Development of new biofuel crops requires automated data collection

Sorghum, a cereal crop, is a promising biofuel candidate. The advancement of new genetic strains of sorghum requires massive plant data collection, a time-intensive and costly manual task. This motivates the development of an automated phenotyping system, able to gather data points on individual plants and plots. While research exists in vision-based crop phenotyping, much of the current work relies on greenhouse conditions or aerial field views.\(^1\)

The Robotanist is our custom ground robot designed for in-row field navigation and equipped with a manipulator and eye-in-hand stereo camera. This research works toward the detection of sorghum stalks in field conditions, with the eventual goal of obtaining information such as stalk diameter and strength.

Methods:
We implemented a geometry-based stalk detection algorithm in ROS and OpenCV, tested on field data using a DUO MLX low-resolution, infrared stereo camera. Rectified images were run through a processing pipeline similar to the one shown above.

Results:
We present a successful but limited approximation of stalk location in messy field data. Geometry-based processing in two domains, depth and intensity, allows for a quick stalk-finding at ~10Hz. However, there are many limitations in this geometry-based detection, especially in the case of vertical leaves.

Future Work:
As the Robotanist project gains access to a mass of real field sorghum field data, a particularly interesting new avenue of investigation will be using larger data sets to serve as the training data for new stalk detection algorithms which incorporate modern Machine Learning techniques.

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Work Referenced: