Detecting Irrigated Field from Remotely Sensed Images

Jenny Wood, Leiqiu Hu, Ph.D. & Cameron Handyside,
National Space Science and Technology Center
Department of Atmospheric Science

Overview

- Problems: Currently, detecting irrigated field relies heavily on visual analysis which can be time consuming and tedious. In addition, spectral signatures of irrigated and unirrigated land are very similar in Alabama.

- Goal: Enhance the computer-based detection of irrigated acreage in Alabama by using high-spatial resolution airborne images**.

- Focus area: Limestone County, Alabama

- Implemented techniques: supervised classification and image enhancements

Fig. 2 (right) shows the false color combination of Limestone County with irrigation pivots categorized by level of difficulty to identify.

Methods/Key Findings

- Four categories of irrigated samples were chosen based on key features of the pivots.

Fig. 3(a) (top left) shows high contrast pivots, identifiable by the difference between the pivot’s area and the surrounding land cover. Fig. 3(b) (top right) shows a track circle pivot, recognizable by the patterns left by the irrigation arm’s track. Fig. 3(c) (bottom left) shows a boom pivot, identifiable by the presence of the irrigation arm, or boom. Fig. 3(d) (bottom right) shows a midpoint pivot, recognizable by the small white area at the pivot’s center.

- Supervised classifications were performed on the ten high contrast images from years 2006-2017.

Fig. 4(a) (left) shows a 2017 high contrast pivot in real color combination with an outline of a ground truth pivot. Fig. 4(b) (middle) shows the supervised classification of the image. Using area threshold to improve the detection, Fig. 4(c) (right) illustrates the image as vector data with irrigated field highlighted in yellow.

- Image enhancement techniques were also tested on the different types of pivots to detect line edges and pivot centers.

Fig. 5(a) (left) shows the original image. Fig. 5(b) (right) shows the pivot after applying a high pass filter and a Laplacian filter for edge detection. After converting the image to binary, the pivot’s edges, the boom, and the boom’s circular patterns were more identifiable.

Discussion/Conclusions

- Spectral signatures of each supervised class were averaged together and graphed for comparison.

Fig. 6 (left) is the graph of the mean DN (reflectance) values. The Avg_irrigated_soybeans data was from 2006 which only provided 3 band information.

- While it illustrates that the spectral signatures of unirrigated and irrigated classes were similar, it also exemplifies that irrigated crops typically have higher absorption than those of the same unirrigated crops.

- Area calculations from past surveys were used as ground truth data to compare with the area calculated from the supervised classifications to assess the study’s accuracy.

Fig. 7 (left) is the graph of the area calculated from past irrigation surveys compared to the area calculated from the supervised classifications.

- From the results, it was concluded that while the experiment’s calculations were overestimated, they were still fairly close in value.

- Perhaps with further implementation of other enhancement techniques, even more accurate results could be obtained.

Acknowledgements

Thank you to UAH and the RCEU staff for support during this opportunity. Thank you to sponsors UAH Office of the Provost, UAH Office of the Vice President for Research and Economic Development and the Alabama Space Grant Consortium. Jenny Wood also acknowledges Leiqiu Hu, Ph.D. and Cameron Handyside for their suggestions and guidance throughout this project.