CS5330: PATTERN RECOGNITION & COMPUTER VISION
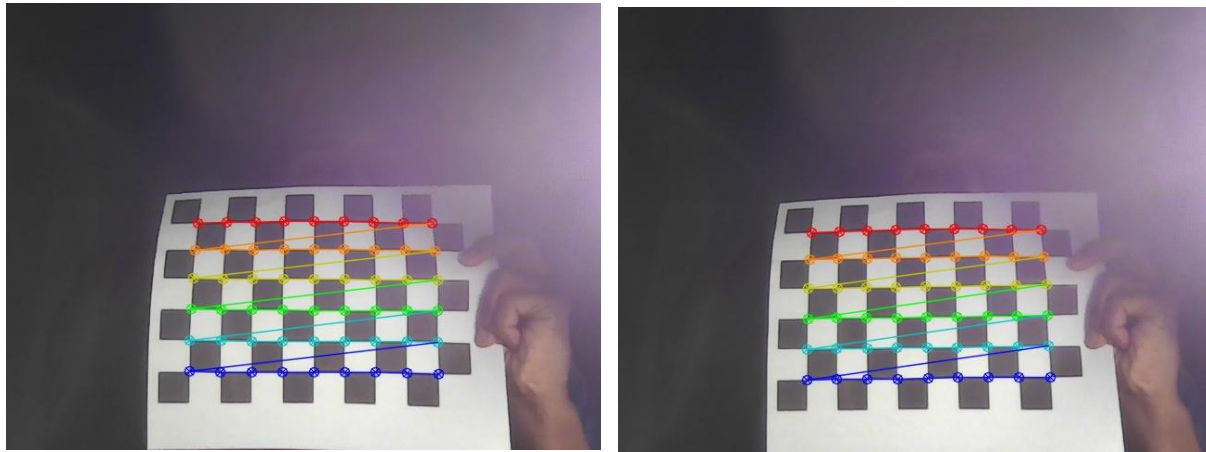# PROJECT 4: CALIBRATION & AUGMENTED REALITY
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Summary:

The paper contains the findings and observations from the fourth project, which involved calibrating a camera using the OpenCV package and then using the calibration parameters to overlay virtual objects over a checkerboard pattern. The pattern is printed and using computer vision, the chessboard corners are detected. Error estimate and rotational vectors are printed and 3D shapes are shown.

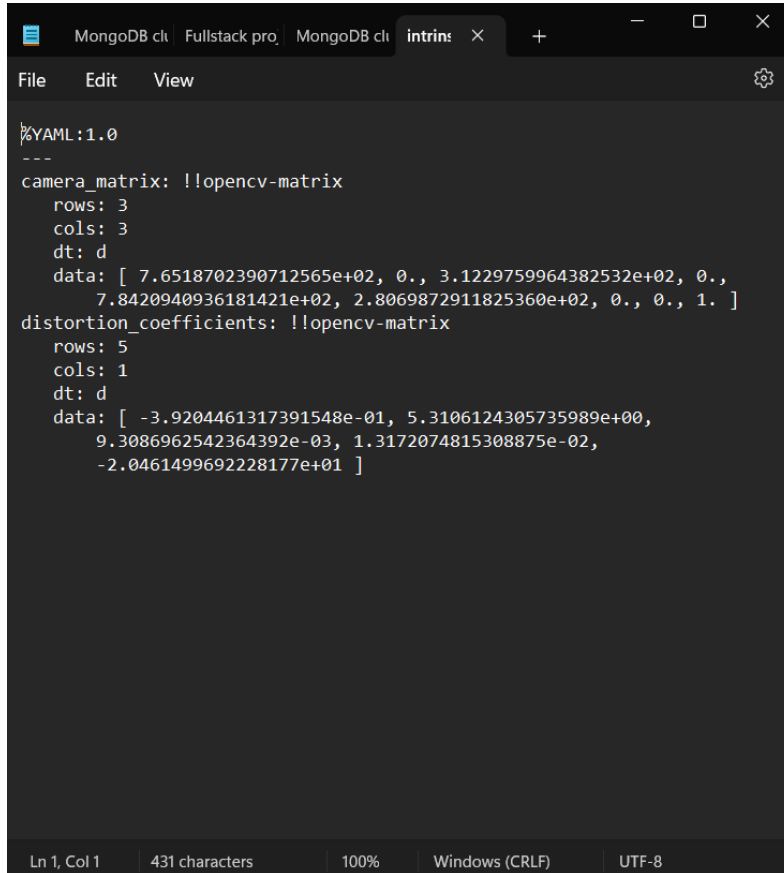## Task 1 & 2: Detecting and extracting chessboard corners:

