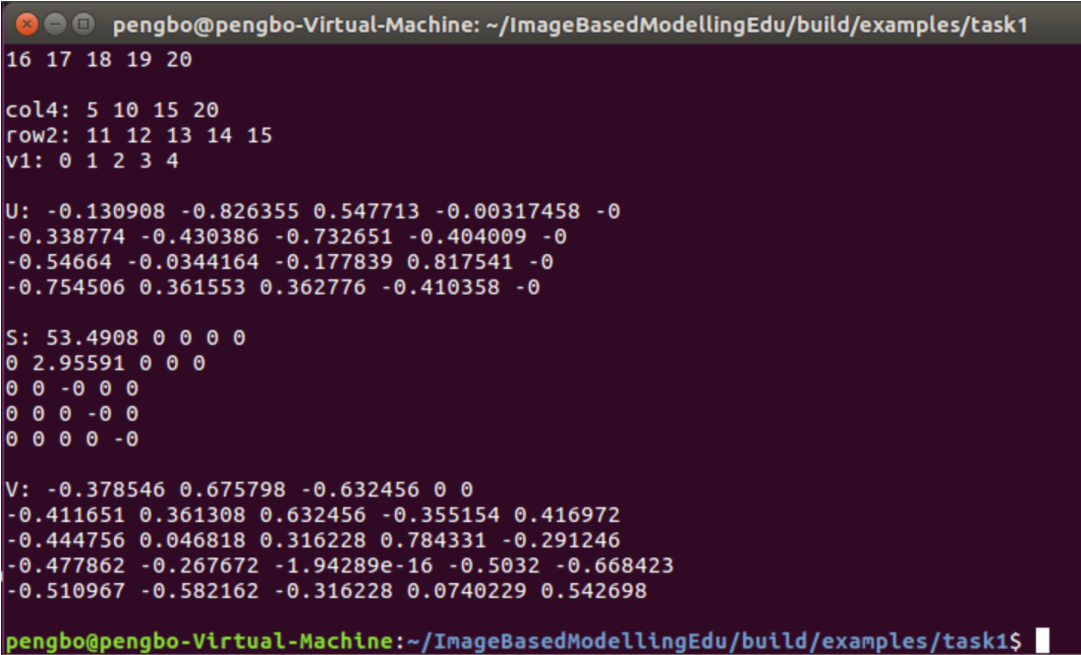


# 基于图像的三维重建 - 作业 1

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1. 在终端运行程序结果如 Fig.1所示。

A terminal window with a dark background and light-colored text. The title bar shows 'pengbo@pengbo-Virtual-Machine: ~/ImageBasedModellingEdu/build/examples/task1'. The output consists of several lines of numbers and labels. The first line is '16 17 18 19 20'. The next three lines are 'col4: 5 10 15 20', 'row2: 11 12 13 14 15', and 'v1: 0 1 2 3 4'. Then there is a block of 20 numbers labeled 'U:'. This is followed by a block of 16 numbers labeled 'S:'. Then another block of 20 numbers labeled 'V:'. The final line is the terminal prompt 'pengbo@pengbo-Virtual-Machine:~/ImageBasedModellingEdu/build/examples/task1\$' with a cursor.

```
pengbo@pengbo-Virtual-Machine: ~/ImageBasedModellingEdu/build/examples/task1
16 17 18 19 20

col4: 5 10 15 20
row2: 11 12 13 14 15
v1: 0 1 2 3 4

U: -0.130908 -0.826355 0.547713 -0.00317458 -0
-0.338774 -0.430386 -0.732651 -0.404009 -0
-0.54664 -0.0344164 -0.177839 0.817541 -0
-0.754506 0.361553 0.362776 -0.410358 -0

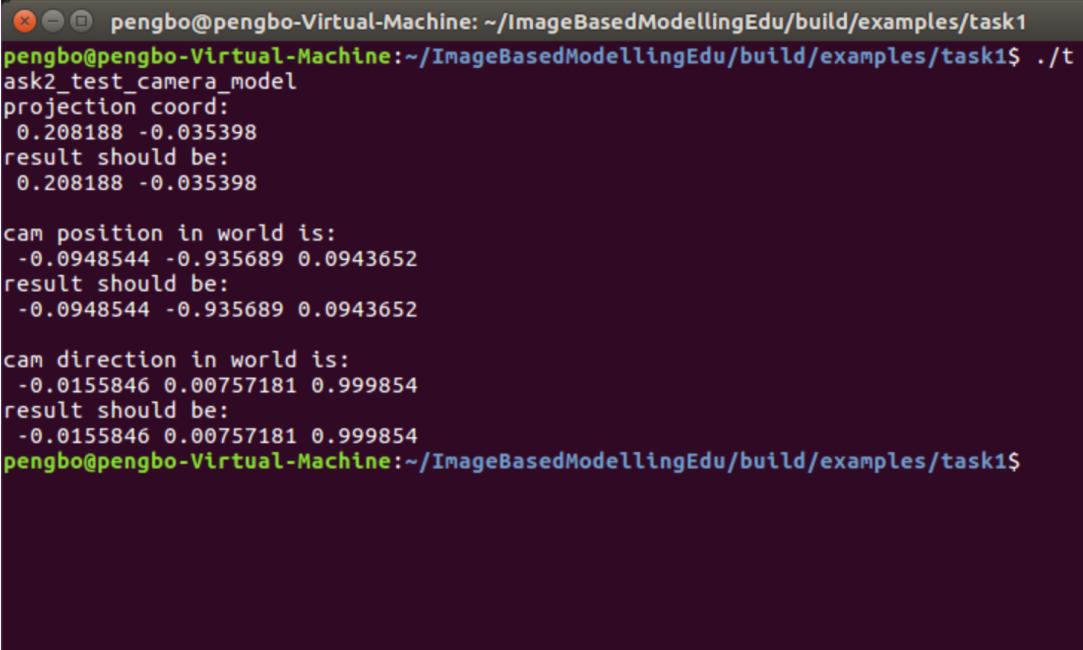
S: 53.4908 0 0 0 0
0 2.95591 0 0 0
0 0 -0 0 0
0 0 0 -0 0
0 0 0 0 -0

V: -0.378546 0.675798 -0.632456 0 0
-0.411651 0.361308 0.632456 -0.355154 0.416972
-0.444756 0.046818 0.316228 0.784331 -0.291246
-0.477862 -0.267672 -1.94289e-16 -0.5032 -0.668423
-0.510967 -0.582162 -0.316228 0.0740229 0.542698

pengbo@pengbo-Virtual-Machine:~/ImageBasedModellingEdu/build/examples/task1$
```

