Quality Report

Generated with Pix4Denterprise version 4.3.31

Important: Click on the different icons for:

Help to analyze the results in the Quality Report

Additional information about the sections

Click here for additional tips to analyze the Quality Report

Summary

Project	stan_4k_2_re
Processed	2019-01-25 06:47:07
Camera Model Name(s)	RedEdge_5.5_1280x960 (Blue), RedEdge_5.5_1280x960 (Green), RedEdge_5.5_1280x960 (Red), RedEdge_5.5_1280x960 (NIR), RedEdge_5.5_1280x960 (Red edge)
Rig name(s)	«MicaSense 5 band»
Average Ground Sampling Distance (GSD)	8.79 cm / 3.46 in
Area Covered	0.597 km^2 / 59.7419 ha / 0.23 sq. mi. / 147.7017 acres
Time for Initial Processing (without report)	05h:25m:56s

Quality Check

Images	median of 7025 keypoints per image	⚠
Dataset	11430 out of 11495 images calibrated (99%), 5 images disabled	✓
Camera Optimization	1.23% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 1289.03 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

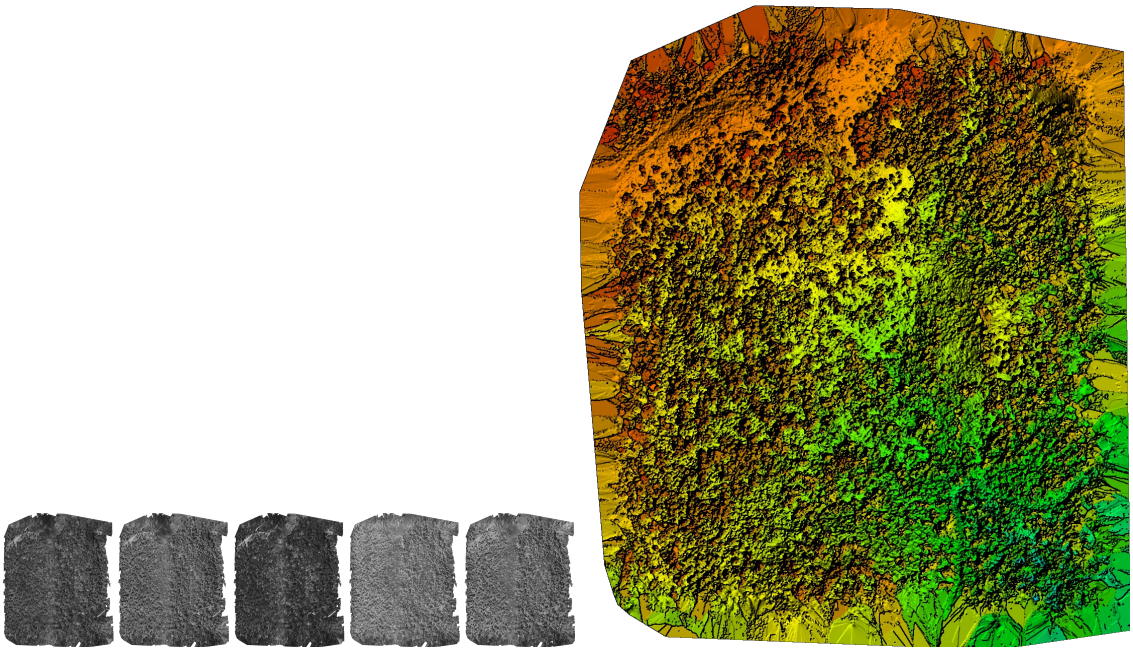


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	11430 out of 11500
Number of Geolocated Images	11500 out of 11500

