Problem 2

1-IntelRGB

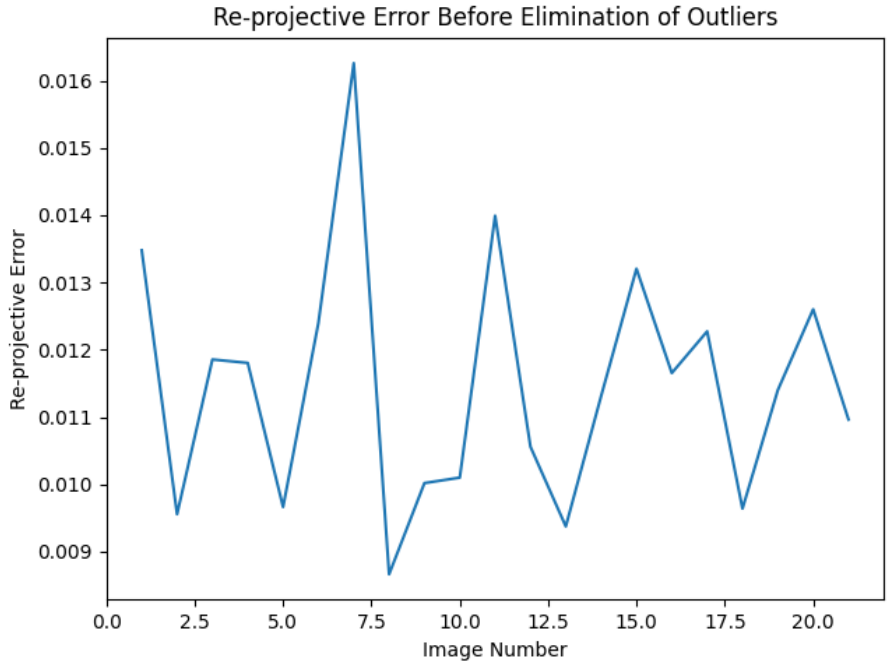
Results

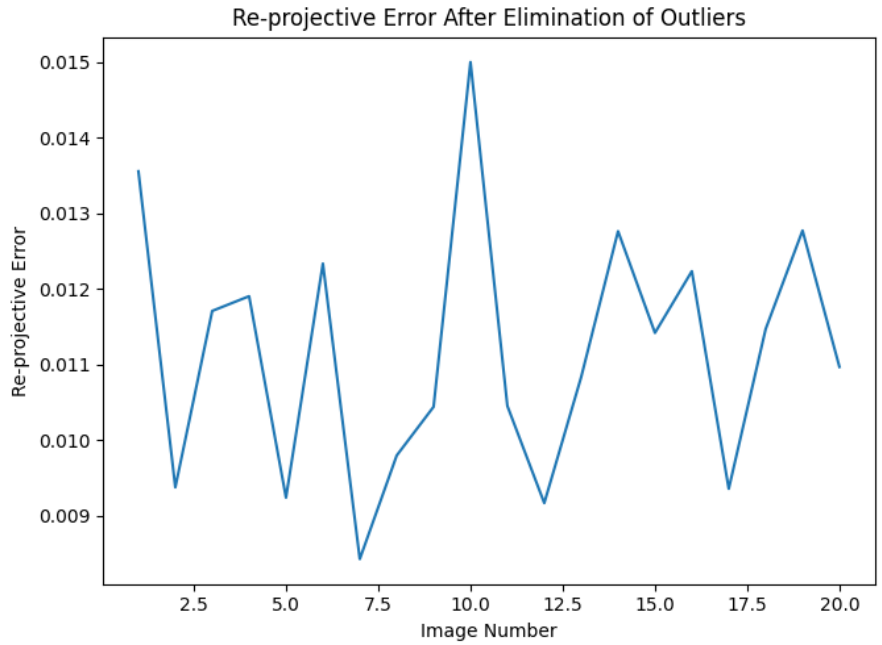
Mean Re-projective Error: 0.011160417930001304

Camera Intrinsic Matrix:
[[615.91794656 0. 317.95220817]
[0. 616.36127696 249.60556603]
[0. 0. 1.]]

