CS543/ECE549 Assignment 3

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Part 1: Homography estimation

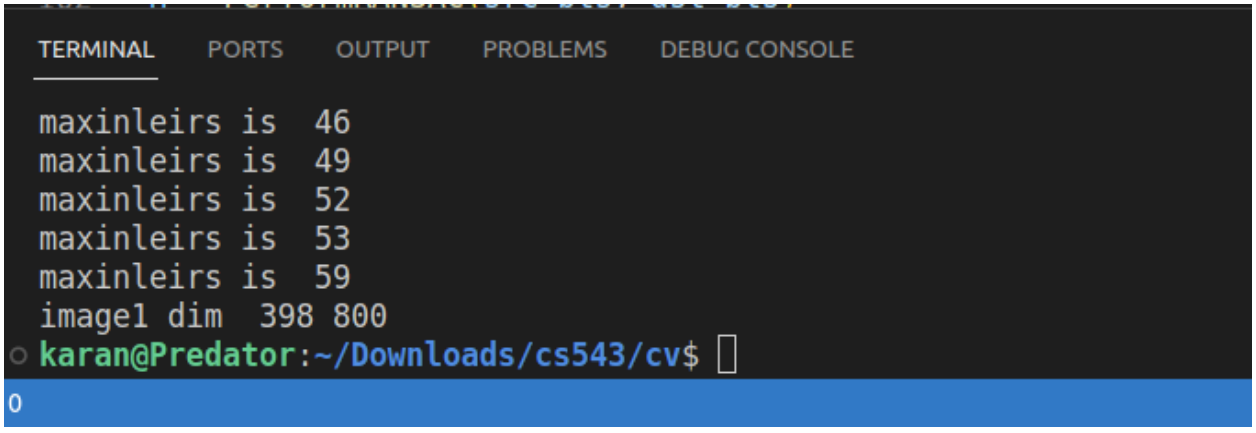
A: Describe your solution, including any interesting parameters or implementation choices for feature extraction, putative matching, RANSAC, etc.

For Ransac one interesting approach was to change the threshold for a point being an inlier or not an inlier. When the threshold was high, even though we had more points, the homography came over warped which suggests that what matters more than more number of points is more number of “low threshold” high quality points for calculating the homography.

This reduces time and space complexity of code and thus improves the performance of homography.

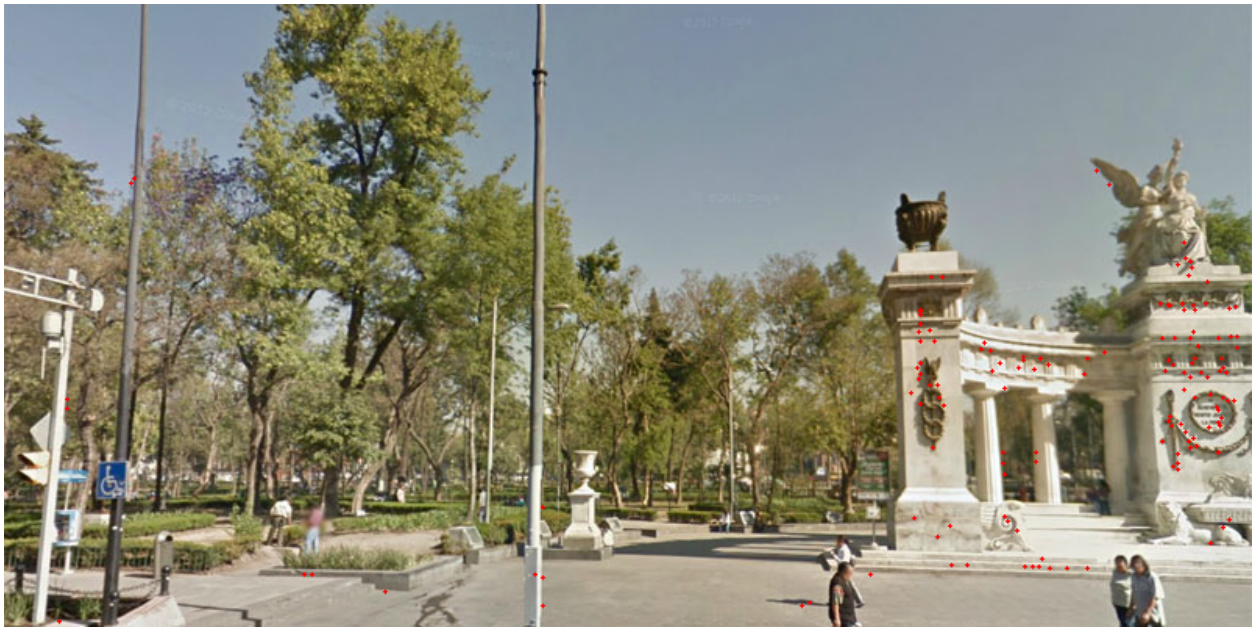
For putative matching, changing the threshold greatly varied the number of matching feature points so the best solution was to sort the matches according to distance(difference between descriptors) and pick the best 100 matches.

