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_3k_3_re
Processed	2019-01-23 11:56:27
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)	8.89 cm / 3.50 in
Area Covered	0.614 km^2 / 61.3861 ha / 0.24 sq. mi. / 151.7669 acres
Time for Initial Processing (without report)	12h:21m:58s

Quality Check

Images	median of 35728 keypoints per image	✓
Dataset	10520 out of 10560 images calibrated (99%), 5 images disabled	✓
Camera Optimization	1.39% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 6945.96 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

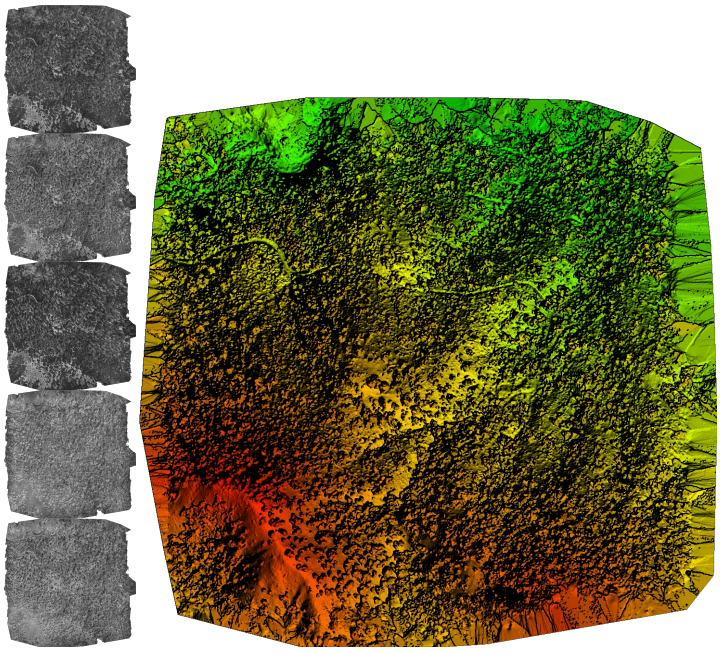


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	10520 out of 10565
Number of Geolocated Images	10565 out of 10565