Initial Image Positions

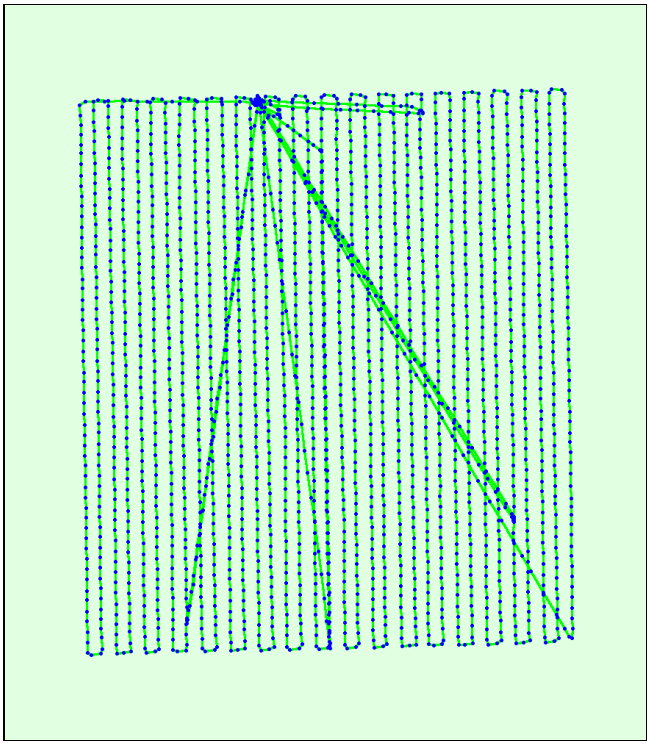
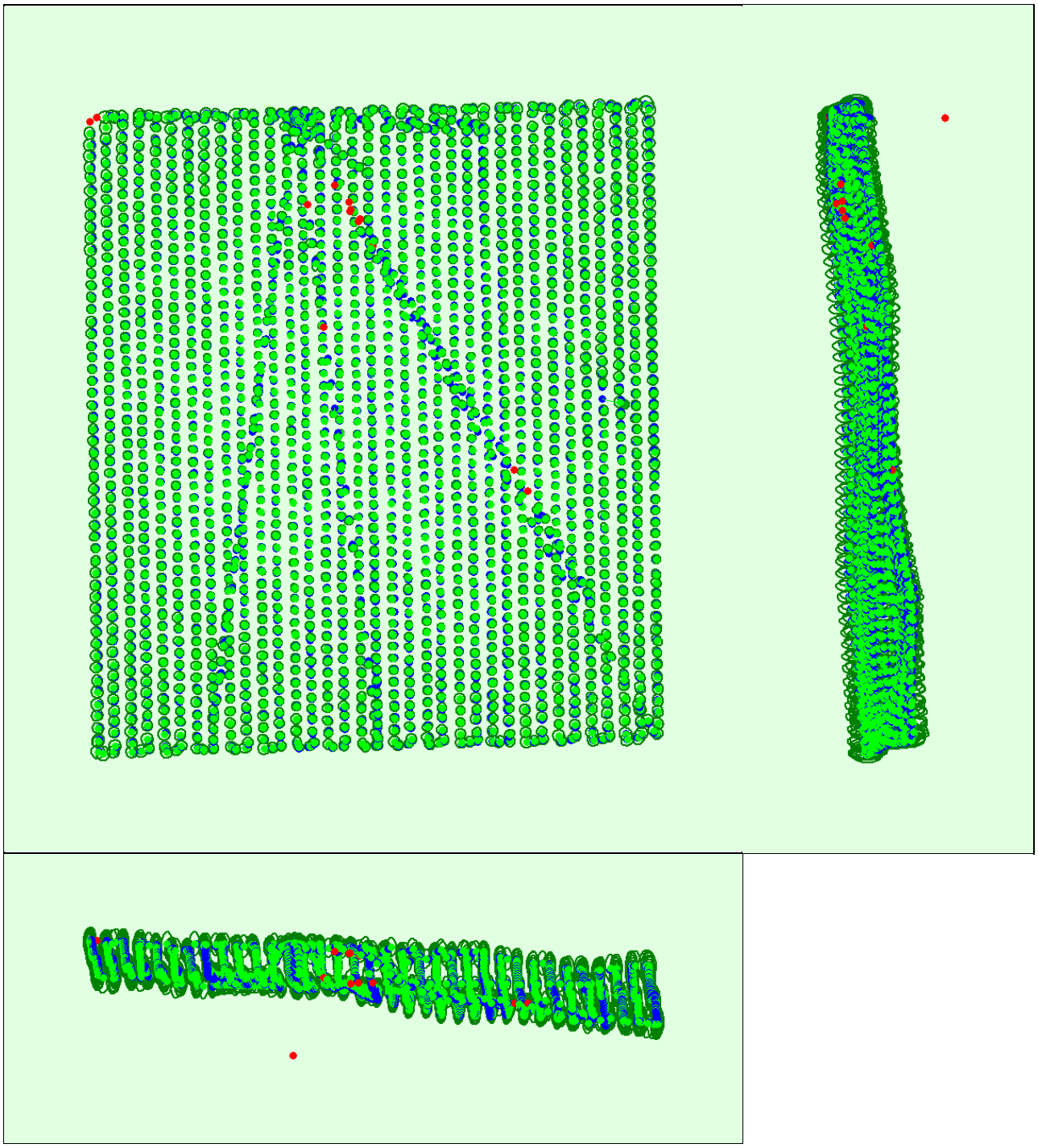


