Computer Vision and Imaging [06-30213]
Summative Assignment 2

9:30am, Monday, 10 May 2021

Submission deadline:	**9:30am (BST), Monday, 17 May 2021**
Instructor:	Dr. Hyung Jin Chang Dr. Yixing Gao Dr. Mohan Sridharan Dr. Masoumeh Mansouri
Total marks:	100
Contribution to overall module mark:	25%
Submission Method:	This assignment must be submitted through Canvas.

Part 1

For the following sub-questions, you will have to submit the following files as well as everything asked for in the pdf report:

- **Question 1.1.2:**
  1. calibration file cameracalib.mat
  2. code username_assignment2_part112.m
  3. figure username_assignment2_reconstruction112.fig
  4. All images needed for the code to function
- **Question 1.1.3:**
  1. code username_assignment2_part113.m
  2. figure username_assignment2_reconstruction113.fig
  3. All images needed for the code to function
- **Question 1.2:**
  1. code username_assignment2_part12.m
  2. figure username_assignment2_reconstruction12.fig
  3. All images needed for the code to function
- **Question 1.3:**
  1. code username_assignment2_part13.m
  2. figure username_assignment2_reconstruction13.fig
  3. (Optional) video username_assignment2_dyn_reconstruction13.mp4/avi
  4. All images/video needed for the code to function

Question 1.1 **Question 1.1.1** One reason could be that the keypoints match too well. Either the camera didn't move enough between the two images, or two different cameras took the pictures from a very similar spot.

one way to rectify this could be to crop the images off-center, to give the illusion that they were taken in different spots. Another solution could be to get the structure from something else than motion, such as focus or texture.

Question 1.1.2 The radial distortion is the vector [0.0712, -0.2095], and the mean re-projection error is equal to 0.8368.

Figure 1: Figures for Question 1.1.2

Question 1.1.3

1st Can Estimate	(7.1878/1.5790)*3.5=15.93 cm
2nd Can Estimate	(5.8016/1.6892)*3.5=12.02 cm
3rd Can Estimate	(8.3968/2.8989)*3.5=10.14 cm
4th Can Estimate	(4.4722/1.4356)*3.5=10.90 cm
5th Can Estimate	(5.9179/1.5511)*3.5=13.35 cm
6th Can Estimate	(6.9471/1.1533)*3.5=21.08 cm
7th Can Estimate	(7.4215/2.2728)*3.5=11.43 cm
8th Can Estimate	(5.1368/1.1795)*3.5=15.24 cm
9th Can Estimate	(6.3072/1.7383)*3.5=12.70 cm
10th Can Estimate	(5.8291/1.4644)*3.5=13.93 cm
Overall estimate	13.67 cm

We estimate the can's height by getting the proportion between the radius and the height of the modeled cylinder, and scaling it using the can's real world radius of 3.5 cm. I calculated the average estimate of 13.67 cm from 10 models to reduce the uncertainty.

Question 1.2 I used 10 images for this reconstruction.

Question 1.3 No answer

Part 2

For this task, you will have to submit the following file:

