Politecnico di Milano - Courses on Photogrammetry
Laboratory report

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Lab Topic:	Satellite Photogrammetry		

Description of the performed activity *(max 50 lines)*

1 **Satellite Photogrammetry Lab Workflow**
2 **Abstract**

3   This report delineates a comprehensive workflow for processing stereo-couple images, with a specific
4 emphasis on generating a 3D model of the Belvedere Glacier using Agisoft Metashape. The survey
5 incorporated two distinct cameras calibrated with Rational Polynomial Coefficients (RPC) and
6 encompassed a dataset spanning 3950 hectares at an altitude of 1490 meters. The document meticulously
7 details camera specifications, locations, orientations, ground control points, and the resulting Digital
8 Elevation Model (DEM).

9 **Camera Information**
10   Two cameras were calibrated using RPC, with distinct specifications. The first camera had a resolution
11 of 12346*12465 pixels, and the second had a resolution of 12130*12083 pixels.Camera locations were
12 plotted, indicating positions at varying distances. The average errors in X, Y, and Z were minimal, with
13 an overall total error of 1.32 nm. Camera orientations, including yaw, pitch, and roll errors, were
14 negligible.
15 **Ground Control Points**
16   Distribution of Ground Control Points (GCPs) and their error estimates were illustrated, showing high
17 accuracy with RMSE values for control points at 8.08 cm and check points at 58.61 cm.
18 **Digital Elevation Model (DEM)**
19   The reconstructed DEM exhibited a resolution of 1.04 m/pix, providing a detailed representation of the
20 surveyed area.
21 **Processing Parameters**
22   General processing parameters, including tie points, RMS reprojection error, and key point statistics,
23 were detailed. The alignment accuracy was set to "High," contributing to the overall precision of the
24 reconstruction.
25 **Tie Point Analysis**
26   Tie Point Analysis results include an RMS reprojection error of 0.092 and a Max reprojection error of
27 0.279.
28 **Photogrammetric Monitoring**
29   The document concludes with a detailed guide on photogrammetric monitoring, presenting steps for
30 creating masks, computing height and volume variations, finding points on orthophotos, and extracting 3D
31 coordinates. The methodologies demonstrated in this section provide a robust framework for assessing
32 changes in glacier morphology over time.
33 **Comparative Analysis**
34   The report provides a detailed comparison between the 2017 acquired satellite survey and a 2009
35 survey, evaluating the loss of ice volume over an 8-year span. Accuracy assessments for the DEM and
36 orthophoto are presented, demonstrating promising results from the optimization of camera parameters in
37 Metashape. The analyses between the 2009 and 2017 surveys revealed a significant volume loss:
38   - Volume: 27,617,647.91 cubic meters
39   - Pixel count: 1,853,483
40   - Area: 185 Hectare
41 **Accuracy Assessment**

42   The accuracy of the object coordinates imported from aerial photogrammetry is discussed, considering
43   an accuracy of 0.5/0.7. The report emphasizes the vertical and horizontal resolutions based on the relation
44   drawn from the drone survey and justifies the accuracy of 40 cm for the DEM and 50/70 cm for vertical
45   resolution.

46 **Conclusion**

47   Satellite image processing provides a comprehensive solution, specifically tailored for monitoring
48   the Belvedere Glacier. The accurate and detailed results obtained through Agisoft Metashape processing
49   lay the foundation for subsequent analyses and continuous monitoring of the Belvedere Glacier.

List of attachments