Photogrammetric Accuracy and Modeling of Consumer Cameras

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SUMMARY

Unmanned aerial vehicles (UAVs) are becoming increasingly popular in professional mapping for stockpile analysis, construction site monitoring, and many other applications. Due to their robustness and competitive pricing, consumer UAVs are used more and more for these applications, but they are usually equipped with rolling shutter cameras. This is a significant obstacle when it comes to extracting high accuracy measurements using available photogrammetry software packages. In this paper, we evaluate the impact of the rolling shutter cameras of typical consumer UAVs on the accuracy of a 3D reconstruction. Hereto, we use a beta-version of the Pix4Dmapper 2.1 software to compare traditional (non rolling shutter) camera models against a newly implemented rolling shutter model with respect to both the accuracy of geo-referenced validation points and to the quality of the motion estimation. Multiple datasets have been acquired using popular quadro copters (DJI Phantom 2 Vision+, DJI Inspire 1 and 3DR Solo) following a gridf light plan. For comparison, we acquired a dataset using a professional mapping drone (senseFly eBee) equipped with a global shutter camera. The bundle block adjustment of each dataset shows a significant accuracy improvement on validation ground control points when applying the new rolling shutter camera model for flights at higher speed (8 m=s). Competitive accuracies can be obtained by using the rolling shutter model, although global shutter cameras are still superior. Furthermore, we are able to show that the speed of the drone (and its direction) can be solely estimated from the rolling shutter effect of the camera.