The practical Application of UAV-based Photogrammetry under economic Aspects

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Overview

1. Intro – practical applications and customer requirements
2. Processing of a test data set
3. Analysis and Discussion
4. Conclusions – Bottlenecks and Improvement

Practical Applications

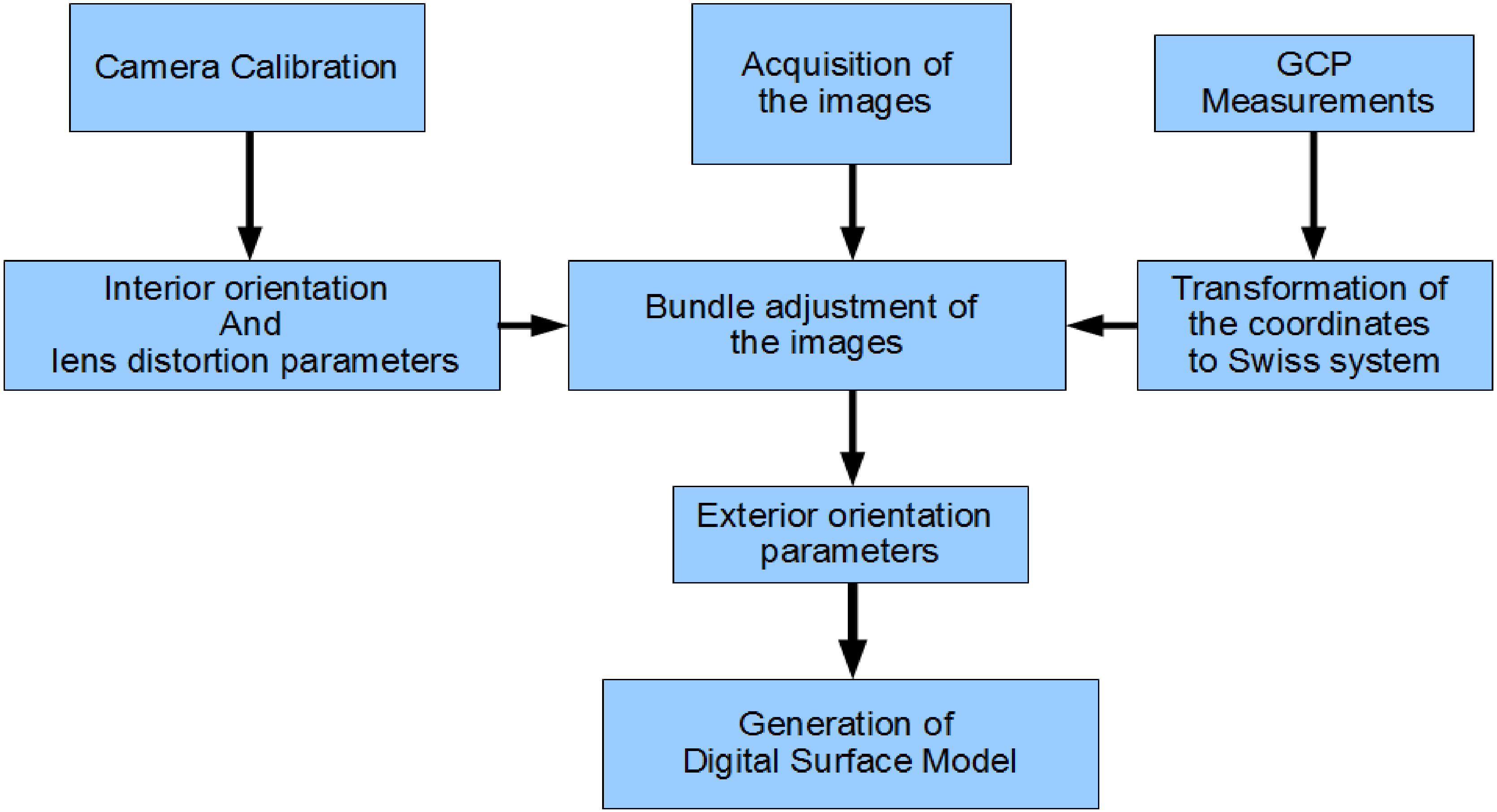
- Motivation of this investigation: UAV image processing as a service too expensive
- 3D volume calculations based on DTMs/DSMs
- Documentation (orthoimages)
- 3D object measurements (buildings, roads...)
- 3D City Modeling → 3DKataster Tool