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions



Uncertainty ellipses 50x magnified

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

	X [m]	Y [m]	Z [m]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.090	0.091	0.192	0.042	0.045	0.017
Sigma	0.014	0.014	0.040	0.005	0.004	0.004

Overlap

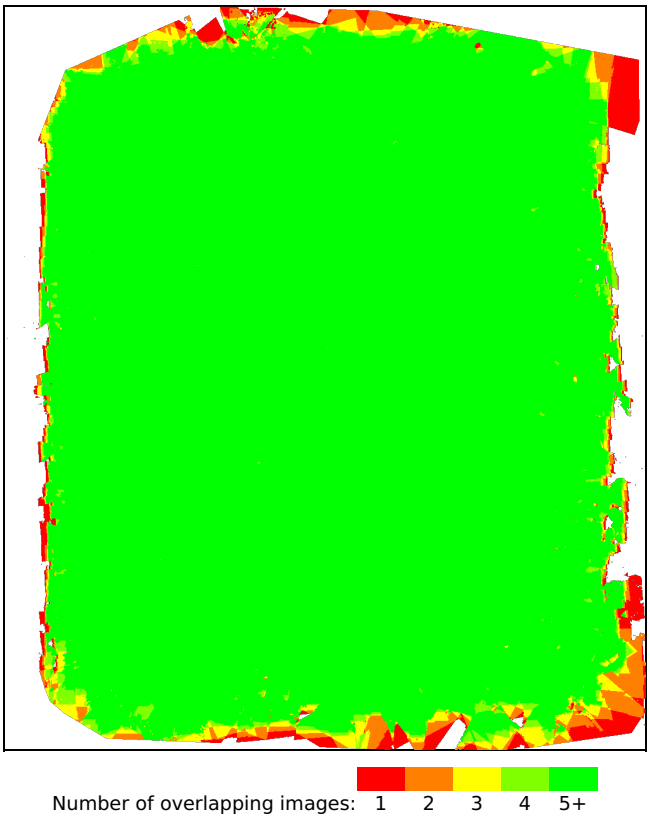


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint matches is also sufficient for these areas (see Figure 5 for keypoint matches).

Bundle Block Adjustment Details

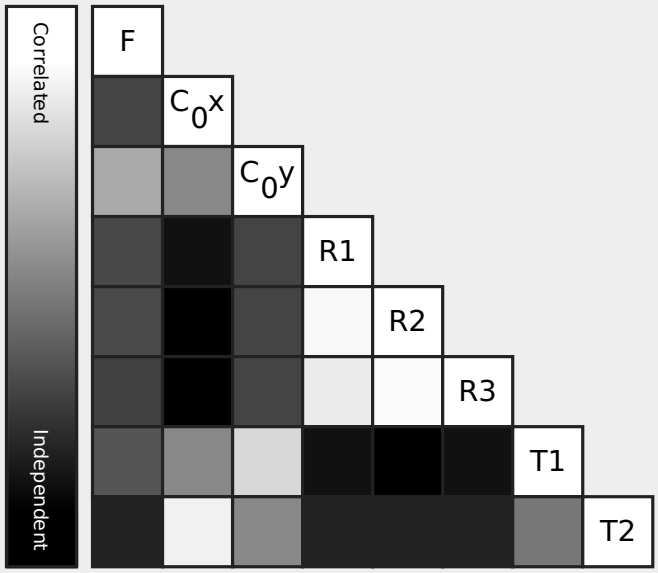
Number of 2D Keypoint Observations for Bundle Block Adjustment	4616664
Number of 3D Points for Bundle Block Adjustment	1565902
Mean Reprojection Error [pixels]	0.188

Internal Camera Parameters

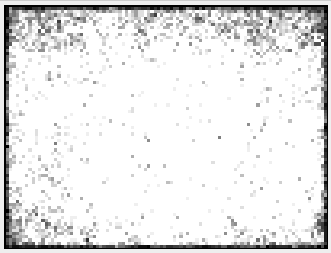
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

EXIF ID: RedEdge_5.5_1280x960

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1466.667 [pixel] 5.500 [mm]	657.605 [pixel] 2.466 [mm]	495.123 [pixel] 1.857 [mm]	-0.097	0.149	-0.017	0.000	0.000
Optimized Values	1448.250 [pixel] 5.431 [mm]	654.261 [pixel] 2.453 [mm]	495.036 [pixel] 1.856 [mm]	-0.100	0.187	-0.120	0.000	-0.000
Uncertainties (Sigma)	0.240 [pixel] 0.001 [mm]	0.216 [pixel] 0.001 [mm]	0.161 [pixel] 0.001 [mm]	0.001	0.011	0.024	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.