B: For the image pair provided, report the number of homography inliers and the average residual for the inliers. Also, display the locations of inlier matches in both images.



The number of homography inliers are 59.

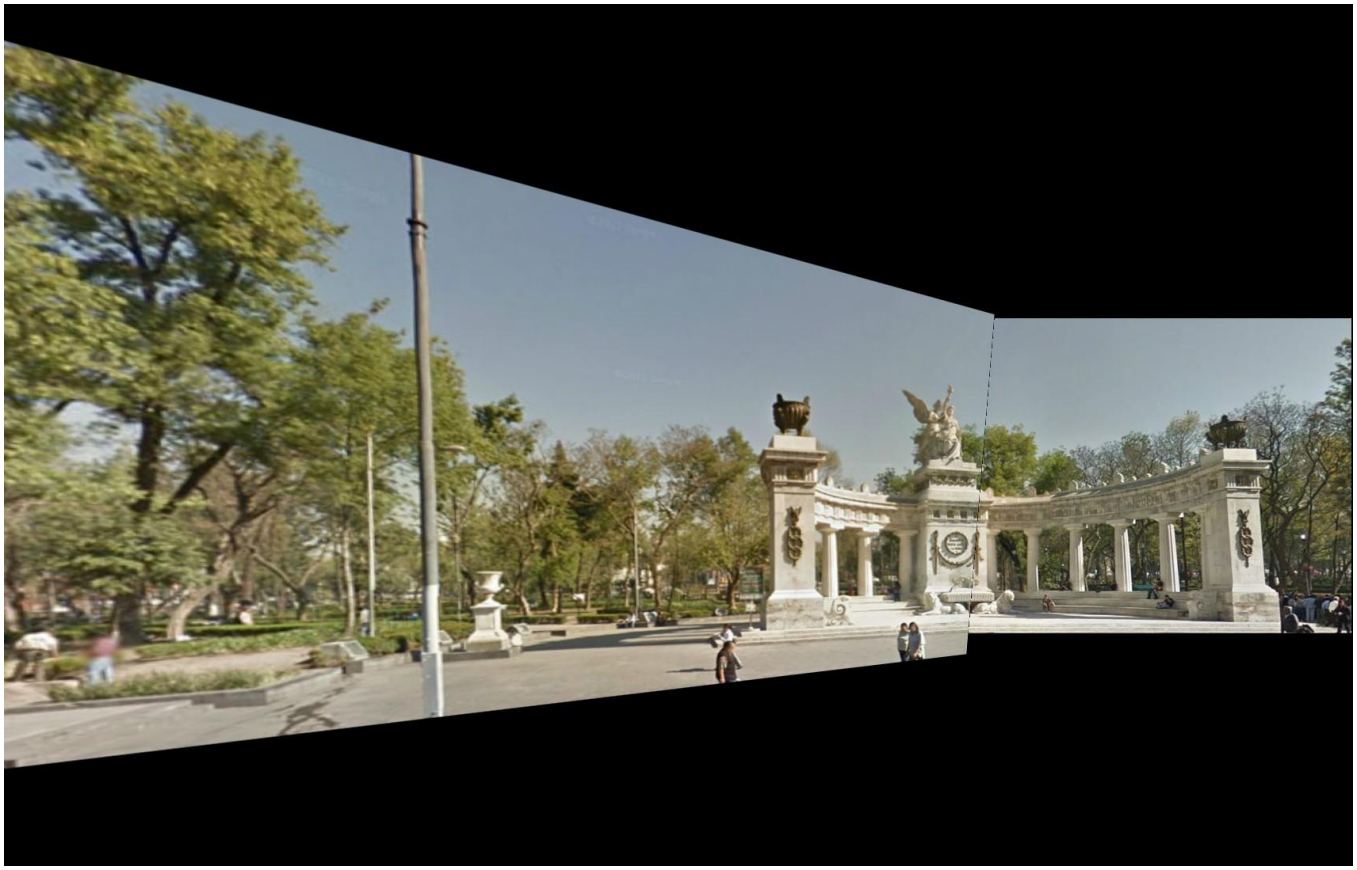
INLIERS: Left image



INLIERS: Right Image

INLIER MATCHES Both images:

