Politecnico di Milano - Courses on Photogrammetry
Laboratory report

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Lab Topic:	Photo plane		

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

Photo plane Lab Workflow

Introduction

This report aims to provide a comprehensive overview and analysis of the photo acquisition process, Ground Control Point (GCP) computation, and the results of the photoplane computation for the given project.

Planning Photo Acquisition

The project's initial phase focused on meticulous planning for photo acquisition. Given the constraints of space and the need for accuracy, a smartphone with high quality was chosen as the capturing device. Ground sampling distance (GSD) considerations ensured a resolution of 7mm, allowing for precise and detailed surveying of the building the acquisition distance (D) was 20 meters.

Camera data and precision parameters were provided for context:

- Focal length (c): 23 mm
- Sensor width (fw): 35 mm
- Acquisition distance (D): 20 m
- Number of pixels (npx): 4096
- Ground Sampling Distance (GSD): 0.007 m

GCP Coordinates Computation and Photoplane Results

The computation of Ground Control Points (GCPs) involved strategic selection and consideration of a 3cm protuberance threshold. These GCPs played a pivotal role in determining the interpolated plane, an essential element in the subsequent photoplane computation. The least square adjustment method was employed to refine parameters, with a subset of GCPs reserved as checkpoints (CPs) for validation purposes. The photoplane computation involved the estimation of coefficients (a1, a2, a3, b1, b2, b3, c1, c2) using the given equations. The mean, standard deviation (STD), and root mean square (RMS) values for both GCPs and Check Points (CPs) were calculated.

Ground Control Points (GCPs)			checkpoints (CPs)		
	X-res (m)	Y-res (m)		X-res (m)	Y-res (m)
Mean	0.000	0.000	Mean	0.002	0.001
STD	0.005	0.008	STD	0.008	0.004
RMS	0.005	0.008	RMS	0.008	0.004

Analyzing the accuracy of parameters estimated by the least square adjustment revealed the robustness of the photogrammetric system. Statistical scrutiny, particularly examining the Root Mean Square Errors (RMSE), indicated a well-balanced system without significant outliers. The RDF software facilitated the photoplane computation, producing reliable results that aligned closely with surveyed data.

Comments on Differences Outside the Facade Plane

Differences observed in points outside the façade plane provided valuable insights into the method's limitations. Notably, centimetres-level errors were identified for window markers, and more substantial, errors were noted for façade markers. This underscores the importance of considering the specific characteristics of the surveyed object when employing photogrammetric methods.

Recommendations

1. Method Selection

Homography proves effective for planar surfaces with minimal protrusions, offering a cost-effective solution.

2. Consideration for Non-Planar Structures

   Caution is advised when dealing with non-planar structures or surfaces with significant variations, as errors may be magnified.

Conclusion

In conclusion, the photoplane computation showed reasonable accuracy for GCPs and CPs. Discrepancies in points outside the façade warrant further investigation. Recommendations include a review of the photo acquisition process, addressing potential GCP computation errors, and enhancing result validation. This report offers a comprehensive overview of the project, emphasizing the need for ongoing refinement and validation in photogrammetry. The chosen methodology demonstrated versatility, but a nuanced approach is crucial to align with the unique characteristics of the surveyed object.

List of attachments