

Computer Vision and Imaging [06-30213]

Summative Assignment 2

May 17, 2021

Name: Tesfahun Yohanis-Wolleli ID:1960422 user name: TXY822

Part 1

Question 1.1 Question 1.1.1 The reason why reconstruction of objects using two image is more two dimensional than three dimensional is, firstly in order to construct 3D from 2D we need more features and textures to learn from them and be able to match and secondly multi view from different angle are necessary. So by increasing more views or angles we can rectify and construct better 3D.

Question 1.1.2 Before starting constructing 3D, the first step was to calibrate the camera using the given pattern board and be able to know camera parameters. The following image shows the relative camera position.

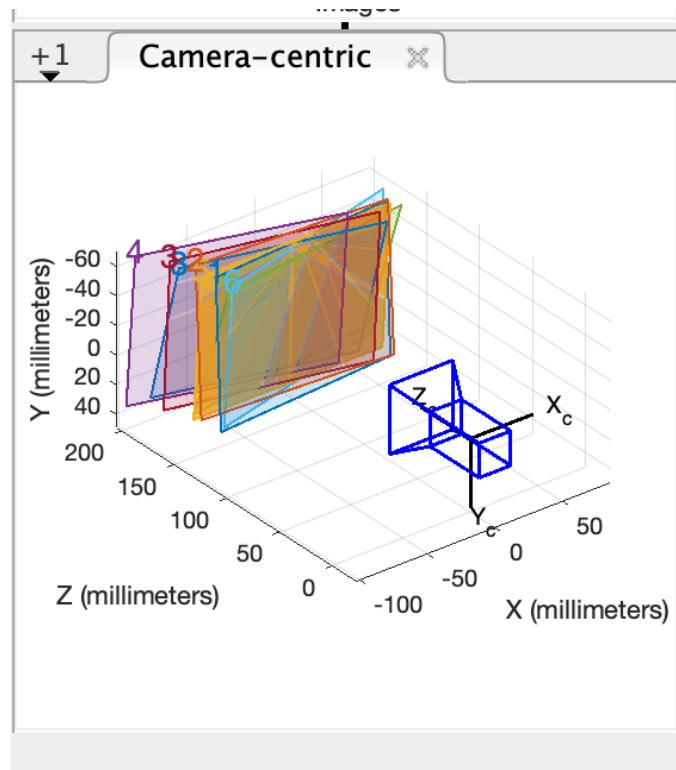


Figure 1: Relative camera position

- Additionally, the value of radial distortion is $=[0.0712, -0.209]$ and the mean re-projection error=0.836.

Using this calibrated camera parameters it was intended to reconstruct 3D image for this question using the given two library images. However, as using only two images couldn't give good reconstruction,it gives sometimes really different structure. The tracked feature image is shown below.



Figure 2: Tracked Features

- Additionally, the following two images are reconstructed.

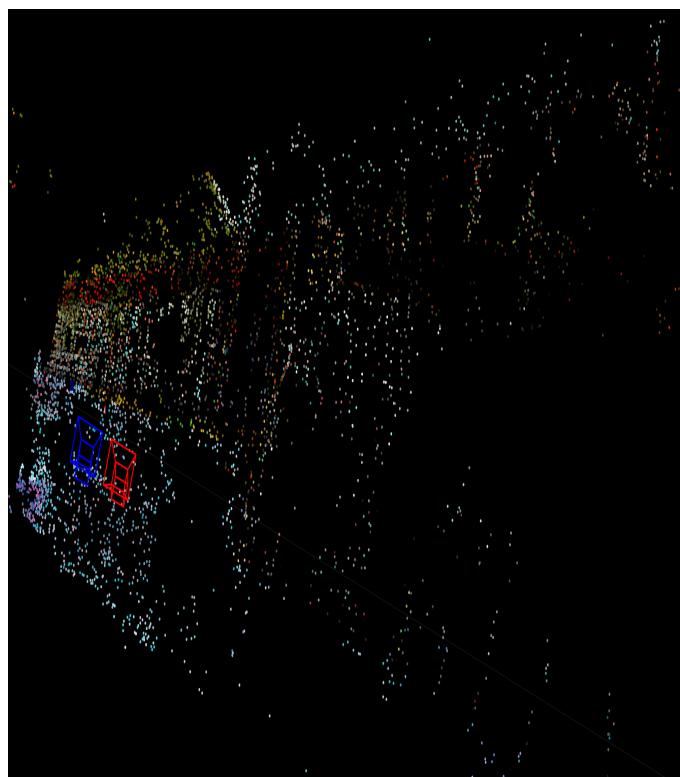


Figure 3: Reconstruction 1

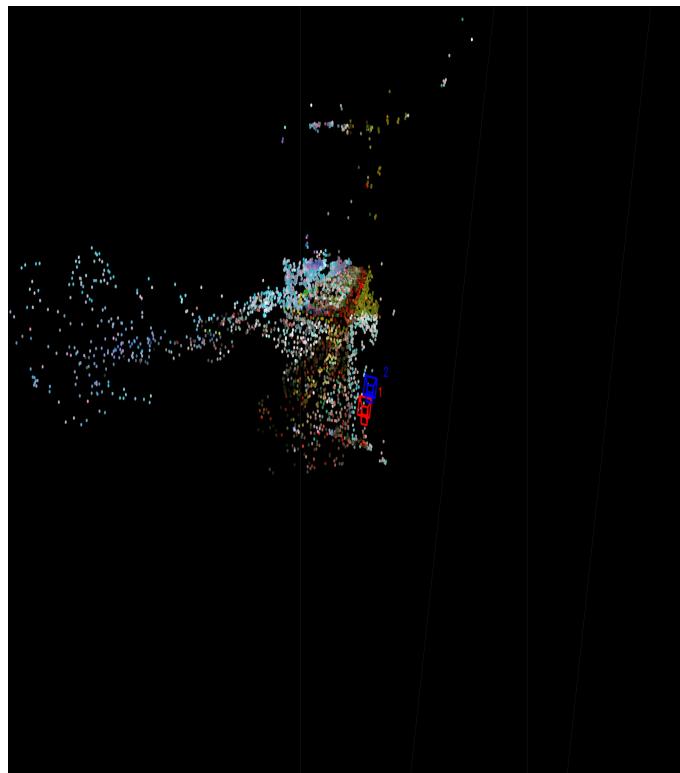


Figure 4: Reconstruction 2

Question 1.1.3 For this question, the same procedure but two different images are used. My algorithm still struggles to reconstruct 3D images from two images. The tracked feature images , unfitted reconstruction image, cylinder three fitted reconstruction images are shown below consecutively.

