Mekelle University

Detection & Classification of Agricultural Plant Leaf Diseases Using Image Processing & ConvNet

We Are

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Outlines

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Introduction

- This project is about:
  - ❖ detecting weather there is a disease in the plant or not.
  - ❖ classify what type of disease is it.

- Preserving health of agricultural plants is the key to guarantee the lives of human beings and animals.

- We have collected the dataset from PlantVillage dataset.

…Introduction

- We focused on 20 classes of plant leaf diseases. Some of which are:

Corn (maize) Common rust

Pepper, bell Bacterial spot

Potato Early blight

Tomato Bacterial spot

Tomato Late blight

Tomato mosaic virus

Potato late blight

Tomato Yellow Leaf Curl Virus

Background

- Though many researches are conducted in this area, there are limitations that we are interested to solve.
  - Some of the limitations are:
- Less accurate.
- Most of the papers are focusing on either detection or classification not both.
- The studies focus on little or one type of plant.
- There are few or no such research is conducted in our country.

Problems

- Little or no technologies related to agriculture.
- Current detection system is naked eye system.
- Botanists are rare and expensive.
- detection is not at early.

Problem solutions

- Detection of these diseases at early stages.
- Identification of type of disease solely.

Objectives

- Reducing threats of Agricultural Products.
- Developing an application that is capable of detecting and classifying crop plant leaf diseases.
- Make a great contribution for the Nutrition of Ethiopians.
- Increasing economical status of our country, because our country is dependent on agriculture.

Motivation

- Ethiopia has little or no usage of such technologies in agriculture.
  - ❖ No detection and classification applications are available in our country.

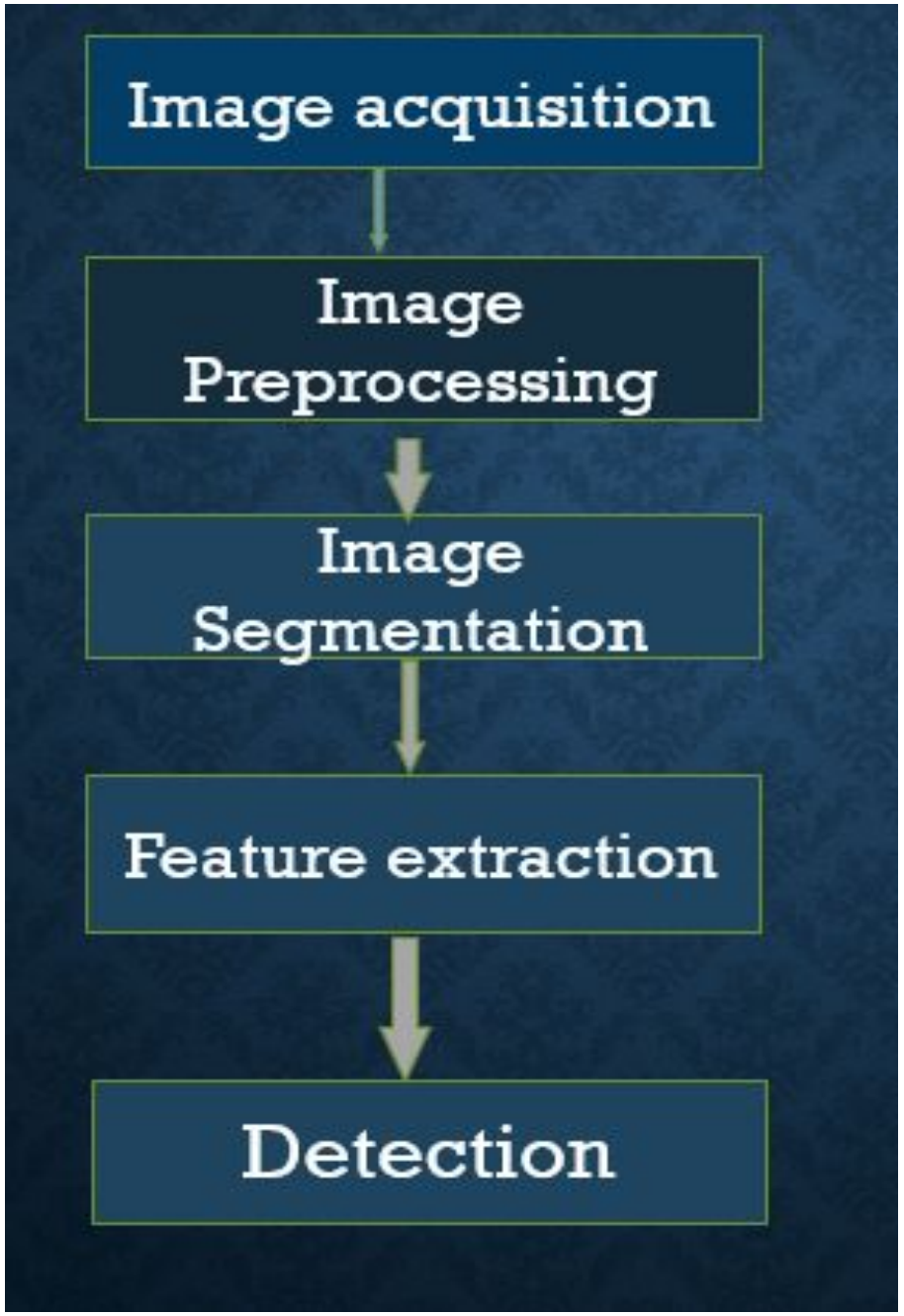
- Agricultural plants are the major source of our Nutrition.

Scope of the project

- Our project is all about detection and classification of agricultural plant leaf diseases.
- It doesn’t include liveness detection and classification mechanism.
- Doesn’t include treatment and preventive mechanisms.

