Quality Report

Generated with Pix4Dmapper version 4.4.12

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	tw_miaoli_toufen_tuniu-river_4k_20190411
Processed	2019-12-21 14:21:51
Camera Model Name(s)	FC6310R_8.8_5472x3648 (RGB)
Average Ground Sampling Distance (GSD)	3.59 cm / 1.41 in
Area Covered	0.243 km^2 / 24.2918 ha / 0.09 sq. mi. / 60.0575 acres
Time for Initial Processing (without report)	49m:40s

Quality Check

Images	median of 65620 keypoints per image	✓
Dataset	216 out of 216 images calibrated (100%), all images enabled	✓
Camera Optimization	0.21% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 15497.4 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

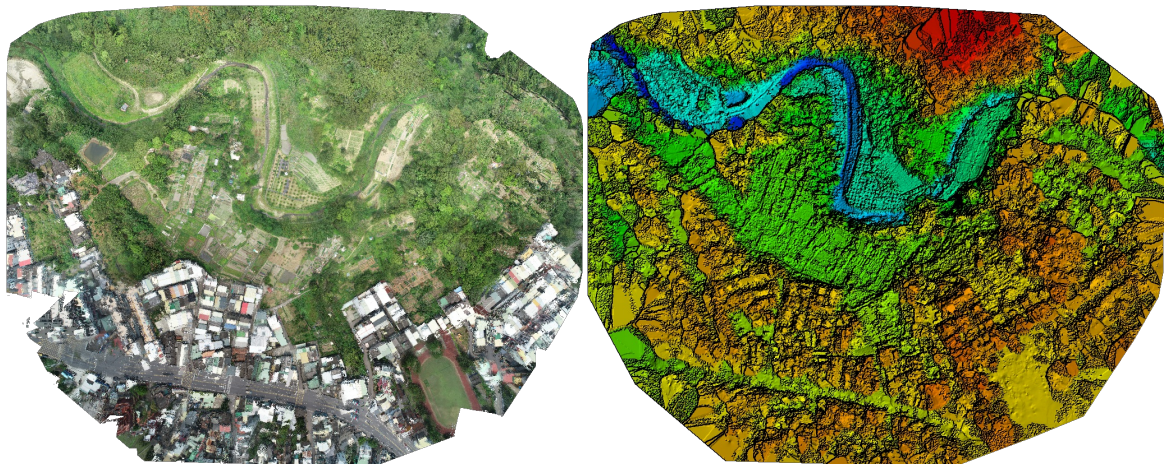


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	216 out of 216
Number of Geolocated Images	216 out of 216