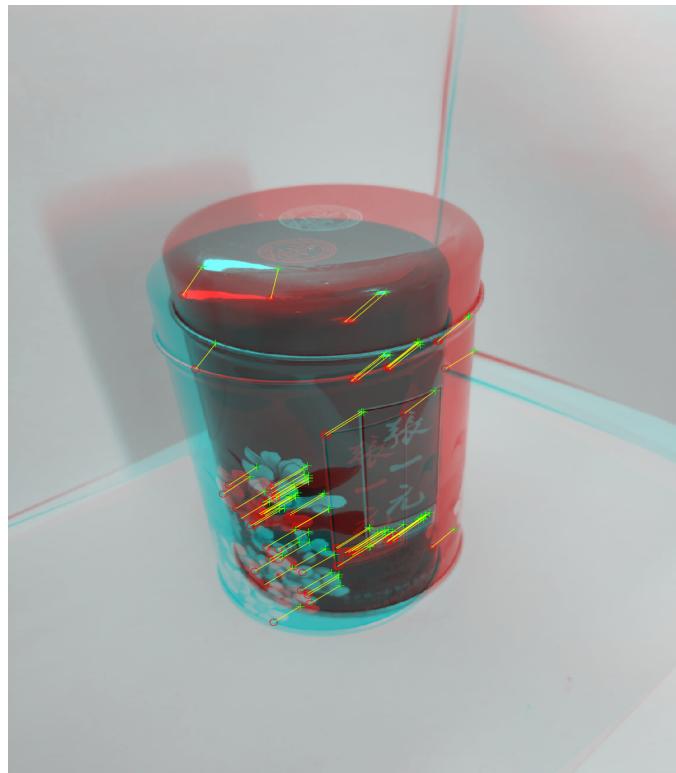


Figure 5: Tracked Features

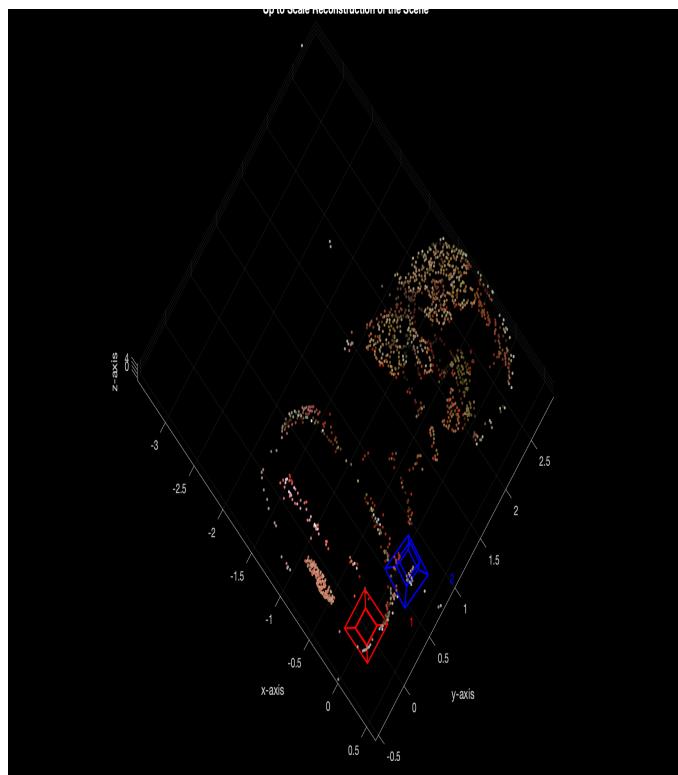


Figure 6: Unfitted reconstruction

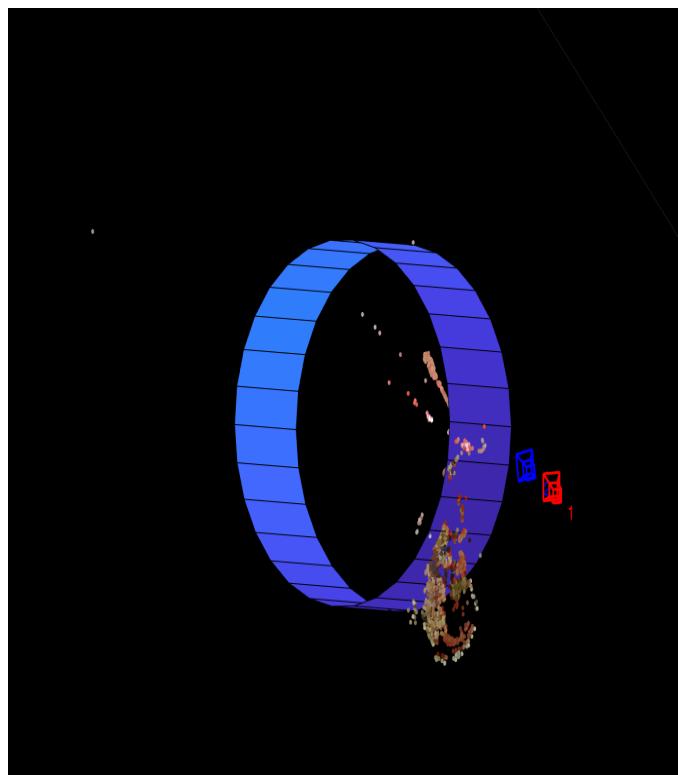


Figure 7: Cylinder fitting

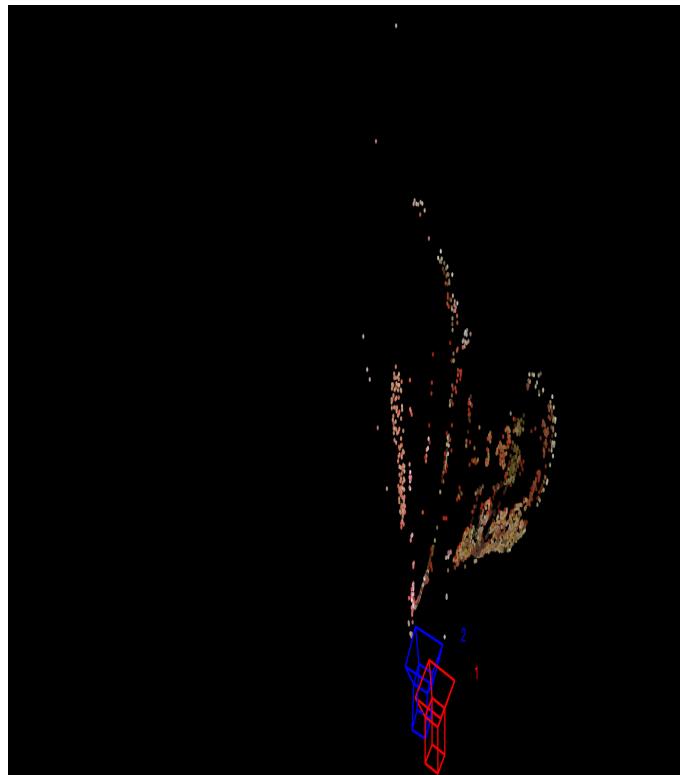


Figure 8: Metric fitted reconstruction 1

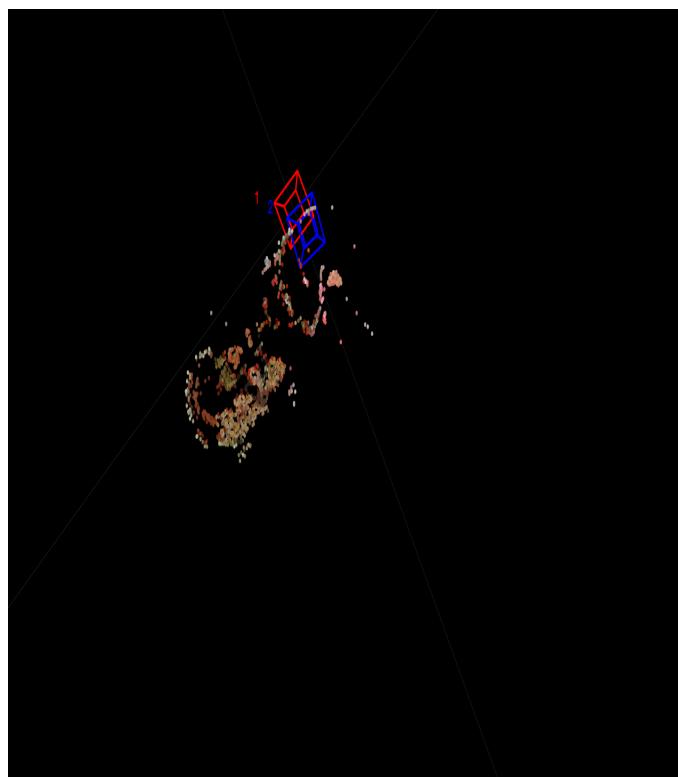


Figure 9: Metric fitted reconstruction 2

