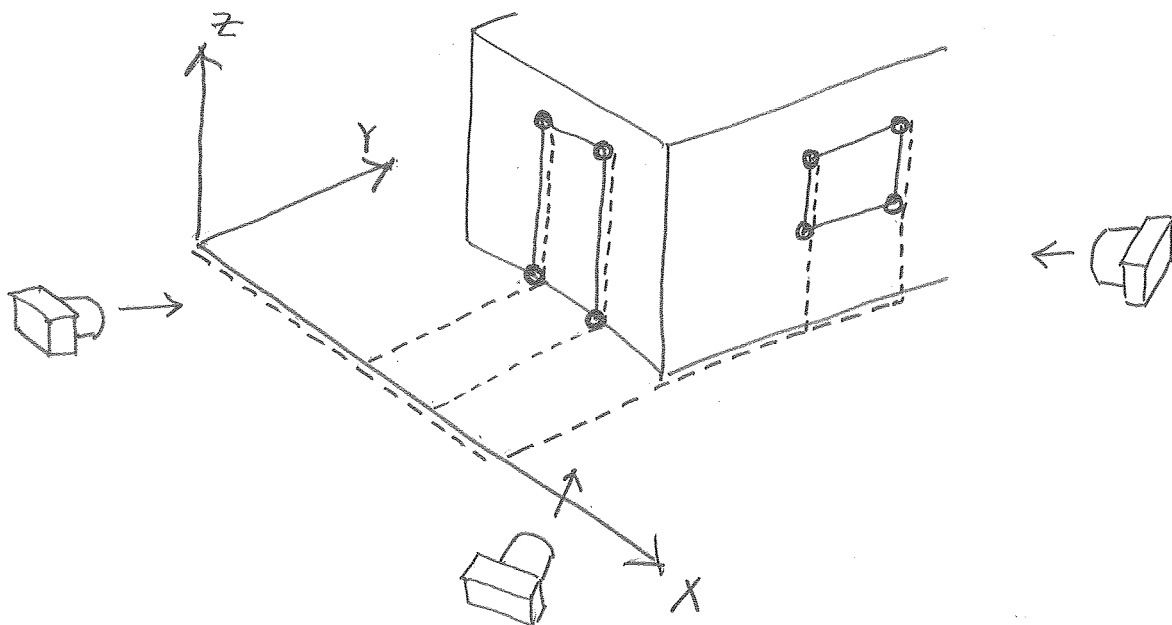


# Photogrammetry Homework 5

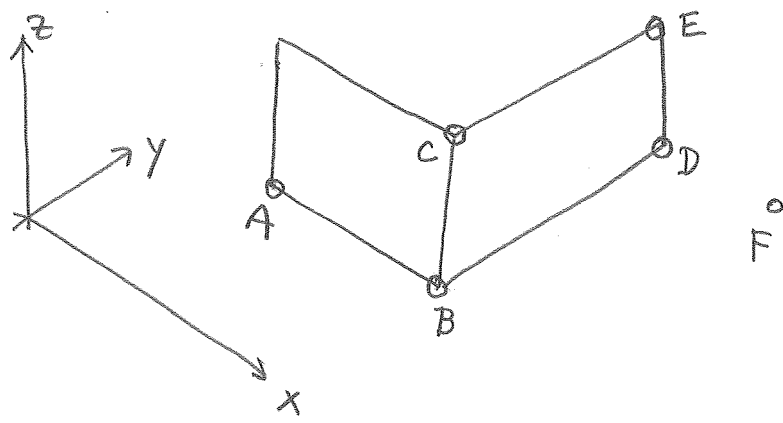
assigned 4 April, 2013, due 23 April (2½ weeks)

1/5

1. Select a scene/object which can be modeled with polygons (building, tower, bridge, structure, vehicle, room interior, furniture, ...). Avoid objects with too much intricate detail or curved surfaces which would be difficult to model by a polygon surface.
2. Take photographs with your calibrated camera to cover as much of the object as you wish to model/render. (at least 6 photographs, no upper limit)
3. Include in each photo a rectangle (door, window, floor tile, etc.) with coordinates estimated in a common reference coordinate system (can establish by taping, pacing, etc.) This rectangle will be used to estimate the orientation of each photo. Example:



