Quality Report



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Summary

Project	MilanBabicKonacno
Processed	2024-01-19 02:04:28
Camera Model Name(s)	FC6310_8.8_5472x3648 (RGB)(1), FC6310_8.8_5472x3648 (RGB)(2)
Average Ground Sampling Distance (GSD)	0.47 cm / 0.19 in
Area Covered	0.008 km ² / 0.7837 ha / 0.00 sq. mi. / 1.9375 acres

Quality Check

Images	median of 49727 keypoints per image	\bigcirc
② Dataset	387 out of 388 images calibrated (99%), all images enabled	\bigcirc
Camera Optimization	0.07% relative difference between initial and optimized internal camera parameters	\bigcirc
Matching	median of 18858.6 matches per calibrated image	0
Georeferencing	yes, 4 GCPs (4 3D), mean RMS error = 0.012 m	Δ



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 $\label{eq:Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.$

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Calibration Details

Number of Calibrated Images	387 out of 388
Number of Geolocated Images	386 out of 388

Initial Image Positions



Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions

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Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane). Red dots indicate disabled or uncalibrated images. Dark green ellipses indicate the absolute position uncertainty of the bundle block adjustment result.

?	Absolute	camera	position	and	orientation	uncertainties	
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X [m] Y [m] Z [m] Omega [degree] Phi [degree] Kappa [degree]	
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Mean	0.009	0.009	0.010	0.048	0.025	0.045
Sigma	0.003	0.003	0.003	0.061	0.004	0.026

Overlap



Number of overlapping images: 1 2 3 4 5+

Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.

Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint matches is also sufficient for these areas (see Figure 5 for keypoint matches).

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Bundle Block Adjustment Details

Number of 2D Keypoint Observations for Bundle Block Adjustment	6893209
Number of 3D Points for Bundle Block Adjustment	2748532
Mean Reprojection Error [pixels]	0.232

Internal Camera Parameters

FC6310_8.8_5472x3648 (RGB)(1). Sensor Dimensions: 12.833 [mm] x 8.556 [mm]

EXIF ID: FC6310_8.8_5472x3648

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	3668.759 [pixel] 8.604 [mm]	2736.001 [pixel] 6.417 [mm]	1823.999 [pixel] 4.278 [mm]	0.003	-0.008	0.008	-0.000	0.000
Optimized Values	3670.440 [pixel] 8.608 [mm]	2752.232 [pixel] 6.455 [mm]	1861.196 [pixel] 4.365 [mm]	0.003	-0.006	0.006	0.002	0.002
Uncertainties (Sigma)	0.369 [pixel] 0.001 [mm]	0.627 [pixel] 0.001 [mm]	0.608 [pixel] 0.001 [mm]	0.000	0.001	0.001	0.000	0.000



The correlation between camera internal parameters determined by the bundle adjustment. White indicates a full correlation between the parameters, ie. any change in one can be fully compensated by the other. Black indicates that the parameter is completely independent, and is not affected by other parameters.

The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

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Internal Camera Parameters

➡ FC6310_8.8_5472x3648 (RGB)(2). Sensor Dimensions: 12.833 [mm] x 8.556 [mm]

EXIF ID: FC6310_8.8_5472x3648

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	3668.759 [pixel] 8.604 [mm]	2736.001 [pixel] 6.417 [mm]	1823.999 [pixel] 4.278 [mm]	0.003	-0.008	0.008	-0.000	0.000
Optimized Values	3672.480 [pixel] 8.613 [mm]	2752.818 [pixel] 6.456 [mm]	1859.598 [pixel] 4.361 [mm]	0.003	-0.004	0.005	0.002	0.002
Uncertainties (Sigma)	0.636 [pixel] 0.001 [mm]	0.556 [pixel] 0.001 [mm]	0.626 [pixel] 0.001 [mm]	0.001	0.002	0.002	0.000	0.000



The correlation between camera internal parameters determined by the bundle adjustment. White indicates a full correlation between the parameters, ie. any change in one can be fully compensated by the other. Black indicates that the parameter is completely independent, and is not affected by other parameters.