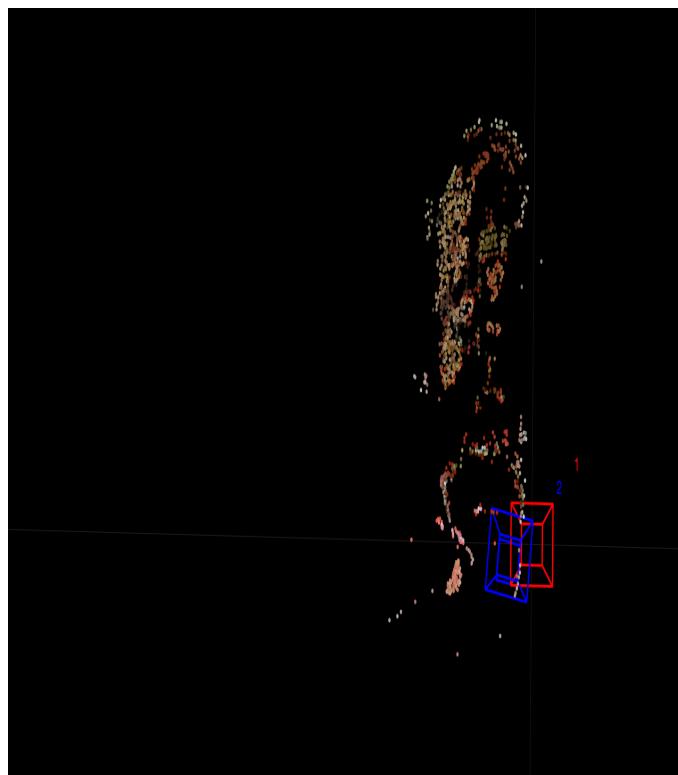


Figure 10: Metric fitted reconstruction 3

From the metered reconstruction I think it is possible to find the height of the can by reconstructing on three dimensional grid with metered values. However, my reconstruction really couldn't the value of the height.

Question 1.2 The 3D reconstructed image for this question is shown below. I used only two images.