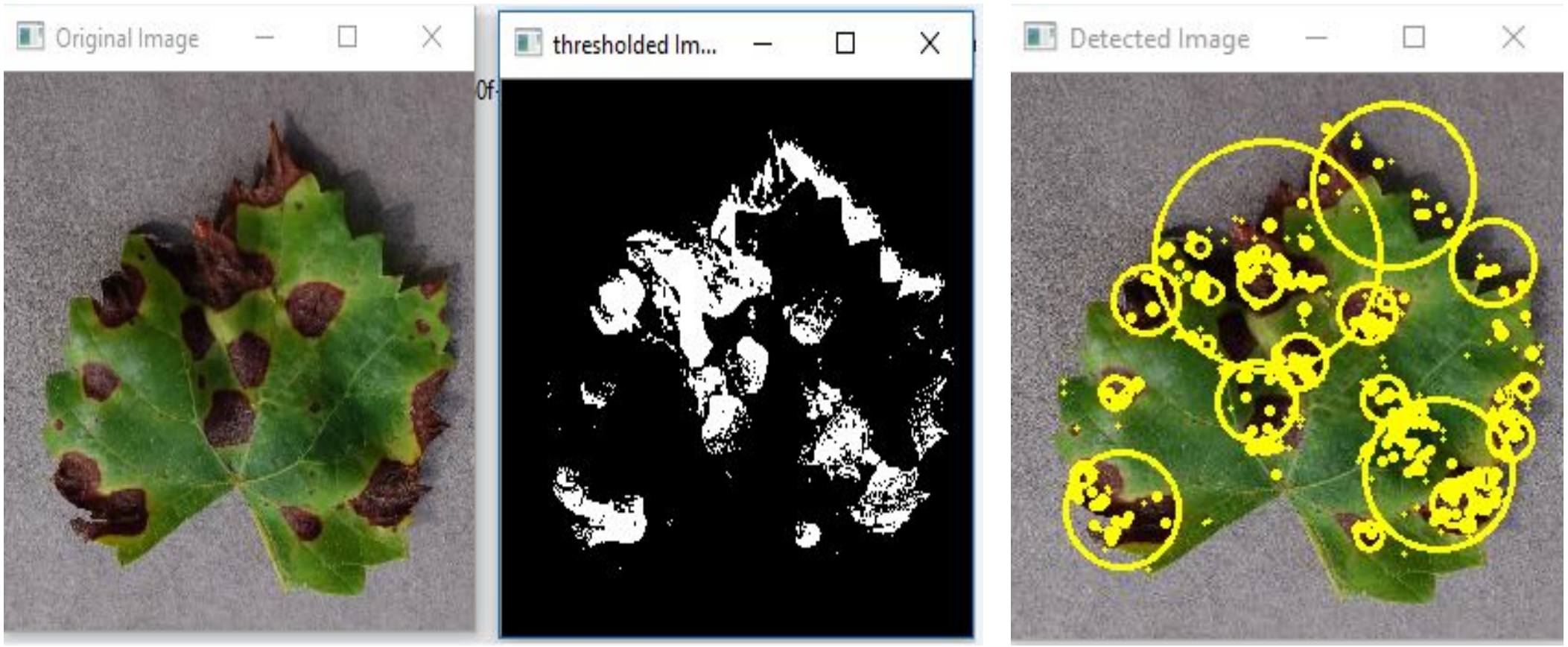
System Design
Detection

- Extracting the character stick feature of unhealthy part.
- These features include color, texture and etc.
- Store images in JPEG format
- Color transformation is required.



