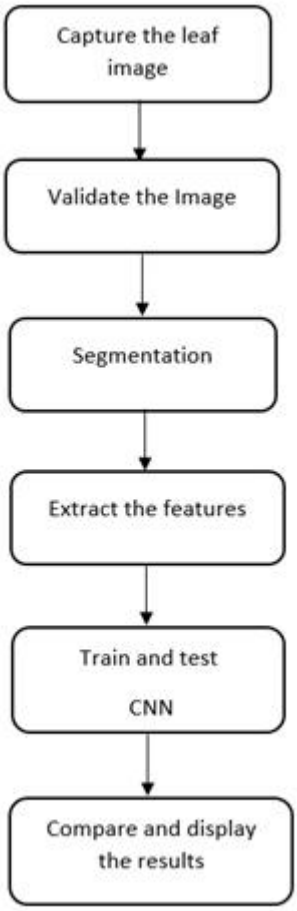
TECHNICAL STACK:

We employ Convolutional Neural Network (CNN) with image and data processing techniques to implement general purpose automated leaf recognition for plant classification. It has an accuracy greater than 95%. Compared with other approaches, the algorithm is an accurate artificial intelligence approach which is fast in execution and easy in implementation.

Flow diagram of how the process is carried out is given below.



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ARCHITECTURE OF CNN:

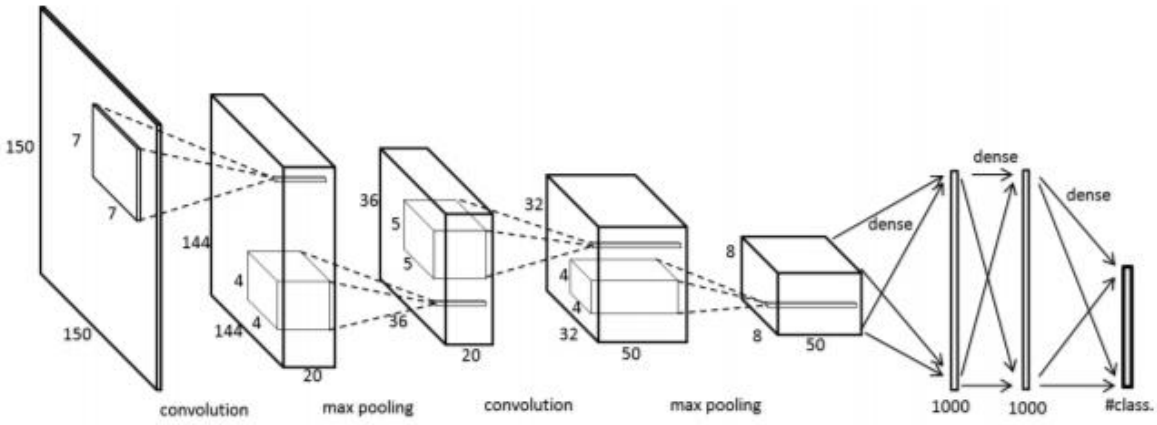


IMAGE PRE-PROCESSING:

A. Converting RGB image to binary image:

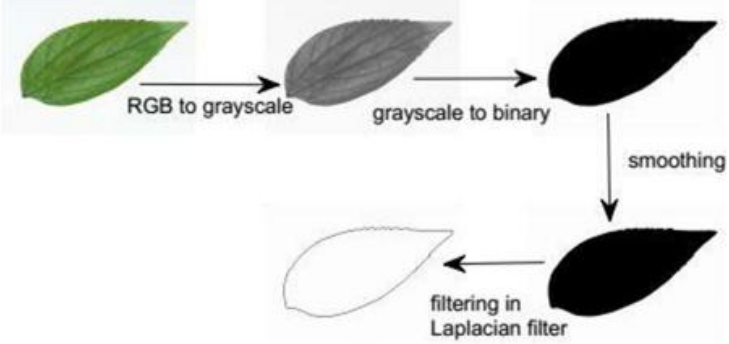
- The leaf image is acquired by device's cameras. The image format here is JPEG. All leaf images are in 800 x 600 resolutions. There is no restriction on the direction of leaves when photonic.
- An RGB image is firstly converted into a gray scale image. The formula used to convert RGB value of a pixel into its gray scale value is,

gray = 0.2989*R + 0.5870*G + 0.1140*B

- The level to convert grayscale into binary image is deter-mined according to the RGB histogram. We accumulate the pixel values to color R, G, B respectively for 3000 leaves and divide them by 3000, the number of leaves.