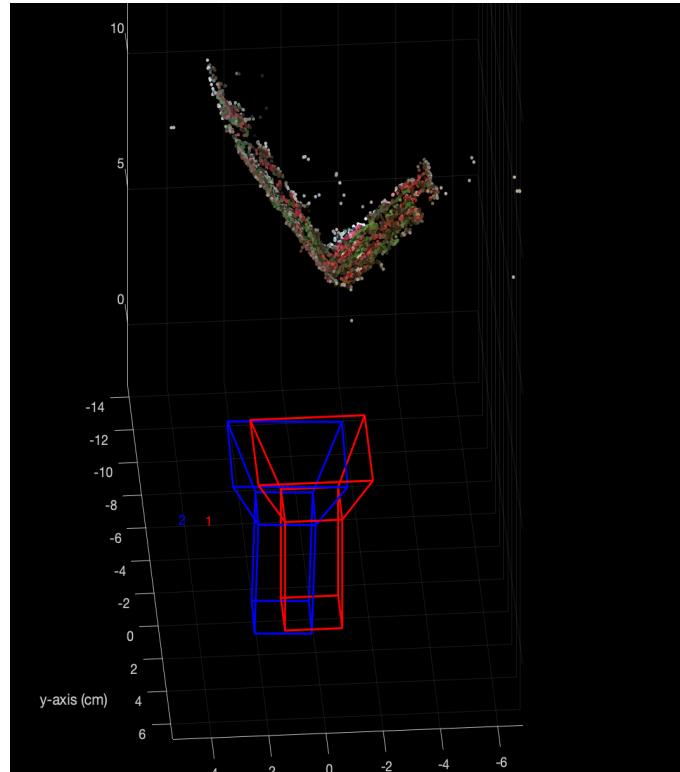


Figure 11: reconstruction 1

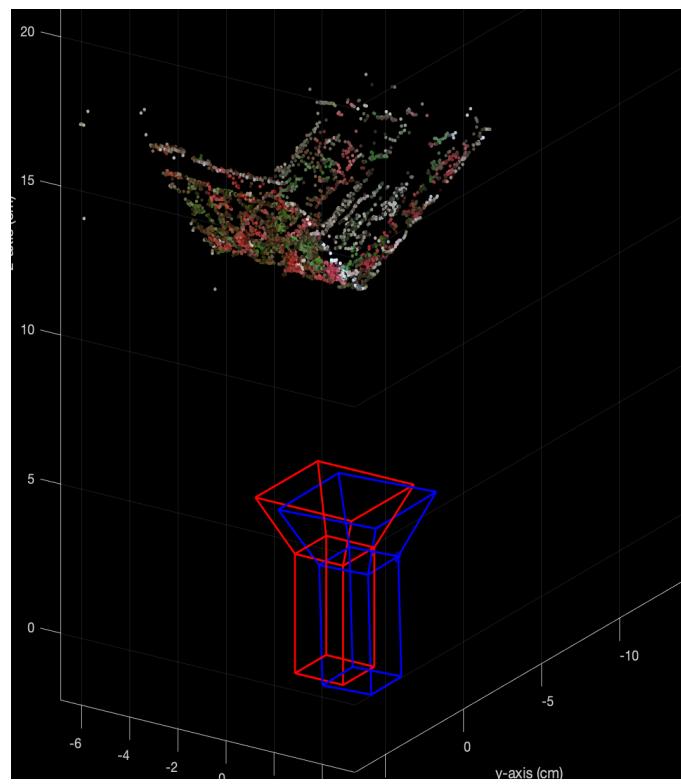


Figure 12: reconstruction 2

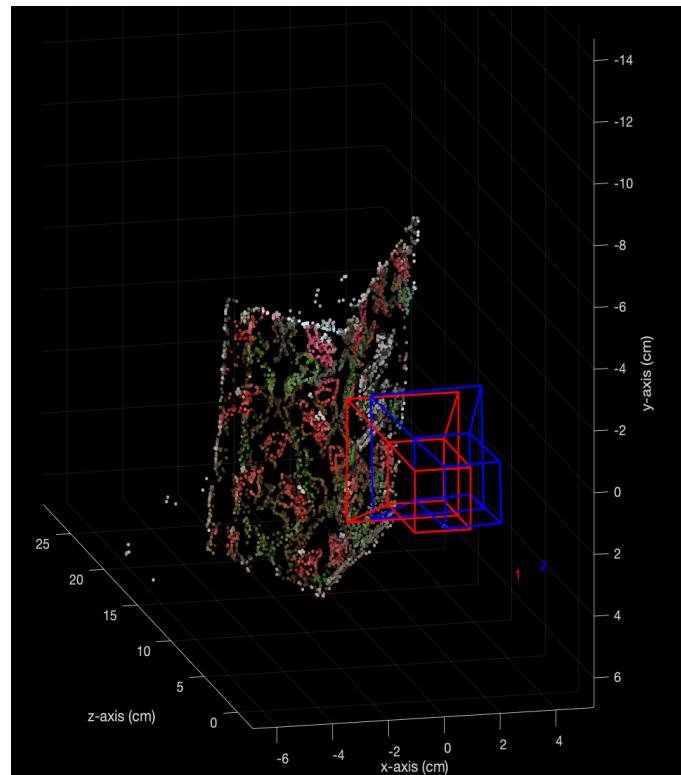


Figure 13: reconstruction 3

Question 1.3 For this question once after collecting images from the given video, it was so challenging generate enough matching points. As shown below only few are strongest corners to detect.



Figure 14: Strongest Corners

Part 2

- code `username_assignment2_part2.m`

Question 2.1 The top 10 eigenvalues, E, for the mass spectrometer data set.

$$E = \begin{bmatrix} 1.43E + 3 \\ 8.29E + 2 \\ 8.96E + 1 \\ 3.84E + 1 \\ 1.40E + 1 \\ 1.18E + 1 \\ 8.10E + 0 \\ 6.30E + 0 \\ 5.80E + 0 \\ 4.80E + 0 \end{bmatrix}$$

Question 2.2 For this problem, the selected principal components vs cumulative variance as shown below.

