ABSTRACT

Xiong, Weifeng. M.S., Purdue University, December 2016. Feature-based approach for the registration of pushbroom imagery with existing orthophotos. Major Professor: Ayman F. Habib.

Low-cost Unmanned Airborne Vehicles (UAVs) are rapidly becoming a suitable platform for remote sensing data acquisition that can meet the needs of a wide range of applications. For example, a UAV-based mobile mapping system (MMS) is emerging as a novel phenotyping tool that delivers several advantages to alleviate the drawbacks of conventional manual plant trait measurements. Moreover, UAVs equipped with direct geo-referenced frame cameras and pushbroom scanners can acquire geospatial data for comprehensive high-throughput phenotyping. UAVs for mobile mapping platforms are low-cost and easy to use, can fly closer to the objects, and are filling an important gap between ground wheel-based and traditional manned-airborne platforms. However, consumer-grade UAVs are capable of carrying only equipment with a relatively light payload and their flying time is determined by a limited battery life. These restrictions of UAVs unfortunately force potential users to adopt lower-quality direct geo-referencing and imaging systems that may negatively impact the quality of the deliverables. Recent advances in sensor calibration and automated triangulation have made it feasible to obtain accurate mapping using low-cost camera systems equipped with consumer-grade GNSS/INS units. However, ortho-rectification of the data from a linear-array scanner is challenging for low-cost UAV systems, because the derived geo-location information from pushbroom sensors is quite sensitive to the performance of the implemented direct geo-referencing unit. This thesis presents a novel approach for improving the ortho-rectification of hyperspectral pushbroom scanner imagery with the aid of orthophotos generated from frame cameras through the identification of conjugate features while modeling the impact of residual artifacts

in the direct geo-referencing information. The experimental results qualitatively and quantitatively proved the feasibility of the proposed methodology in improving the geo-referencing accuracy of real datasets collected over an agricultural field.