Figure 1: Task 1-1

2. 补充针孔相机成像代码后得到程序运行结果如 Fig.2。

A terminal window with a dark purple background and light green text. The window title is 'pengbo@pengbo-Virtual-Machine: ~/ImageBasedModellingEdu/build/examples/task1'. The prompt is 'pengbo@pengbo-Virtual-Machine:~/ImageBasedModellingEdu/build/examples/task1\$'. The user enters './task2\_test\_camera\_model'. The output shows three test cases: projection coordinates, camera position in world, and camera direction in world. Each case displays the calculated values and the expected values for comparison.

```
pengbo@pengbo-Virtual-Machine: ~/ImageBasedModellingEdu/build/examples/task1
pengbo@pengbo-Virtual-Machine:~/ImageBasedModellingEdu/build/examples/task1$ ./task2_test_camera_model
projection coord:
 0.208188 -0.035398
result should be:
 0.208188 -0.035398

cam position in world is:
-0.0948544 -0.935689 0.0943652
result should be:
-0.0948544 -0.935689 0.0943652

cam direction in world is:
-0.0155846 0.00757181 0.999854
result should be:
-0.0155846 0.00757181 0.999854
pengbo@pengbo-Virtual-Machine:~/ImageBasedModellingEdu/build/examples/task1$
```

Figure 2: Task 1-2

3. 筛选前和筛选后进行特征匹配的结果如 Fig.3-Fig.4所示，可以发现使用 lowe-ratio 进行筛选可以抑制大量的不稳定匹配，提高匹配效果。



Figure 3: Task 1-3 (筛选前)

