Precision Sustainable Agriculture

USDA ARS Agricultural Research Service

NC STATE UNIVERSITY

A low-cost and open-source camera system to detect drought in Soybean and Corn automatically.

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Abstract and Research Objective

Some plants, like corn and soybeans, show in their leaves the presence of abiotic stress and it is possible to determine the rate of drought with only a visual inspection. Taking a technological advantage of this aspect, we have been developed a low cost computer vision system that takes time lapse images in the field and processes them to determine whether or not there is drought.

Figure 1. Cameras installed in Corn and Soybean.

OBJECTIVE: Develop a computer vision system to determine the rate of drought on corn and soybean plantations.

Methodology

Treatments with different kind of cameras: RGB , IR, WAL, Stereo cameras. Different kind of inclination and position over the crops.

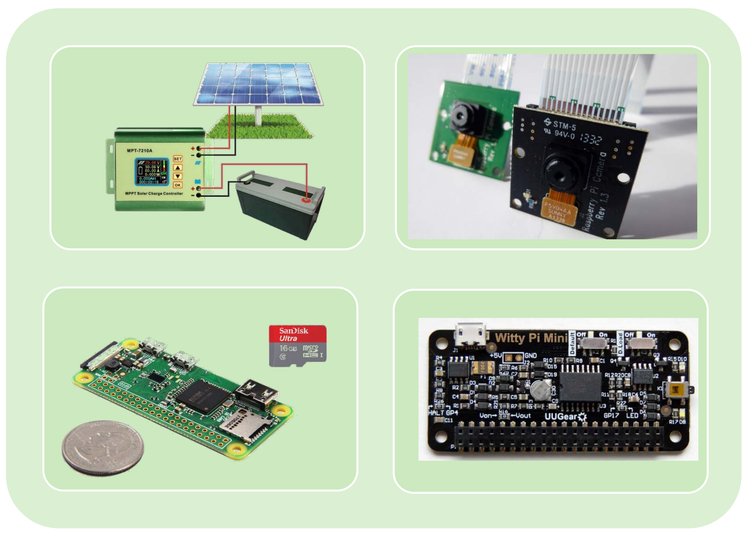

Figure 2. Power Requirements, Camera, Acquire and process, Turn on/off Automatically.

Figure 3. Cameras mounted in the field. Left: Pole camera in corn plot. Middle: Set of cameras tested in the field. Right: Pole camera in soybean

Results

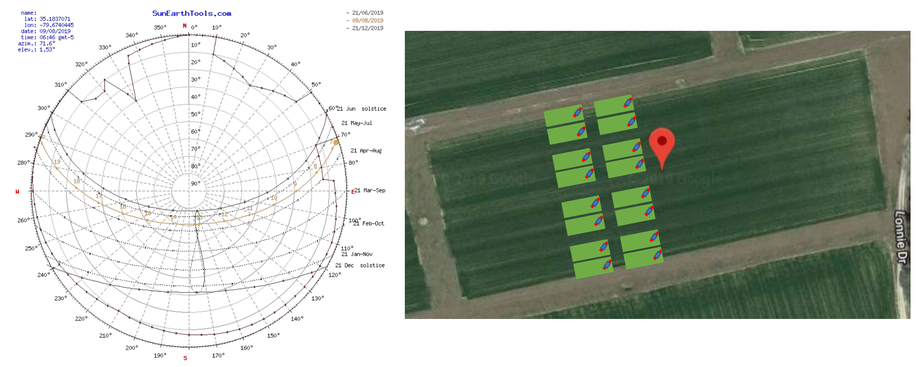

Figure 3. Analysis sun light intensity and sun orientation.

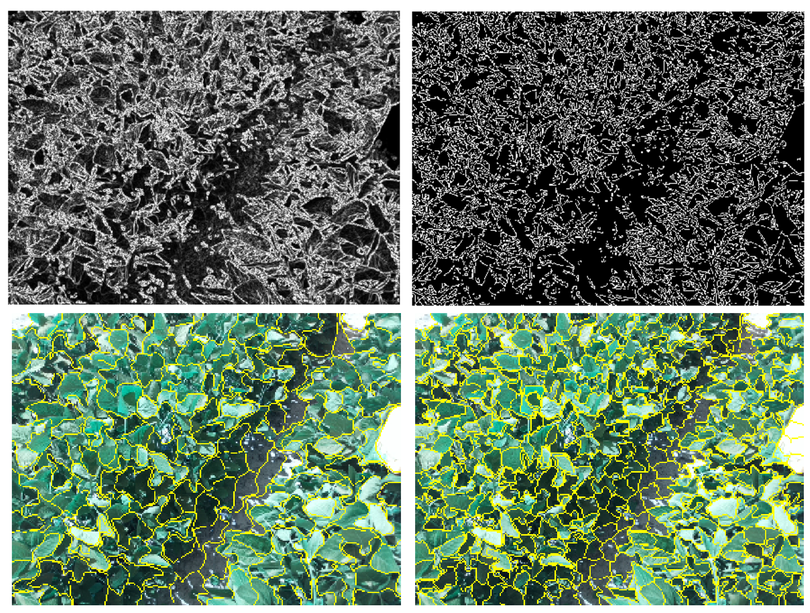

Figure 4. Big Challenge is to process over different lighting conditions resulting into different amounts of shadows and occlusion.

Conclusions

Figure 5. Time Lapse Images. Drought appear in some images during the day.

- Segment the images by means of semantic segmentation, classify the different types of leaves in the images: upwards, downwards, sideways, shaded, over-lit, occluded, rotated.
- Achieving pre-processing adjustments by means of sensors measuring solar radiation and orientation of the sun, to eliminate the most critical problems of the images.
- So far we have created a dataset of more than 20000 images, with related data of canopy temperature, short and long wave radiation, hour and date.