System Design

…Detection

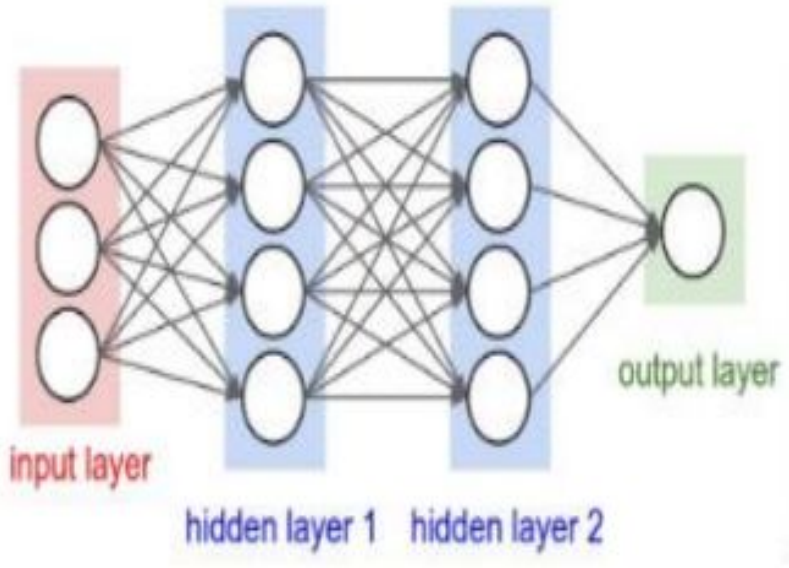


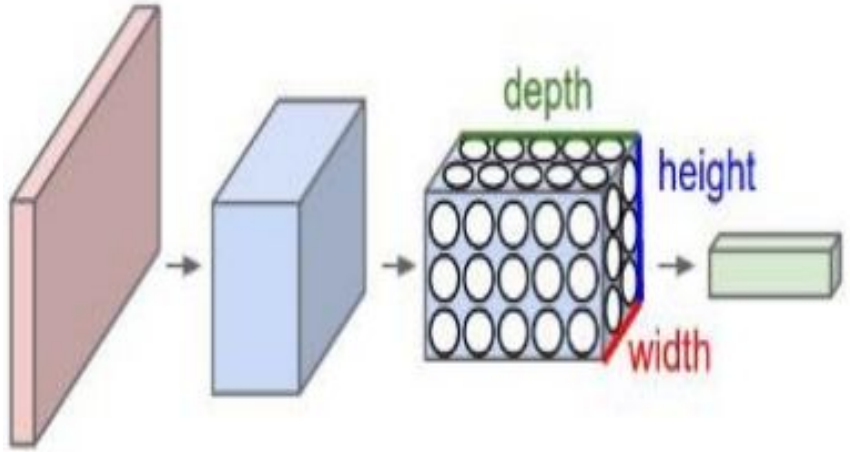
System Design

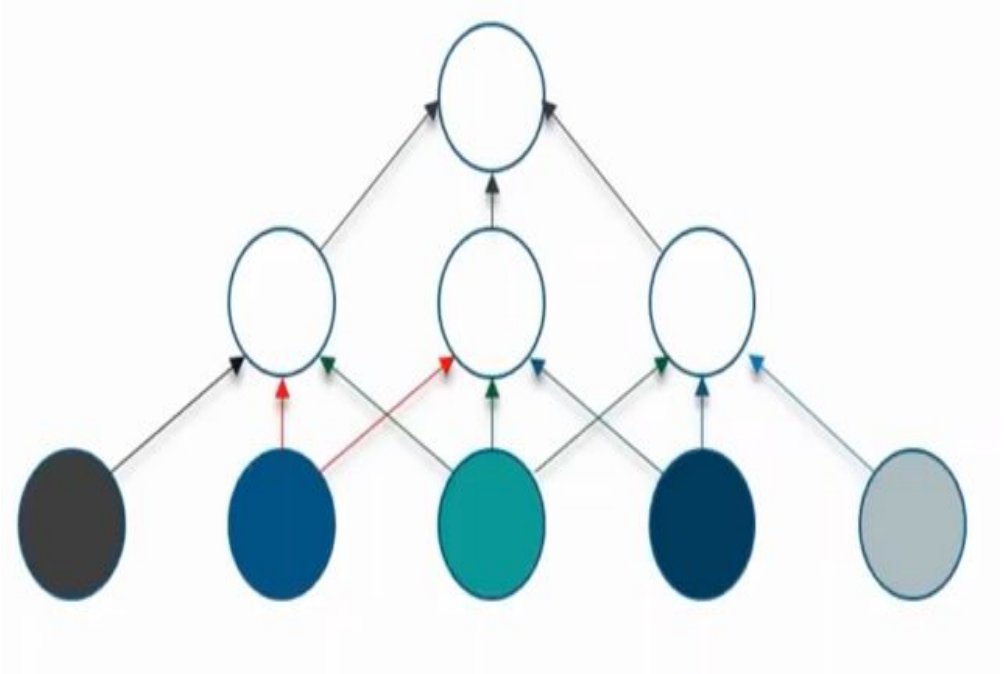
classification

Why CNN?

- 28x28x3 = 2352 weights
- 200x200x3 = 120k weights



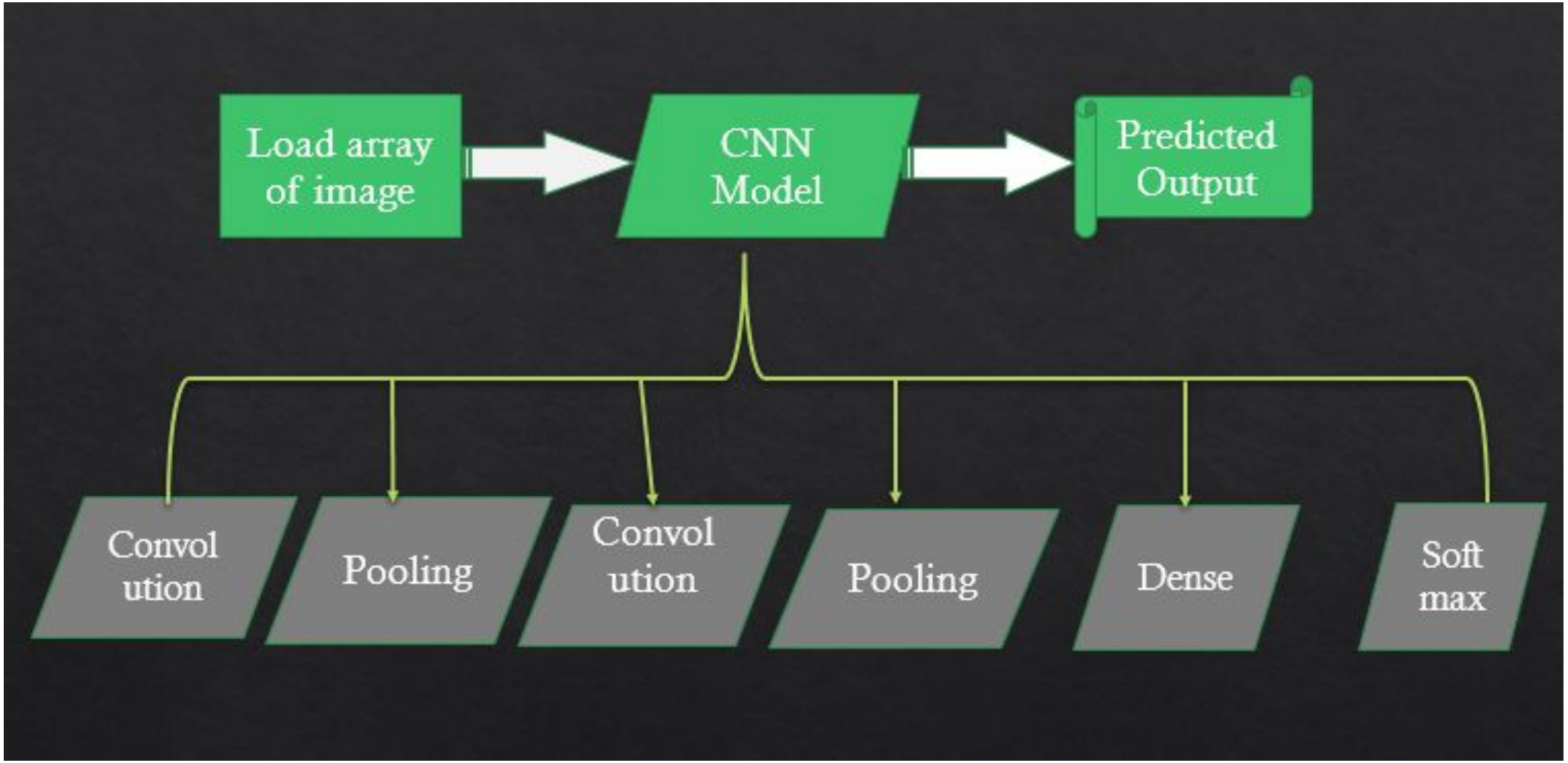




…Why CNN? Cont'd.

- ConvNet is most widely used in image classification
- Number of Operations are very dainty compared to ANN
- ConvNet are three dimensional, Neurons in a layer will only be connected to a small region of the layer before it.
- ConvNet receive array of integers (images).

CNN Model


Load array of image
CNN Model
Predicted Output
Convol ution
Pooling
Convol ution
Pooling
Dense
Soft max

…CNN Model Cont’d.