Task 3: Error Estimate

Writing the coefficients into a file:

```
%YAML:1.0
---
camera_matrix: !!opencv-matrix
   rows: 3
   cols: 3
   dt: d
   data: [ 7.6518702390712565e+02, 0., 3.1229759964382532e+02, 0.,
       7.8420940936181421e+02, 2.8069872911825360e+02, 0., 0., 1. ]
distortion_coefficients: !!opencv-matrix
   rows: 5
   cols: 1
   dt: d
   data: [ -3.9204461317391548e-01, 5.3106124305735989e+00,
       9.3086962542364392e-03, 1.3172074815308875e-02,
       -2.0461499692228177e+01 ]
```

Task 4: Rotation & Translation vector printed:

```
Number of corners: 54
Coordinates of first corner: (192.145, 216.268)
Rotation vector:
[-0.3026024020946401;
 -0.02369624973338491;
 0.07364692048844033]
Translation vector:
[-3.316482433622239;
 -1.725117715821041;
 20.68611082410976]
Number of corners: 54
Coordinates of first corner: (192.145, 216.268)
Rotation vector:
[-0.3026024020946401;
 -0.02369624973338491;
 0.07364692048844033]
Translation vector:
[-3.316482433622239;
 -1.725117715821041;
 20.68611082410976]
Number of corners: 54
Coordinates of first corner: (198.62, 219.98)
