ADVANCED REMOTE SENSING

Assignment#2 UAV

ABSTRACT

Georeferencing of the Aerial images captured with drone camera and generation of DEM and orthomosaic from those images using Agisoft meta Professional software.

Submitted by:

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Aerial data processing (with GCPs) – Orthomosaic & DEM generation

Processing of aerial images with **Metashape Professional** includes the following main steps:

- loading images into Metashape;
- aligning photos;
- GCPs input as markers
- optimizing camera alignment
- building dense point cloud;
- building digital elevation model (DEM);
- building orthomosaic;
- export DEM, orthomosaic;

Align Photos:

At this stage Metashape estimates the camera position and orientation for each photo and generates a sparse point cloud consisting of the tie points. The result of this processing step consists of estimated exterior (translation and rotation) and interior camera orientation parameters together with a sparse point cloud containing triangulated positions of matched image points. In the align photos dialog box we select the desired alignment options and set accuracy to high.

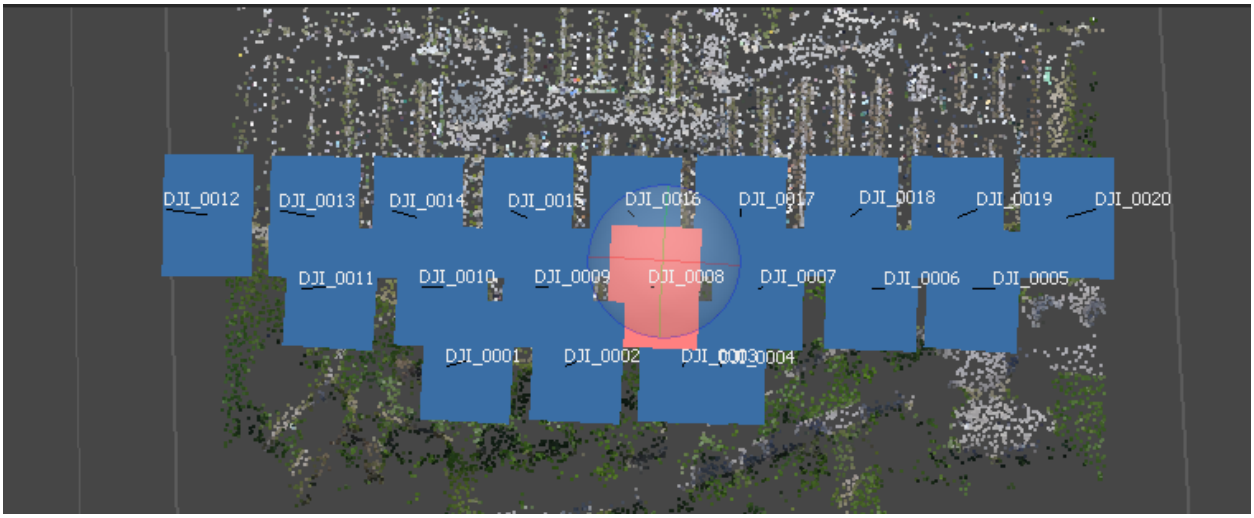

Figure 1 Computed camera positions and a sparse point cloud with 24,851 tie points

Image Quality:

Image quality Poor input, e. g. vague photos, can influence alignment results badly. Exclude poorly focused images from processing using automatic image quality estimation feature. Images with quality value of less than 0.5 units are recommended to be disabled and thus excluded from photogrammetric processing, providing that the rest of the photos cover the whole scene to be

reconstructed. After Image Quality Estimation all of the images showed high quality so none of them were excluded.

Delete the points:

The points that were generated outside the bounding box were deleted using free form selection and delete.

Figure 2 Tie Points outside the region in the point cloud

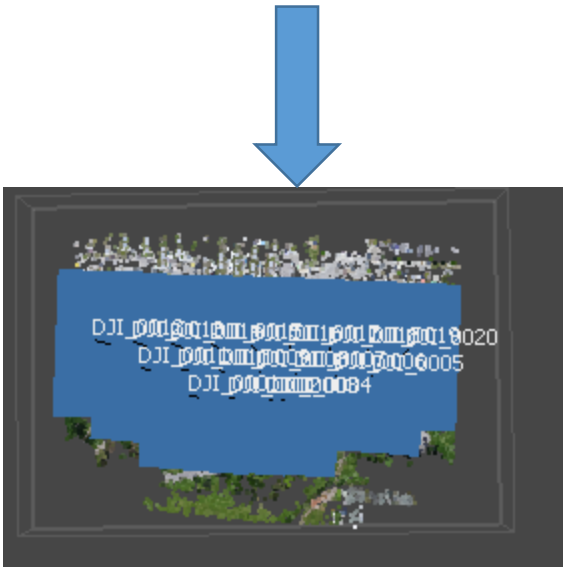

Figure 3 Points out of region deleted

Add Markers:

In this step we import the file with Ground Control Points (GCPs) and coordinates. Finding the exact location of the GSPs on the aligned images is the most important and tricky part which results in correct georeferencing of the images.