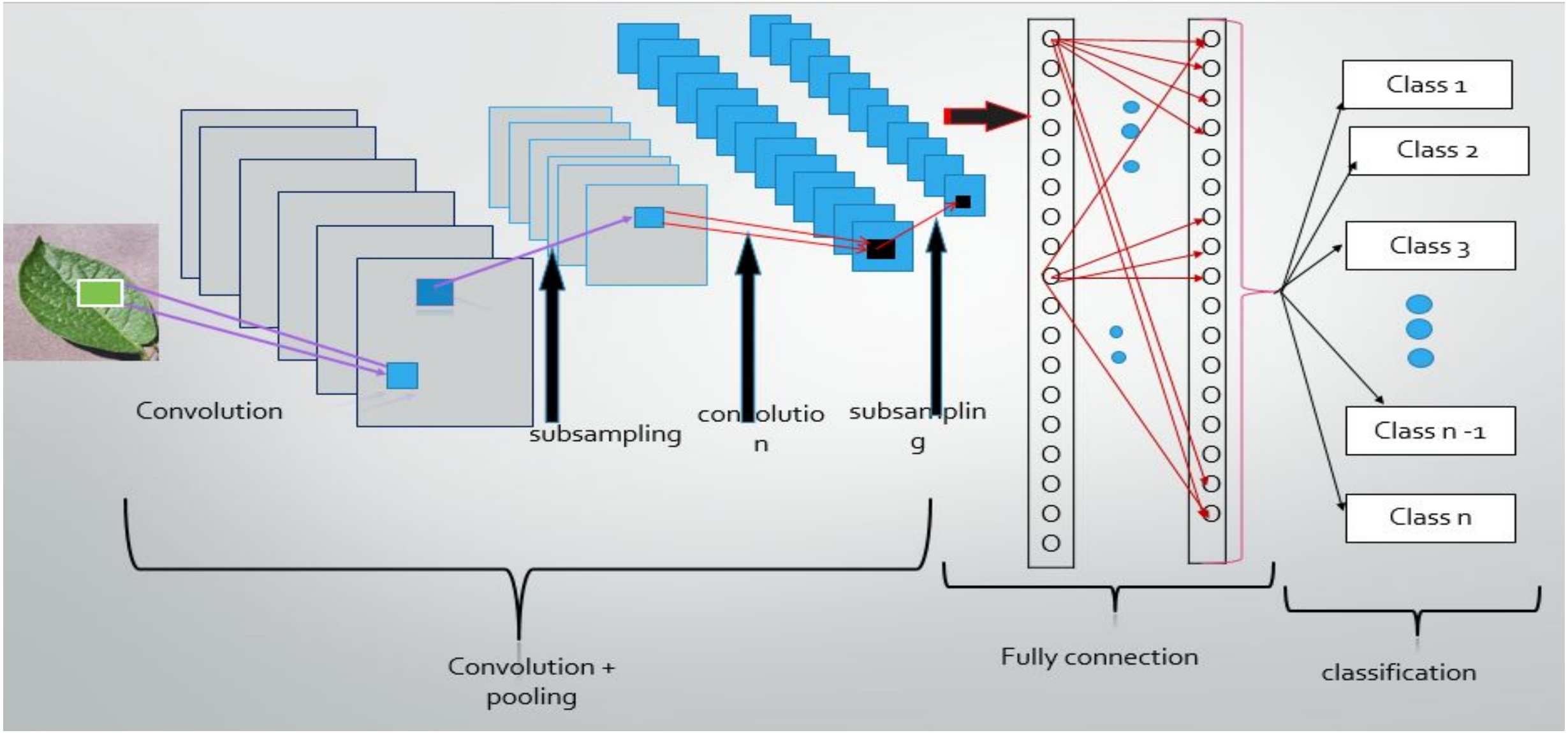
✔ ConvNet has three main layers.

- ❑ Convolutional layer
- ❑ Pooling layer
- ❑ Dense(fully connected layer)

