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_1_re
Processed	2019-01-23 12:04:21
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)	8.36 cm / 3.29 in
Area Covered	0.574 km^2 / 57.4485 ha / 0.22 sq. mi. / 142.0318 acres
Time for Initial Processing (without report)	12h:40m:09s

Quality Check

Images	median of 34587 keypoints per image	✓
Dataset	11010 out of 11040 images calibrated (99%), 5 images disabled	✓
Camera Optimization	1.33% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 6028.58 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

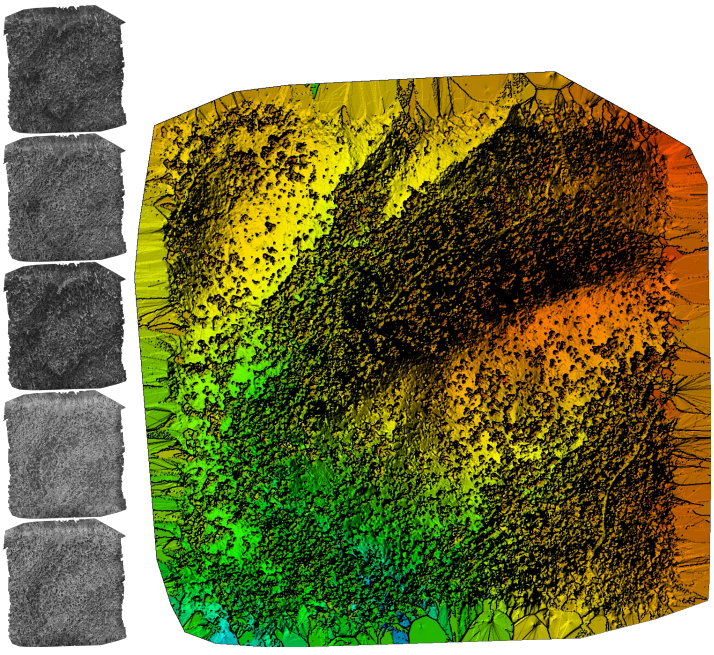


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	11010 out of 11045
Number of Geolocated Images	11045 out of 11045