Figure 4 Sparse point cloud with image thumbnails and GCPs after Georeferencing

Optimize Camera Alignment parameters:

During this optimization Metashape adjusts estimated point coordinates and camera parameters minimizing the sum of reprojection error and reference coordinate misalignment error.

Dense Point Cloud:

Dense point cloud generation is based on depth maps calculated using dense stereo matching. Depth maps are calculated for the overlapping image pairs considering their relative exterior and interior orientation parameters estimated with bundle adjustment.

Figure 5 Dense Point Cloud generated at Medium Quality with 2,982,600

DEM:

A DEM represents a surface model as a regular grid of height values. DEM can be rasterized from a dense point cloud, a sparse point cloud, depth maps or a mesh. Most accurate results are calculated based on dense point cloud data. DEM is calculated for the part of the model within the bounding box.

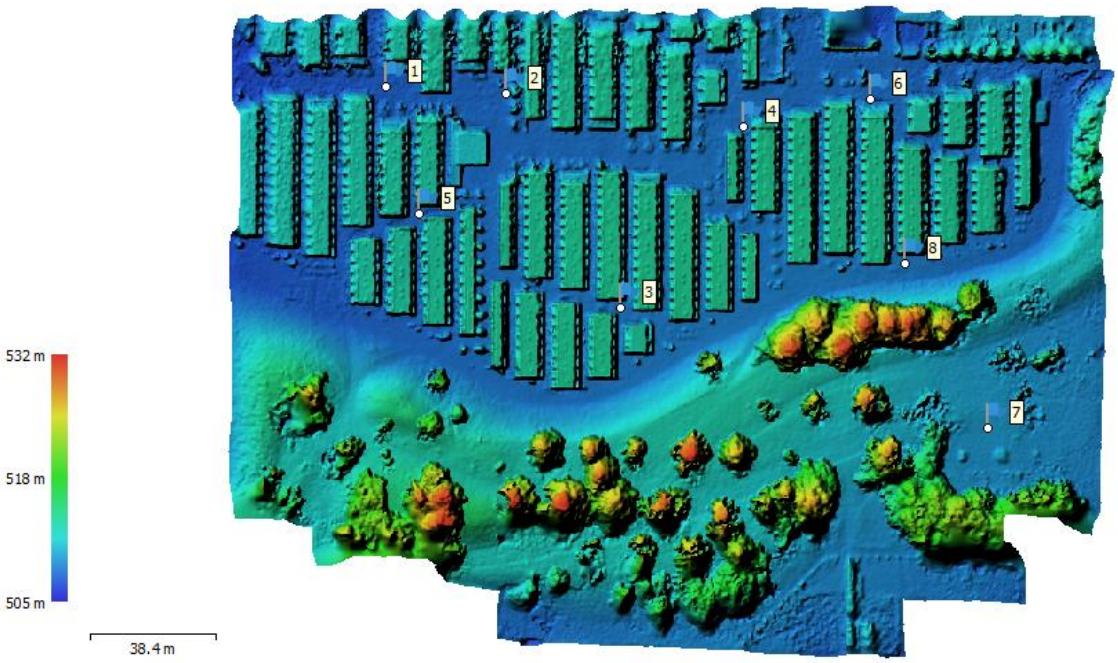

Figure 6 DEM rasterized based on dense point cloud

Orthomosaic:

Orthomosaic is generated based on aerial or satellite imagery. Orthomosaic is obtained by orthorectification of the original images.

Figure 7 Orthomosaic generated based on DEM

Positional Accuracy:

The positional accuracy of the generated DEM and orthomosaic can be validated by overlaying them on a basemap in a GIS environment. For this purpose, orthomosaic was overlayed on OpenStreetMap in QGIS. Visualization of the orthomosaic overlay shows that all the images were perfectly georeferenced to their location on ground based on GCPs.

Figure 8 Orthomosaic Overlayed on OpenStreetMap

The blue rectangle shows that the road feature on the basemap coincides with the road feature on the orthomosaic image which is an evidence for the positional accuracy of the generated orthomosaic and DEM based on GCPs.

Summary:

Digital Elevation Model and Orthomosaic were generated using aerial images taken with UAV. Aerial images are loaded into Agisoft Metashape professional software which is a software for photogrammetric data processing. After loading the photos in the software they are aligned using Align photos tool in the workflow tab as a result a sparse point cloud was generated. After that ground control points are imported into the workplace and the most important and tricky step is performed that is finding the exact position of GCPs in images and georeferencing them. Georeferencing is the process of taking a digital image and adding geographic information to the image so that GIS or mapping software can 'place' the image in its appropriate real world location. After georeferencing, the reference points were updated and camera alignment parameters were optimized. A dense point cloud is generated based on depth maps calculated using dense stereo matching. Based on dense point cloud DEM and orthomosaic of the images were generated and exported in tiff format.