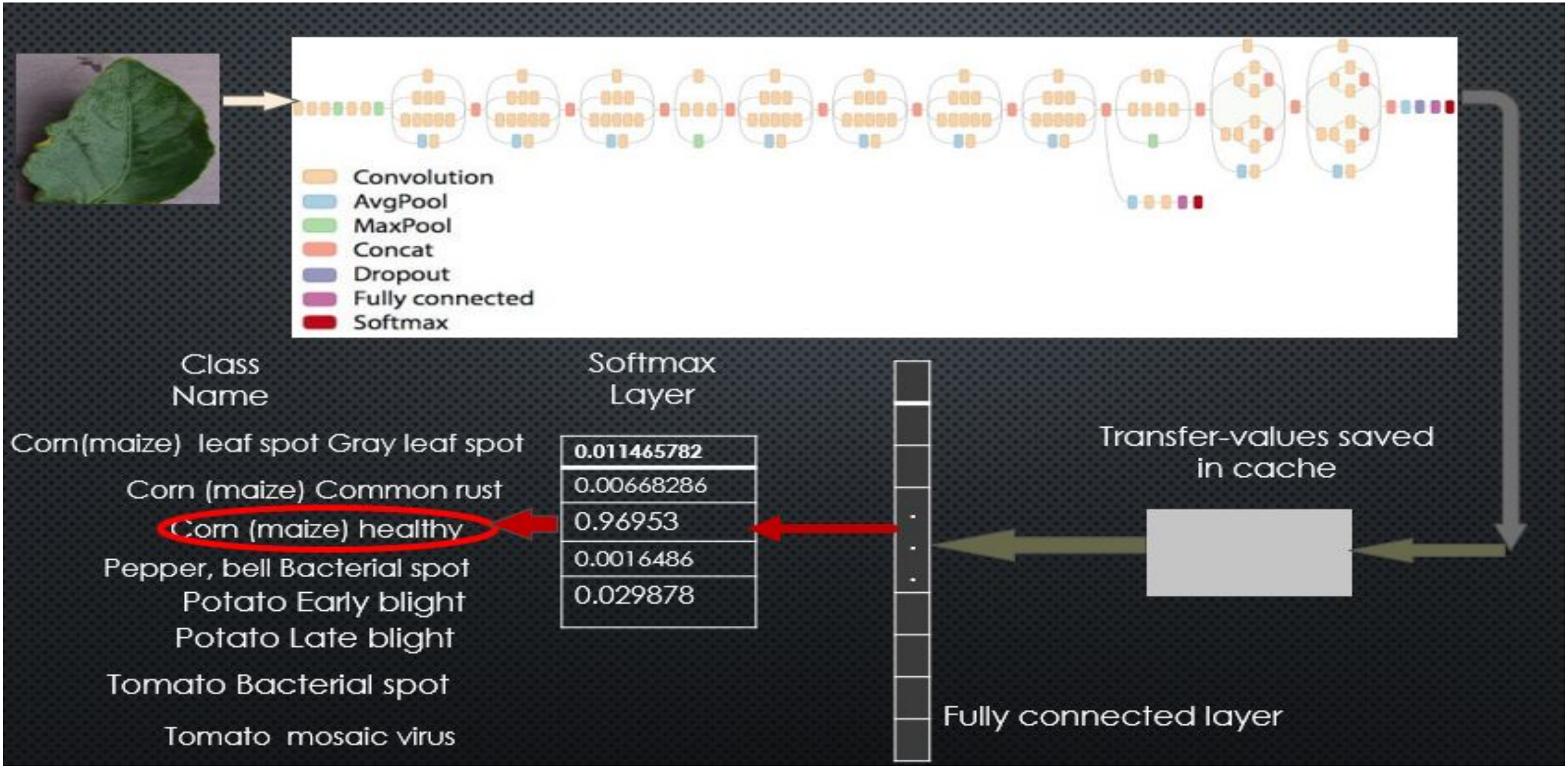
✔ Other layers

- ReLU layer
- softmax

…CNN Model Cont'd.