Rotation vector:
[-0.2914593771018278;
 -0.03008609630035751;
 0.07815655116627676]
Translation vector:
[-3.172540356231837;
 -1.649797535288872;
 20.93027963454617]
```
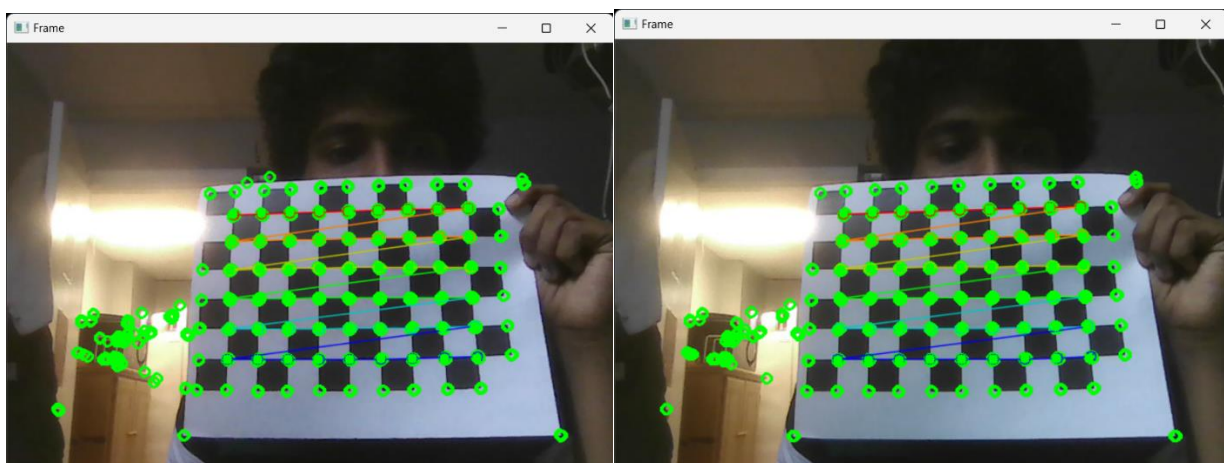
Task 5: Project outside corners
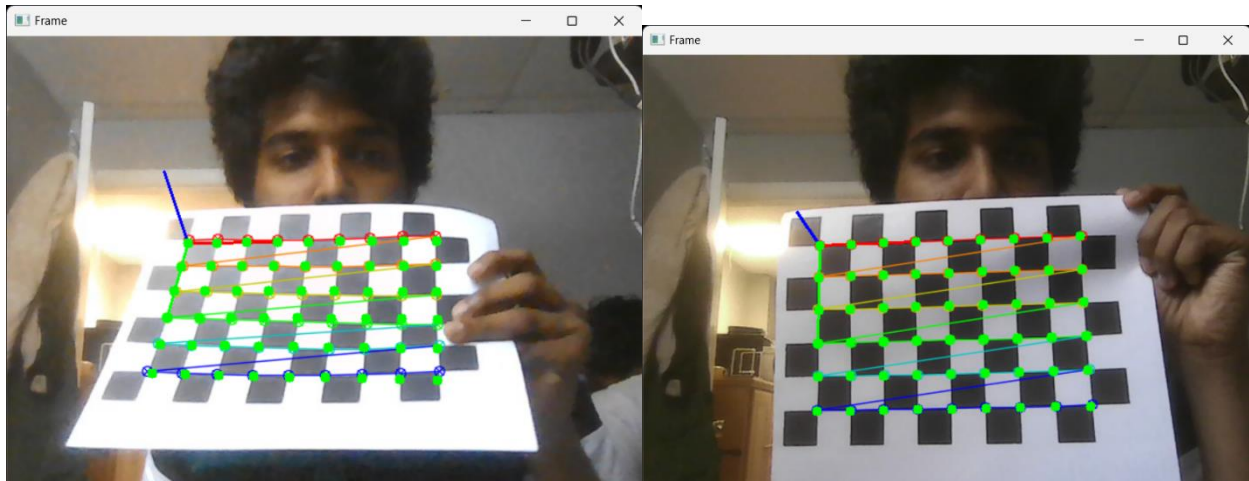
Task 6: Create Virtual Object
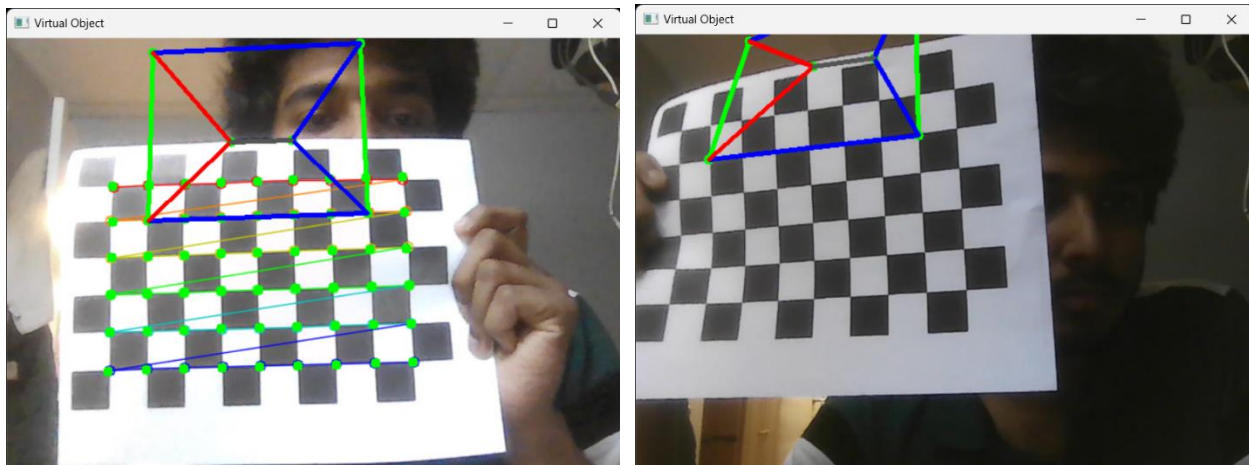
Task 7: Harris Corner Detection

Reflection:

In order to augment a virtual 3D object into a known checkerboard pattern, the project successfully created a system to calibrate a given camera and use the camera calibration parameters. With the help of the implemented code, a real-time augmented reality system may track and project a virtual object onto the checkerboard. This involves tracking the position of the checkerboard. Furthermore, for an object that may be used as feature points for adding 3D virtual objects onto, Harris corner features were calculated.

References:

Computer Vision: Algorithms and Applications, 2nd Ed, Rick Szeliski

Camera Calibration and 3D reconstruction - OpenCV