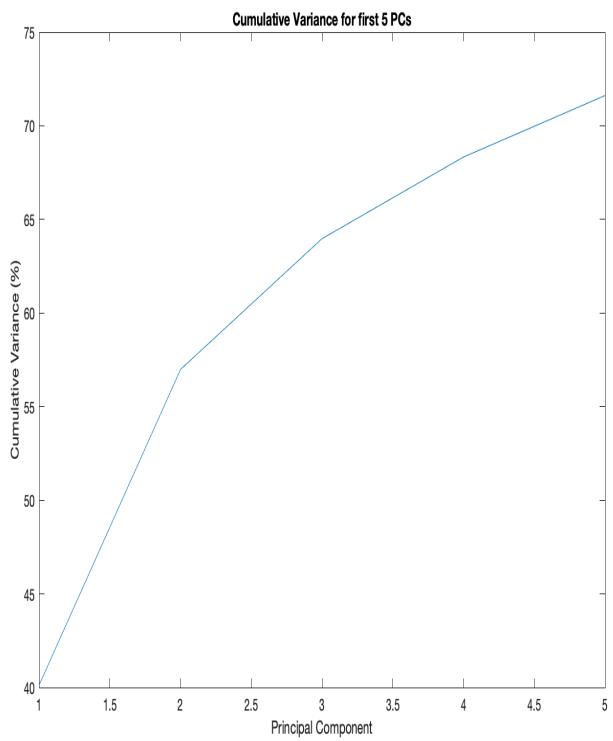


Figure 15: Top 5 principal components

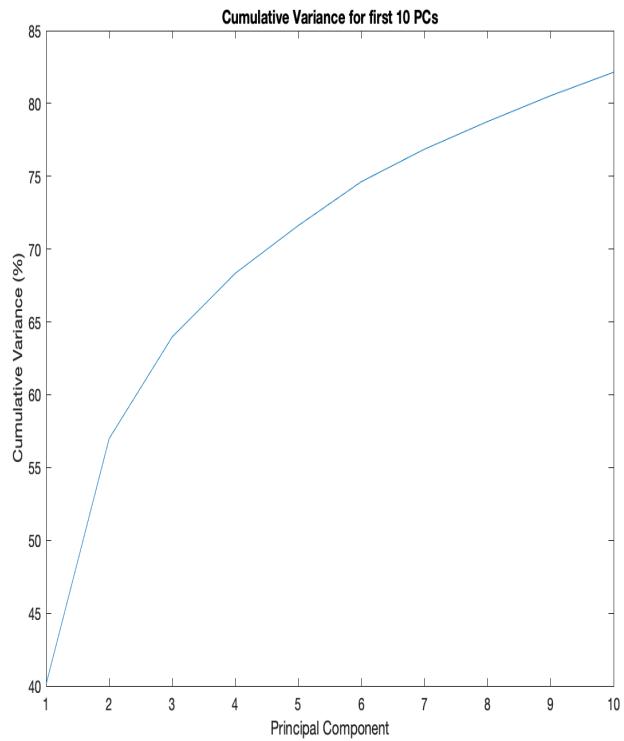


Figure 16: 10 principal components

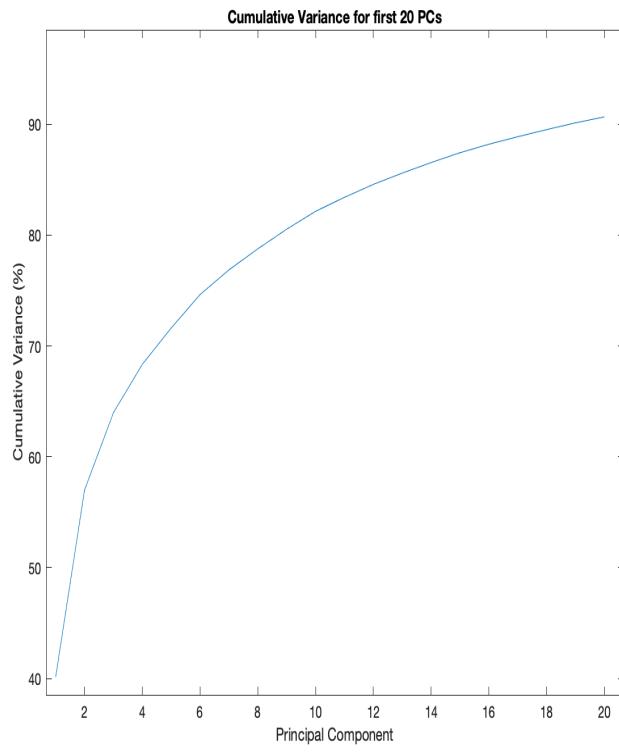


Figure 17: 20 principal components

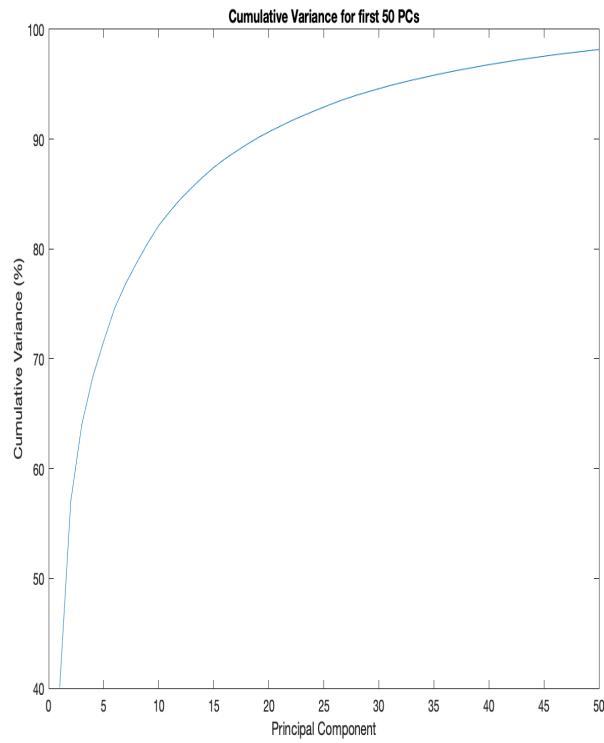


Figure 18: 50 principal components

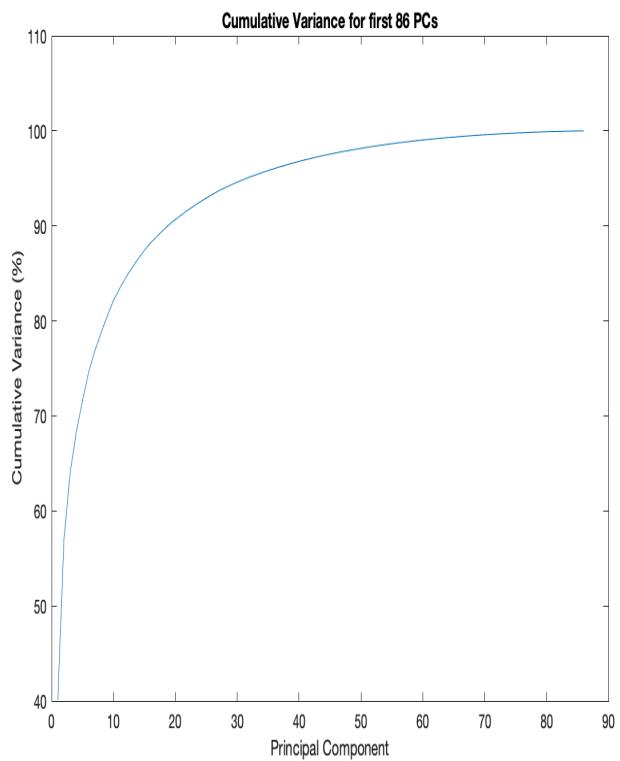


Figure 19: All principal components

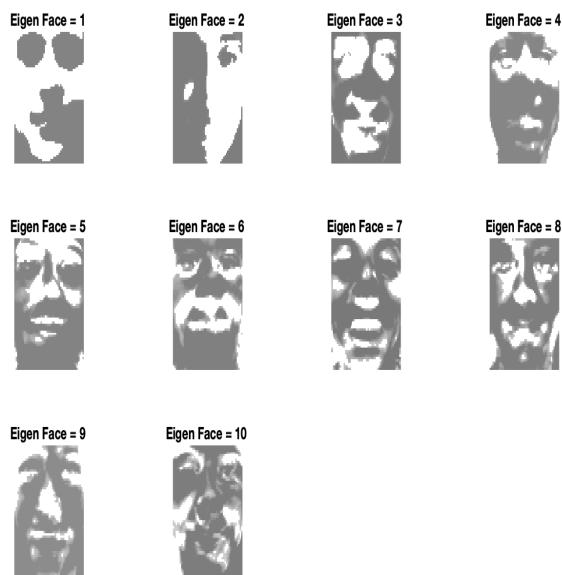


Figure 20: top 10 eigen-faces in ascending order