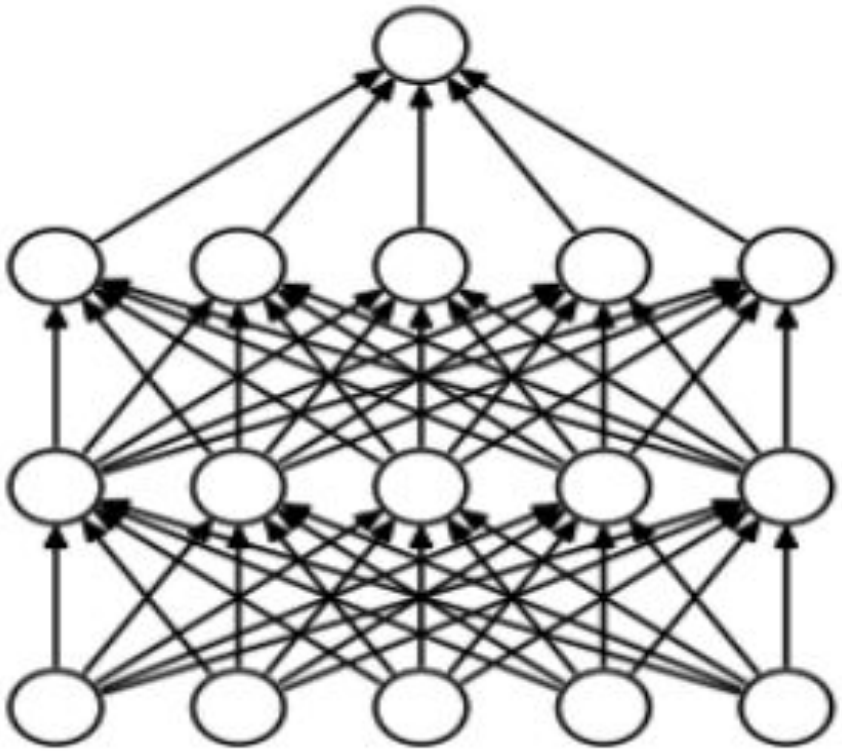


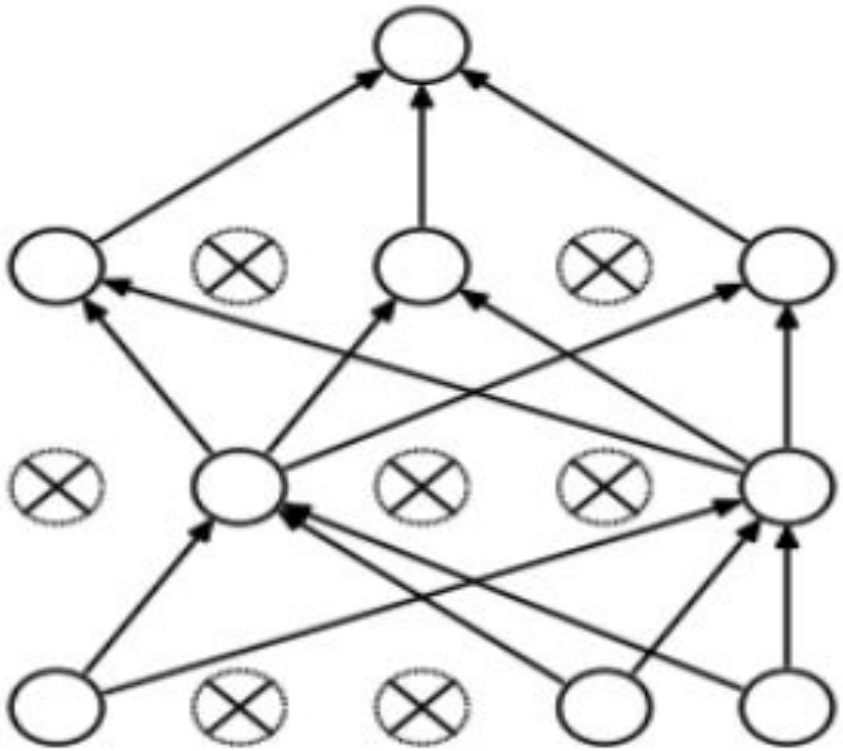
General design of classifier



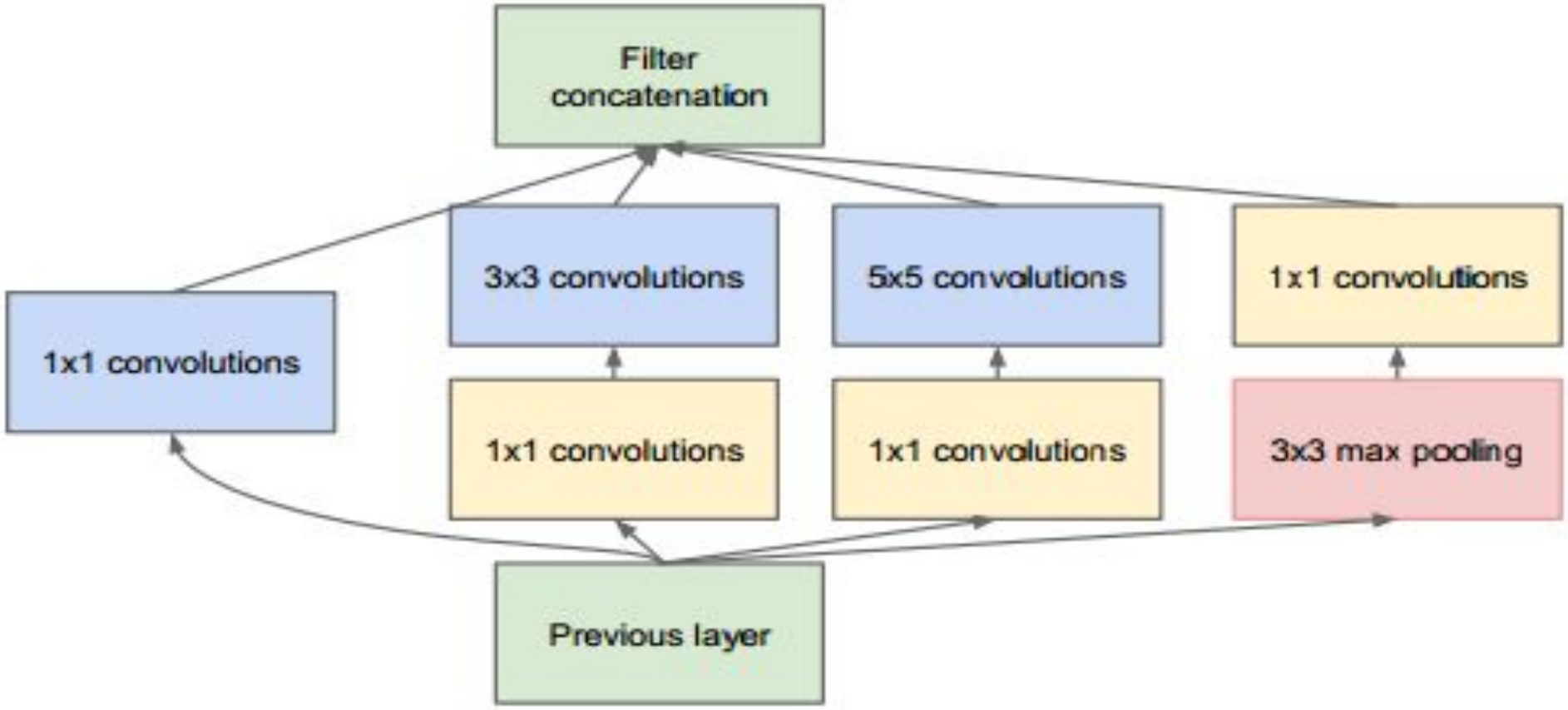
Effect of dropout

- Overcome the problem of overfitting