Initial Image Positions

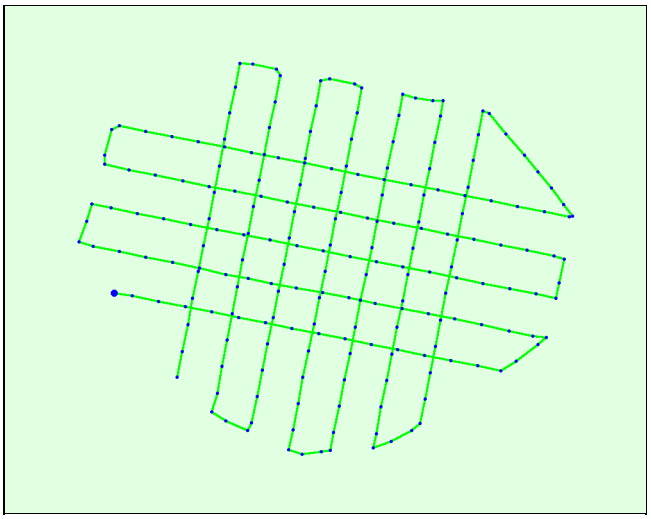


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions

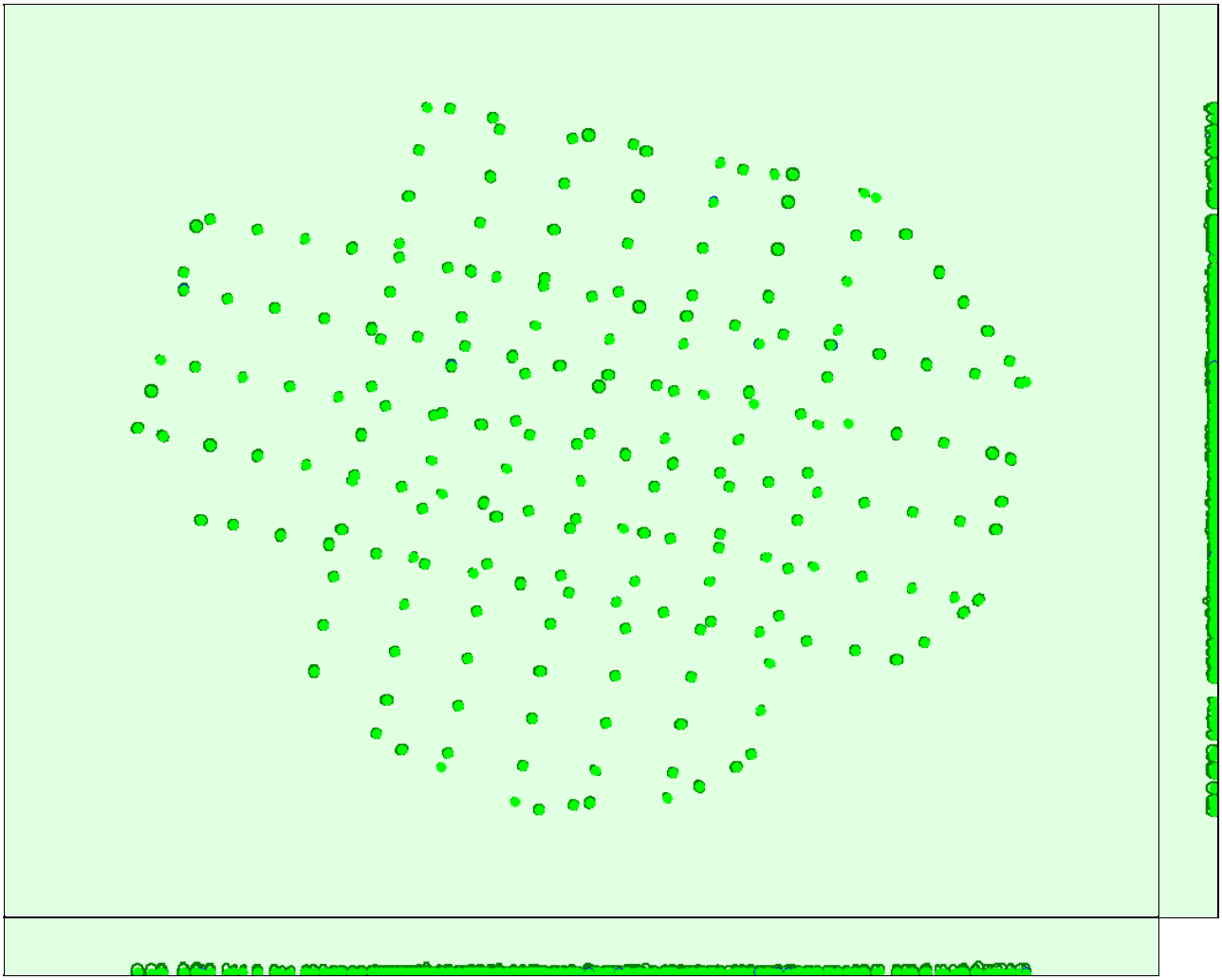


Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane). Dark green ellipses 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	0.002	0.002	0.003	0.002	0.002	0.001
Sigma	0.000	0.000	0.000	0.000	0.000	0.000

