



A FAST METHOD TO DIAGNOSING CITRUS GREENING FOR USE IN WARNING AND ALERT SYSTEMS

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Abstract

Citrus greening or Huanglongbing (HLB), become one of the most devastating disease in the worldwide citrus orchards. Multispectral imaging technique is used to classify diseased and healthy citrus trees in this study. Multispectral images were acquired by five discrete bands multispectral imaging camera embedded in an unmanned aerial system. Support vector machine was used to classify the samples using generated features including 10 vegetation indices and 5 bands. A total of 25 trees, 15 infected and 10 healthy trees were chosen by expert scouting as samples to train, validate and analysis of classifier. The overall classification results in the check samples was obtained 79.60 % for SVM model. Therefore, it demonstrated that multispectral imagery has the great potential to be used for detection of HLB infected trees in citrus orchards.

Keywords: Huanglongbing, Multispectral, Support vector machine, Vegetation indices, Band registration

1. Introduction

Nowadays, quality and quantity of agricultural products are vital due to population increase, economic situation, and instability in production due to weather conditions [1]. Therefore, crops health monitoring plays an important role in controlling and increasing their fertility and harvest. Moreover, supervising techniques of crops conditions in precise agriculture are essential for production improvement and amount prediction of crop. In addition, prediction of effecting problems on crops such as spreads of pests or diseases should be considered at the proper time before the harm is happened. Therefore, evaluation of crops biophysical and biochemical parameters such as chlorophyll and nitrogen are good indicator to estimate crops production, stress situation and amount of access to nutrients [2].

Utilization of remote sensing non-destructive methods feasible acquisition of crops biophysical

and biochemical and supervision modeling of their status as growth and health. These methods are based on optical features and radiometric behavior of crops. Hyperspectral, multispectral, thermal and visible-near infrared data acquired by space born, airborne and ground-based platforms are widely used as remote sensing techniques in agricultural applications [3-6]. These techniques combine spatial and spectral information of the target that acquired by imaging and conventional spectroscopy techniques. Compared to ground-based spectroscopy that relies on spot measurement, space-borne and airborne spectroscopy (hyperspectral and multispectral) information has more advantages by inspecting whole trees or orchards at a time [7].

In recent decades, airborne platforms, especially unmanned aerial vehicles (UAS) has emerged and provided greatest opportunities to many different industries specially in agricultural applications such as crop growth monitoring, yield estimation, nutrients optimization, water management, environmental and economic impacts evaluation, stress, pest and disease detection [5, 8-11].

This paper evaluates the potential of unmanned aerial systems (UASs) for citrus greening detection using multispectral imagery. For the purpose, Citrus Greening is shortly introduced and its symptoms are reviewed. Then proposed methods and materials are extendedly discussed and results are presented and analyzed to inspect the successfulness of methods in Citrus Greening detection.

1.1. Citrus Greening or Hunbglongbing

Citrus greening or huanglongbing (HLB) is one of the most common destructive diseases which has attracted wide attention of citrus industries [13]. Fastidious gram-negative bacteria cause HLB, which has three species: *Candidatus Liberibacter asiaticus* (Las), *Candidatus Liberibacter americanus* (Lam) and *Candidatus Liberibacter africanus* (Laf). Bacterium associated with HLB can be spread by grafting citrus to citrus or by *Trioza erytreae* and *Diaphorina citri* psyllid vectors [14]. HLB infected

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