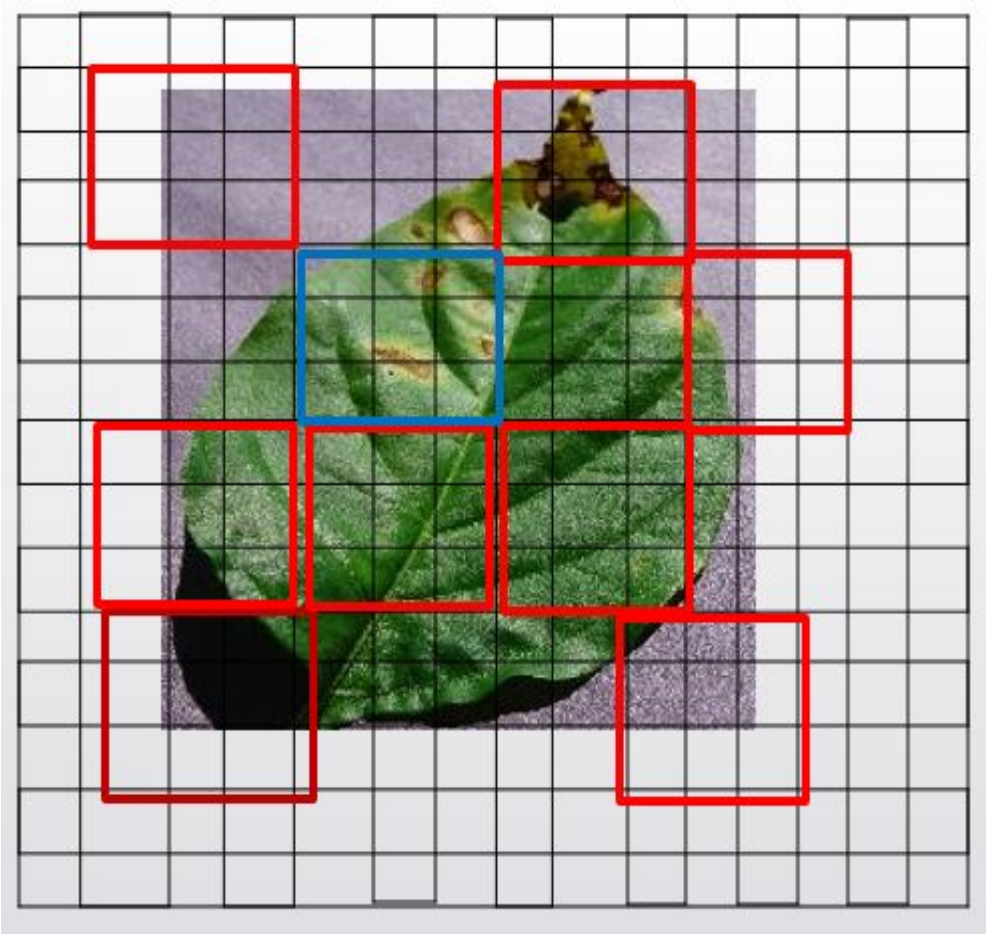
Concatenation

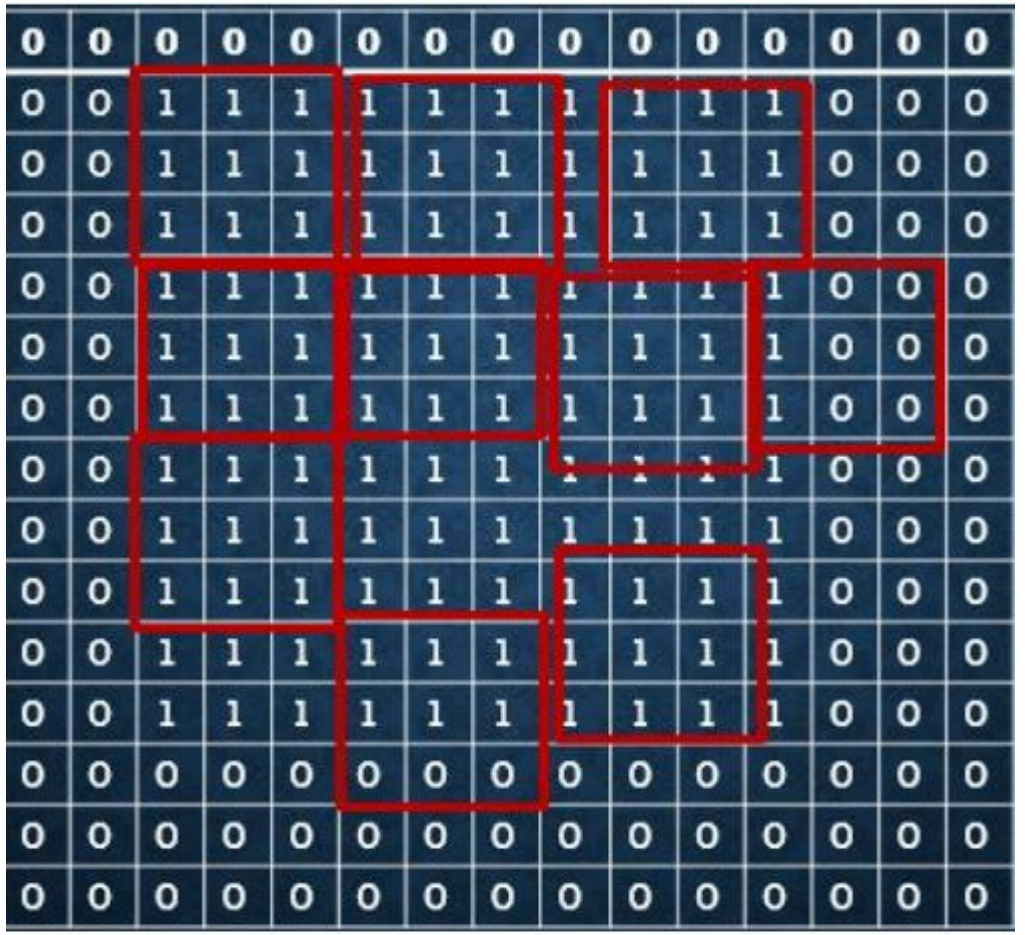


[Szegedy et al., 2014,Going Deeper with convolutions]

System Implementation

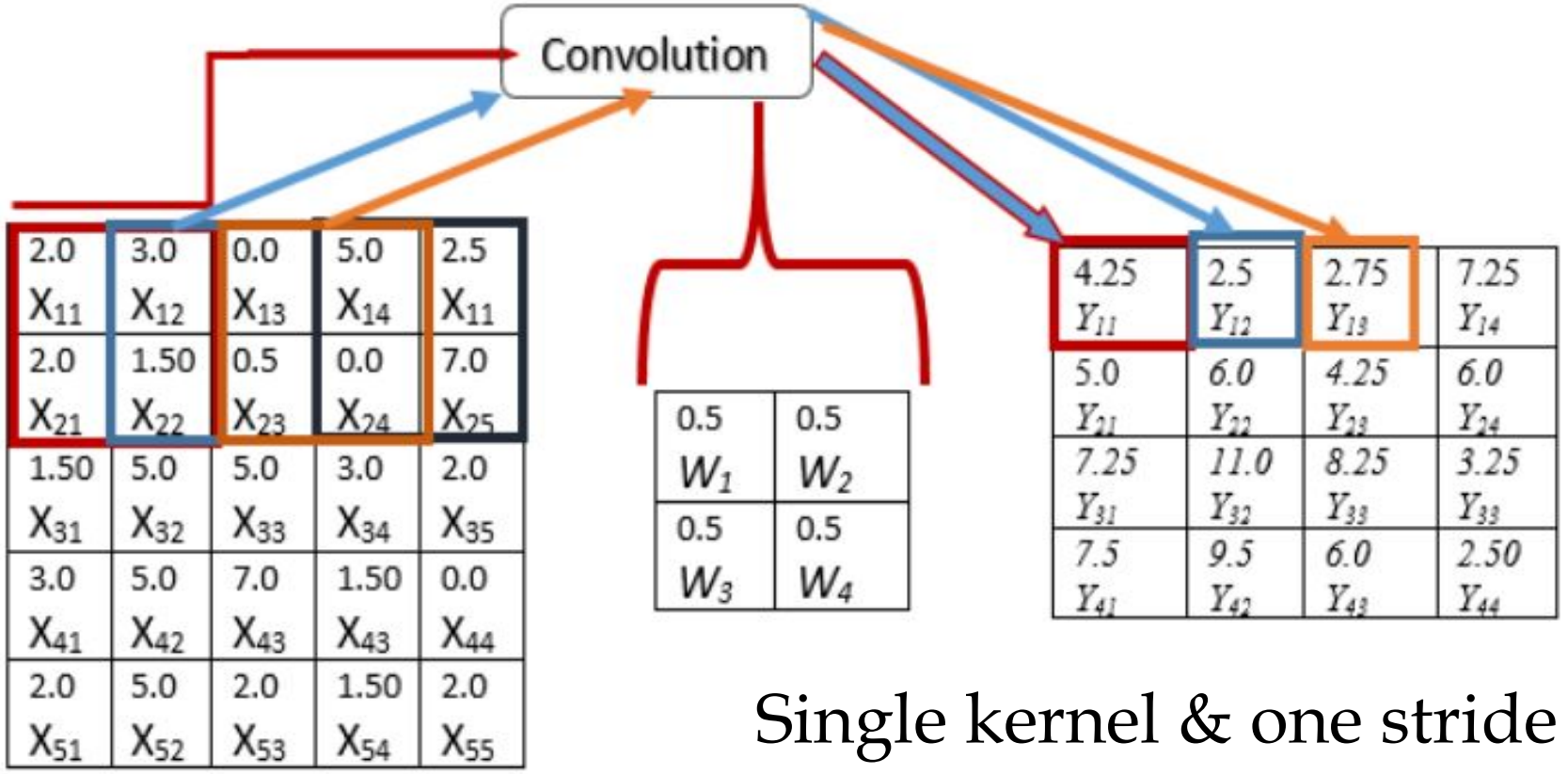
What are Kernels/Filters?