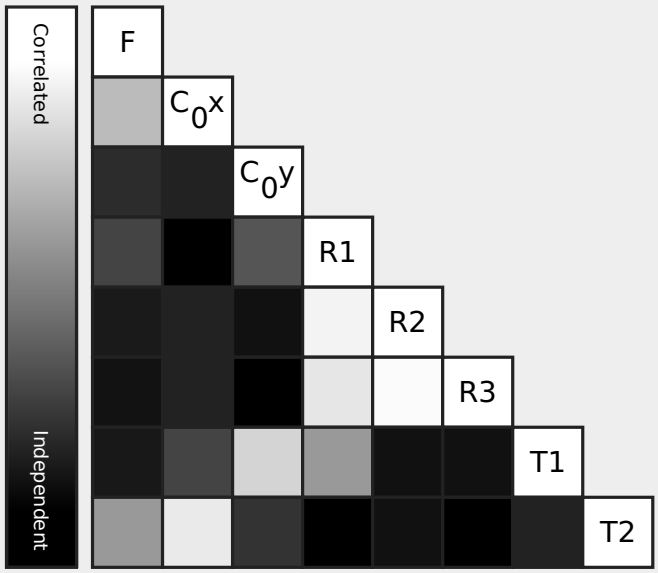
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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.

Internal Camera Parameters

RedEdge_5.5_1280x960 (Green). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

EXIF ID: RedEdge_5.5_1280x960

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1466.667 [pixel] 5.500 [mm]	657.835 [pixel] 2.467 [mm]	481.299 [pixel] 1.805 [mm]	-0.099	0.143	-0.021	0.000	0.001
Optimized Values	1444.906 [pixel] 5.418 [mm]	655.747 [pixel] 2.459 [mm]	481.570 [pixel] 1.806 [mm]	-0.100	0.161	-0.059	0.000	0.000
Uncertainties (Sigma)	0.226 [pixel] 0.001 [mm]	0.067 [pixel] 0.000 [mm]	0.054 [pixel] 0.000 [mm]	0.000	0.003	0.007	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.

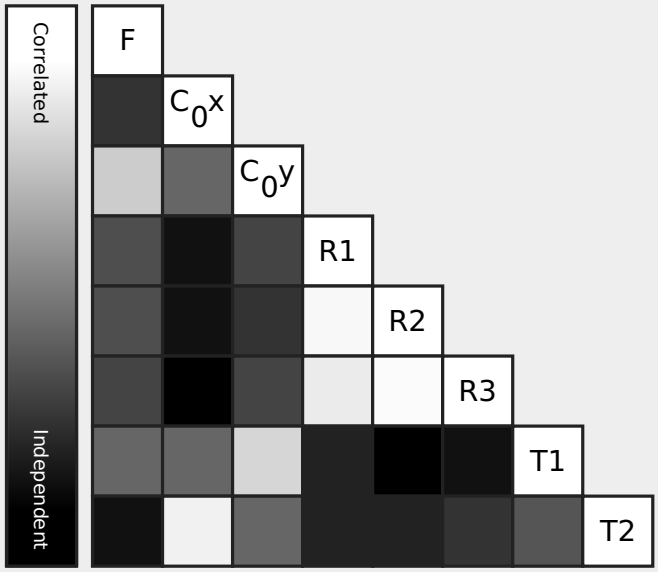
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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.

Internal Camera Parameters

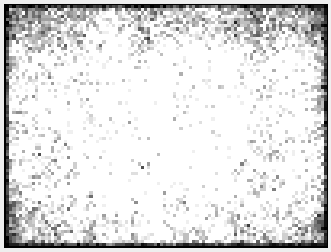
RedEdge_5.5_1280x960 (Red). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

EXIF ID: RedEdge_5.5_1280x960

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1466.667 [pixel] 5.500 [mm]	657.200 [pixel] 2.465 [mm]	493.864 [pixel] 1.852 [mm]	-0.100	0.131	-0.003	-0.000	0.000
Optimized Values	1450.376 [pixel] 5.439 [mm]	653.659 [pixel] 2.451 [mm]	493.268 [pixel] 1.850 [mm]	-0.102	0.152	-0.048	-0.000	-0.000
Uncertainties (Sigma)	0.243 [pixel] 0.001 [mm]	0.235 [pixel] 0.001 [mm]	0.175 [pixel] 0.001 [mm]	0.002	0.011	0.026	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.



