Chapter 13

Image Segmentation for Feature Extraction: A Study on Disease Diagnosis in Agricultural Plants

C. Deisy
Thiagarajar College of Engineering, India

Mercelin Francis
Thiagarajar College of Engineering, India

ABSTRACT

This chapter explores the prevailing segmentation methods to extract the target object features, in the field of plant pathology for disease diagnosis. The digital images of different plant leaves are taken for analysis as most of the disease symptoms are visible on leaves apart from other vital parts. Among the different phases of processing a digital image, the substantive focus of the study concentrates mainly on the methodology or algorithms deployed on image acquisition, preprocessing, segmentation, and feature extraction. The chapter collects the existing literature survey related to disease diagnosis methods in agricultural plants and prominently highlights the performance of each algorithm by comparing with its counterparts. The main aim is to provide an insight of creativeness to the researchers and experts to develop a less expensive, accurate, fast and an instant system for the timely detection of plant disease, so that appropriate remedial measures can be taken.

INTRODUCTION

Agriculture plays a major role in the existence of life. India is one of the largest producers in the world globe, depending mainly on agriculture of various crops. It is the second largest producer of rice, wheat, sugarcane, cotton, oilseeds, fruits & vegetables throughout the world. India holds the second largest agricultural land in the world, about 157.35 million hectares as of June 2017. Out of which a large area of the whole land is used for cultivating rice (Agriculture, 2017).

DOI: 10.4018/978-1-5225-5775-3.ch013
Different types of crops are produced in a land area based on the climate, soil, etc. Crops can be categorized as Kharif (rice, maize, cotton, etc.), Rabi (wheat, potato, tomato, etc.) and Zaid (cucumber, bitter gourd, etc.) based on the different seasons. Based on usage, crops can be categorized into 4 namely- Food crops (wheat, maize, rice, etc.), Cash crops (sugarcane, cotton, etc.), plantation crops (coconut, rubber, etc.) and Horticulture crops (fruits and vegetables). In India, the highest producer of rice, wheat, cotton, coffee, and spices is West Bengal, Uttar Pradesh, Gujarat, Karnataka, Kerala respectively. Major producers of different crops in Tamilnadu are rice, cotton, sugarcane, tea, and coffee. In Tamilnadu, the per-hectare yield of sugarcane is high when compared to its other major producers (Crops in India, 2016).

The mainstream of our population is farmers, who play a primary role in India’s economic system. Poor farmers may possess small area of land for agriculture and they rely on other off-farm income for their survival. Current generation, after foreseeing the growing challenges in farming, the researchers and the practitioners together with the extension workers and farmers, were successful in incorporating Information and Communication Technology (ICT) tools for agriculture to improve its yield and thereby facilitating the future farming. ICT plays a vital role in exchange or sharing of knowledge between the extension workers and farmers in a more convenient way, with limited time, via Web portals, call centres (mobile or telephone), etc. TNAU AGRITECH portal is one of the ICT enabled agricultural initiative in Tamilnadu for agro-advisory services. Similarly, a large number of ICT projects are developed in national (Farmers Call centre, KVK, etc.) and international level (JavaRosa, CropLife, etc.) (Saravanan, 2012).

NEED FOR DISEASE DIAGNOSIS IN AGRICULTURAL PLANTS

Though, India has positioned one among the top countries in producing food cereals, farmers are still struggling for their livelihood. This may be due to several reasons like- less yield, unaware about the current market value, etc. Fewer yields may be due to many factors, in which, the most prominent one is the occurrence of disease in crops. Disease in crops reduces the products quality and quantity; thereby makes the farmers poorer and poor. Consequently, it affects our economy also.

Disease can be defined as any abnormality found in plants based on its appearance or function suspending its growth. Plant diseases can be categorized into 2- Biotic and Abiotic diseases. The causal agents are called pathogens. Disease affected plants are caused by pathogens namely fungi, bacteria and virus, depreciating the major functions of the plant viz. photosynthesis, transpiration, etc. A water-soaked tiny pale green spot which later gets enlarged and appear as dry dead spots can be identified as a symptom for bacterial infection. Symptoms found for viral diseases are wrinkling and curling up of the leaves followed with stop in growth. These diseases are difficult to diagnose as the same symptoms can be caused due to nutrient deficiencies and herbicide injury. Table 1 shows the various visual symptoms of occurrence various types of pathogens, its mode of transmission and lists some diseases caused by each pathogen. Amount of damage caused may vary depending on the type of pathogen and its combinations infected. The virulence of infection depends on the susceptibility of the variety, timing of infection, insects, and environmental conditions. Therefore early diagnosis of disease is necessary for increasing the productivity, quality of the food.

In recent decades wheat blast is one of the most fearsome and intractable wheat diseases caused by the fungus Magnaporthe oryzae. Recently, wheat blast menace entered India through Bengal-Bangladesh border. The fungus entered Asia, in 2016, for the first time creating havoc in Bangladesh where crops of over 20,000 hectares in six districts had to be burnt. Once infected there is no way to cure rather than
Related Content

A Randomized Framework for Estimating Image Saliency Through Sparse Signal Reconstruction
Kui Fu and Jia Li (2018). *International Journal of Multimedia Data Engineering and Management* (pp. 1-20).
[www.igi-global.com/article/a-randomized-framework-for-estimating-image-saliency-through-sparse-signal-reconstruction/201913?camid=4v1a](www.igi-global.com/article/a-randomized-framework-for-estimating-image-saliency-through-sparse-signal-reconstruction/201913?camid=4v1a)

Building Tag-Aware Groups for Music High-Order Ranking and Topic Discovery
[www.igi-global.com/article/building-tag-aware-groups-music/45752?camid=4v1a](www.igi-global.com/article/building-tag-aware-groups-music/45752?camid=4v1a)

Toward LessonCapture: A New Approach to Screencasting and Lecture Capture
[www.igi-global.com/chapter/toward-lessoncapture-new-approach-screencasting/75415?camid=4v1a](www.igi-global.com/chapter/toward-lessoncapture-new-approach-screencasting/75415?camid=4v1a)

Semi-Supervised Multimodal Fusion Model for Social Event Detection on Web Image Collections
Zhenguo Yang, Qing Li, Zheng Lu, Yun Ma, Zhiguo Gong, Haiwei Pan and Yangbin Chen (2015). *International Journal of Multimedia Data Engineering and Management* (pp. 1-22).
[www.igi-global.com/article/semi-supervised-multimodal-fusion-model-for-social-event-detection-on-web-image-collections/135514?camid=4v1a](www.igi-global.com/article/semi-supervised-multimodal-fusion-model-for-social-event-detection-on-web-image-collections/135514?camid=4v1a)