Initial Image Positions

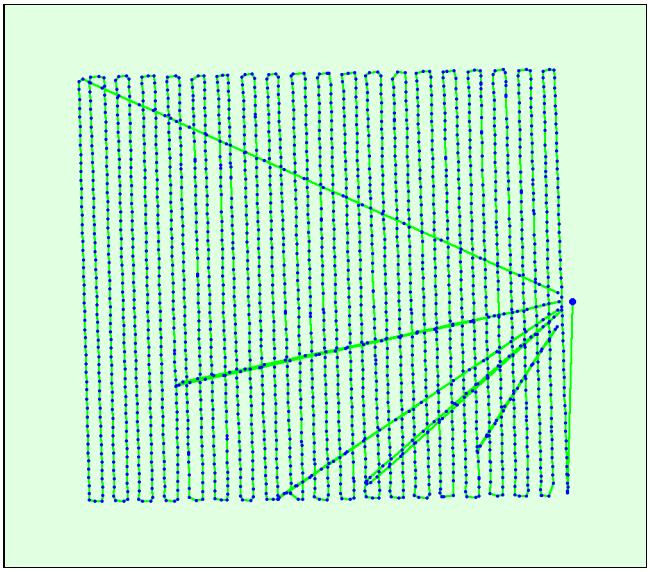
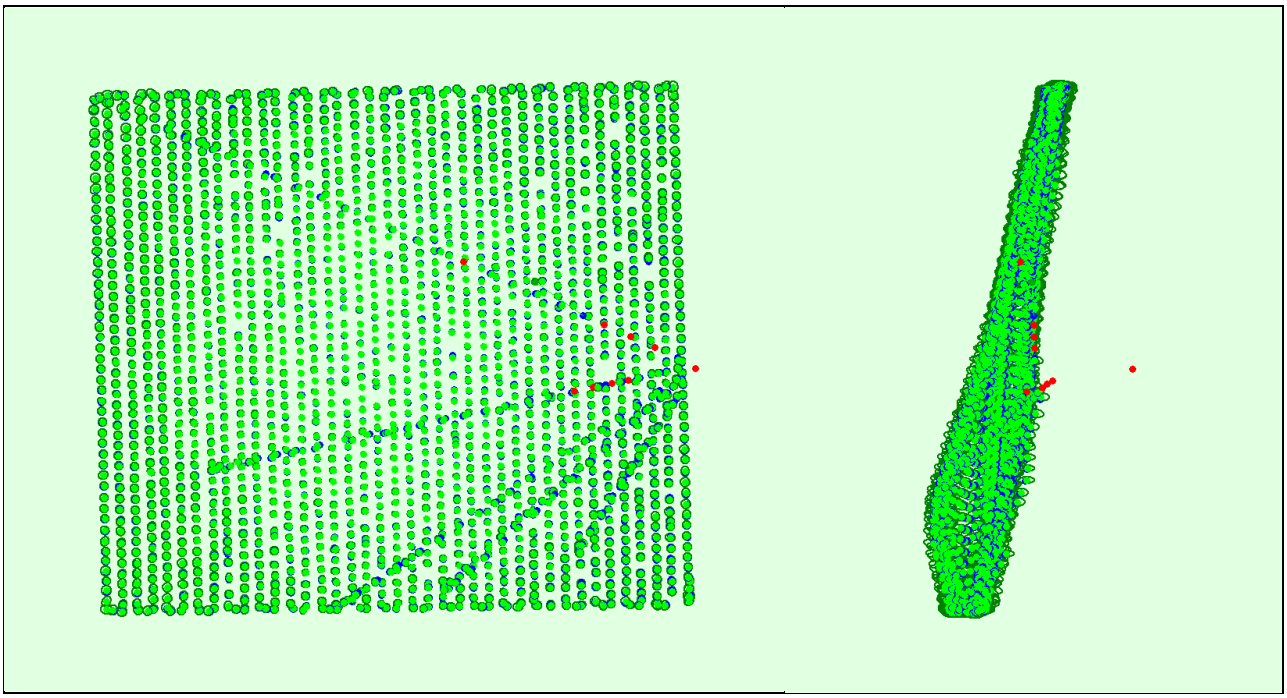
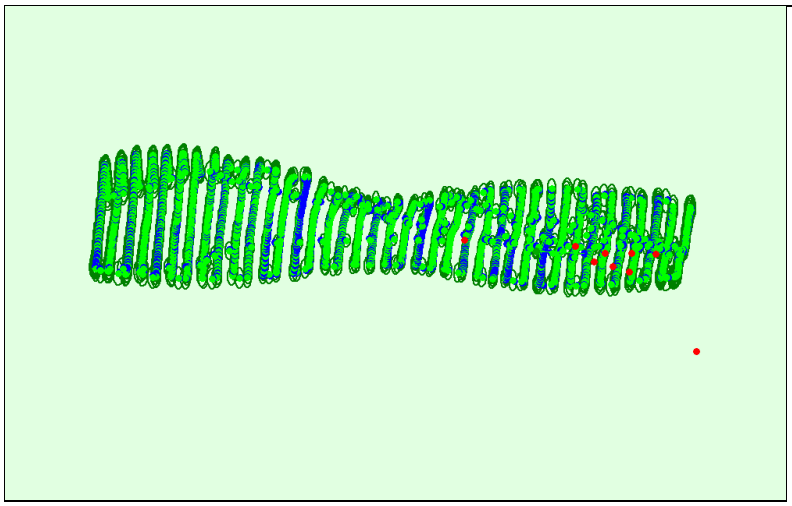


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.080	0.080	0.178	0.036	0.034	0.014
Sigma	0.013	0.013	0.036	0.002	0.002	0.003