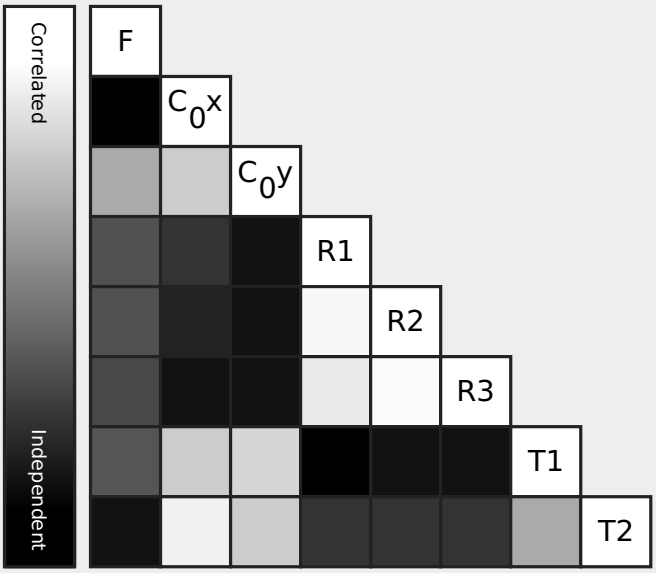
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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.

Internal Camera Parameters

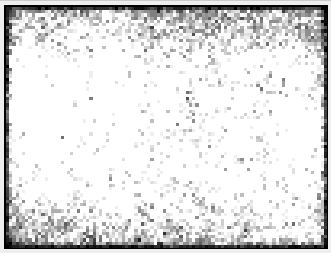
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

EXIF ID: RedEdge_5.5_1280x960

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1466.667 [pixel] 5.500 [mm]	666.605 [pixel] 2.500 [mm]	482.221 [pixel] 1.808 [mm]	-0.105	0.153	-0.045	0.000	0.000
Optimized Values	1450.816 [pixel] 5.441 [mm]	662.561 [pixel] 2.485 [mm]	482.268 [pixel] 1.809 [mm]	-0.107	0.181	-0.115	0.000	-0.000
Uncertainties (Sigma)	0.244 [pixel] 0.001 [mm]	0.234 [pixel] 0.001 [mm]	0.173 [pixel] 0.001 [mm]	0.002	0.011	0.025	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.



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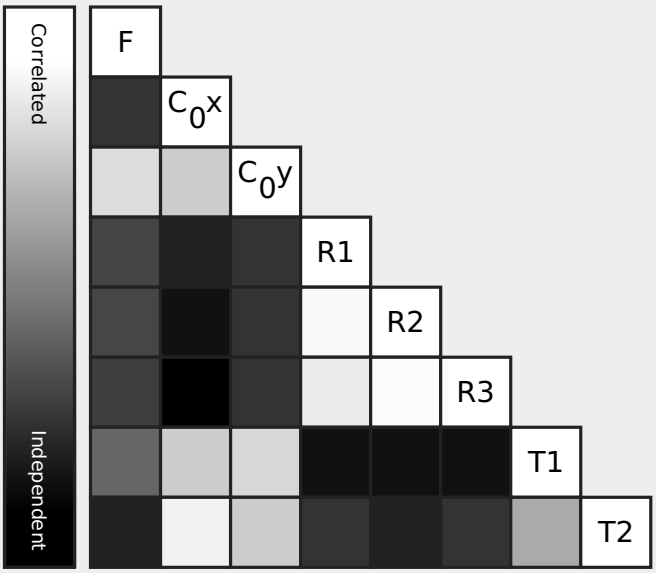
Internal Camera Parameters

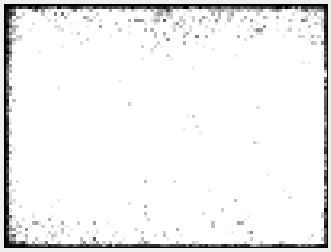
RedEdge_5.5_1280x960 (Red edge). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

EXIF ID: RedEdge_5.5_1280x960

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1466.667 [pixel] 5.500 [mm]	661.440 [pixel] 2.480 [mm]	495.379 [pixel] 1.858 [mm]	-0.103	0.155	-0.049	0.000	0.001
Optimized Values	1448.361 [pixel] 5.431 [mm]	657.922 [pixel] 2.467 [mm]	494.057 [pixel] 1.853 [mm]	-0.102	0.160	-0.068	0.000	-0.000
Uncertainties (Sigma)	0.238 [pixel] 0.001 [mm]	0.198 [pixel] 0.001 [mm]	0.147 [pixel] 0.001 [mm]	0.001	0.010	0.022	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.



