Rakshith Churchagundi Amarnath
CWID: A20424771

CS – 512 – Computer Vision
Homework 5 – Report

Problem statement

The problem focused on this assignment is to implement a camera calibration non planar/on-coplanar calibration.

- Creating a code that extracts feature points from the calibration target.
- Display them on the image using functions.
- Write a response program that implements the calibration process from a text file (3D points) and its corelated 2D points.
- The program with including both intrinsic and extrinsic parameters along with the mean square error between the computed positions of the image points.
- RANSAC algorithm for strong estimation which should have the automatic estimate of the number of draws and the probability where a data point will be an inlier.

Proposed Solution

OpenCV functions are used to extract points and the points which are detected will be written into a file. We are writing it into two different files which are after computing the SVD of the Matrix AtA for the camera calibration.

RANSAC algorithm is coded in another file. A matrix 'M' is computed and after computing the SVD of the Matrix AtA for the camera calibration, the calculation is done for extracting values for vector named 'V'. The matrix A is similar to the matrix of equations given by the 3DH points and we are considering every points it has been created.

The non- planar calibration equation will be used to compute all the prameters once we have the matrix M.

For the RANSAC algorithm, we have to do the theses steps gradually for k number of times. The steps are as follows:

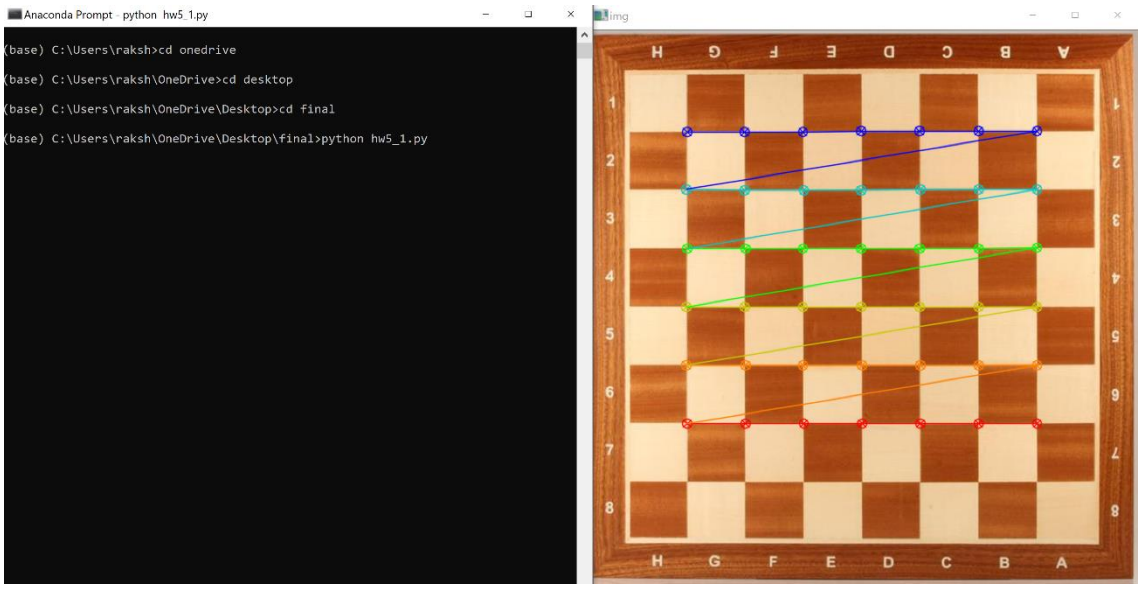
1. Create Matrix M For n random points.
2. M in turn helps to estimate image points which generated.
3. 2D and real points distance are figured out.
4. Compute t as 1.5*median of the values in the step 3.
5. For all smaller t values, data inliers are computed.
6. Recompute matrix M after factoring it.
7. Mean Squared error for all the points using the matrix M are computed.

