Building Height Using the UAS DJI Phantom 3 and Drone2Map Software

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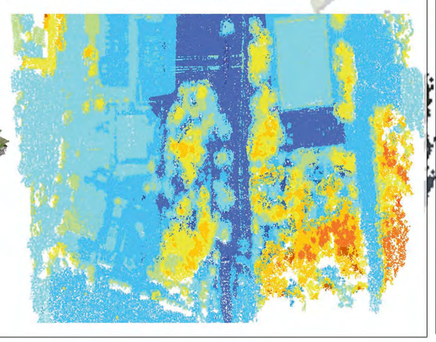
Introduction

At Stephen F. Austin State University, the Arthur Temple College of Forestry and Agriculture has invested in the most current drone technology in order to keep up with the new trends in Geographic Information System (GIS). Students and faculty can fly the drone and get up to date images of the area. When it comes to analyzing data and creating maps, all measurements must be extremely accurate in order for the map to be reliable. With this in mind, the objective of this project is to determine if the height measurements from DJI Phantom 3 drone are as accurate as the real-world measurements.

Method

Thirty measurements were taken from a DJI Phantom 3 of various objects, and buildings, in and around the Jim and Beth Children's Garden located in Nacogdoches, Texas. Once these measurements of the area were taken, they were then uploaded and created into an ArcGIS 10.3 LAS dataset. Once the LAS dataset is created, the 30 objects were analyzed, and measured in ArcScene and ArcMap LAS profile view. With these 30 points identified, the next step was to use 2013 Pictometry® at a resolution of 4 inches and measure the height of the objects in the CONNECTExplorer web interface. Once these measurements were completed in Pictometry®, the next measurements were taken with a telescoping measuring pole for the actual measured height. After collecting the measurements from ArcScene, ArcMap LAS profile view, Pictometry®, and the real-world measurements, measurements were then submitted to Dr. I-Kuai Hung to calculate the root mean square error (RMSE).



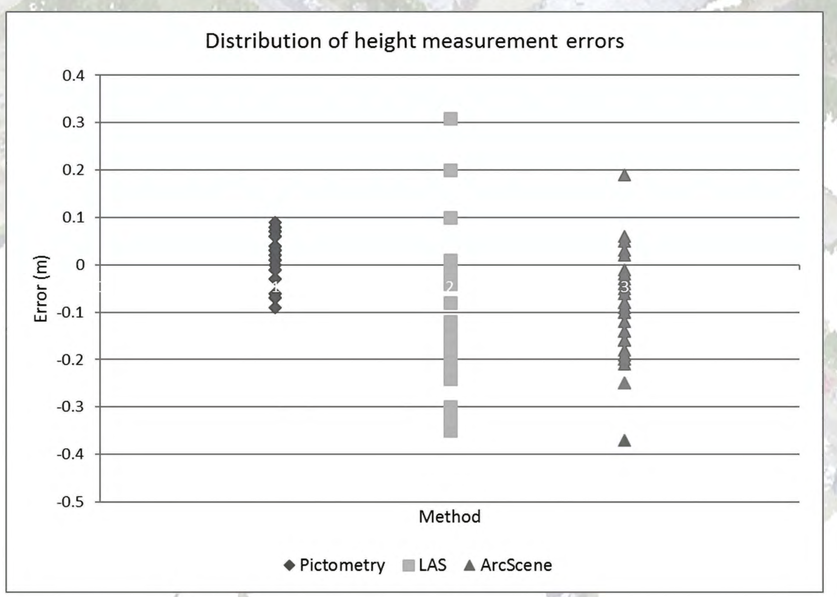
Results

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*	*Tukey*
Pictometry	30	1.38	**0.0460**	0.000756	**A**
LAS	30	5.08	**0.1693**	0.012413	**B**
ArcScene	30	3.74	**0.1247**	0.007315	**B**

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.233947	2	0.116973	17.13092	5.33E-07	3.101296
Within Groups	0.594053	87	0.006828			
Total	0.828	89				



Discussion

When looking at the results of the RMSE, the Pictometry measurements had a RMSE of 0.0534, the ArcScene measurements had a RMSE of 0.2017 and ArcMap measurements had a RMSE of 0.1504. After calculating the RMSE, an analysis of variance (ANOVA) was performed on the absolute errors of the height measurement at the significant level of 0.05. The results were that Pictometry had the lowest of 0.0460 meters, followed by ArcScene with 0.1247 m, and then last was the ArcMap LAS profile view with 0.1693 m. After the ANOVA was performed, a Tukey test confirmed that Pictometry was most accurate compared to the other measurements taken in the other programs. Also there was no significant difference between the ArcMap LAS profile view and ArcScene when looking at the real-world measurements vs pictometry. According to the data, Pictometry® was the most accurate out of the three, followed by measurements taken in ArcScene and lastly the ArcMap LAS profile view measurements. However, the measurements taken in ArcMap and ArcScene show the usefulness of this technique with an error of 0.12 m to 0.17 m at a height of 119 meters.

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