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Camera Rig «MicaSense 5 band» Relatives. Images: 11495

	Transl X [m]	Transl Y [m]	Transl Z [m]	Rot X [degree]	Rot Y [degree]	Rot Z [degree]
RedEdge_5.5_1280x960 (Green)	Reference Camera					
RedEdge_5.5_1280x960 (Blue)						
Initial Values	0.030	0.000	0.000	0.000	0.000	0.000
Optimized values	0.030	0.000	0.000	-0.110	0.110	-0.374
Uncertainties (sigma)				0.007	0.009	0.001
RedEdge_5.5_1280x960 (Red)						
Initial Values	0.000	0.022	0.000	0.000	0.000	0.000
Optimized values	0.000	0.022	0.000	0.067	0.072	-0.064
Uncertainties (sigma)				0.007	0.010	0.001
RedEdge_5.5_1280x960 (NIR)						
Initial Values	0.030	0.022	0.000	0.000	0.000	0.000
Optimized values	0.030	0.022	0.000	-0.143	-0.128	0.119
Uncertainties (sigma)				0.007	0.010	0.001
RedEdge_5.5_1280x960 (Red edge)						
Initial Values	0.015	0.011	0.000	0.000	0.000	0.000
Optimized values	0.015	0.011	0.000	-0.059	-0.569	-0.320
Uncertainties (sigma)				0.006	0.008	0.001

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	7025	1289
Min	5344	26
Max	9396	5578
Mean	7038	1444

2D Keypoints Table for Camera RedEdge_5.5_1280x960 (Blue)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	6301	865
Min	5344	64
Max	8210	3752
Mean	6373	1008

2D Keypoints Table for Camera RedEdge_5.5_1280x960 (Green)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	7046	1368
Min	5541	153
Max	9271	5578
Mean	7044	1568

2D Keypoints Table for Camera RedEdge_5.5_1280x960 (Red)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	6528	917

Min	5640	26
Max	8102	4043
Mean	6570	1020

2D Keypoints Table for Camera RedEdge_5.5_1280x960 (NIR)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	7698	1110
Min	6168	40
Max	9396	4661
Mean	7677	1211

2D Keypoints Table for Camera RedEdge_5.5_1280x960 (Red edge)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	7515	1177
Min	5706	65
Max	9040	3895
Mean	7471	1284

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

	RedEdge_5.5_12... (Blue)	RedEdge_5.5_1... (Green)	RedEdge_5.5_128... (Red)	RedEdge_5.5_128... (NIR)	RedEdge_5.... (Red edge)
RedEdge_5.5_1280x960 (Blue)	18 / 88 / 2571	8 / 33 / 1379	23 / 122 / 1783	9 / 38 / 511	11 / 53 / 830
RedEdge_5.5_1280x960 (Green)		13 / 63 / 4051	7 / 28 / 1080	6 / 24 / 849	8 / 34 / 1817
RedEdge_5.5_1280x960 (Red)			22 / 109 / 2912	8 / 33 / 481	10 / 46 / 695
RedEdge_5.5_1280x960 (NIR)				18 / 120 / 3625	17 / 137 / 1353
RedEdge_5.5_1280x960 (Red edge)					13 / 82 / 2596

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	1054863
In 3 Images	246059
In 4 Images	103143
In 5 Images	51670
In 6 Images	30489
In 7 Images	19459
In 8 Images	13569
In 9 Images	9765
In 10 Images	7300
In 11 Images	5496
In 12 Images	4347
In 13 Images	3326
In 14 Images	2741
In 15 Images	2147
In 16 Images	1761
In 17 Images	1362
In 18 Images	1131
In 19 Images	986
In 20 Images	823
In 21 Images	663
In 22 Images	569
In 23 Images	470
In 24 Images	398