Initial Image Positions

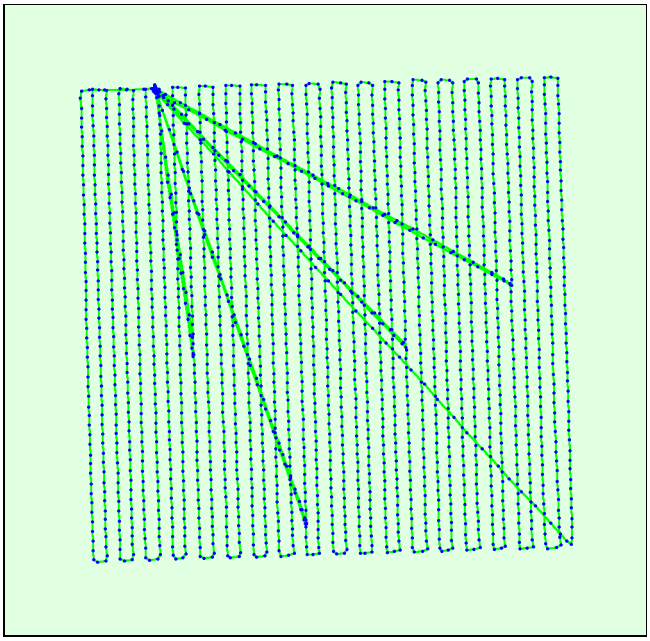
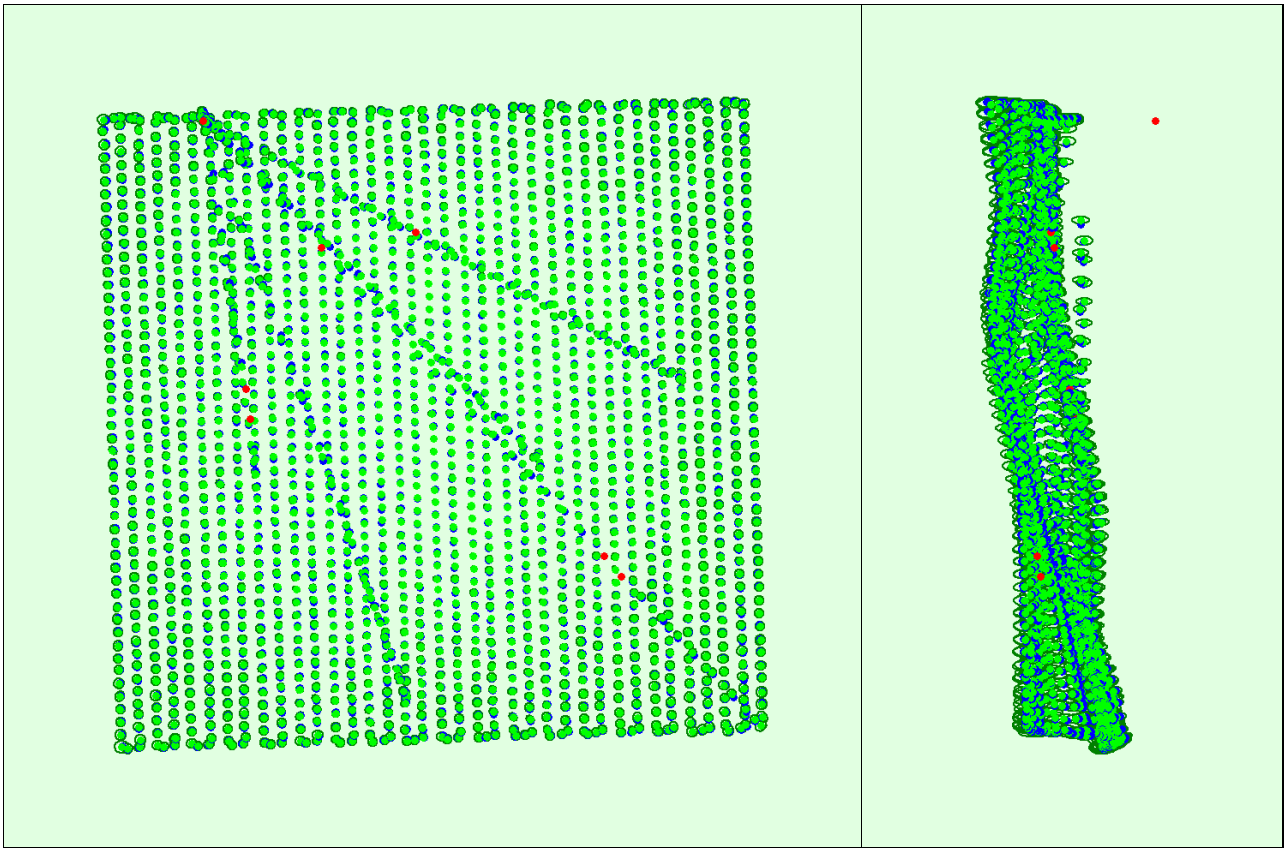
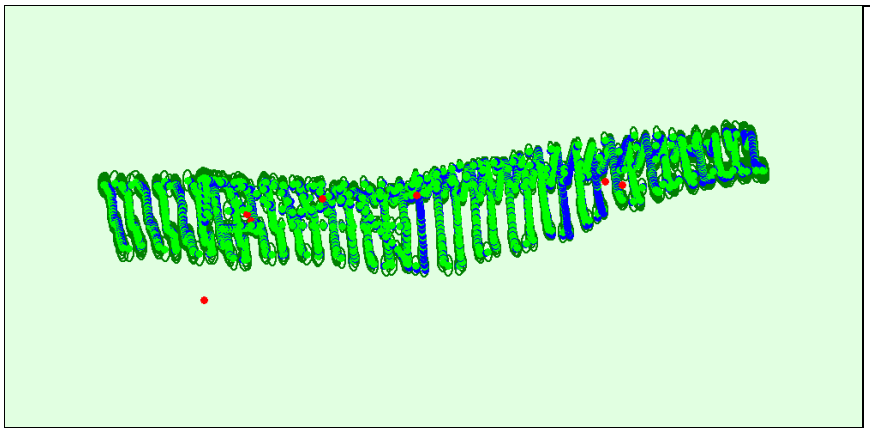