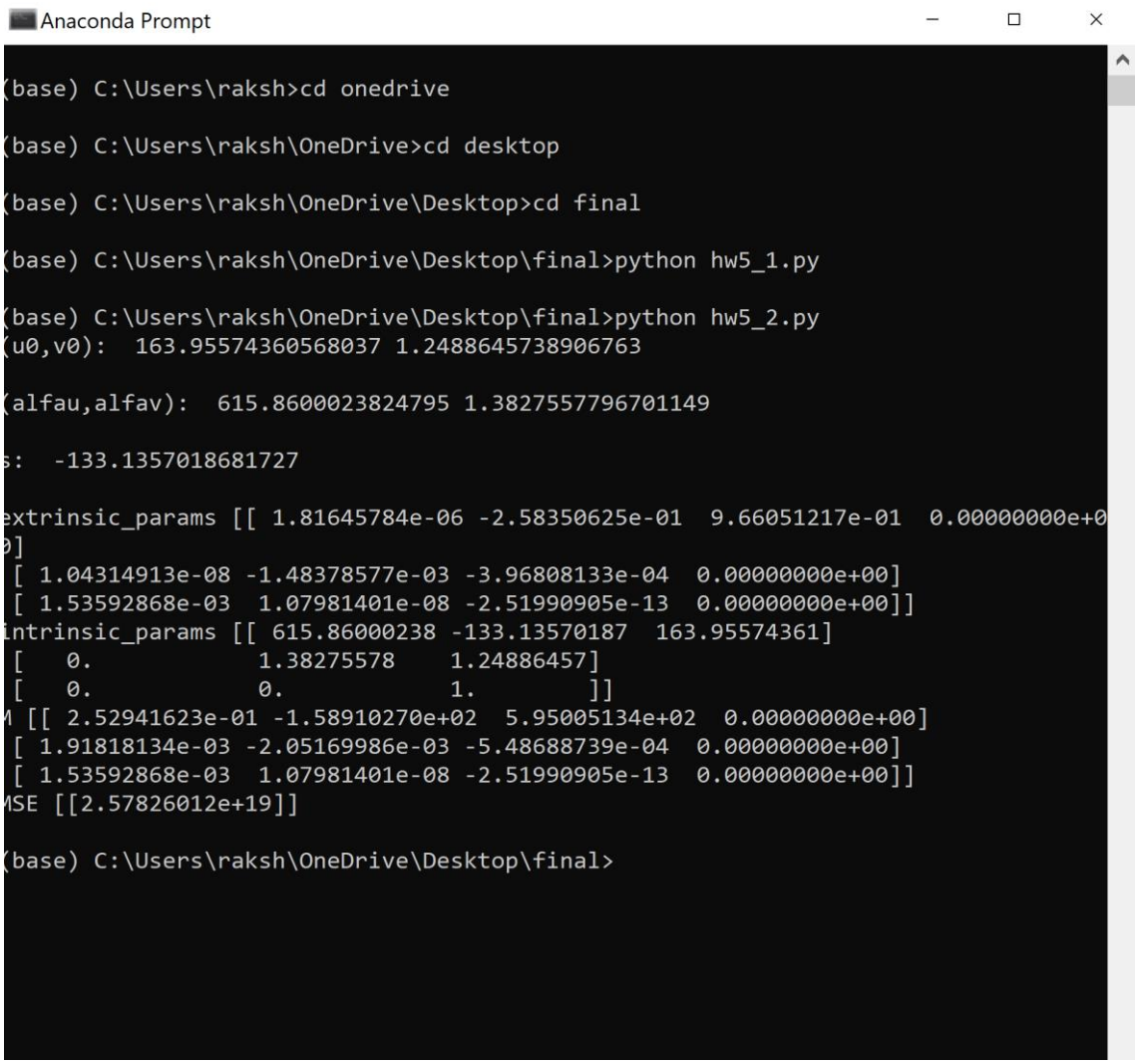
Computing the matrix M and the distance in all these loops.
After iterating this for k number of times we have some matrices M with the corresponding MSE of each of them. We have to select the one with the least MSE to be the best one and its corresponding matrix M and its parameters.

Implementation details

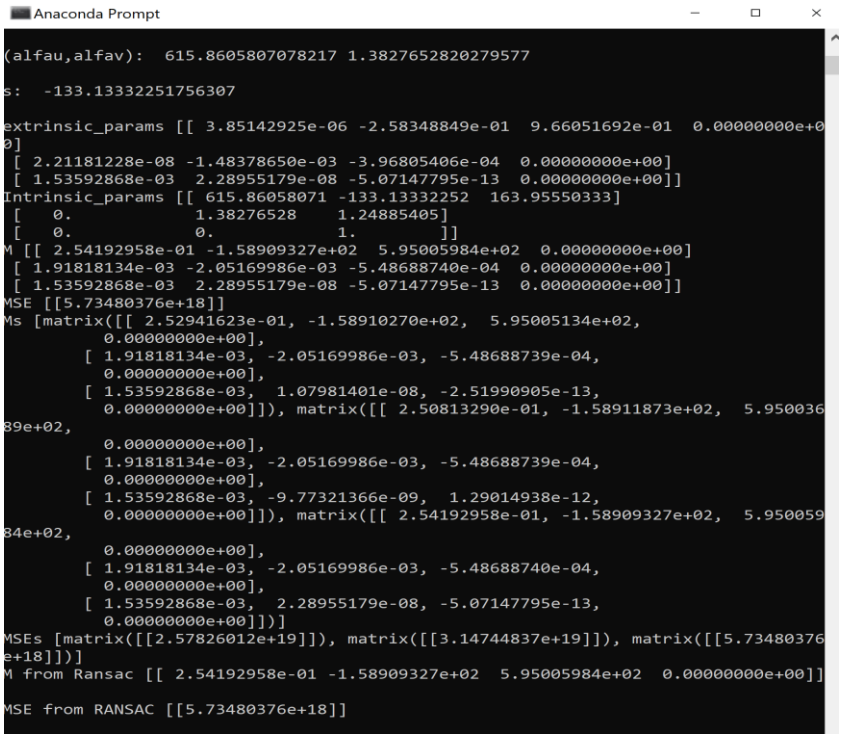
The implementation of both parts is as follows:
The first program creates the points and writes it into two different files.
The data which is written by the second program and performs the calibration process and outputs the intrinsic and extrinsic parameters and mean square error.

The points marked in the image are as follows:





In the second and third parts, the result is the matrix M and the intrinsic and extrinsic parameters and the MSE associated to them.



References

- https://docs.opencv.org/3.0-beta/doc/tutorials/calib3d/camera_calibration/camera_calibration.html
- https://docs.opencv.org/3.0-beta/modules/calib3d/doc/camera_calibration_and_3d_reconstruction.html
- https://docs.opencv.org/3.0-beta/doc/tutorials/features2d/trackingmotion/corner_subpixeles/corner_subpixeles.html