Automatic Extraction of Small Spatial Plots from Geo-Registered UAS Imagery

Keith Cherkauer and Anthony Hearst

Argicultural and Biological Engineering, Purdue University, West Lafayette, IN, United States (cherkaue@purdue.edu)

Accurate extraction of spatial plots from high-resolution imagery acquired by Unmanned Aircraft Systems (UAS), is a prerequisite for accurate assessment of experimental plots in many geoscience fields. If the imagery is correctly geo-registered, then it may be possible to accurately extract plots from the imagery based on their map coordinates. To test this approach, a UAS was used to acquire visual imagery of 5 ha of soybean fields containing 6.0 m2 plots in a complex planting scheme. Sixteen artificial targets were setup in the fields before flights and different spatial configurations of 0 to 6 targets were used as Ground Control Points (GCPs) for geo-registration, resulting in a total of 175 geo-registered image mosaics with a broad range of geo-registration accuracies. Geo-registration accuracy was quantified based on the horizontal Root Mean Squared Error (RMSE) of targets used as checkpoints. Twenty test plots were extracted from the geo-registered imagery. Plot extraction accuracy was quantified based on the percentage of the desired plot area that was extracted. It was found that using 4 GCPs along the perimeter of the field minimized the horizontal RMSE and enabled a plot extraction accuracy of at least 70%, with a mean plot extraction accuracy of 92%. The methods developed are suitable for work in many fields where replicates across time and space are necessary to quantify variability.