Overlap

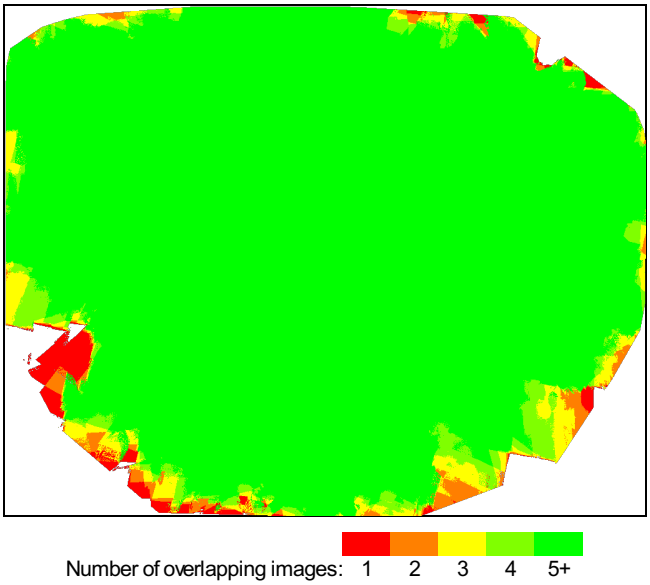


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

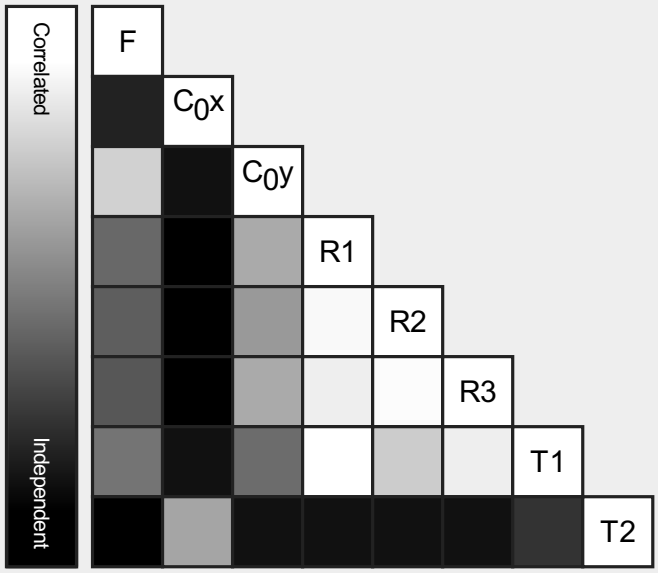
Number of 2D Keypoint Observations for Bundle Block Adjustment	3366430
Number of 3D Points for Bundle Block Adjustment	1235911
Mean Reprojection Error [pixels]	0.172

Internal Camera Parameters

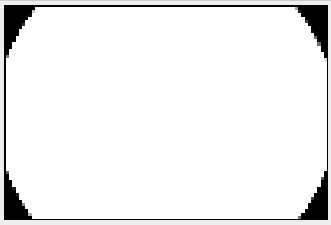
FC6310R_8.8_5472x3648 (RGB). Sensor Dimensions: 12.833 [mm] x 8.556 [mm]

EXIF ID: FC6310R_8.8_5472x3648

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	3658.300 [pixel] 8.580 [mm]	2722.500 [pixel] 6.385 [mm]	1835.100 [pixel] 4.304 [mm]	-0.269	0.112	-0.033	0.000	-0.001
Optimized Values	3650.447 [pixel] 8.561 [mm]	2726.238 [pixel] 6.394 [mm]	1847.133 [pixel] 4.332 [mm]	-0.268	0.111	-0.032	0.001	0.000
Uncertainties (Sigma)	0.063 [pixel] 0.000 [mm]	0.056 [pixel] 0.000 [mm]	0.077 [pixel] 0.000 [mm]	0.000	0.000	0.000	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.