Overlap

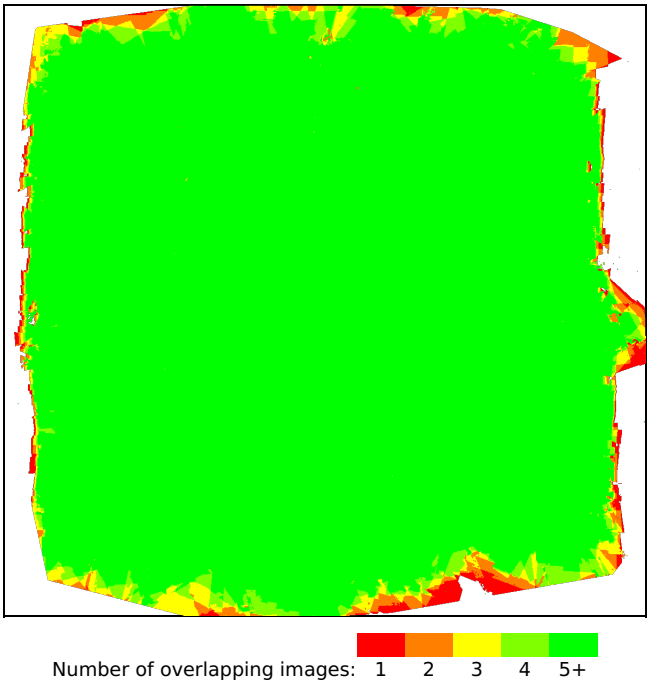


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

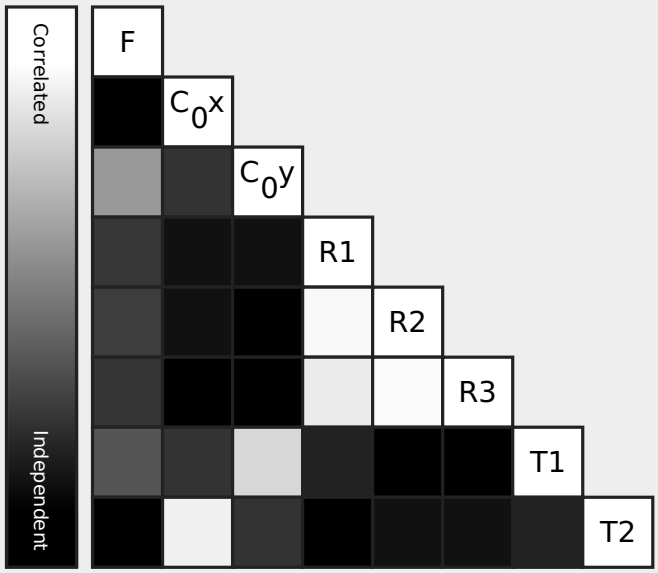
Number of 2D Keypoint Observations for Bundle Block Adjustment	22310362
Number of 3D Points for Bundle Block Adjustment	7627219
Mean Reprojection Error [pixels]	0.209

Internal Camera Parameters

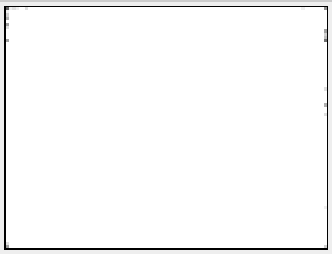
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1445.917 [pixel] 5.422 [mm]	654.368 [pixel] 2.454 [mm]	495.158 [pixel] 1.857 [mm]	-0.100	0.181	-0.104	0.000	-0.000
Uncertainties (Sigma)	0.139 [pixel] 0.001 [mm]	0.104 [pixel] 0.000 [mm]	0.078 [pixel] 0.000 [mm]	0.001	0.005	0.011	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.



