

# Chapter 10

## Image Pre-Processing and Paddy Pests Detection Using Tensorflow

**Rahul Sharma**

*Lovely Professional University, India*

**Amar Singh**

*Lovely Professional University, India*

### **ABSTRACT**

*Agriculture is one of the important sources of earning worldwide. With the rapid expansion of the human population and food security for all, the agriculture sector needs to be boosted to increase the yield. Agriculture is the prime source of livelihood in India for more than 50% of the total population. As per Indian agriculture and allied industries industry report, agriculture is one of the major contributors in gross value. Agricultural crops suffer heavy losses due to insect damage and plant diseases. Worldwide, out of the crop losses, major losses are caused by plant pests. In this chapter, various image pre-processing methods and the need of pre-preprocessing are discussed in detail. For image classification, TensorFlow deep neural network is presented. Deep learning model is used for automatic and early detection of paddy pests. Early detection of the pests will aid farmers in adopting necessary preventive measures. Multiple ways to reduce overfitting during model training are also suggested.*

### **INTRODUCTION**

Computer vision has evolved over the years. Today with the availability of smartphones, tablets, etc raw digital lot of digital data is available. Different computer vision techniques can be used to extract hidden data patterns (O'Mahony et al., 2019) by processing images using machine learning techniques to draw meaningful information. Machine learning is being used for automating manual processes thereby increasing productivity.

DOI: 10.4018/978-1-7998-7188-0.ch010

Real-world images are collected using different types of devices having different device settings. So images collected from different sources may have a lot of variations. Image properties like resolution, aspect ratio, orientation, intensity level, contrast, sharpness, etc variations in the collected dataset must be handled properly before applying any machine learning algorithms (Sharma et al., 2020). No matter how good a machine learning model architecture is designed, it will not learn anything useful if the training data is invalid. A model trained on invalid data will give invalid results. Serious flaws in the data should be properly dealt with before starting the training phase of a machine learning model. The unwanted or invalid data can be disposed of during preprocessing.

## **IMAGE VARIATIONS AND PRE-PROCESSING METHODS**

The image classification system must take into consideration the following variations in the images:

**Viewpoint Variation:** A single instance of an object can be photographed or viewed in many ways with different camera positions (Chu et al., 2019). The image of an object captured in different angles must be labeled to the same class.

**Scale Variation:** Images can have different sizes. During pre-processing, the images are resized for uniformity.

**Deformation:** Many objects of interest are not rigid bodies and can be deformed. Deformed object images must be labeled correctly.

**Occlusion:** The objects of interest can be hidden behind another type of object in the image and only a small portion of an object is visible.

**Illumination Conditions:** The effects of illumination are drastic on the pixel level. Image classification algorithm must be able to handle changes in illumination.

**Background Clutter:** When the object of interest and background of the image is similar. The objects of interest may blend into the background. This makes the image classification task hard.

**Intra-Class Variation:** When objects belonging to one category or class have variations. For example plant leaf images belonging to one type of disease has variation in symptoms.

Images acquired from different devices are not directly provided as input to a machine learning algorithm, instead, images are pre-processed to enhance the image dataset. Pre-processing involves noise reduction, brightness, and contrast enhancements. Thus the aim of image pre-processing is to remove noise or unwanted data and enhance the image features, the consistent physical geometry of the image, image resizing, image augmentation, etc (Elgendi et al., 2021). A consistent and enhanced image dataset will improve the accuracy of the model. Different image pre-processing techniques to enhance the pictorial information for interpretation and analysis are

1. **Resize Image:** Images captured from different devices may vary in size. Before inputting images to a machine learning algorithm, base size is defined for all the images. All the acquired images are resized accordingly.
2. **Uniform Aspect Ratio**
3. **Noise Removal by Image Filters:** Filter those images so that the noise present in the image can be removed and to enhance certain characteristics of the image like contrast enhancement. Acquired images may be blurred either due to the cammer's settings or the lens not properly focused. The other kind of blurred image maybe because of clicking the picture from a moving platform (mov-

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