Microdrones MD4-1000

Customer Requirements

- most important for surveyors: accuracy
- the customer: „I need it as accurate as possible!“
- Reality: Sometimes, 10cm, sometimes 2cm, sometimes 1m would be sufficient
- Accuracy ←→ Resolution, often misunderstood
- Depending on the application, it can be necessary to react within short time (organise and plan flights, fast processing)
- Data acquisition should not disturb the ongoing work

General Workflow

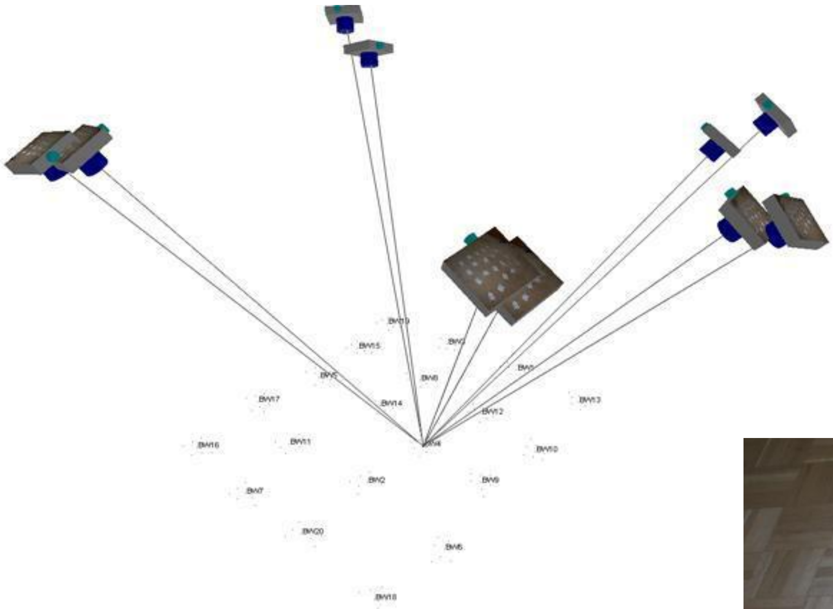


Premises

- Traditional photogrammetric block without oblique images
- Use of INS/GPS data from UAV as initial approximation of image orientation
- Accomplish the whole processing within 1 software and identify the bottlenecks
- Come up with a concept of how to overcome the weaknesses in the frame of our possibilities
- Reduction of human interaction is the key factor as much as possible

Camera Calibration

- **iWitness colour-coded targets**
- **Results imported to LPS (x, y of principal point, radial lens distortion values)**



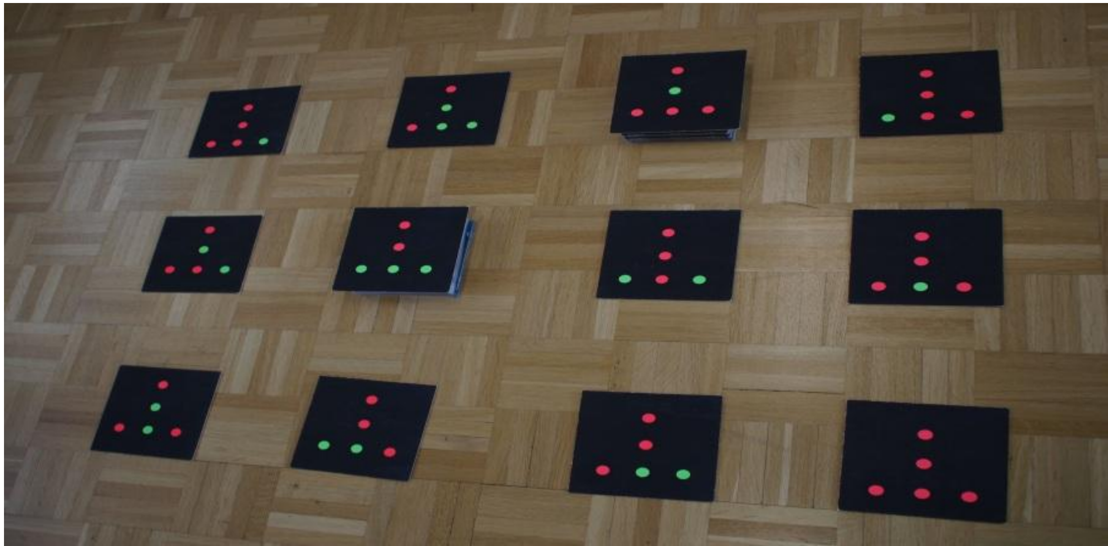


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Image Orientation

- **Block setup in LPS**
- **automatic tie point generation**
- **GCP measurement**
- **Total RMSE 0.6323 pixels**
- **RMSE in GCPs:**
  - X 0.04 m
  - Y 0.1 m
  - Z 0.04 m