C: Display the final result of your stitching:

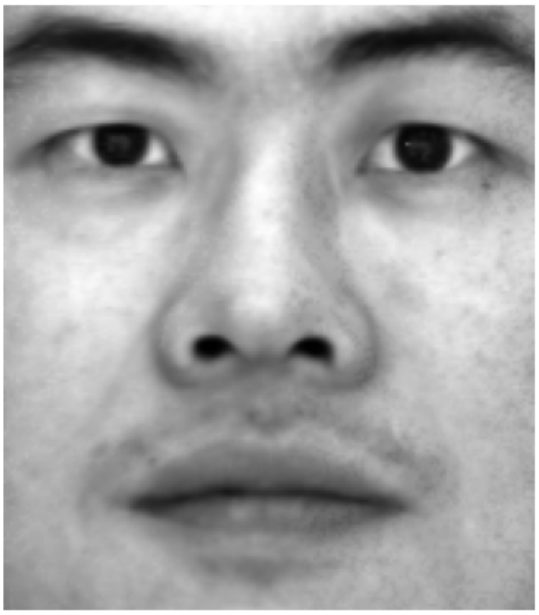


Part 2: Shape from shading

A: Estimate the albedo and surface normals

Insert the albedo image of your test image here:
BO1

B02



B05

B07

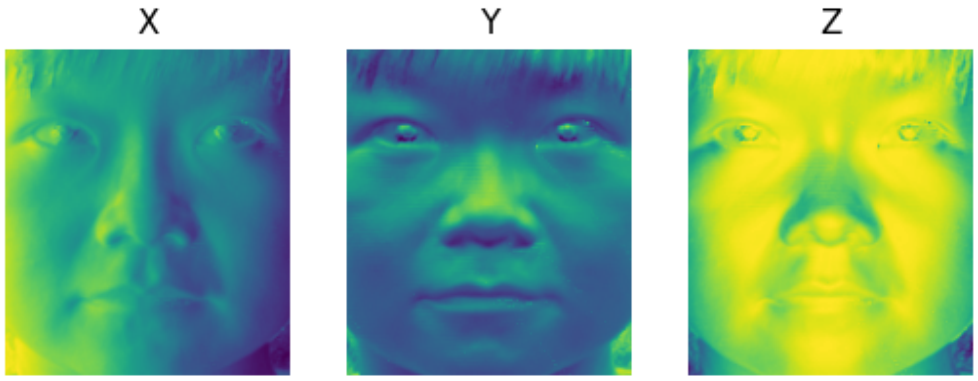
What are some artifacts and/or limitations of your implementation, and what are possible reasons for them?