4. Select "pass points" so that the photographs are strongly linked to each other. Each photo must be linked to another by minimum 3 points (not in a line), preferably by more. Assign unique ID to each pass point.  
 Select 3 points to serve as minimal constraints:

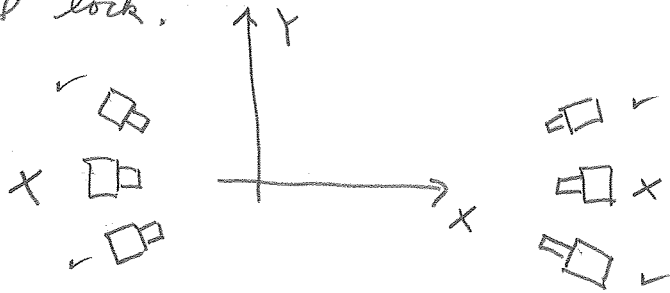


for example  $A(x, y, z)$ ,  $B(x, y, z)$ ,  $C(-, y, -)$ , or  
 $B(x, y, z)$ ,  $D(x, y, z)$ ,  $E(x, -, -)$ , or  
 $B(x, y, z)$ ,  $D(x, y, z)$ ,  $F(-, -, z)$ , etc.

these 3 coordinates should appear in cp.dat with the listed coordinates having small  $\sigma$  (0.001 m for example) and the "missing" coordinates, having an approximate value but with large  $\sigma$  ( $1.0 \times 10^5$  for example)

5. Measure all points (pass points and control points) on all photos where they are visible. Use `imeas.m` or equivalent photo measurement utility with data format: ID column row, and filename same as photo name but with extension, `.txt`,

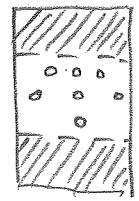
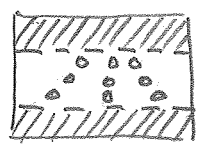
6. Avoid camera looking parallel to X-axis, this can lead to gimbal lock.



7. Make sure cam.dat (format from calibration) is filled in with your camera data and has  $\sigma$ 's for the fixed case. Make sure you have constructed pho.dat by running axp-ee.m for each photo (need appropriate rect.txt, ca.txt, output appended to pho.dat) List photo measurement filenames in profiles.dat. Make sure you have cp.dat from step 4.

8. Run `pha-sc.m` to minimize measurement corrections and estimate exterior orientation for each photo, and coordinates for each pass point. Expectation is the RMS for image measurements should be  $\sim 1$  pixel.

If the RMS is much larger, look for individual measurements to investigate. If RMS is  $2^+$  pixels it may go back to calibration targets too much clustered in the center of image, not in the corners.



9. When you have acceptable adjustment results, extract the point list to file: `point_list.txt`. Manually assign vertices to quadrilateral corners in `quads.txt` format:

ID1	ID2	ID3	ID4	Material_code
ID1	ID2	ID3	ID4	Material_code
⋮				
ID1	ID2	ID3	ID4	Material_code

ID's must match exactly. Material code just assigns a color - you may change as needed. Run the program `blt-geom.m` to make & display the resulting geometric model.

Currently only quadrilaterals are allowed. It can easily be extended to allow triangles. Let me know if needed.

10. Document all steps. I need to be able to reconstruct your model. So send digital copy of point\_list.txt, quads.txt, and bld\_geom.m if you have modified it.