DSM generation

- Software used: LPS eATE

- dense 3D point cloud by means of:

➢ hierarchical approach NCC

➢ Refinement using LSM

➢ Edge constraint applied

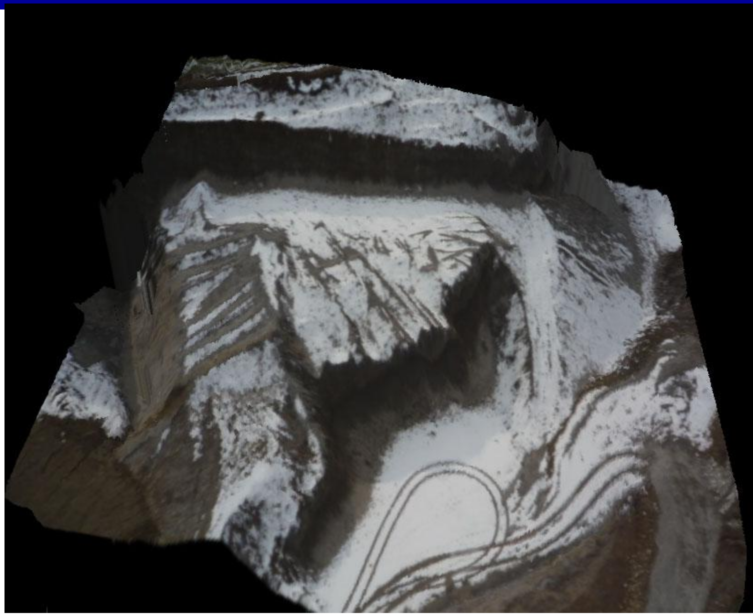
➢ Reverse matching with tolerance threshold

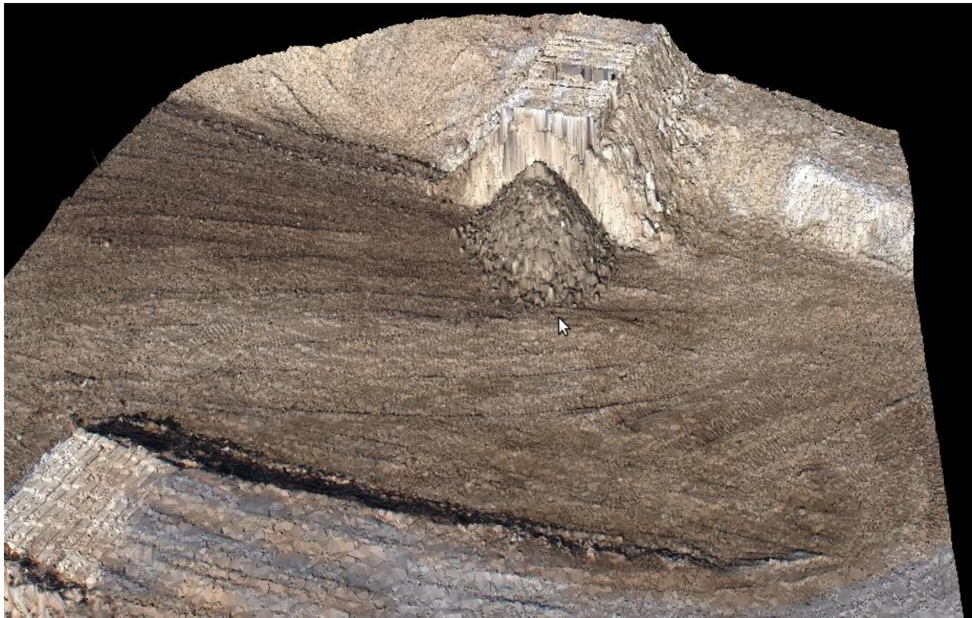
➢ Matching candidates filtered by means of PCA blunder detection

