CITRUS ADVANCED TECHNOLOGY PROGRAM

QUARTERLY & FINAL REPORTS: Control of Citrus Greening, Canker & Emerging Diseases of Citrus

▶ INSTRUCTIONS

(●) *Quarterly Report* ( ) *Annual Report* ( ) *Final*

Required: What is the "headline" for this report (e.g. a one-sentence "newspaper headline" describing what you accomplished)

Automatic gain control and three classification results

Proposal Title

Sensing system for symptomatic citrus greening infected leaves using polarized light

Today's Date	Sponsoring Organization (drop-down)	Category (drop down)
7/15/12	Citrus Research and Development Foundation	Pathogen/Disease Detection

REPORT UPDATE (500 words; summarize your accomplishments)

We found that the camera's automatic gain control (AGC) function is designed to maintain image's intensity and contrast consistently regardless of the illumination conditions and this function would prevent us from identifying the effect of starch accumulation in the images. In order to resolve this problem, a two-step calibration was performed using the background pixel values. At the first step, all the images in each specific illumination and filter direction situation were calibrated separately. Also the actual background's reflectance in each situation was measured using a portable spectrophotometer and the ratios between them were used for the second step of the calibration. Using this approach the effect of AGC was cancelled and the real reflectance measurement was calculated.

Using the image acquisition system, two datasets each including both healthy and HLB infected leaves were created. A 4-class (healthy leaf, healthy vein, HLB leaf and HLB vein classes) training set of 25 healthy samples and 25 HLB samples were selected from one of the datasets. Analyzing the histogram of this training dataset showed that the healthy leaf and HLB leaf classes could be distinguished in the images captured with 591 nm illumination and perpendicular filters. In addition, the healthy vein class is very similar to the healthy leaf class, and the HLB vein class is very similar to the HLB leaf class. This can mean that although healthy vein has a color similar to HLB leaf and vein, however healthy vein has different pixel value in 591 nm with perpendicular filters because there is no starch accumulation in healthy veins. Both datasets were classified using this training set and a linear classifier. The classifier was able to identify the HLB samples with 100% accuracy, but it also misclassified 28% of healthy samples of the first dataset and 36% healthy samples of the second dataset in the HLB class. This might be due to either the classification error or the healthy samples actually being infected by the disease.

Furthermore, a dataset containing 4 classes of different kinds of yellow leaves (HLB, young leaves, zinc deficient and unknown symptoms) plus a healthy class as the control class was created to find out the difference between HLB yellowish symptoms and yellowish symptoms with other reasons. The analysis of variance (ANOVA) results showed that all five classes were significantly different.

In order to find the effect of starch on polarized light, the absorbance of four levels of starch solutions plus pure water were measured using the spectrophotometer and in three conditions: no filter, parallel filters and perpendicular filters. The results showed that the absorbance increases as the starch concentration increases in the solution. However the Min/Max ratio (the ratio between absorbance data using perpendicular filters to parallel filters) didn't show any reasonable results.

PI First Name Won Suk

PI Last Name Lee

Email wslee@ufl.edu

Phone 352-392-1864 Ext. 227

Organization University of Florida

Contract Number 11-124-423

Project Duration (years) 1 *Year of Project* 2

Total Funds (current year) $55,500.00

SUBMIT REPORT

CITRUS RESEARCH AND DEVELOPMENT FOUNDATION, INC.