2D Keypoints Table

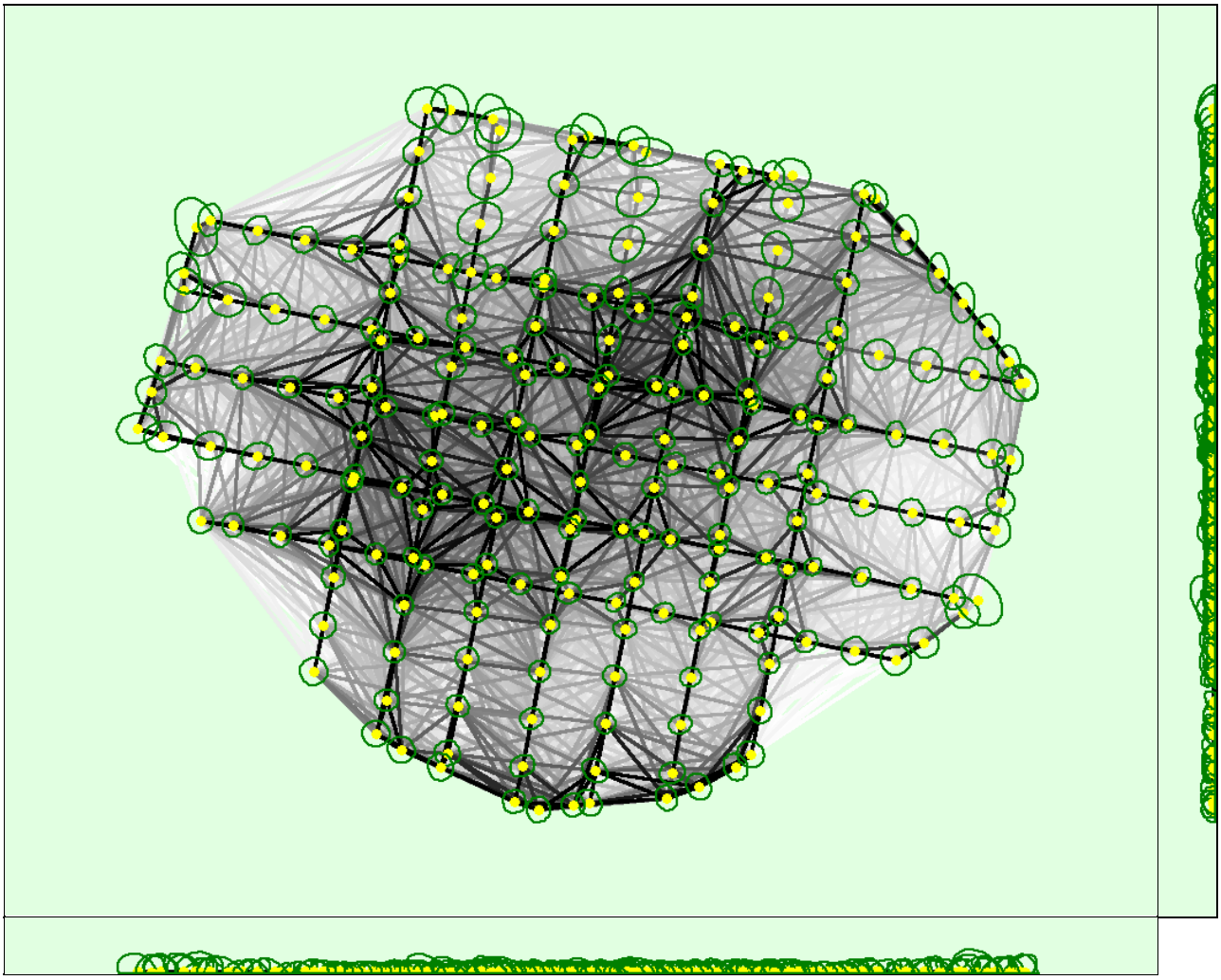
	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	65620	15497
Min	41935	3379
Max	75392	25146
Mean	63106	15585

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	860637
In 3 Images	193779
In 4 Images	76347
In 5 Images	38821
In 6 Images	22116
In 7 Images	13551
In 8 Images	8769
In 9 Images	5879
In 10 Images	4093
In 11 Images	2944
In 12 Images	2107
In 13 Images	1572
In 14 Images	1117
In 15 Images	934
In 16 Images	678
In 17 Images	514
In 18 Images	410
In 19 Images	324
In 20 Images	266
In 21 Images	186
In 22 Images	167
In 23 Images	148