- code **username_assignment2_part2.m**

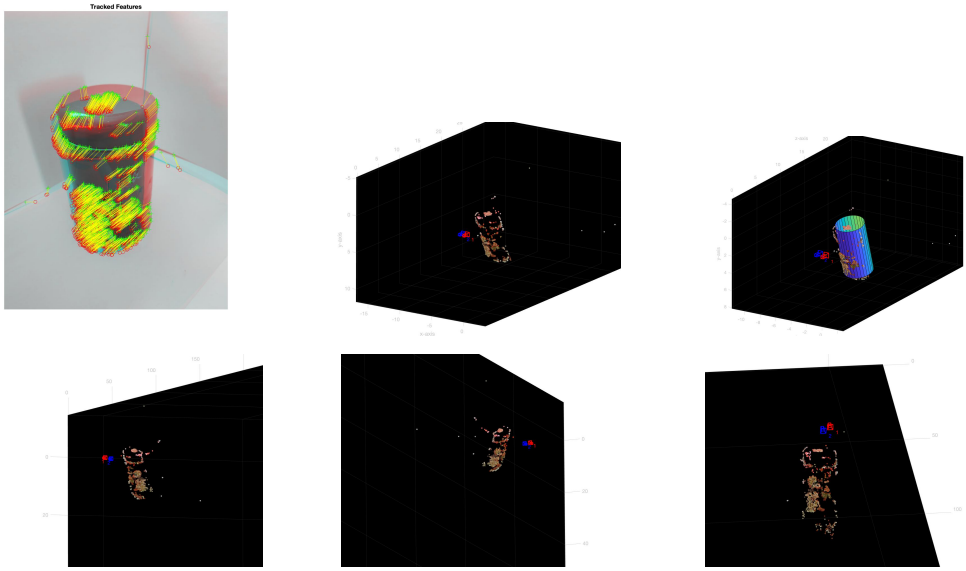

Figure 2: Figures for Question 1.1.3

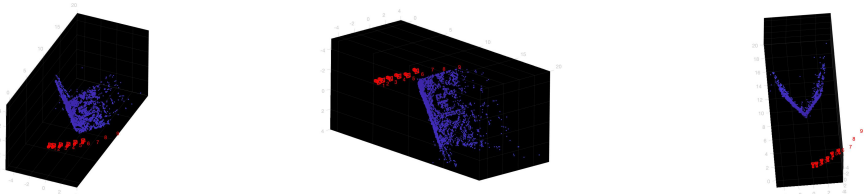

Figure 3: Figures for Question 1.2

Question 2.1

Largest Eigenvalue	1.50
2nd Largest Eigenvalue	0.53
3rd Largest Eigenvalue	0.38
4th Largest Eigenvalue	0.30
5th Largest Eigenvalue	0.28
6th Largest Eigenvalue	0.24
7th Largest Eigenvalue	0.17
8th Largest Eigenvalue	0.14
9th Largest Eigenvalue	0.13
10th Largest Eigenvalue	0.11

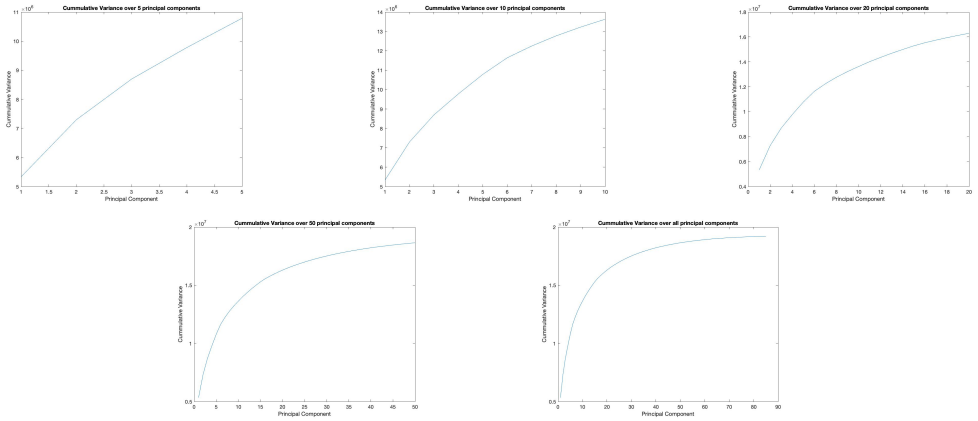

Figure 4: Figures for Question 2.2: PCAs

Question 2.2

Question 2.3

Figure 5: First 10 Eigenfaces (for 2.2)

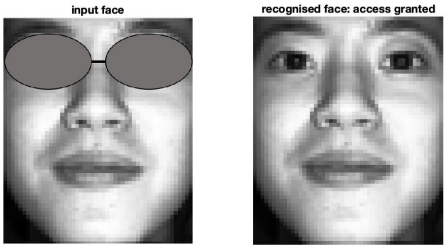

Figure 6: Figures for Question 2.3: both case scenarios