Display the surface normal estimation images below:

B01

B02

B05

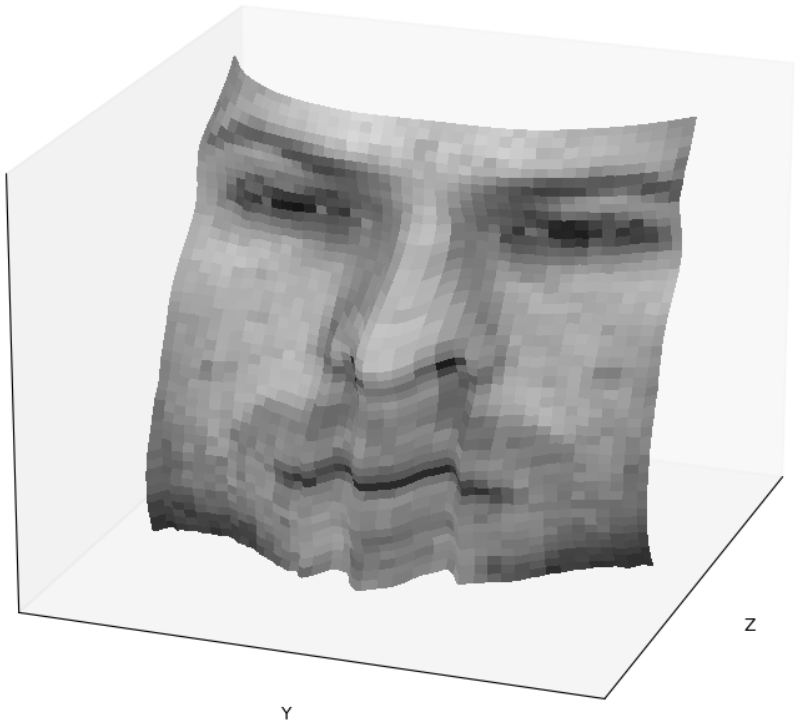


B07:

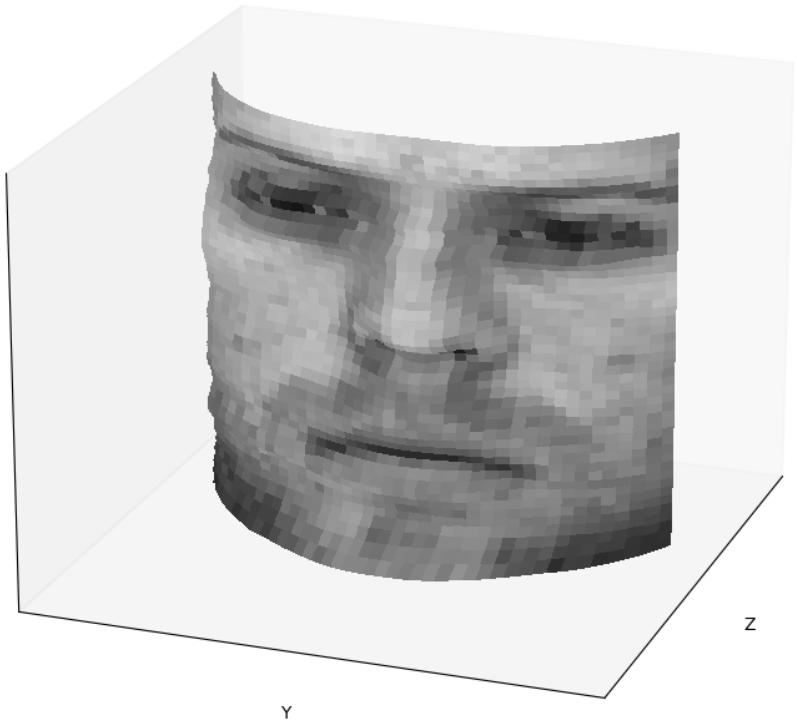
B: Compute Height Map:

For every subject, display the surface height map by integration. Select one subject, list height map images computed using different integration methods and from different views; for other subjects, only from different views, using the method that you think performs best. When inserting results images into your report, you should resize/compress them appropriately to keep the file size manageable -- but make sure that the correctness and quality of your output can be clearly and easily judged.