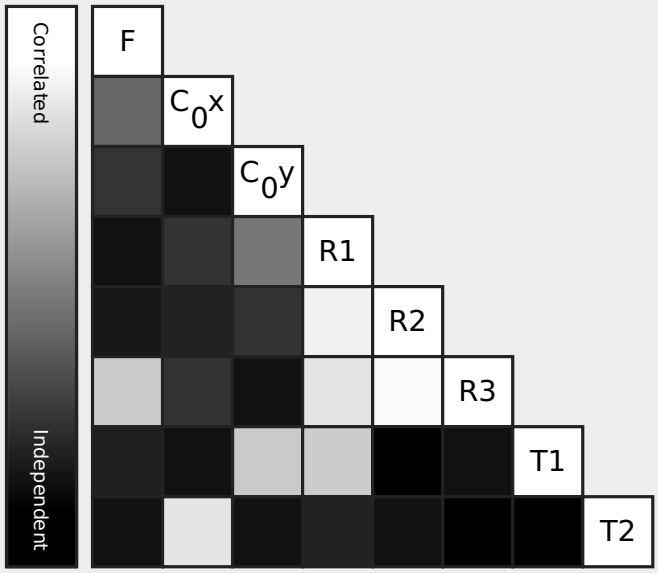
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

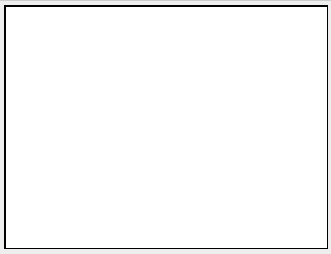
RedEdge_5.5_1280x960 (Green). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1442.731 [pixel] 5.410 [mm]	655.614 [pixel] 2.459 [mm]	481.621 [pixel] 1.806 [mm]	-0.098	0.139	-0.013	0.000	0.000
Uncertainties (Sigma)	0.134 [pixel] 0.001 [mm]	0.031 [pixel] 0.000 [mm]	0.025 [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.



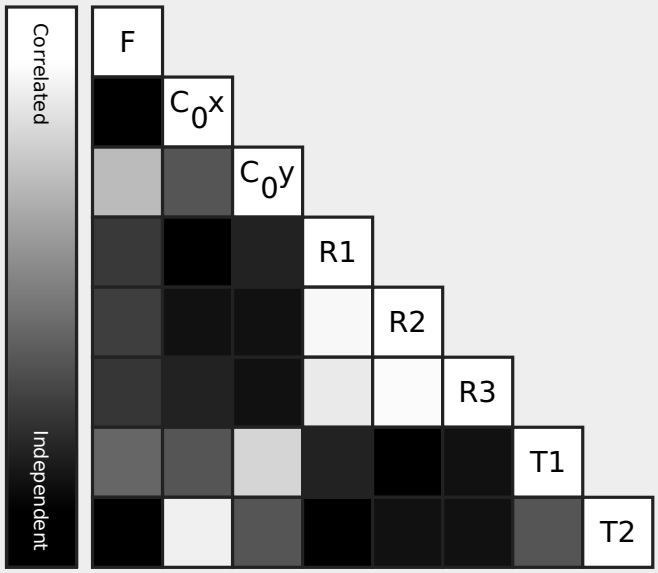
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1447.906 [pixel] 5.430 [mm]	653.723 [pixel] 2.451 [mm]	494.118 [pixel] 1.853 [mm]	-0.100	0.141	-0.028	-0.000	-0.000
Uncertainties (Sigma)	0.140 [pixel] 0.001 [mm]	0.110 [pixel] 0.000 [mm]	0.083 [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.

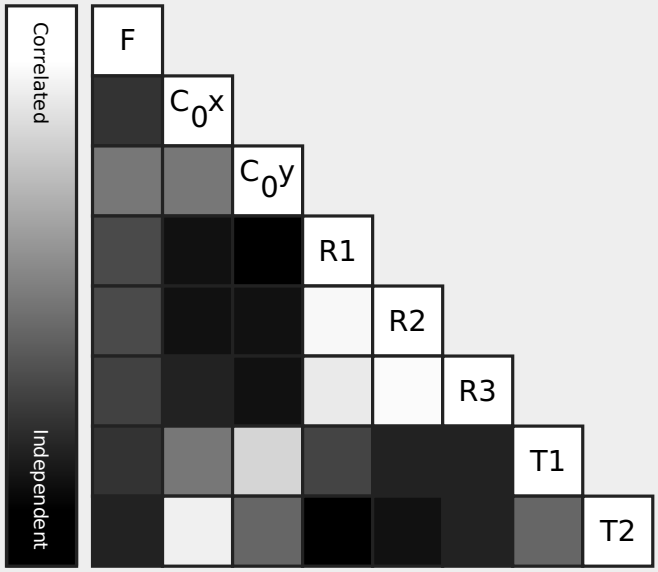
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

