CIVE 7397 – Optical Imaging Metrology

Lab #5 – Resection

Lab Description

The purpose of this lab is to determine image orientation using single photo resection. The table below contains corrected (i.e. lens distortion and atmospheric effects already removed) image measurements of common object points for both images 27 and 28. This camera is the same as that used for Labs #1-#4. The images were capture from an elevation of 1860 meters, with an average ground elevation of 1100 meters, the scale number of the imagery is 5000, and the images are standard 9 inch square analog photographs. For your estimated accuracy of the image measurements, use the RMSE of the errors from your affine transformation in the first lab assignment.

Assignment

Create an algorithm (i.e. Matlab or Python script) to perform single photo resection given image measurements of at least 3 ground control points.

	Corrected Image Coordinates				Independently-Surveyed Ground Control Point Coordinates		
	Image 27		Image 28				
ID	x (mm)	y (mm)	x (mm)	y (mm)	X(m)	Y(m)	Z(m)
100	-9.444	96.236	-105.378	98.756	-399.28	-679.72	1090.96
104	18.919	-81.819	-72.539	-79.786	475.55	-538.18	1090.5
105	90.289	-91.049	-1.405	-86.941	517.62	-194.43	1090.65
200	18.174	109.538	-77.840	113.375	-466.39	-542.31	1091.55
201	44.681	7.483	-48.786	10.165	42.73	-412.19	1090.82
202	-7.578	-49.077	-98.814	-48.039	321.09	-667.45	1083.49
203	52.736	-93.140	-38.924	-90.035	527.78	-375.72	1092

Tasks:

1. Using the above observations, and your single resection algorithm determine exterior orientation parameters for images 27 and 28 separately using:
    a. Points 100, 104, 105, 200
    b. Points 100, 104, 105, 200 and 201
    c. Points 100, 104, 105, 200, 201 and 202
    d. All Points

2. Define and justify the convergence criteria you used for the above adjustments.

3. For each of the above solutions:
    a. Compute estimated standard deviations of the solutions for the exterior orientation parameters.
    b. Compute correlation coefficients between each of the unknown parameters
    c. Compute residuals and RMSE of residuals for all observations

4. Plot the change in the estimated standard deviations and correlation coefficients as a function of the number of observed image points. Comment on the trends in the plots.

5. Compare the final estimated orientation parameters from Task 1, with the absolute orientation values derived in Lab #4. Why are the results different? Which is the more accurate approach?

Notes:

- Points will be deducted for sloppy programming style and/or results format, and failure to properly document your code, and tabular results.

Due Date: April 19, 2023 at 10:00 am (hand in at start of class)