B. Boundary Enhancement:

- When mentioning the leaf shape, the first thing appears in your mind might be the margin of a leaf. To make boundary as a black curve on white background, the "0" "1" value of pixels is swapped.



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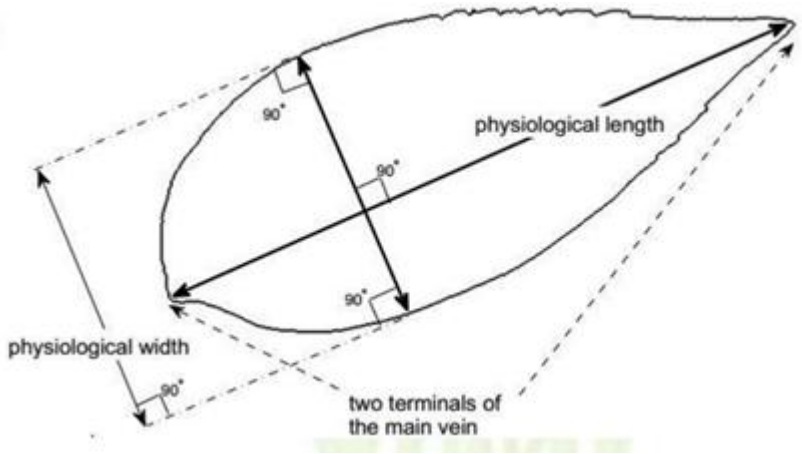
FEATURE EXTRACTION:

A. BASIC GEOMETRIC FEATURES:

- We obtain five geometric features namely: diameter, physiological length, physiological Width, leaf area and leaf perimeter.



Digital morphological features:

- Based on the five geometric features let us define the following morphological features used for image recognition namely, smooth factor, aspect ratio, form factor, rectangularity, narrow factor, perimeter ratio of diameter, perimeter ratio of physiological length, physiological width ,vein features etc.
- When using the algorithm, one can use the mapping $\mathbf{f : R^{12} \rightarrow R^5}$ to obtain the values of components in the new coordinate system.

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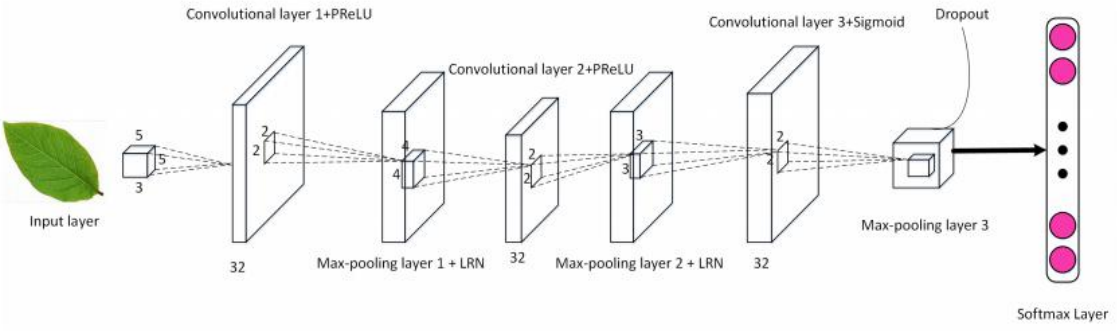
NETWORK STRUCTURE:

- A CNN consists of an input and an output layer, as well as multiple hidden layers. The hidden layers of a CNN typically consist of convolutional layers, pooling layers, fully connected layers and normalization layers.



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Amazon IAM = http://docs.aws.amazon.com/IAM/latest/UserGuide/introduction.ht