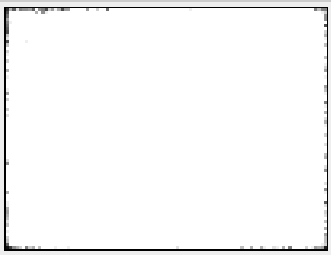
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1448.584 [pixel] 5.432 [mm]	662.543 [pixel] 2.485 [mm]	482.558 [pixel] 1.810 [mm]	-0.103	0.144	-0.020	0.000	-0.000
Uncertainties (Sigma)	0.143 [pixel] 0.001 [mm]	0.136 [pixel] 0.001 [mm]	0.101 [pixel] 0.000 [mm]	0.001	0.006	0.014	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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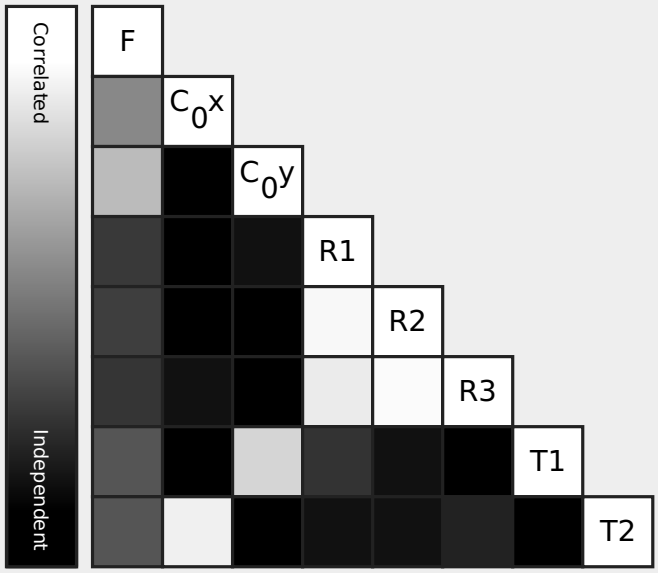
Internal Camera Parameters

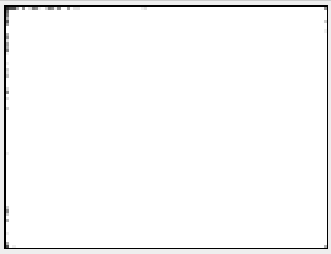
RedEdge_5.5_1280x960 (Red edge). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.217 [pixel] 5.423 [mm]	657.443 [pixel] 2.465 [mm]	494.577 [pixel] 1.855 [mm]	-0.101	0.147	-0.034	0.000	-0.000
Uncertainties (Sigma)	0.140 [pixel] 0.001 [mm]	0.108 [pixel] 0.000 [mm]	0.081 [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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Camera Rig «MicaSense 5 band» Relatives. Images: 10560

	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	-0.105	0.114	-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	0.045	0.087	-0.061
Uncertainties (sigma)				0.003	0.005	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	-0.147	-0.134	0.120
Uncertainties (sigma)				0.004	0.006	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	-0.075	-0.582	-0.320
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	35728	6946
Min	18226	82
Max	43354	27284
Mean	34683	7558

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

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

Median	29794	4842
Min	19723	253
Max	37086	18697
Mean	29580	5216

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	36474	7483
Min	23844	617
Max	43354	27284
Mean	36248	8341

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	27516	4731
Min	18283	185
Max	35320	17251
Mean	27340	5199

