

MASTER'S THESIS

A transputer-based image analysis sytem for the analysis of leaf consumption by insect herbivores and leafminers

Kwok, Kam Cheung

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**A TRANSPUTER-BASED IMAGE ANALYSIS SYSTEM
FOR
THE ANALYSIS OF LEAF CONSUMPTION
BY
INSECT HERBIVORES AND LEAFMINERS**

KAM-CHEUNG KWOK

**A thesis submitted in partial fulfillment of the requirements of Postgraduate Studies
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A Transputer-Based Image Analysis System
for
the Analysis of Leaf Consumption by Insect Herbivores and Leafminers

by

KAM-CHEUNG KWOK

Abstract

A transputer-based image analysis system has been set up which automatically measures the leaf area and leaf consumption by insect herbivores and leafminers. Besides, some of the algorithms are implemented in parallel by image parallelism and processor farms parallelism models in a transputer network to improve the performance of the whole system. The main components of the system are a leaf area measurement module, a leaf consumption by insects module and a leaf tunnel analysis module. With the help of image enhancement, segmentation and image analysis techniques, the leaf area measurement module measures the leaf area automatically in a few seconds. In order to ensure the accuracy of the result, regression analysis is employed. The leaf consumption by insects module mainly reconstructs the boundary of defoliated margins of the leaf consumed by leaf insect herbivores and calculates the percentage of leaf consumed by them. To remove noise from the image, a parallel median filter is developed. After extracting the boundary of a leaf, the computer automatically searches the position of the defoliated margins from the curvature of the boundary. Based on the boundary data points on the left and right hand sides of a defoliated margin, the defoliated leaf boundary is reconstructed in parallel by the method of least squares. Then, the percentage of leaf consumed by insect herbivores can be found. The last module, the leaf tunnel analysis module, extracts the leaf tunnels from the leaf and calculates the leaf consumption. In order to extract the leaf tunnels created by leafminers, segmentation process is applied twice. Then, parallel thinning algorithm extracts the skeleton of the leaf tunnel. Afterwards, the midrib of the leaf is obtained and removed by a classification rule to prevent it from being classified as a leaf tunnel. Following this, a criteria function is employed to connect the broken leaf tunnels due to midrib deletion and segmentation process. Another classification rule is set up to recognize the leaf tunnels by parallel object recognition procedure. At the same time, the area, length and width of leaf tunnels are also measured. Therefore, the percentage of leaf consumed by leafminer can be calculated.

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