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Plant Biometric Estimation Using 3D Models

IP Status: Pending US Patent; **Application #:** 16/296,856

Using 2D images to estimate crop biometrics

This technology is a new device and method for autonomously estimating a variety of crop biometrics using ordinary, two-dimensional images of the field. First, the system creates a three-dimensional (3D) model of the crop using images captured by an unmanned vehicle. Next, the locations and orientations of leaves and stems of individual plants are autonomously defined by the system. Using this information, the system can estimate crop biometrics, including:

- Plant Height
- Leaf Length
- Leaf Area Index
- Leaf Count
- Angles of Leaves-Stem
- Internodal Distance

Monitor crop growth status and health without destruction

Early detection of crop deficiencies, and periodic evaluation of the status of growth is critical for managing healthy crops and maximizing the yield. Plant biometrics information is routinely used for assessing crop health and growth status. However, obtaining this information often requires destruction of the crops being analyzed. On the other hand, nondestructive techniques tend to be labor intensive and lack resolution and accuracy. Alternatively, detailed 3D models of the crops created using high-resolution images obtained from an unmanned vehicle can be used. Recently, researchers at the University of Minnesota have developed a system to autonomously construct a detailed 3D model of the crops using ordinary, RGB images. The system is also capable of processing the 3D model to estimate a variety of useful plant biometric data, made readily available to the farmers. This new biometrics detection method helps farmers better understand the needs of not only the entire farm, but also of individual plants. Such high accuracy biometrics data enables farmers to quickly identify nutrition requirements and steer potential treatment decisions directed towards a small area to an entire farm.

Phase of Development

- Proof of Concept.

Benefits

- Low-cost, mobile and easily deployable
- Improve yield and profit by closely monitoring growth status
- Detect nutritional deficiencies early and plan potential treatment strategies
- Non-destructive alternative to existing cumbersome biometric estimation methodologies
- Autonomous estimation of biometrics reduces manual labor

Features

Technology ID
20180266

Category
Engineering & Physical Sciences/Instrumentation, Sensors & Controls
Engineering & Physical Sciences/Robotics
Software & IT/Algorithms
Software & IT/Image & Signal Processing
Agriculture & Veterinary/Ag Biotechnology

View online

- Autonomously estimates 6 different crop biometrics
- Estimations are done using detailed 3D models - more accurate than 2D models
- Unmanned vehicle equipped with imaging device and crop modeling device
- Robust, computationally efficient Self-Organized Map (SOM) algorithm

Applications

- Crop biometrics
- Precision agriculture
- Agricultural automation

Researchers

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Publications

Combining Machine Learning with Computer Vision for Precision Agriculture Applications

University of Minnesota Ph.D. dissertation. April 2018

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