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	31077	5369
Min	18226	296
Max	37734	15089
Mean	31021	5578

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	35720	6151
Min	20857	82
Max	41028	16523
Mean	35267	6468

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)	34 / 302 / 9406	22 / 111 / 7298	47 / 384 / 6498	17 / 83 / 653	24 / 146 / 1482
RedEdge_5.5_1280x960 (Green)		33 / 173 / 26175	20 / 101 / 6376	10 / 41 / 3000	15 / 73 / 7377
RedEdge_5.5_1280x960 (Red)			36 / 340 / 10633	17 / 84 / 804	25 / 152 / 1652
RedEdge_5.5_1280x960 (NIR)				32 / 377 / 12397	37 / 378 / 4373
RedEdge_5.5_1280x960 (Red edge)					26 / 273 / 11613

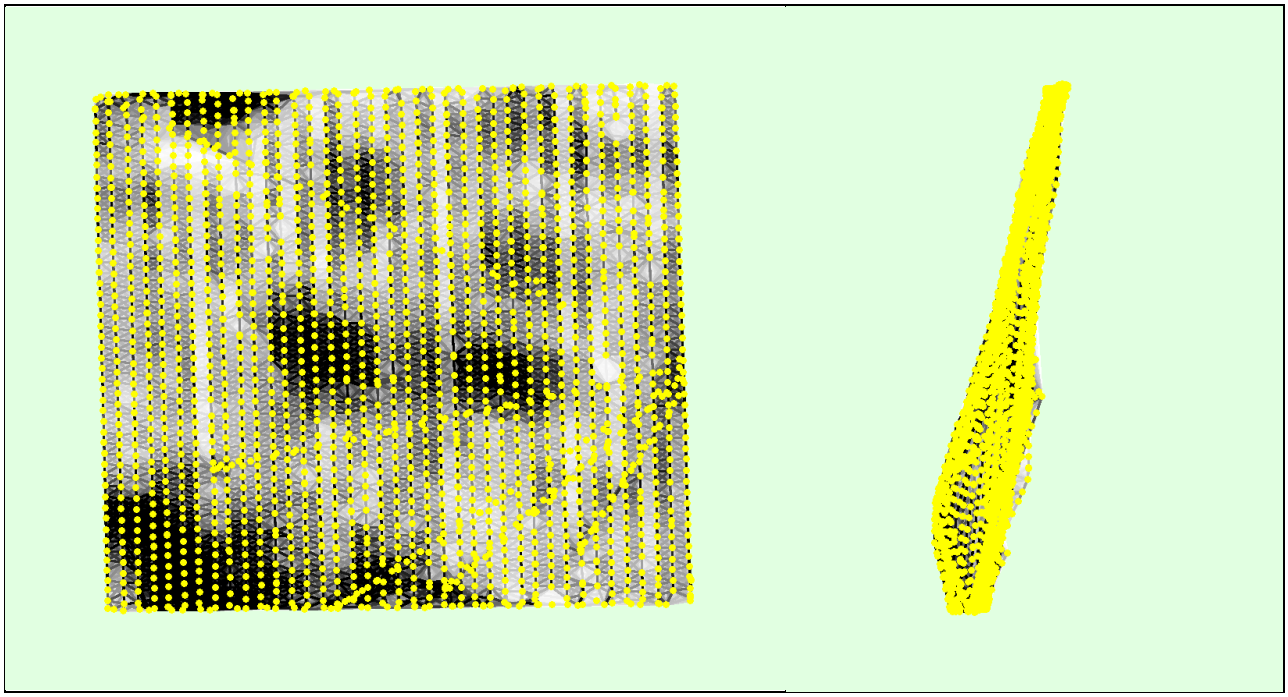
3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	5121944
In 3 Images	1232183
In 4 Images	515735
In 5 Images	247119
In 6 Images	143363