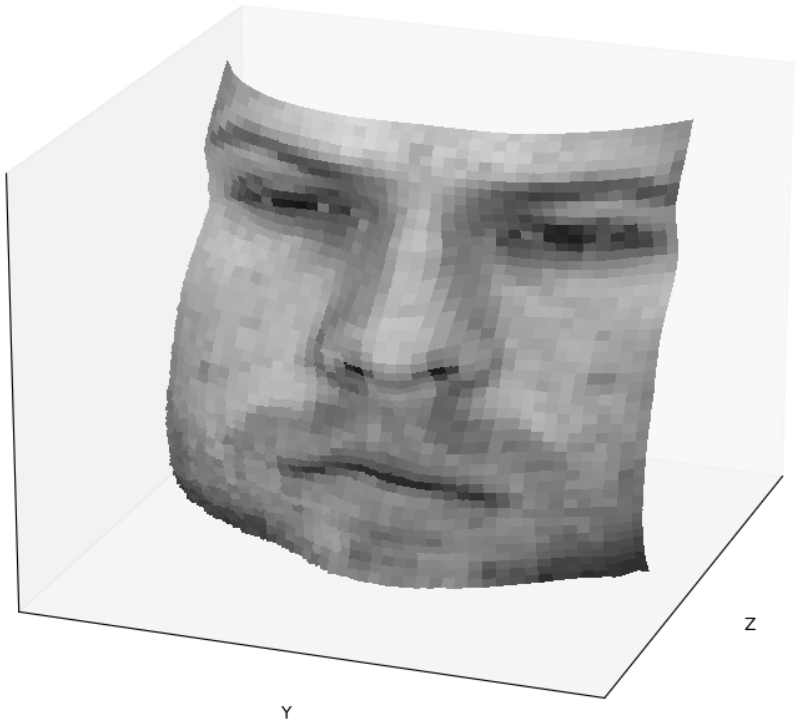
B01 row



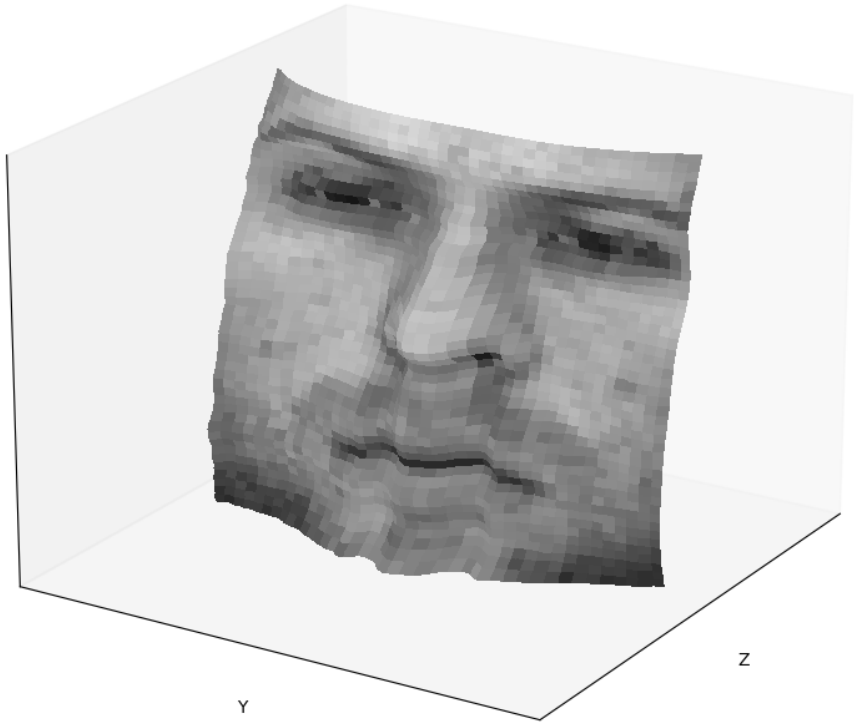
B01 column



B01 random



B01 average



Which integration method produces the best result and why?
The random method produces the best results most of the time because by randomly selecting paths (either rows or columns) multiple times, it effectively averages the height estimates over those paths. Thus reducing noise and leading to a more robust and accurate height map.

Compare the average execution time (only on your selected subject, “average” here means you should repeat the execution for several times to reduce random error) with each integration method, and analyze the cause of what you’ve observed:

Integration method	Execution time