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.071	0.071	0.159	0.031	0.032	0.012
Sigma	0.012	0.012	0.035	0.002	0.002	0.002

Overlap

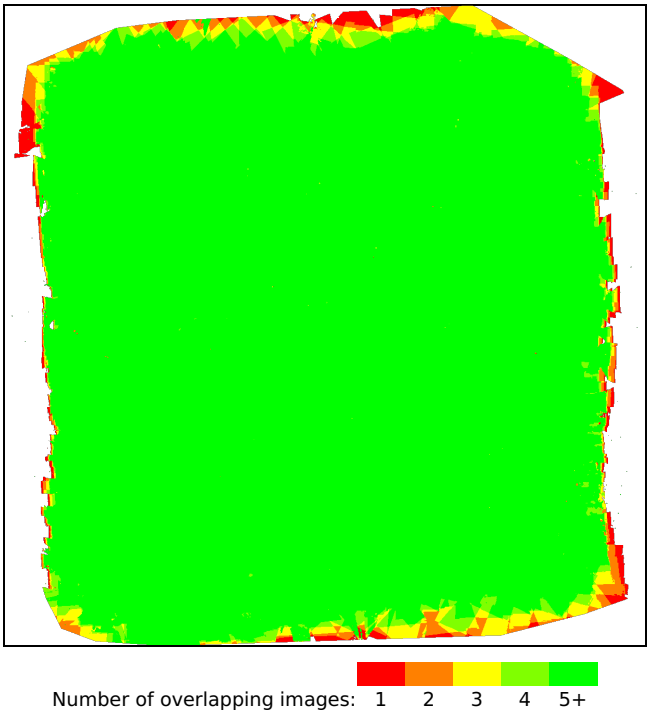


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint 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	20555182
Number of 3D Points for Bundle Block Adjustment	6531941

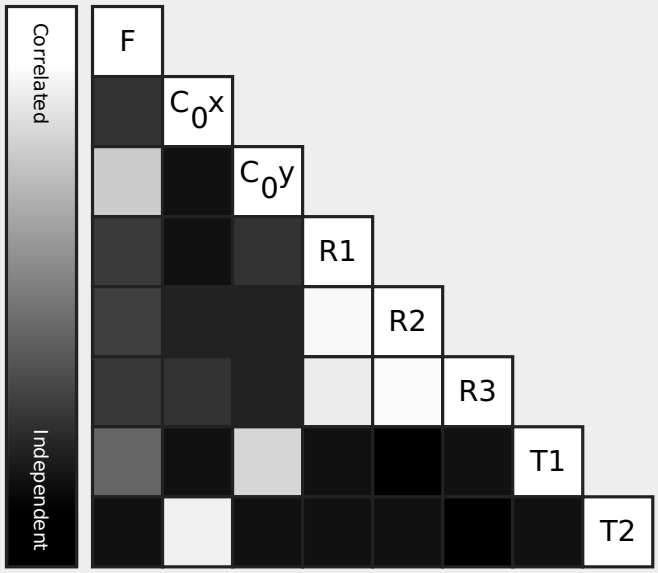
Mean Reprojection Error [pixels]	0.202

Internal Camera Parameters

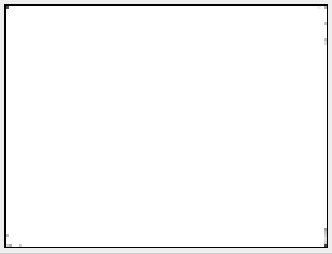
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.672 [pixel] 5.425 [mm]	654.465 [pixel] 2.454 [mm]	494.989 [pixel] 1.856 [mm]	-0.099	0.166	-0.059	0.000	-0.000
Uncertainties (Sigma)	0.111 [pixel] 0.000 [mm]	0.089 [pixel] 0.000 [mm]	0.067 [pixel] 0.000 [mm]	0.001	0.004	0.009	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.