In 7 Images	90020
In 8 Images	61250
In 9 Images	42865
In 10 Images	32092
In 11 Images	24816
In 12 Images	19139
In 13 Images	15206
In 14 Images	12323
In 15 Images	10029
In 16 Images	8363
In 17 Images	6950
In 18 Images	5741
In 19 Images	4866
In 20 Images	4159
In 21 Images	3612
In 22 Images	3038
In 23 Images	2681
In 24 Images	2365
In 25 Images	2022
In 26 Images	1770
In 27 Images	1576
In 28 Images	1398
In 29 Images	1150
In 30 Images	992
In 31 Images	933
In 32 Images	825
In 33 Images	788
In 34 Images	652
In 35 Images	614
In 36 Images	573
In 37 Images	478
In 38 Images	387
In 39 Images	381
In 40 Images	338
In 41 Images	296
In 42 Images	263
In 43 Images	256
In 44 Images	196
In 45 Images	173
In 46 Images	144
In 47 Images	122
In 48 Images	103
In 49 Images	118
In 50 Images	107
In 51 Images	73
In 52 Images	64
In 53 Images	61
In 54 Images	36
In 55 Images	41
In 56 Images	34
In 57 Images	34
In 58 Images	32
In 59 Images	32
In 60 Images	26
In 61 Images	22
In 62 Images	26
In 63 Images	22
In 64 Images	24
In 65 Images	19

In 66 Images	17
In 67 Images	19
In 68 Images	15
In 69 Images	14
In 70 Images	12
In 71 Images	10
In 72 Images	10
In 73 Images	4
In 74 Images	12
In 75 Images	4
In 76 Images	4
In 77 Images	7
In 78 Images	7
In 79 Images	6
In 80 Images	4
In 81 Images	4
In 83 Images	3
In 86 Images	1
In 87 Images	1
In 88 Images	1
In 89 Images	2
In 93 Images	1
In 95 Images	1

2D Keypoint Matches



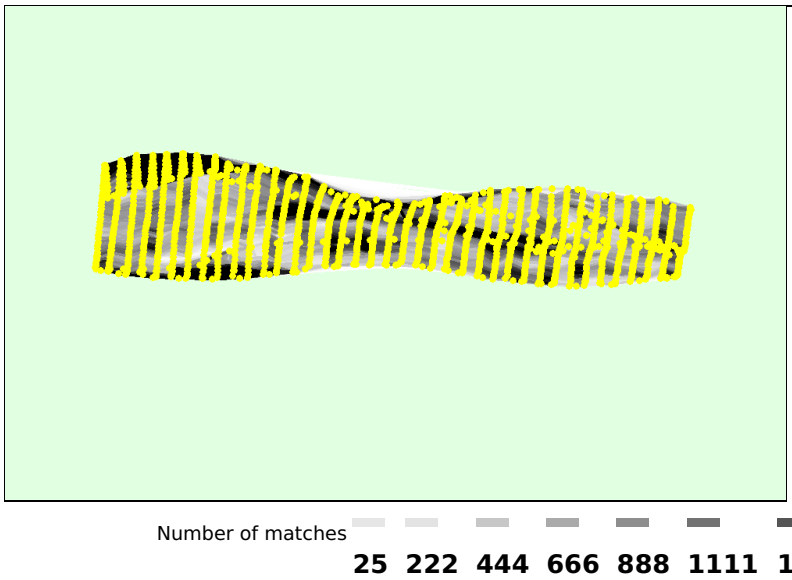


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

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	0.05	0.10	0.00
-3.00	0.00	54.30	54.74	40.96
0.00	3.00	45.60	45.07	59.04
3.00	6.00	0.05	0.10	0.00
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]		-0.000226	-0.000285	0.000772
Sigma [m]		0.561221	0.951338	1.065485
RMS Error [m]		0.561221	0.951338	1.065485

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	100.00	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:24s
Time for Point Cloud Classification	01m:10s
Time for 3D Textured Mesh Generation	10m:24s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	11389094
Average Density (per m^3)	4.72

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (8.89 [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 (8.89 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	49s
Time for Orthomosaic Generation	01h:10m:47s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:24m:13s
Time for Index Map Generation	33s

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	✓