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	49727	18859
Min	20027	245
Max	80597	35411
Mean	48592	17812

2D Keypoints Table for Camera FC6310_8.8_5472x3648 (RGB)(1)

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s per Image

2D Keypoints Table for Camera FC6310_8.8_5472x3648 (RGB)(2)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	63649	20429
Min	52009	10691
Max	80597	29935
Mean	64232	21246

Median / 75% / Maximal Number of Matches Between Camera Models

	FC6310_8.8_5(RGB)(1)	FC6310_8.8_5(RGB)(2)
FC6310_8.8_5472x3648 (RGB)(1)	19 / 150 / 20787	
FC6310_8.8_5472x3648 (RGB)(2)		141 / 561 / 14702

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	2104626
In 3 Images	363539
In 4 Images	128580
In 5 Images	60288
In 6 Images	32616
In 7 Images	18792
In 8 Images	11722
In 9 Images	7575
In 10 Images	5079
In 11 Images	3650
In 12 Images	2625
In 13 Images	2011
In 14 Images	1490
In 15 Images	1115
In 16 Images	871
In 17 Images	728
In 18 Images	593
In 19 Images	427
In 20 Images	377
In 21 Images	262
In 22 Images	256
In 23 Images	199
In 24 Images	153
In 25 Images	148
In 26 Images	117
In 27 Images	100
In 28 Images	69

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In 29 Images	68
In 30 Images	55
In 31 Images	49
In 32 Images	47
In 33 Images	49
In 34 Images	16
In 35 Images	31
In 36 Images	21
In 37 Images	27
In 38 Images	19
In 39 Images	16
In 40 Images	20
In 41 Images	12
In 42 Images	9
In 43 Images	14
In 44 Images	9
In 45 Images	11
In 46 Images	10
In 47 Images	7
In 48 Images	2
In 49 Images	1
In 50 Images	4
In 51 Images	4
In 52 Images	2
In 53 Images	4
In 54 Images	2
In 56 Images	4
In 57 Images	2
In 58 Images	1
In 59 Images	3
In 60 Images	1
In 61 Images	1
In 64 Images	1
In 72 Images	1
In 78 Images	1

2D Keypoint Matches



Number of matches

25 222 444 666 888 1111 1333 1555 1777 2000

Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty of the bundle block adjustment result.



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	X [m]	Y [m]	Z [m]	Omega [degree]	Phi [degree]	Kappa [degree]	
Mean	0.002	0.002	0.002	0.022	0.011	0.017	
Sigma	0.001	0.001	0.001	0.028	0.003	0.012	

② Manual Tie Points

MTP Name	Projection Error [pixel]	Verified/Marked
mtp1	1.026	85 / 85
mtp2	1.140	22 / 22
mtp3	0.882	42 / 42
mtp4	1.164	36 / 36
mtp5	0.744	7 / 7
mtp6	1.123	30 / 30
mtp7	0.205	4 / 4
mtp8	0.506	36 / 36
mtp9	0.236	3/3
mtp10	0.576	5 / 7
mtp11	0.779	6 / 9
mtp12	0.628	4 / 4
mtp13	0.572	4 / 4
mtp14	1.353	4 / 4
mtp15	1.025	7 / 7

Projection errors for manual tie points. The last column counts the number of images where the manual tie point has been automatically verified vs. manually marked.

Geolocation Details

③ Ground Control Points

GCP Name	Accuracy XY/Z [m]	Error X [m]	Error Y [m]	Error Z [m]	Projection Error [pixel]	Verified/Marked
mico1 (3D)	0.020/ 0.020	0.016	0.007	-0.010	0.499	87 / 87
mico2 (3D)	0.020/ 0.020	-0.008	-0.019	0.016	0.760	196 / 196
mico3 (3D)	0.020/ 0.020	-0.002	0.001	0.016	0.437	28 / 28
mico4 (3D)	0.020/ 0.020	-0.006	0.011	-0.022	0.953	114 / 114
Mean [m]		0.000011	0.000002	0.000001		
Sigma [m]		0.009545	0.011391	0.016747		
RMS Error [m]		0.009545	0.011391	0.016747		

Localisation accuracy per GCP and mean errors in the three coordinate directions. The last column counts the number of calibrated images where the GCP has been automatically verified vs. manually marked.