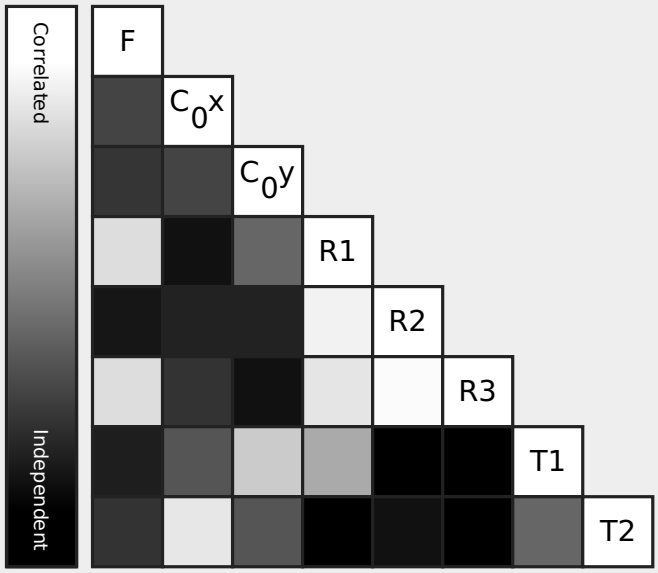
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

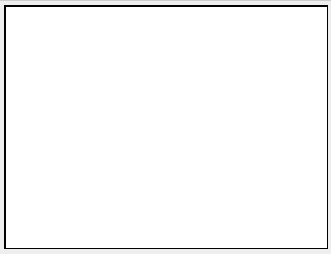
RedEdge_5.5_1280x960 (Green). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1443.451 [pixel] 5.413 [mm]	655.540 [pixel] 2.458 [mm]	481.573 [pixel] 1.806 [mm]	-0.100	0.152	-0.036	0.000	0.000
Uncertainties (Sigma)	0.106 [pixel] 0.000 [mm]	0.028 [pixel] 0.000 [mm]	0.023 [pixel] 0.000 [mm]	0.000	0.001	0.003	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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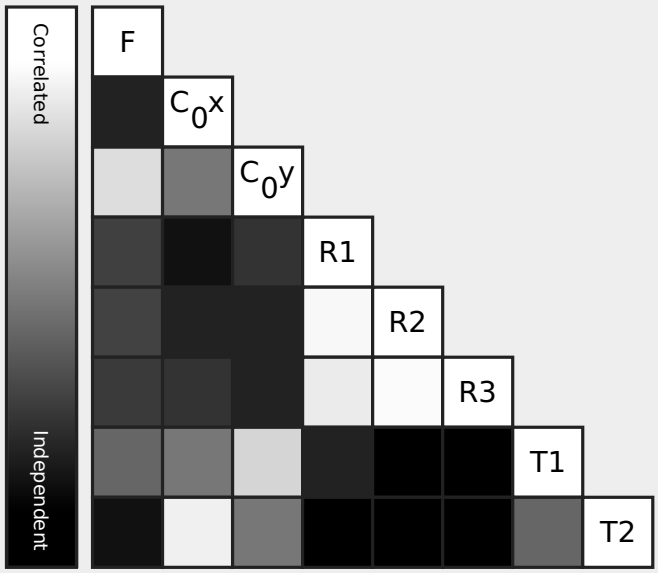
Internal Camera Parameters

RedEdge_5.5_1280x960 (Red). 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	1448.738 [pixel] 5.433 [mm]	653.850 [pixel] 2.452 [mm]	493.767 [pixel] 1.852 [mm]	-0.099	0.130	0.006	-0.000	-0.000
Uncertainties (Sigma)	0.112 [pixel] 0.000 [mm]	0.097 [pixel] 0.000 [mm]	0.073 [pixel] 0.000 [mm]	0.001	0.005	0.010	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.

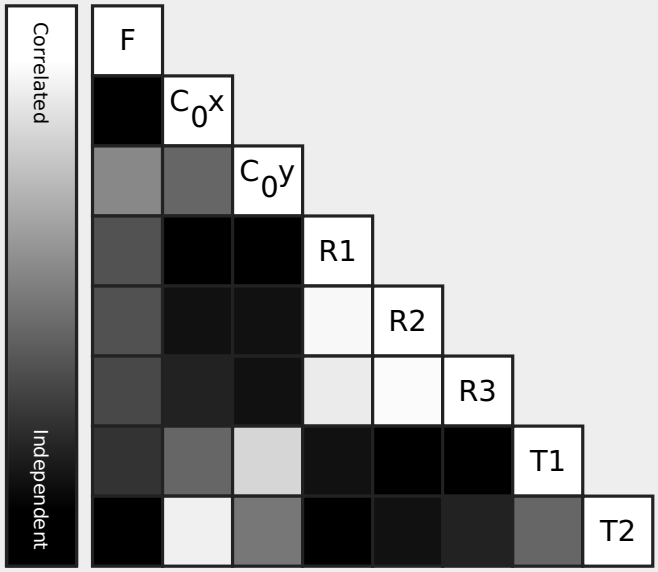
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