In 24 Images	101
In 25 Images	89
In 26 Images	65
In 27 Images	44
In 28 Images	47
In 29 Images	44
In 30 Images	29
In 31 Images	21
In 32 Images	24
In 33 Images	19
In 34 Images	16
In 35 Images	8
In 36 Images	13
In 37 Images	6
In 38 Images	7
In 39 Images	8
In 40 Images	2
In 41 Images	3
In 42 Images	2
In 43 Images	1
In 45 Images	1
In 46 Images	1
In 54 Images	1

2D Keypoint Matches



Uncertainty ellipses 1000x magnified

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.

Relative camera position and orientation uncertainties

	X [m]	Y [m]	Z [m]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.005	0.005	0.004	0.003	0.003	0.002
Sigma	0.001	0.001	0.001	0.001	0.001	0.001

Geolocation Details

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-0.04	0.00	0.00	0.00
-0.04	-0.03	0.00	0.00	0.00
-0.03	-0.02	0.00	0.00	0.93
-0.02	-0.01	0.00	0.00	2.78
-0.01	-0.01	1.85	0.93	16.67
-0.01	0.00	46.30	51.39	23.15
0.00	0.01	50.93	47.22	38.89
0.01	0.01	0.93	0.46	14.81
0.01	0.02	0.00	0.00	2.78
0.02	0.03	0.00	0.00	0.00
0.03	0.04	0.00	0.00	0.00
0.04	-	0.00	0.00	0.00
Mean [m]		-0.000005	-0.000001	0.000081
Sigma [m]		0.002453	0.002293	0.007665
RMS Error [m]		0.002453	0.002293	0.007665

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]	98.15	99.54	99.54
[-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]	0.008863	0.008863	0.021220
Sigma of Geolocation Accuracy [m]	0.000283	0.000283	0.000795

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

Geolocation Orientational Variance	RMS [degree]
Omega	0.823
Phi	0.694
Kappa	2.148

Geolocation RMS error of the orientation angles given by the difference between the initial and computed image orientation angles.

Initial Processing Details

System Information

Hardware	CPU: Intel(R) Xeon(R) CPU E3-1505M v5 @ 2.80GHz RAM: 32GB GPU: Intel(R) HD Graphics P530 (Driver: 23.20.16.4973)
Operating System	Windows 10 Pro, 64-bit

Coordinate Systems

Image Coordinate System	WGS 84
Output Coordinate System	TWD97 / TM2 zone 121

Processing Options

Detected Template	DJI P4 RTK*
Keypoints Image Scale	Full, Image Scale: 1
Advanced: Matching Image Pairs	Aerial Grid or Corridor
Advanced: Matching Strategy	Use Geometrically Verified Matching: yes
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Automatic
Advanced: Calibration	Calibration Method: Geolocation Based 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
Minimum Number of Matches	3
3D Textured Mesh Generation	yes
3D Textured Mesh Settings:	Resolution: Medium Resolution (default) Color Balancing: yes
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	04h:13m:19s
Time for Point Cloud Classification	23m:09s
Time for 3D Textured Mesh Generation	46m:06s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	23227447
Average Density (per m^3)	67.11

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (3.59 [cm/pixel])
DSM Filters	Noise Filtering: yes Surface Smoothing: yes, Type: Sharp
Raster DSM	Generated: yes Method: Inverse Distance Weighting Merge Tiles: yes
Orthomosaic	Generated: yes Merge Tiles: yes GeoTIFF Without Transparency: no Google Maps Tiles and KML: yes
Raster DTM	Generated: yes Merge Tiles: yes
DTM Resolution	10 x GSD (3.59 [cm/pixel])
Time for DSM Generation	36m:35s
Time for Orthomosaic Generation	01h:32m:05s
Time for DTM Generation	03m:33s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	00s
Time for Index Map Generation	00s