random	34.91s
average	0.63s
row	0.62s
column	0.62s

C: Violation of the assumptions

Discuss how the Yale Face data violate the assumptions of the shape-from-shading method covered in the slides.

Answer:

LRS assumption: The yale face database violates the Lambertian Reflectance assumption because the reflectance properties of surfaces are not in fact constant due to presence of things like skin, hair.

Calibration: It also does not provide a very accurate knowledge of calibration like geometry of the scene, camera parameters, and light source positions.

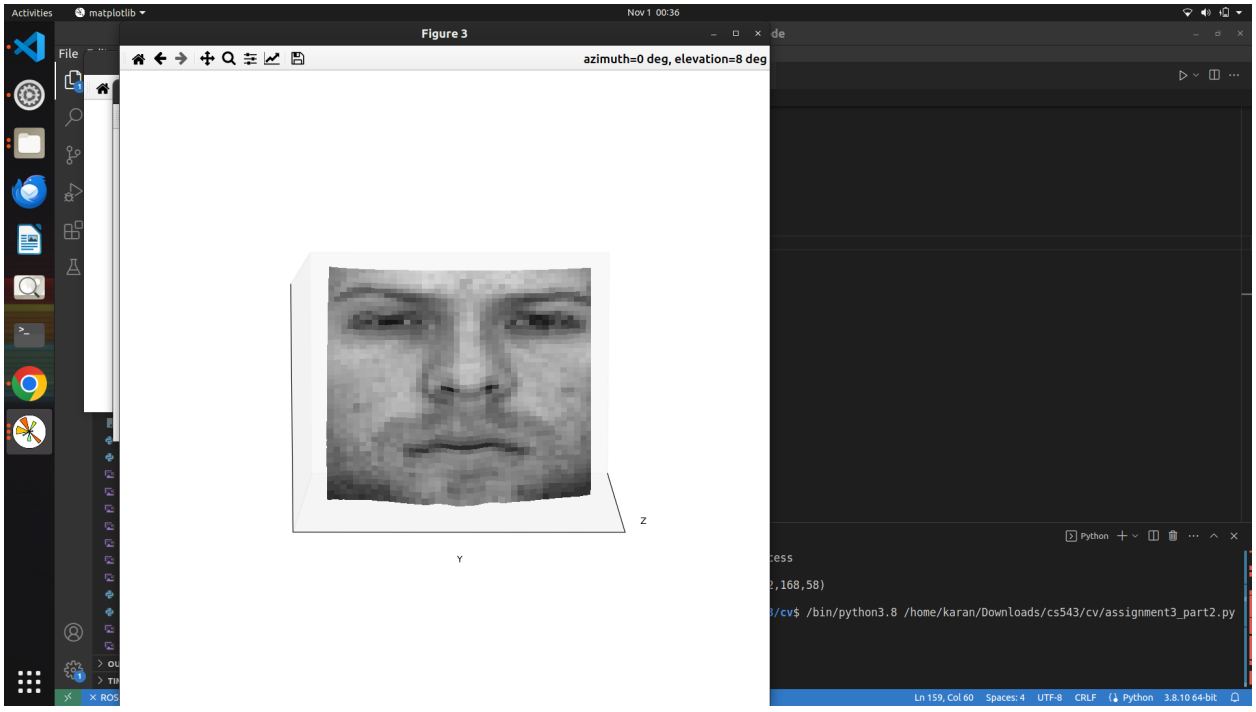
Resolution: The resolution of images in the database is also not very high which leads to coarse height maps and not smooth integration.