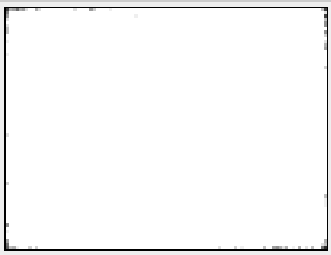
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1449.340 [pixel] 5.435 [mm]	662.938 [pixel] 2.486 [mm]	482.458 [pixel] 1.809 [mm]	-0.104	0.151	-0.043	0.000	-0.000
Uncertainties (Sigma)	0.115 [pixel] 0.000 [mm]	0.117 [pixel] 0.000 [mm]	0.087 [pixel] 0.000 [mm]	0.001	0.005	0.012	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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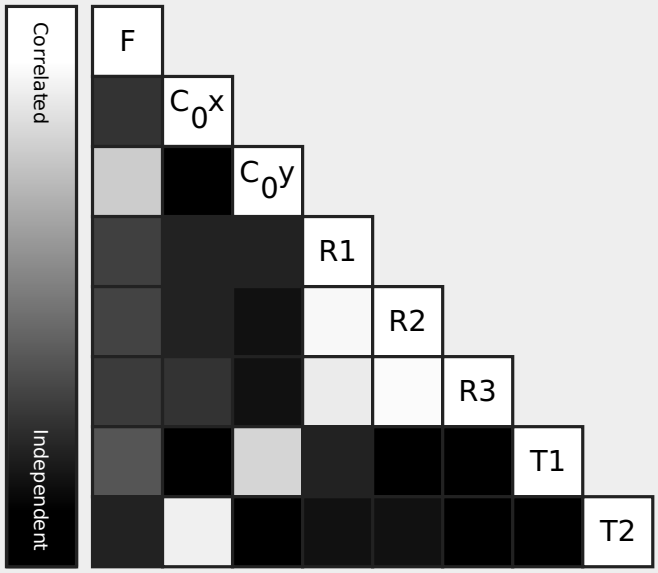
Internal Camera Parameters

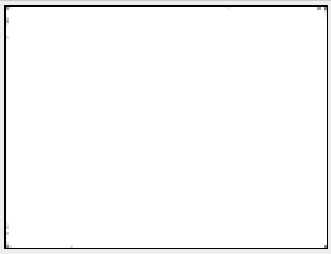
RedEdge_5.5_1280x960 (Red edge). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.953 [pixel] 5.426 [mm]	657.950 [pixel] 2.467 [mm]	494.427 [pixel] 1.854 [mm]	-0.102	0.146	-0.031	0.000	-0.000
Uncertainties (Sigma)	0.111 [pixel] 0.000 [mm]	0.095 [pixel] 0.000 [mm]	0.071 [pixel] 0.000 [mm]	0.001	0.005	0.010	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: 11040

	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	-0.106	0.129	-0.372
Uncertainties (sigma)				0.003	0.004	0.000
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	0.048	0.091	-0.061
Uncertainties (sigma)				0.003	0.004	0.000
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	-0.148	-0.106	0.118
Uncertainties (sigma)				0.004	0.005	0.000
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	-0.074	-0.559	-0.322
Uncertainties (sigma)				0.003	0.004	0.000

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	34587	6029
Min	18299	28
Max	43658	25011
Mean	34019	6652

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image

Median	30765	4591
Min	20350	39
Max	40073	14800
Mean	30238	5014

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	35149	6462
Min	18299	591
Max	43658	25011
Mean	34921	7139

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	28215	4711
Min	19768	28
Max	38069	13725
Mean	28591	5271

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	33163	5038
Min	20692	124
Max	38574	19128
Mean	32617	5538

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	35983	5399
Min	25955	117
Max	42182	19742
Mean	35694	5959