point\_list

01	8. 170	47. 218	99. 990
02	18. 799	47. 252	99. 961
03	18. 812	51. 769	99. 953
04	18. 818	51. 956	100. 040
05	8. 172	51. 759	99. 962
06	8. 163	51. 942	100. 028
07a	8. 194	53. 346	97. 252
07b	8. 511	53. 342	97. 343
07c	8. 522	53. 378	97. 251
08	12. 912	53. 385	97. 189
09a	12. 911	55. 960	97. 187
09	12. 916	56. 301	97. 304
09b	8. 525	55. 978	97. 216
09c	8. 519	56. 313	97. 271
10	12. 915	56. 467	97. 387
11	12. 894	57. 895	94. 007
12	12. 928	58. 079	94. 107
13	12. 886	54. 953	94. 022
14	18. 792	54. 967	93. 880
15	19. 105	57. 958	93. 974
16	19. 109	58. 137	94. 044
17	24. 928	56. 488	92. 896
18	27. 841	56. 483	92. 947
19	27. 841	56. 512	95. 368
20	26. 225	49. 386	93. 014
21	26. 402	52. 292	93. 893
100	10. 000	50. 000	100. 000
101	10. 008	51. 539	100. 000
102	10. 902	51. 538	99. 989
103	10. 903	49. 998	100. 011
104	10. 156	50. 149	100. 016
105	10. 152	51. 393	99. 997
106	10. 753	51. 393	99. 995
107	10. 752	50. 146	100. 006
110	13. 035	49. 998	99. 992
111	13. 036	51. 538	99. 986
112	13. 931	51. 537	99. 981
113	13. 939	49. 997	100. 012
114	13. 185	50. 147	100. 005
115	13. 186	51. 389	99. 994
116	13. 787	51. 393	99. 977
117	13. 781	50. 146	99. 968
120	16. 072	49. 996	99. 996
121	16. 079	51. 536	99. 996
122	16. 972	51. 541	99. 978
123	16. 975	50. 000	100. 000
124	16. 225	50. 144	99. 980
125	16. 224	51. 394	99. 979
126	16. 832	51. 398	99. 981
127	16. 822	50. 141	99. 979
130	14. 096	55. 160	94. 048
131	14. 097	56. 553	94. 042
132	14. 996	56. 560	94. 037
133	14. 997	55. 153	94. 066
134	14. 247	55. 300	94. 037
135	14. 239	56. 409	94. 028
136	14. 841	56. 410	94. 029
137	14. 840	55. 300	94. 043
140	15. 312	55. 156	94. 059
141	15. 311	56. 567	94. 027
142	16. 218	56. 566	94. 032
143	16. 215	55. 162	94. 046
144	15. 466	55. 304	94. 042

point\_list

145	15. 465	56. 416	94. 012
146	16. 061	56. 414	94. 034
147	16. 061	55. 310	94. 035
150	16. 542	55. 160	94. 065
151	16. 543	56. 564	94. 037
152	17. 441	56. 564	94. 048
153	17. 442	55. 160	94. 056
154	16. 697	55. 305	94. 048
155	16. 692	56. 411	94. 042
156	17. 291	56. 416	94. 022
157	17. 289	55. 305	94. 038
22	25. 615	49. 383	93. 000
23	25. 614	48. 988	93. 010
24	26. 228	48. 986	93. 005
25	12. 528	48. 258	99. 993
501	19. 105	54. 967	93. 880
502	19. 105	47. 252	93. 880
503	18. 792	47. 252	93. 880
504	18. 792	54. 817	93. 880

quads

01 02 03 05 wall  
06 07c 08 04 roof  
08 04 14 13 roof  
08 13 11 09 wall  
07c 08 09a 09b wall  
09a 09b 09c 09 wall  
100 101 105 104 stone  
101 102 106 105 stone  
102 103 107 106 stone  
103 100 104 107 stone  
104 105 106 107 glass  
110 111 115 114 stone  
111 112 116 115 stone  
112 113 117 116 stone  
113 110 114 117 stone  
114 115 116 117 glass  
120 121 125 124 stone  
121 122 126 125 stone  
122 123 127 126 stone  
123 120 124 127 stone  
124 125 126 127 glass  
130 131 135 134 stone  
131 132 136 135 stone  
132 133 137 136 stone  
133 130 134 137 stone  
134 135 136 137 glass  
140 141 145 144 stone  
141 142 146 145 stone  
142 143 147 146 stone  
143 140 144 147 stone  
144 145 146 147 glass  
150 151 155 154 stone  
151 152 156 155 stone  
152 153 157 156 stone  
153 150 154 157 stone  
154 155 156 157 glass  
20 24 23 22 stone  
13 11 15 501 wall  
14 501 502 503 wall  
02 03 504 503 wall





