COL780:A3: Camera Calibration

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Libraries Used:

matplotlib, numpy, PIL, pandas, scipy and standard python libraries.

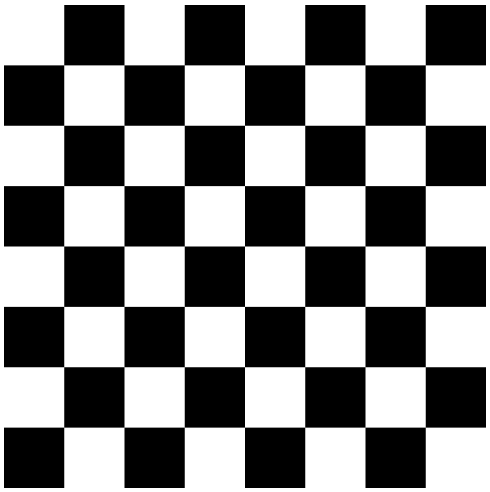
Run:

For running the camera camera calibration use **python3 main.py {input_data.csv} {test_data.csv}**. You will be able to see the original points and the predicted points visualized in **output.png**

Q1

Dataset creation

Now I took a Oneplus phone camera to create the dataset. I printed 3 images of the checkerboard given below and placed them orthogonally. Then later, I marked around 20 points manually on the 3 sheets



and calculated their 3d coordinates. After that I clicked the setup's picture and then later manually marked those points on the image using opencv functions to get their 2d coordinates. This all helped me to create the dataset **data.csv** which contains points and their corresponding 3d and 2d coordinates.

Procedure used

I converted the equations of projective geometry as discussed in class, to matrix multiplication using the concept of direct linear transformation. Then using its SVD decomposition, I calculated the eigenvector corresponding to the smallest eigenvalue, to give me the value of the optimal projection variables. Now using the first three columns of the projection matrix and its RQ decomposition, I got the K matrix which consists of the intrinsic parameters of the camera. Now writing K as the following matrix as discussed in class.

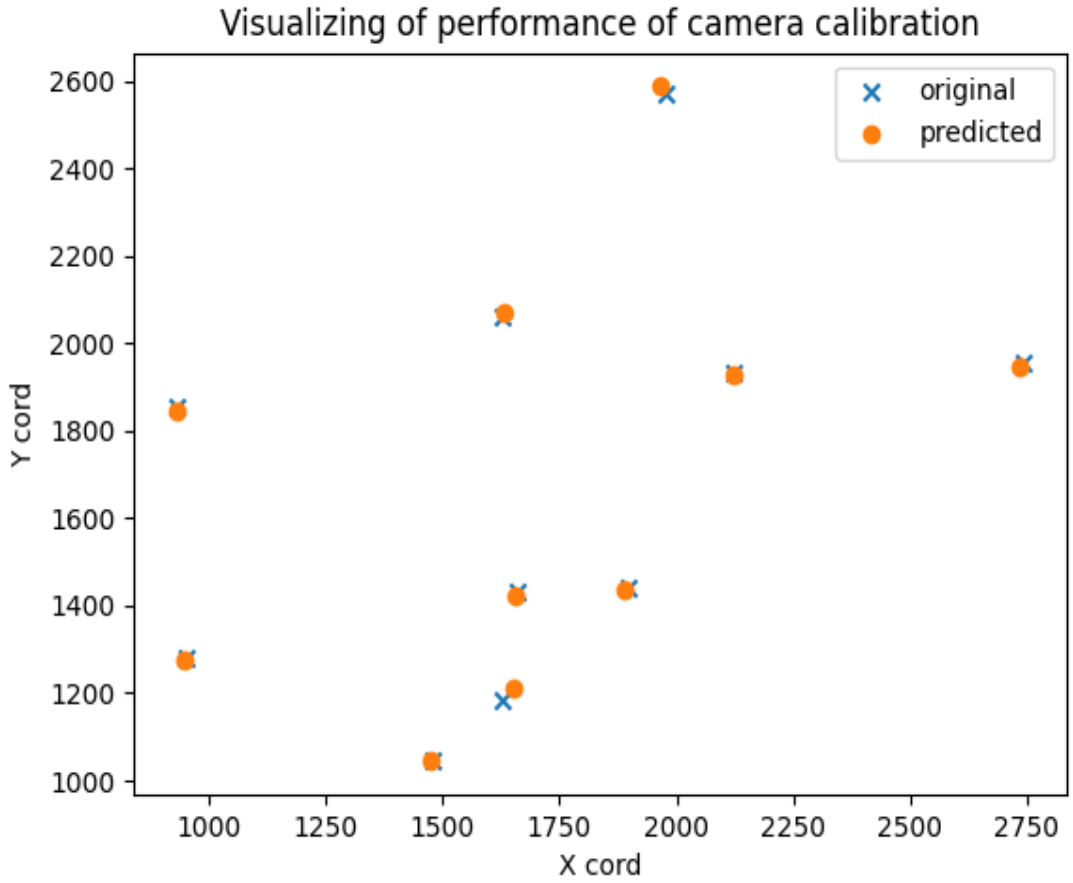
$$K = \begin{bmatrix} f_x & s & c_x \\ 0 & f_y & c_y \\ 0 & 0 & 1 \end{bmatrix}$$

I equated the parameters with obtained K, to get the final variable values in pixels as follows.

f_x	3887.38
f_y	3822.61
s	96.53
c_x	1733.84
c_y	2177.45

Testing

Now I marked 10 points separately on the setup and calculated its coordinates on the image manually and using the projection matrix as well. The rmse error between the original(manually) and predicted(using projection matrix) points came out to be **14.73 pixels**. The figure below gives us a visual idea of the accuracy of our approach.



Q2

References

- Lecture on DLT
- concepts of camera projection

- intrinsic parameters