Question 2.3 The face recognition function recognises well for those registered or seen before. However, when new faces or distorted face is used as it recognises or give some similarity image depending of the euclidean distance. For example, for both of given test images it try to match from the stored images as shown below.



Figure 21: Recognised image 1



Figure 22: Falsely recognized

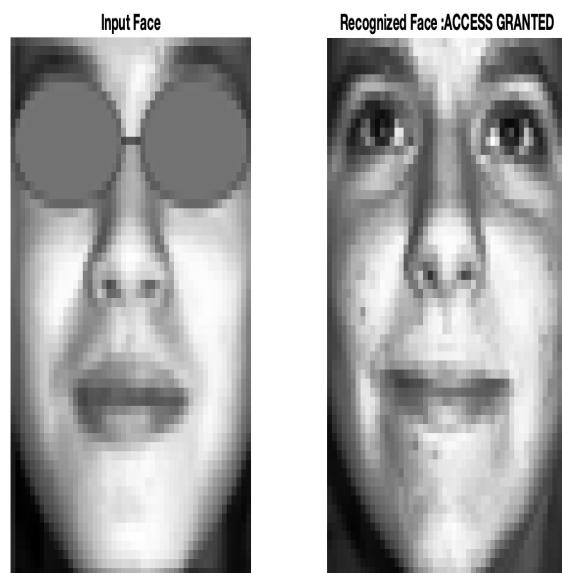


Figure 23: Recognized image