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)	76 / 425 / 10239	45 / 182 / 5734	88 / 499 / 5089	17 / 93 / 1916	31 / 164 / 3565
RedEdge_5.5_1280x960 (Green)		56 / 267 / 17670	41 / 162 / 3910	13 / 55 / 4526	23 / 109 / 9595
RedEdge_5.5_1280x960 (Red)			83 / 568 / 10149	16 / 89 / 1429	33 / 170 / 2515
RedEdge_5.5_1280x960 (NIR)				40 / 369 / 15045	36 / 321 / 6086
RedEdge_5.5_1280x960 (Red edge)					35 / 288 / 12336

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	4173164
In 3 Images	1088436
In 4 Images	481500
In 5 Images	241481
In 6 Images	142428

In 7 Images	91415
In 8 Images	63649
In 9 Images	46113
In 10 Images	34986
In 11 Images	27503
In 12 Images	22133
In 13 Images	17522
In 14 Images	14702
In 15 Images	11844
In 16 Images	9949
In 17 Images	8211
In 18 Images	6945
In 19 Images	5847
In 20 Images	5224
In 21 Images	4436
In 22 Images	3786
In 23 Images	3381
In 24 Images	2714
In 25 Images	2391
In 26 Images	2212
In 27 Images	1857
In 28 Images	1656
In 29 Images	1476
In 30 Images	1298
In 31 Images	1165
In 32 Images	1099
In 33 Images	957
In 34 Images	863
In 35 Images	767
In 36 Images	690
In 37 Images	582
In 38 Images	542
In 39 Images	523
In 40 Images	429
In 41 Images	407
In 42 Images	363
In 43 Images	316
In 44 Images	305
In 45 Images	301
In 46 Images	279
In 47 Images	266
In 48 Images	210
In 49 Images	198
In 50 Images	169
In 51 Images	178
In 52 Images	161
In 53 Images	163
In 54 Images	165
In 55 Images	137
In 56 Images	125
In 57 Images	104
In 58 Images	110
In 59 Images	107
In 60 Images	113
In 61 Images	97
In 62 Images	77
In 63 Images	76
In 64 Images	90
In 65 Images	80

In 66 Images	81
In 67 Images	84
In 68 Images	86
In 69 Images	70
In 70 Images	73
In 71 Images	62
In 72 Images	69
In 73 Images	49
In 74 Images	63
In 75 Images	57
In 76 Images	51
In 77 Images	51
In 78 Images	40
In 79 Images	54
In 80 Images	42
In 81 Images	45
In 82 Images	34
In 83 Images	35
In 84 Images	25
In 85 Images	29
In 86 Images	21
In 87 Images	20
In 88 Images	33
In 89 Images	23
In 90 Images	19
In 91 Images	26
In 92 Images	13
In 93 Images	17
In 94 Images	23
In 95 Images	10
In 96 Images	21
In 97 Images	8
In 98 Images	13
In 99 Images	10
In 100 Images	8
In 101 Images	7
In 102 Images	12
In 103 Images	5
In 104 Images	9
In 105 Images	3
In 106 Images	6
In 107 Images	6
In 108 Images	4
In 109 Images	6
In 110 Images	3
In 111 Images	4
In 112 Images	2
In 113 Images	5
In 114 Images	3
In 115 Images	2
In 116 Images	3
In 117 Images	2
In 119 Images	1
In 120 Images	4
In 121 Images	1
In 123 Images	1
In 125 Images	1
In 127 Images	2
In 130 Images	1

In 132 Images	1
In 134 Images	1
In 136 Images	1
In 137 Images	1
In 139 Images	1
In 142 Images	1
In 143 Images	2
In 149 Images	1
In 150 Images	1

