Feature-based approach for the registration of push-broom imagery with existing orthophotos
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Low-cost Unmanned Airborne Vehicles (UAVs) equipped with imaging sensors provide geospatial data that are capable of meeting the needs of a wide range of applications. For example, UAV-based mobile mapping systems are emerging as a novel phenotyping tool that delivers several advantages to alleviate the drawbacks of conventional manual plant trait measurements. Moreover, UAVs which are equipped with directly geo-referenced frame cameras and push-broom scanners can acquire geo-spatial data for comprehensive high-throughput phenotyping. UAV-based mapping systems are low-cost, easy to store and deploy, and are capable of flying at lower elevation while collecting high resolution data. However, these systems have some drawbacks such as limited endurance and payload. These restrictions lead to the adoption of lower-quality direct geo-referencing and imaging systems, which in turn will negatively impact the quality of derived products. For example, the ortho-rectification of acquired images by push-broom scanners is quite sensitive to the quality of the onboard direct geo-referencing unit. In order to improve the geo-referencing information of push-broom scanners, this paper presents an approach for using generated orthophotos from frame cameras through the identification of conjugate point and linear features. More specifically, an orthophoto generated from frame camera images is used to improve the geometric quality of a partially-rectified push-broom orthophoto, which is contaminated by residual errors in the direct geo-referencing information. The feasibility of the proposed approach has been evaluated through real dataset comprised of images captured by an RGB frame camera onboard a quad-copter and hyperspectral images collected by a push-broom scanner from a fixed-wing platform.