…System Implementation

Convolution



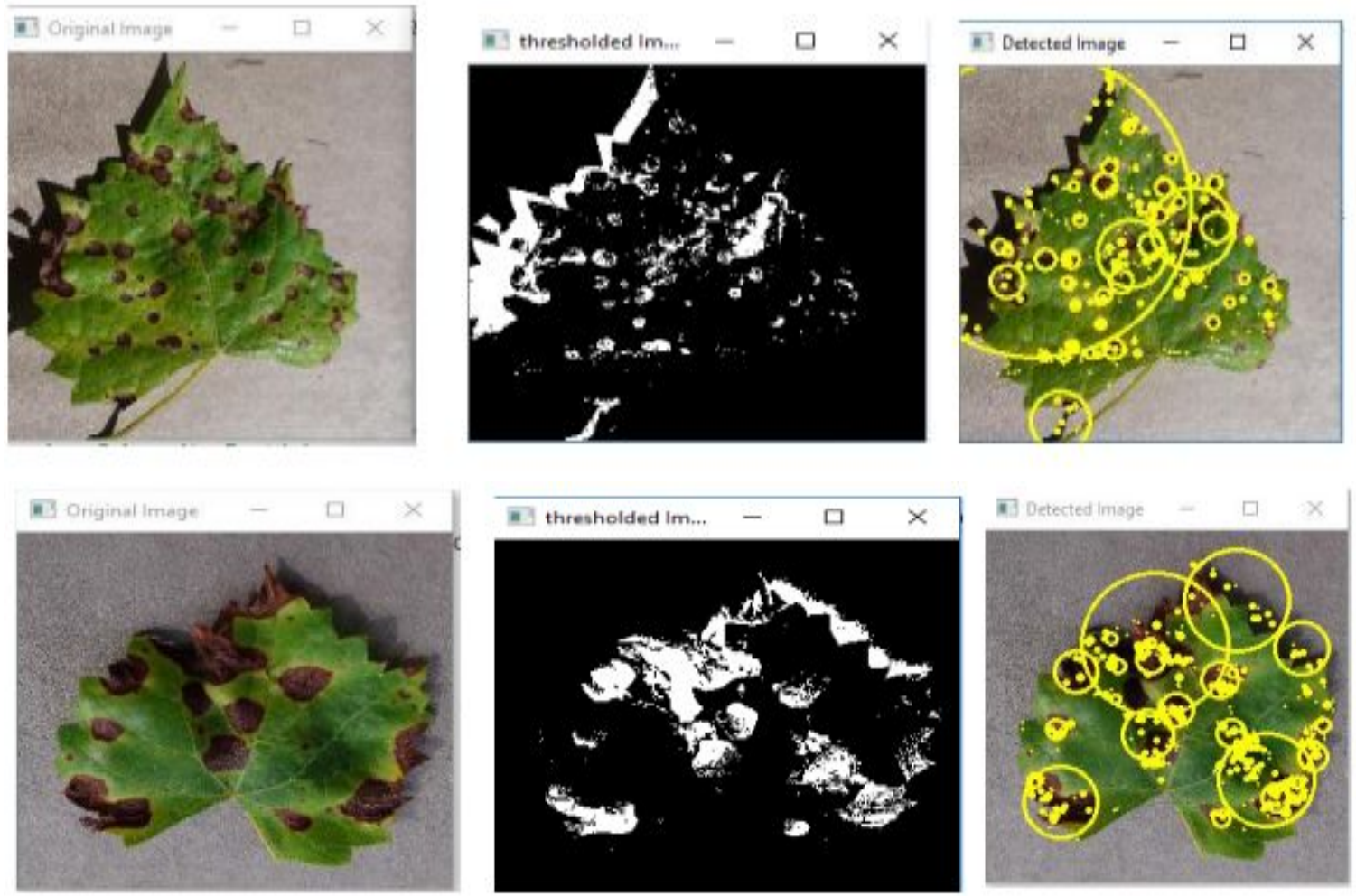
Single kernel & one stride

…System Implementation Cont'd

Pooling

Results obtained

Detection



Result Obtained

Classification

Epochs	Train accuracy	Validation accuracy	Final test accuracy	Time elapsed	No of images
10	39.0%	30.0%	28.0%	1 hour & 38 Minutes	2561
50	70.0%	58.0%	63.6%	1 hour & 49 Minutes	2561
100	75.0%	65.0%	66.4%	1 hours & 54 Minutes	2959
500	82.0%	79.0%	80.4%	2 hours & 12 Minutes	2959
1000	95.0%	92.0%	84.3%	2 hours & 19 Minutes	2959
4000	99.0%	98.0%	96.6%	2 hours & 37 Minutes	2959
10000	99.0%	98.5%	97.47%	3 hours & 12 Minutes	2959

Test results on a class of image at different epochs

Epochs	Images	Actual class	Predictions
1,000		Corn (maize) Common Rust	**corn maize common rust 0.59504163** tomato leaf mold 0.06860768 corn maize northern leaf blight 0.067366146 tomato late blight 0.049814064 pepper bell bacterial spot 0.04395321
4,000		Corn (maize) Common Rust	**corn maize common rust 0.8788823** tomato leaf mold 0.03518347 tomato late blight 0.021420592 corn maize northern leaf blight 0.016385792 pepper bell bacterial spot 0.012960793
10,000		Corn (maize) Common Rust	**corn maize common rust 0.9514657** tomato leaf mold 0.016784368 tomato late blight 0.010004069 corn maize northern leaf blight 0.00549567 pepper bell bacterial spot 0.0045275846

Conclusion

- The synopsis is, accuracy increases as the number of training step and number of image increases.
- Generally, using deep neural network image classifier, one can produce a quality and fruitful agricultural product.

Future work and recommendations

- Making our application android based.

- Adding features like preventive and treatment mechanisms to our application.

Thank you
for
your time!!!

We're waiting
for
your **QUESTIONS**!!!