Participation Pariance Pariance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.00	0.00	0.00
-15.00	-12.00	0.00	0.00	13.51
-12.00	-9.00	0.00	0.00	13.51
-9.00	-6.00	0.00	0.00	0.00
-6.00	-3.00	0.00	0.00	0.00
-3.00	0.00	58.70	46.23	0.00
0.00	3.00	41.30	53.77	3.90
3.00	6.00	0.00	0.00	68.57
6.00	9.00	0.00	0.00	0.52
9.00	12.00	0.00	0.00	0.00
12.00	15.00	0.00	0.00	0.00
15.00	-	0.00	0.00	0.00
Mean [m]		2.491498	3.406885	-0.567841
Sigma [m]		0.289310	0.503881	7.318516
RMS Error [m]		2.508239	3.443945	7.340512

Min Error and Max Error represent geolocation error intervals between -1.5 and 1.5 times the maximum accuracy of all the images. Columns X, Y, Z show the percentage of images with geolocation errors within the predefined error intervals. The geolocation error is the difference between the initial and computed image positions. Note that the image geolocation errors do not correspond to the accuracy of the observed 3D points.

Geolocation Bias	Х	Y	Z
Translation [m]	2.491498	3.406885	-0.567841

Bias between image initial and computed geolocation given in output coordinate system.

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Relative Geolocation Variance

Relative Geolocation Error	Images X [%]	Images Y [%]	Images Z [%]
[-1.00, 1.00]	100.00	100.00	74.55
[-2.00, 2.00]	100.00	100.00	100.00
[-3.00, 3.00]	100.00	100.00	100.00
Mean of Geolocation Accuracy [m]	5.000000	5.000000	10.00000
Sigma of Geolocation Accuracy [m]	0.000000	0.000000	0.000000

Images X, Y, Z represent the percentage of images with a relative geolocation error in X, Y, Z.

Initial Processing Details

System Information

Hardware	CPU: AMD Ryzen 5 5600H with Radeon Graphics RAM: 14GB GPU: AMD Radeon(TM) Graphics (Driver: 27.20.14056.5)
Operating System	Windows 10 Home, 64-bit

Coordinate Systems

Image Coordinate System	WGS 84 (EGM 96 Geoid)	
Ground Control Point (GCP) Coordinate System	MGI 1901 / Balkans zone 6 (EGM 96 Geoid)	
Output Coordinate System	MGI 1901 / Balkans zone 6 (EGM 96 Geoid)	

Processing Options

Detected Template	No Template Available
Keypoints Image Scale	Full, Image Scale: 1
Advanced: Matching Image Pairs	Free Flight or Terrestrial
Advanced: Matching Strategy	Use Geometrically Verified Matching: no
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Automatic
Advanced: Calibration	Calibration Method: Standard Internal Parameters Optimization: All External Parameters Optimization: All Rematch: Auto, yes

Point Cloud Densification details

Processing Options

Image Scale	multiscale, 1/2 (Half image size, Default)
Point Density	Optimal

0



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Minimum Number of Matches	3
3D Textured Mesh Generation	yes
3D Textured Mesh Settings:	Resolution: Medium Resolution (default) Color Balancing: no
LOD	Generated: no
Advanced: 3D Textured Mesh Settings	Sample Density Divider: 1
Advanced: Image Groups	group1
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Time for Point Cloud Densification	02h:29m:30s
Time for Point Cloud Classification	NA
Time for 3D Textured Mesh Generation	16m:40s

Results

Number of Processed Clusters	4
Number of Generated Tiles	1
Number of 3D Densified Points	32250054
Average Density (per m ³)	92525.9