# Computer Vision
# HW1 Report

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## Introduction:

In this assignment, we will implement a camera calibration, show the detail of procedure and compare with Opencv's library camera calibration. Also we will use two kinds of dataset from TA's and ours.

## Implementation procedure:

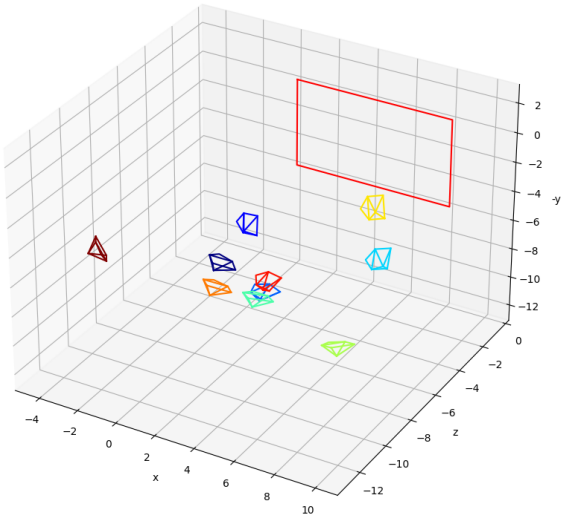
In the beginning, we set the corresponding size of the chessboard and load all the images of a chessboard from different rotations and positions. In order to get the transition matrix of 3d coordinates in real world space to 2d coordinates in image plane, we use findChessboardCorners, which is a function of openCV, to get the corresponding points.

After getting the corresponding 3d and 2d points, we can compute the homography matrix H by Singular Value Decomposition(SVD). Homography matrix is the multiplication of the intrinsic matrix K and extrinsic matrix [R t]. In order to derive the intrinsic matrix K, we get a symmetric and positive definite matrix B = (K^T)K from homography matrix H. By Cholesky factorization, K can be calculated from B.

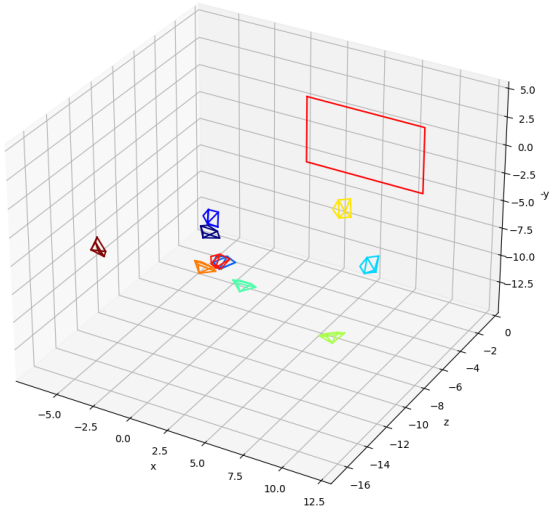
Finally, after getting the intrinsic matrix K, we can easily calculate the extrinsic matrix [R t] of each image and derive the information of the extrinsic matrix [R t] like the rotation and position vector. Then, image distortion can be solved.

**Experimental result (of course you should also try your own images):**

OpenCV Library
TA's data



Our Method
TA's data



Intrinsic matrix

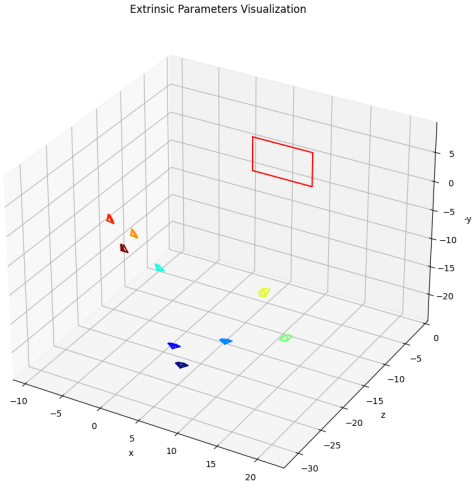
[[2.702e+03, 0, 1.538e+03]
[0, 2.738e+03, 1.96e+03]
[0, 0, 1]]

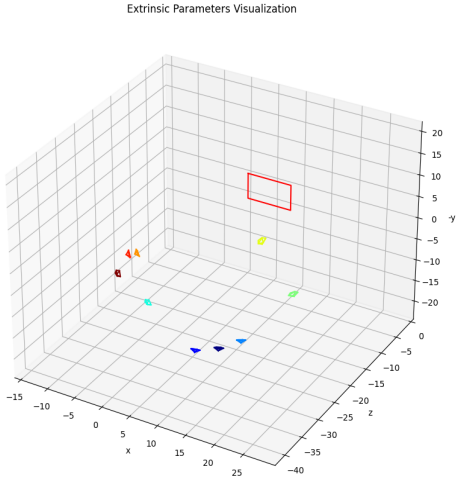
[[ 3.4e+03, -3.525e+01, 1.476e+03]
[0, 3.349e+03, 1.408e+03]
[0, 0,  1]]

OpenCV Library
Our data

Our Method
Our data

[Our datasets]




Intrinsic matrix

[[3.249e+03, 0, 1.784e+03]
[0, 3.0595e+03, 1.681e+02]
[0, 0, 1]]

[[3.626e+03, 0, 2.478e+03]
[0, 3.123e+03, 5.627e+02]
[0, 0,  1]]

## Discussion:

In this camera calibration, we use findChessboardCorners function to get the corresponding points. Getting the corresponding 3d and 2d points, we can compute the homography matrix H. We can estimate the intrinsic matrix and extrinsic matrix from the homography matrix H. Finally, we show that our result is the same as opencv's library,and get the same image between our data and TA's data.

## Conclusion:

We introduce our implementation procedure of the camera calibration in detail, and show the experimental result in this report. We implement the function to calculate the extrinsics parameters, and we show the result and intrinsic matrix are not different from the opencv's library camera calibration.

## Work assignment plan between team members:

main code: 曾揚
data & test result: 郭俊廷
report: 曾揚, 郭俊廷