Distortion Coefficients:
[[0.13701813 -0.6886125 0.00419846 -0.00135203 0.15210989]]

Re-projective Errors





Elimination of Outliers

1. In the OpenCV library, it has a function *findChessboardCorners().* which could detect the chessboard pattern. If the image quality is good, the function will return True. Otherwise, False will be returned due the poor image quality. This function could eliminate those low-quality images before calibration.
2. In the general data preprocessing, outliers are those values who have large distance or variation away from the mean value of a population. In our case, we compute a relative variance between each re-projective error and mean error. If the relative variance is larger than 25%, then this image can be treated as outlier and can be eliminated. The equation is below:

$$absolute(Error_i - Error_{mean}) \,/\, Error_{mean}$$

where $Error_{mean}$ is the mean re-projective error and $Error_i$ is the re-projective error of i-th image.

2-Intel (IR – Camera 1, RGB – Camera 2)

Results

Root Mean Square Error: 0.17041647505420962

Camera 1 Intrinsic Matrix:
[[475.75302667 0. 322.05865013]
[0. 475.72260583 235.56544396]
[0. 0. 1.]]

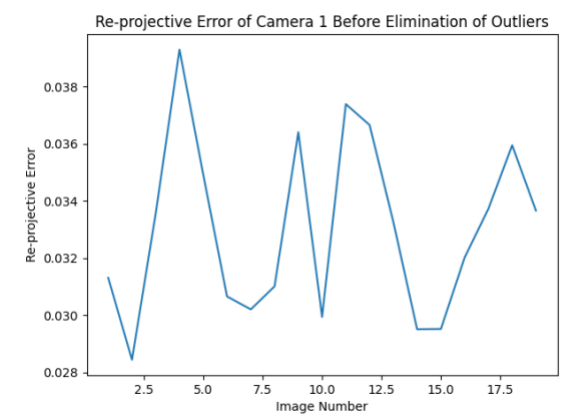
Camera 1 Distortion Coefficients:
[[-1.41980593e-01 1.31273402e-01 2.46139668e-04 1.35830589e-03 -4.13529137e-01]]

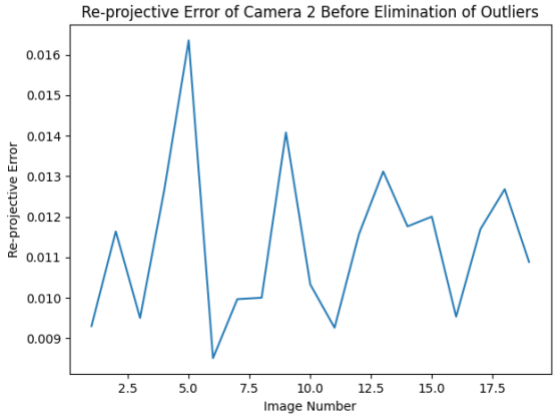
Camera 2 Intrinsic Matrix:
[[615.36616501 0. 317.94872177]
[0. 615.81319092 249.39775434]
[0. 0. 1.]]

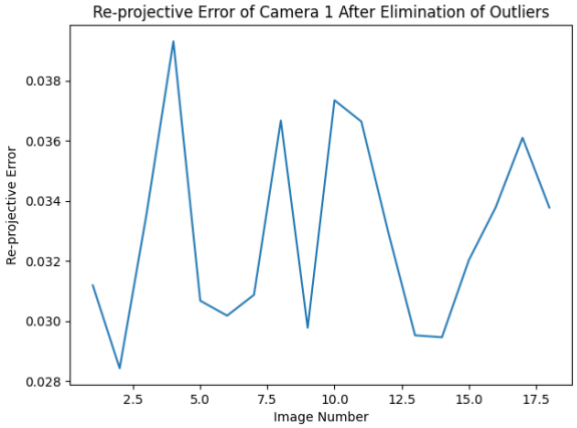
Camera 2 Distortion Coefficients:
[[0.13828937 -0.69942098 0.00423871 -0.00138966 0.18209954]]

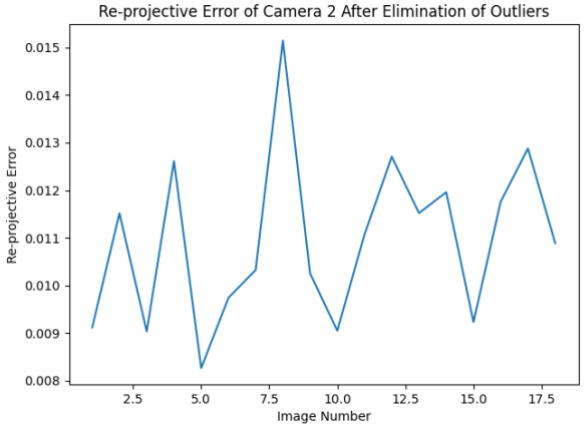
Projective Matrix:
[[1. 0. 0. -347.47930145]
[0. 1. 0. -257.98200989]
[0. 0. 0. 509.55798306]
[0. 0. -41.85572066 0.]]