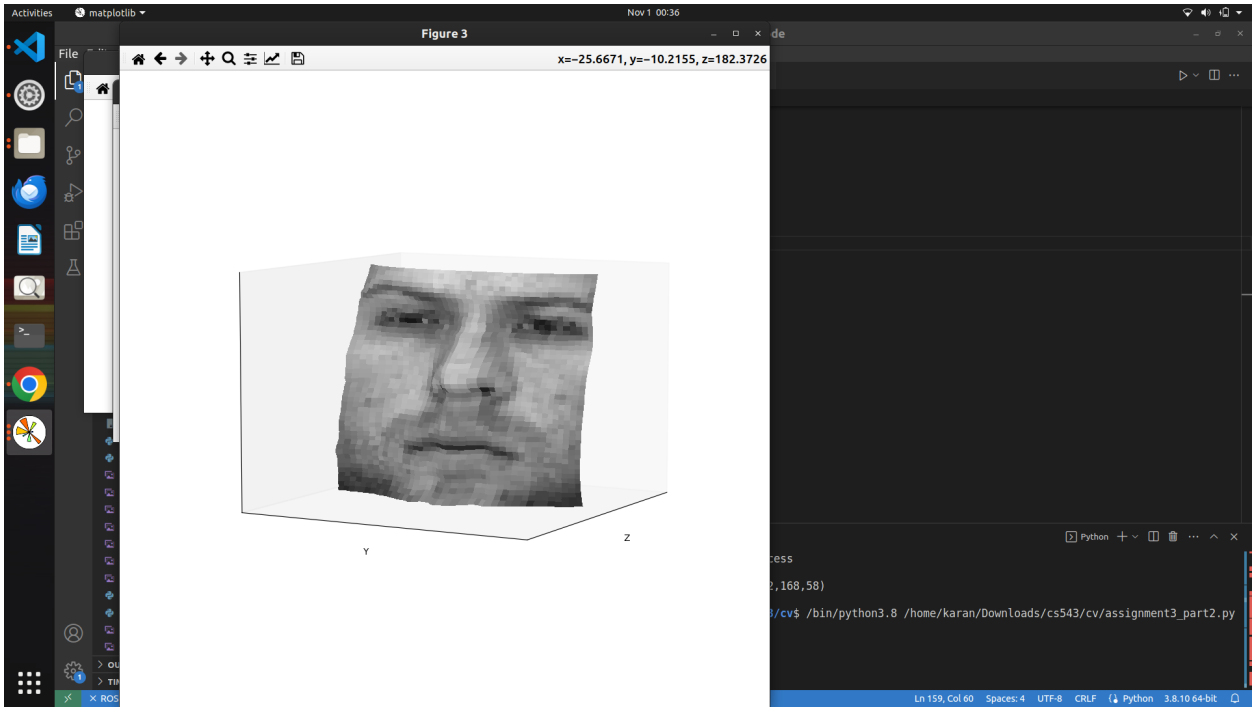
Choose one subject and attempt to select a subset of all viewpoints that better match the assumptions of the method. Show your results for that subset.