In 25 Images	329
In 26 Images	273
In 27 Images	249
In 28 Images	222
In 29 Images	202
In 30 Images	194
In 31 Images	151
In 32 Images	141
In 33 Images	106
In 34 Images	100
In 35 Images	95
In 36 Images	105
In 37 Images	85
In 38 Images	72
In 39 Images	71
In 40 Images	77
In 41 Images	60
In 42 Images	45
In 43 Images	44
In 44 Images	27
In 45 Images	36
In 46 Images	31
In 47 Images	23
In 48 Images	33
In 49 Images	27
In 50 Images	26
In 51 Images	19
In 52 Images	27
In 53 Images	15
In 54 Images	25
In 55 Images	15
In 56 Images	22
In 57 Images	17
In 58 Images	20
In 59 Images	18
In 60 Images	17
In 61 Images	22
In 62 Images	14
In 63 Images	19
In 64 Images	15
In 65 Images	11
In 66 Images	14
In 67 Images	13
In 68 Images	7
In 69 Images	7
In 70 Images	11
In 71 Images	10
In 72 Images	7
In 73 Images	7
In 74 Images	10
In 75 Images	6
In 76 Images	9
In 77 Images	9
In 78 Images	7
In 79 Images	4
In 80 Images	5
In 81 Images	9
In 82 Images	7
In 83 Images	11

In 84 Images	2
In 85 Images	8
In 86 Images	8
In 87 Images	5
In 88 Images	4
In 89 Images	3
In 90 Images	1
In 91 Images	4
In 92 Images	2
In 93 Images	5
In 94 Images	6
In 95 Images	6
In 96 Images	5
In 97 Images	3
In 98 Images	4
In 99 Images	4
In 100 Images	2
In 101 Images	1
In 103 Images	3
In 104 Images	3
In 105 Images	1
In 107 Images	4
In 108 Images	1
In 109 Images	1
In 110 Images	1
In 112 Images	4
In 114 Images	1
In 116 Images	1
In 117 Images	1
In 119 Images	2
In 123 Images	1
In 124 Images	2
In 127 Images	1
In 128 Images	1
In 130 Images	1
In 131 Images	1
In 132 Images	1
In 133 Images	1
In 134 Images	1
In 135 Images	1
In 138 Images	1
In 140 Images	1
In 142 Images	1
In 146 Images	1
In 153 Images	1