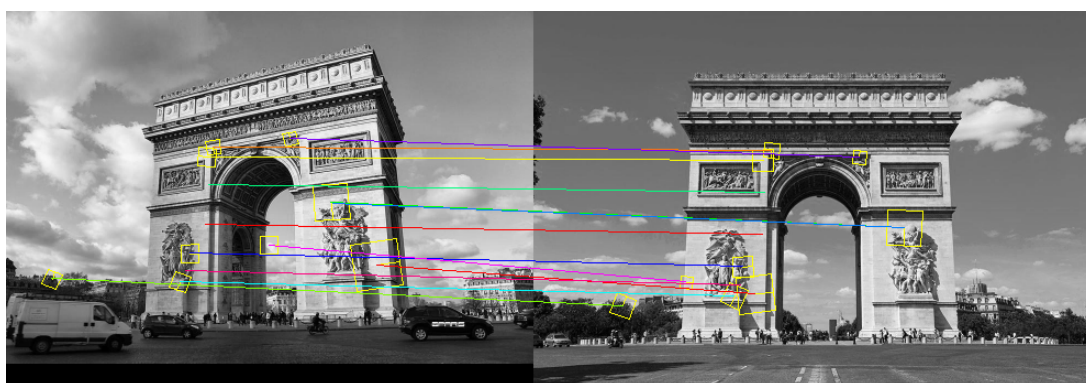
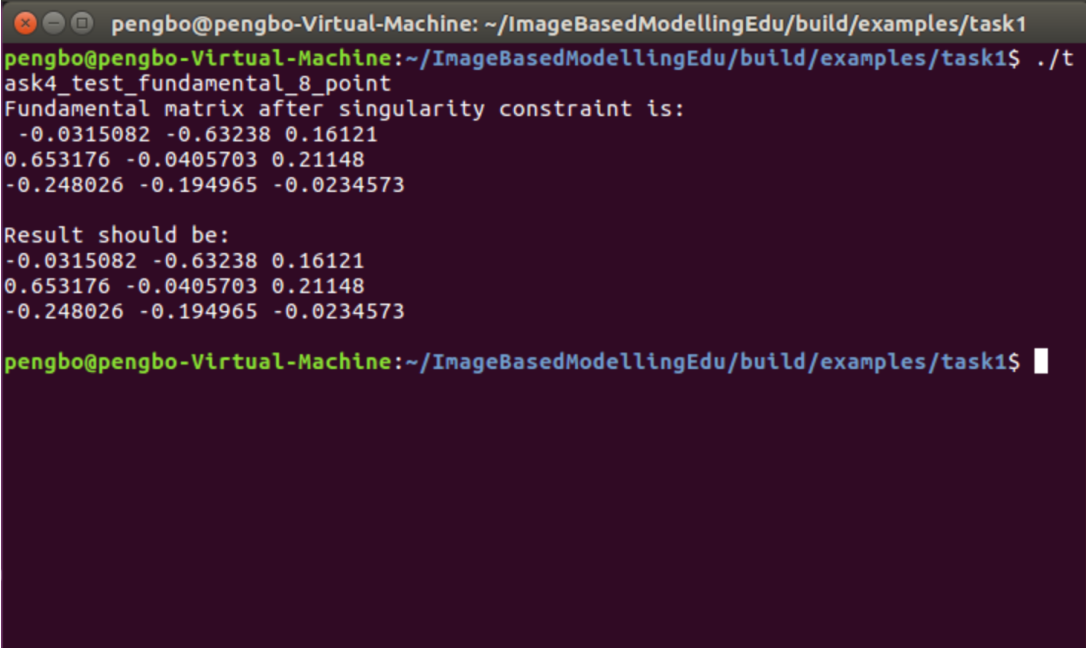


Figure 4: Task 1-3 (筛选后)

4. 补充 8 点法计算基本矩阵代码后得到程序运行结果如 Fig.5。



```
pengbo@pengbo-Virtual-Machine: ~/ImageBasedModellingEdu/build/examples/task1
pengbo@pengbo-Virtual-Machine:~/ImageBasedModellingEdu/build/examples/task1$ ./task4_test_fundamental_8_point
Fundamental matrix after singularity constraint is:
-0.0315082 -0.63238 0.16121
0.653176 -0.0405703 0.21148
-0.248026 -0.194965 -0.0234573

Result should be:
-0.0315082 -0.63238 0.16121
0.653176 -0.0405703 0.21148
-0.248026 -0.194965 -0.0234573

pengbo@pengbo-Virtual-Machine:~/ImageBasedModellingEdu/build/examples/task1$
```

Figure 5: Task 1-4

5. 补充 RANSAC 求解基本矩阵代码后得到程序运行结果如 Fig.6。

```
pengbo@pengbo-Virtual-Machine: ~/ImageBasedModellingEdu/build/examples/task1
pengbo@pengbo-Virtual-Machine:~/ImageBasedModellingEdu/build/examples/task1$ ./task5_test_fundamental_ransac
RANSAC-F: Running for 1177 iterations, threshold 0.0015...
inlier number: 272
F
: -0.00961384 -0.0309071 0.703297
0.0448265 -0.00158655 -0.0555796
-0.703477 0.0648517 -0.0117791

result should be:
inlier number: 272
F:
-0.00961384 -0.0309071 0.703297
0.0448265 -0.00158655 -0.0555796
-0.703477 0.0648517 -0.0117791
pengbo@pengbo-Virtual-Machine:~/ImageBasedModellingEdu/build/examples/task1$
```

Figure 6: Task 1-5

6. 补充本质矩阵分解得到相机位姿代码后得到程序运行结果如 Fig.7。

```
pengbo@pengbo-Virtual-Machine: ~/ImageBasedModellingEdu/build/examples/task1
A for first pose should be:
-0.972222 0 0.180123 0
-0 -0.972222 -0.156584 -0
0.963181 -0.14443 -0.200031 -0.0648336
-0.164975 -0.956437 -0.0669352 -0.969486
X for first pose should be:
3.2043116948585566 -2.7710180887818652 17.195578538234088
Correct pose found!
R:
0.999827 -0.0119578 0.0142419
0.0122145 0.999762 -0.0180719
-0.0140224 0.0182427 0.999735
t:
0.0796625 0.99498 0.0605768
Result should be:
R:
0.999827 -0.0119578 0.0142419
0.0122145 0.999762 -0.0180719
-0.0140224 0.0182427 0.999735
t:
0.0796625 0.99498 0.0605768
pengbo@pengbo-Virtual-Machine:~/ImageBasedModellingEdu/build/examples/task1$
```

Figure 7: Task 1-6