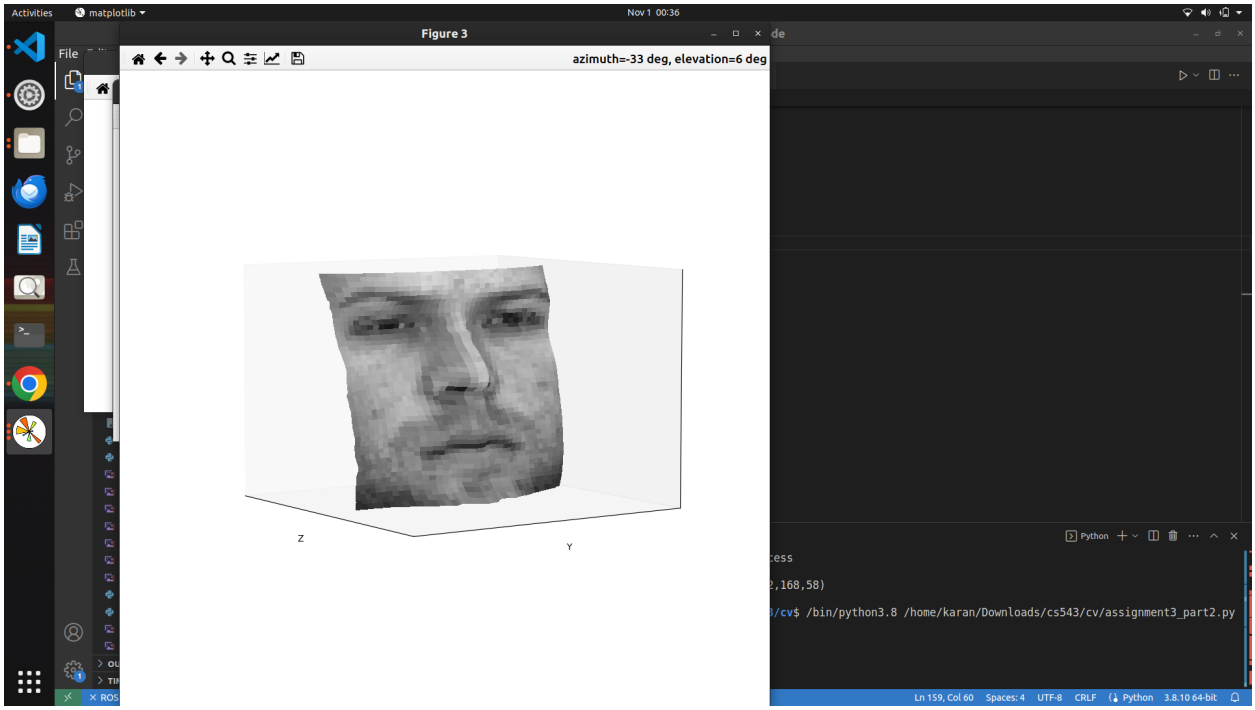
Discuss whether you were able to get any improvement over a reconstruction computed from all the viewpoints.

Answer:

I removed the images with inconsistent face expressions, like the images in which eyes Were either wide open or kind of shut because of the strong lighting coming on the Subject's face. This improved the consistency across images leading to better Reconstruction of map.


Activities
matplotlib
Nov 1 00:36
Figure 3
azimuth=0 deg, elevation=8 deg
Z
Y
Python
ess
,168,58)
/cv$ /bin/python3.8 /home/karan/Downloads/cs543/cv/assignment3_part2.py
Ln 159, Col 60
Spaces: 4
UTF-8
CRLF
Python
3.8.10 64-bit


Activities
matplotlib
Nov 1 00:36
Figure 3
x=−25.6671, y=−10.2155, z=182.3726
Z
Y
Python
ess
,168,58)
/cv$ /bin/python3.8 /home/karan/Downloads/cs543/cv/assignment3_part2.py
Ln 159, Col 60
Spaces: 4
UTF-8
CRLF
Python
3.8.10 64-bit


Activities
matplotlib
Nov 1 00:36
Figure 3
azimuth=-33 deg, elevation=6 deg
Z
Y
Python
,168,58)
/cv$ /bin/python3.8 /home/karan/Downloads/cs543/cv/assignment3_part2.py
Ln 159, Col 60
Spaces: 4
UTF-8
CRLF
Python
3.8.10 64-bit