2D Keypoint Matches

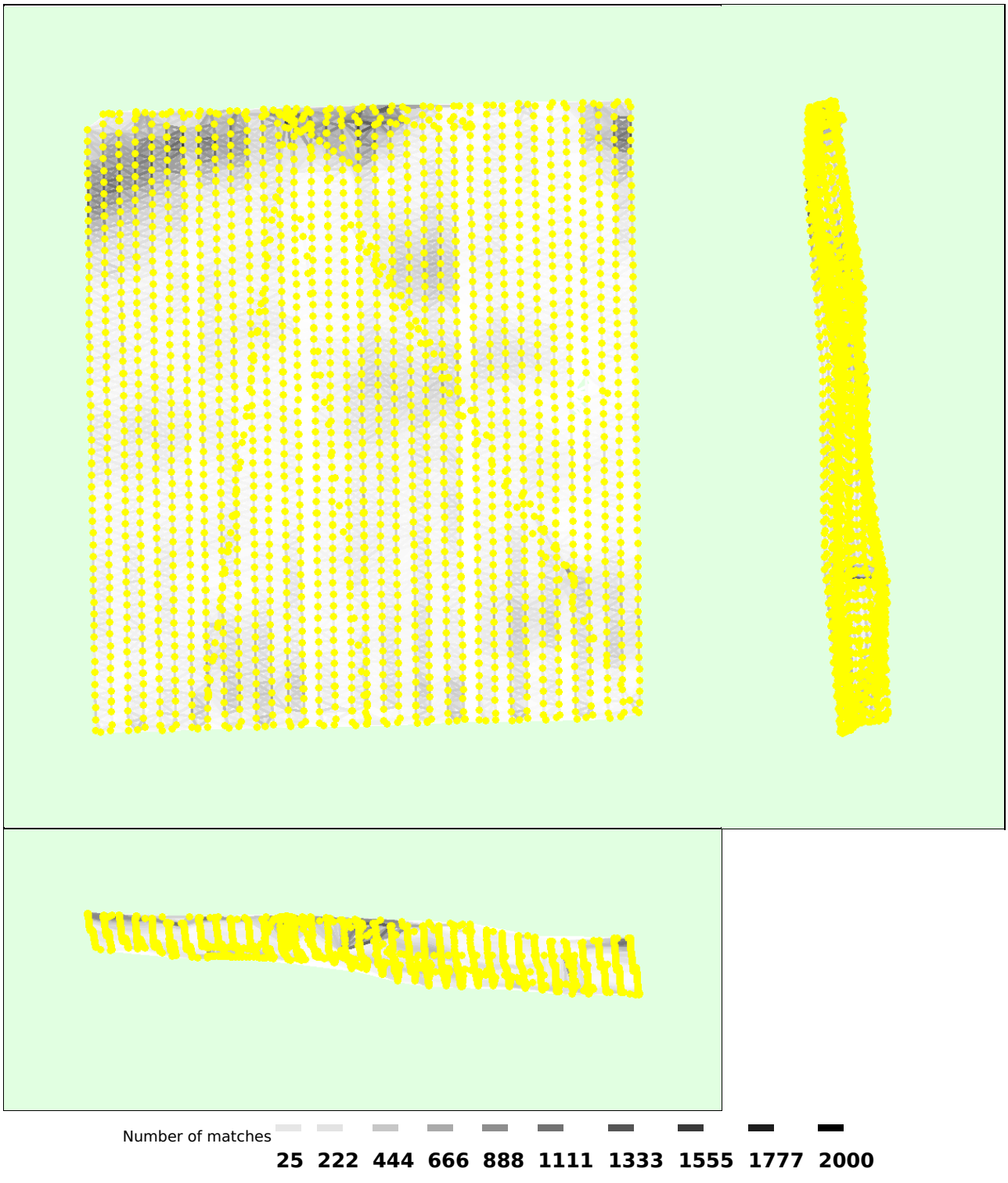

Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Geolocation Details

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.01	0.00	0.00
-15.00	-12.00	0.00	0.00	0.00
-12.00	-9.00	0.00	0.00	0.00
-9.00	-6.00	0.00	0.00	0.00

-6.00	-3.00	0.35	0.80	2.46
-3.00	0.00	44.89	48.07	32.59
0.00	3.00	54.66	50.04	64.95
3.00	6.00	0.09	1.03	0.00
6.00	9.00	0.00	0.05	0.00
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]		0.009241	-0.001664	0.001487
Sigma [m]		0.746668	1.405363	1.218167
RMS Error [m]		0.746725	1.405364	1.218168

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.

Relative Geolocation Variance

Relative Geolocation Error	Images X [%]	Images Y [%]	Images Z [%]
[-1.00, 1.00]	99.95	99.95	100.00
[-2.00, 2.00]	99.99	100.00	100.00
[-3.00, 3.00]	99.99	100.00	100.00
Mean of Geolocation Accuracy [m]	5.000000	5.000000	10.000000
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: Intel(R) Xeon(R) Platinum 8124M CPU @ 3.00GHz RAM: 69GB GPU: no info (Driver: unknown)
Operating System	Linux 4.15.0-1031-aws x86_64

Coordinate Systems

Image Coordinate System	WGS 84 (EGM 96 Geoid)
Output Coordinate System	WGS 84 / UTM zone 10N (EGM 96 Geoid)

Processing Options

Detected Template	No Template Available
Keypoints Image Scale	Custom, Image Scale: 1
Advanced: Matching Image Pairs	Aerial Grid or Corridor
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: Custom, yes
Rig «MicaSense 5 band» processing	optimize relative rotation using a subset of secondary cameras

Point Cloud Densification details

Processing Options

Image Scale	multiscale, 1/2 (Half image size, Default)
Point Density	Optimal
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	Blue, Green, Red, NIR, Red edge
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Time for Point Cloud Densification	09m:30s
Time for Point Cloud Classification	01m:01s
Time for 3D Textured Mesh Generation	11m:05s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	11805387
Average Density (per m^3)	4.23

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (8.79 [cm/pixel])
DSM Filters	Noise Filtering: yes Surface Smoothing: yes, Type: Sharp
Raster DSM	Generated: yes Method: Triangulation Merge Tiles: yes
Orthomosaic	Generated: yes Merge Tiles: yes GeoTIFF Without Transparency: no Google Maps Tiles and KML: no
Radiometric calibration with reflectance target	yes
Index Calculator: Reflectance Map	Generated: yes Resolution: 1 x GSD (8.79 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	54s
Time for Orthomosaic Generation	01h:46m:12s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	02h:10m:50s
Time for Index Map Generation	34s

Camera Radiometric Correction

Camera Name	Band	Radiometric Correction Type	Reflectance target

RedEdge_5.5_1280x960	Blue	Camera and Sun Irradiance	✅
RedEdge_5.5_1280x960	Green	Camera and Sun Irradiance	✅
RedEdge_5.5_1280x960	Red	Camera and Sun Irradiance	✅
RedEdge_5.5_1280x960	NIR	Camera and Sun Irradiance	✅
RedEdge_5.5_1280x960	Red edge	Camera and Sun Irradiance	✅