➢ Interpolation to raster

➢ Simultaneous matching for triplets

➢ long processing time, distributed computing possible

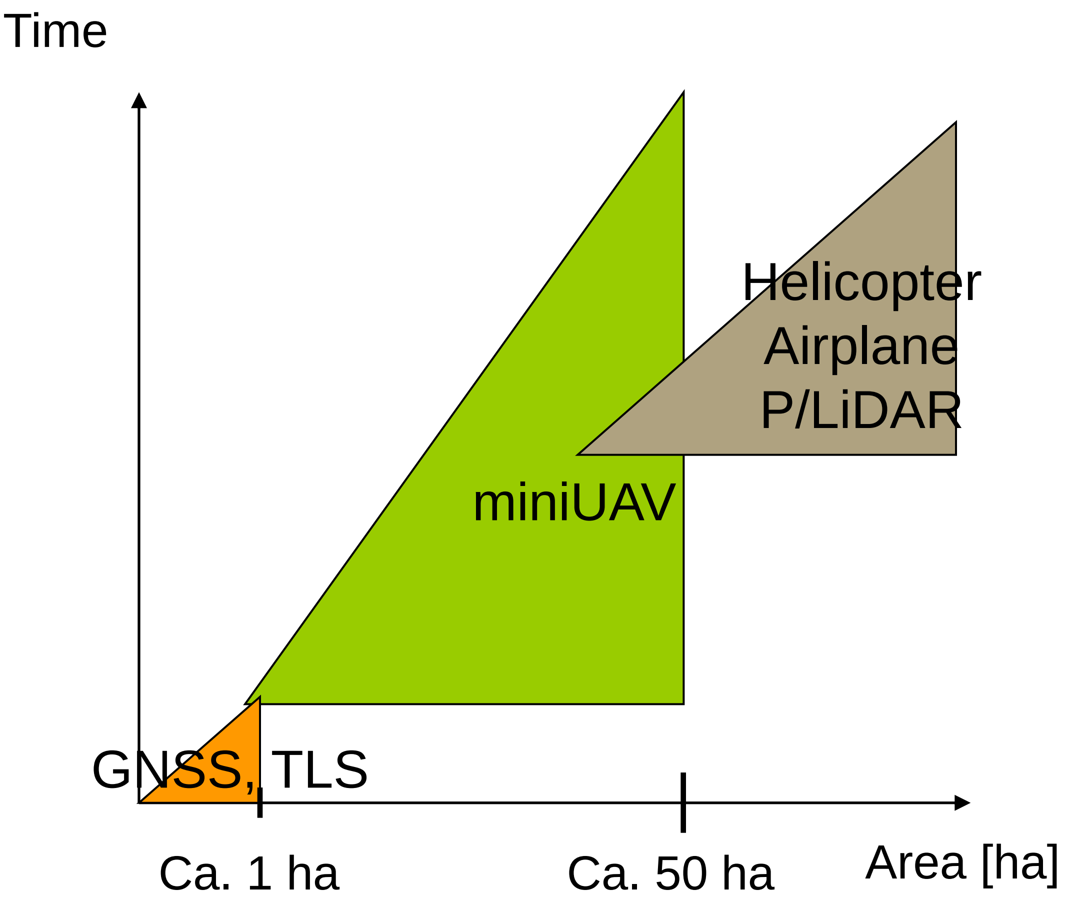




Analysis and Discussion

Step of the workflow	**Time effort in % of the total time required**
Flight Planning	4.1
Data Acquisition	33
Setup of the Project in LPS	2
Aerial Triangulation	11.4
DSM Generation	41.2
Orthoimage Generation	1.4
Mosaicking	6.9
Total	**100**

Time effort required for the wofkflow



Analysis and Discussion

Time effort required for Aerial Triangulation:

Step of Aerial Triangulation (AT)	**Time effort in % of the time required for AT**
Setup of matching parameters for tie point measurement	3
Measurement of tie points	1
Quality control and editing of tie points	12
GCP measurement in images	12
Bundle adjustment	36
Analysis of the results	36
Total AT	**100**

Conclusions

- Identified tie point measurement and editing as a weak point
- Identified DSM editing as weak point
- How to improve these steps?
- Integrate external tools for reliable tie point generation
- Reduce processing time for DSM generation (distributed computing or the cloud), working on a practical solution

- Integrate an efficient flight planning tool into ERDAS VirtualGIS (master thesis for a geomatics student? → sauerbier@mfb-geo.com !!)

Thank you very much for your attention!

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