In order to identify or correctly recognize we can use the distance value(I used euclidean distance for similarity) as the seen or known faces have some value which is less than from those new ones. Therefore, once applying this kind of filtering. The celebrity image which was not seen before is now rejected as shown below but the Sun glass image still recognised .



Figure 24: Unrecognised or Access Denied

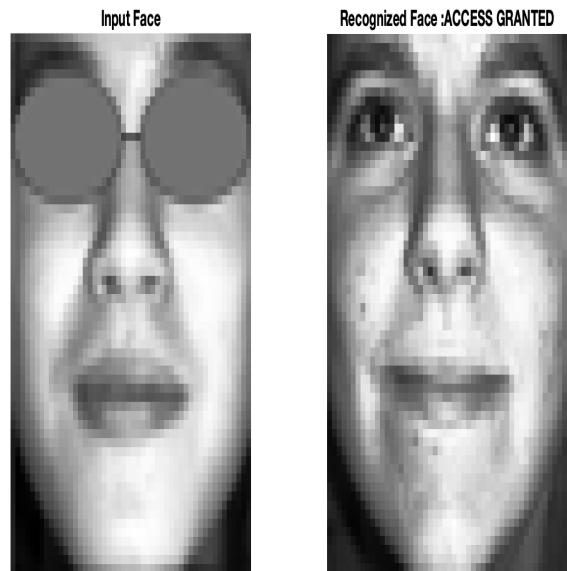


Figure 25: Recognized image