2D Keypoint Matches

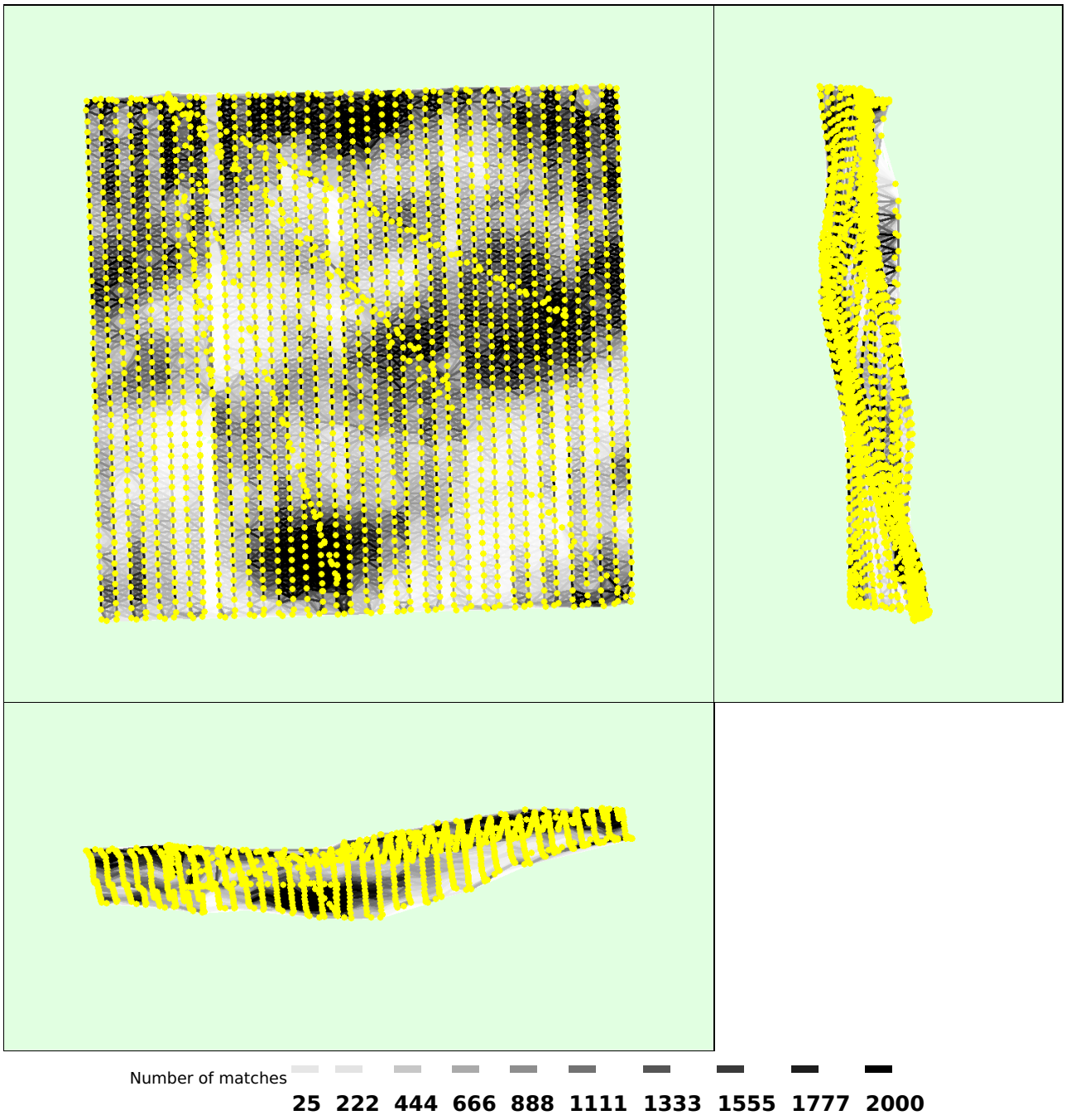

Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Geolocation Details

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.00	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	0.00	0.23	2.63
-3.00	0.00	49.95	48.02	31.14
0.00	3.00	50.05	51.36	66.19
3.00	6.00	0.00	0.39	0.05
6.00	9.00	0.00	0.00	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]		0.020545	0.013308	-0.011091
Sigma [m]		0.615194	1.206100	1.300334
RMS Error [m]		0.615537	1.206173	1.300381

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]	100.00	99.95	100.00
[-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	10.000000
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: 2
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	10m:01s
Time for Point Cloud Classification	59s
Time for 3D Textured Mesh Generation	10m:44s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	11129087
Average Density (per m^3)	4.8

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (8.36 [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 (8.36 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	48s
Time for Orthomosaic Generation	01h:21m:49s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:36m:05s
Time for Index Map Generation	38s

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	✓