Re-projective Errors









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3-Kinect2 (Bonus) (IR – Camera 1, RGB – Camera 2)

Results

Root Mean Square Error: 0.13332708195314444

Camera 1 Intrinsic Matrix:
[[362.43470722 0. 253.65318911]
[0. 362.69442611 207.31937449]
[0. 0. 1.]]

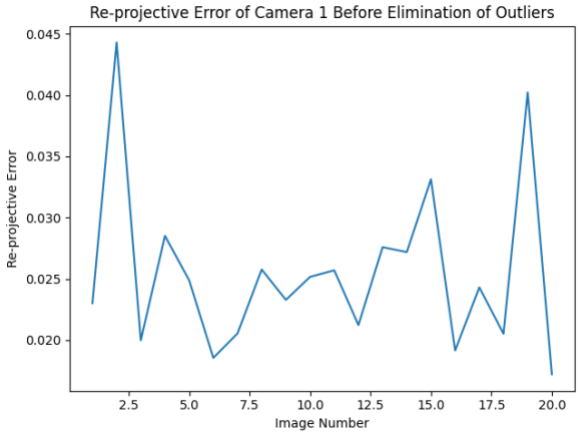
Camera 1 Distortion Coefficients:
[[0.11342378 -0.26691858 0.00115919 -0.00096709 0.03691603]]

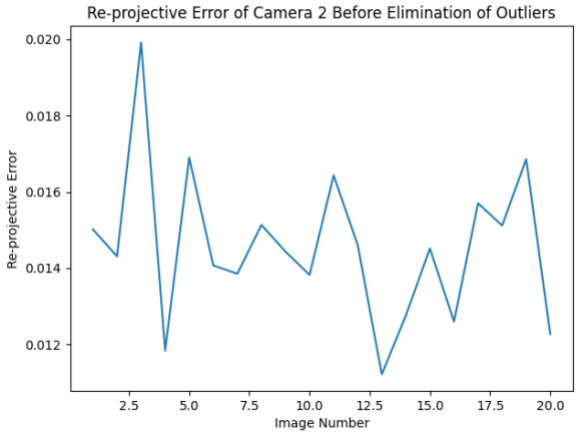
Camera 2 Intrinsic Matrix:
[[535.55126944 0. 498.63317955]
[0. 536.15039653 281.69878589]
[0. 0. 1.]]

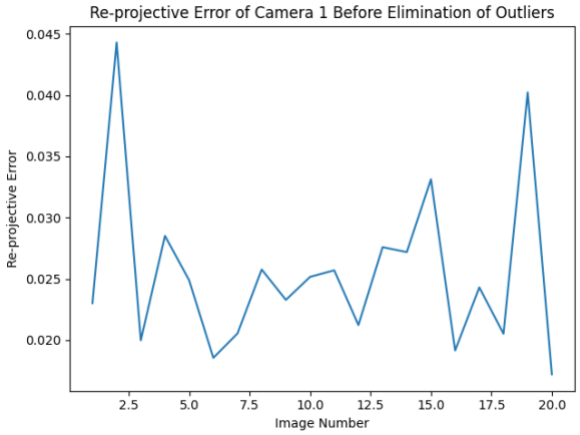
Camera 2 Distortion Coefficients:
[[0.0795811 -0.13356346 0.00133061 -0.00026759 0.05490394]]

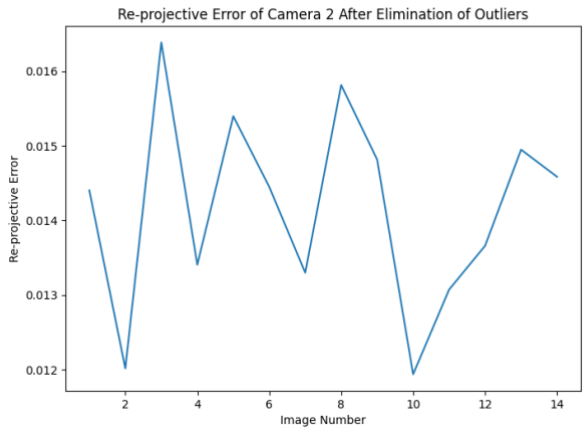
Projective Matrix:
[[1. 0. 0. -375.0845871]
[0. 1. 0. -261.95816422]
[0. 0. 0. 405.5177435]
[0. 0. 19.20552215 -0.]]

Re-projective Errors









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