Assignment - 2 Report

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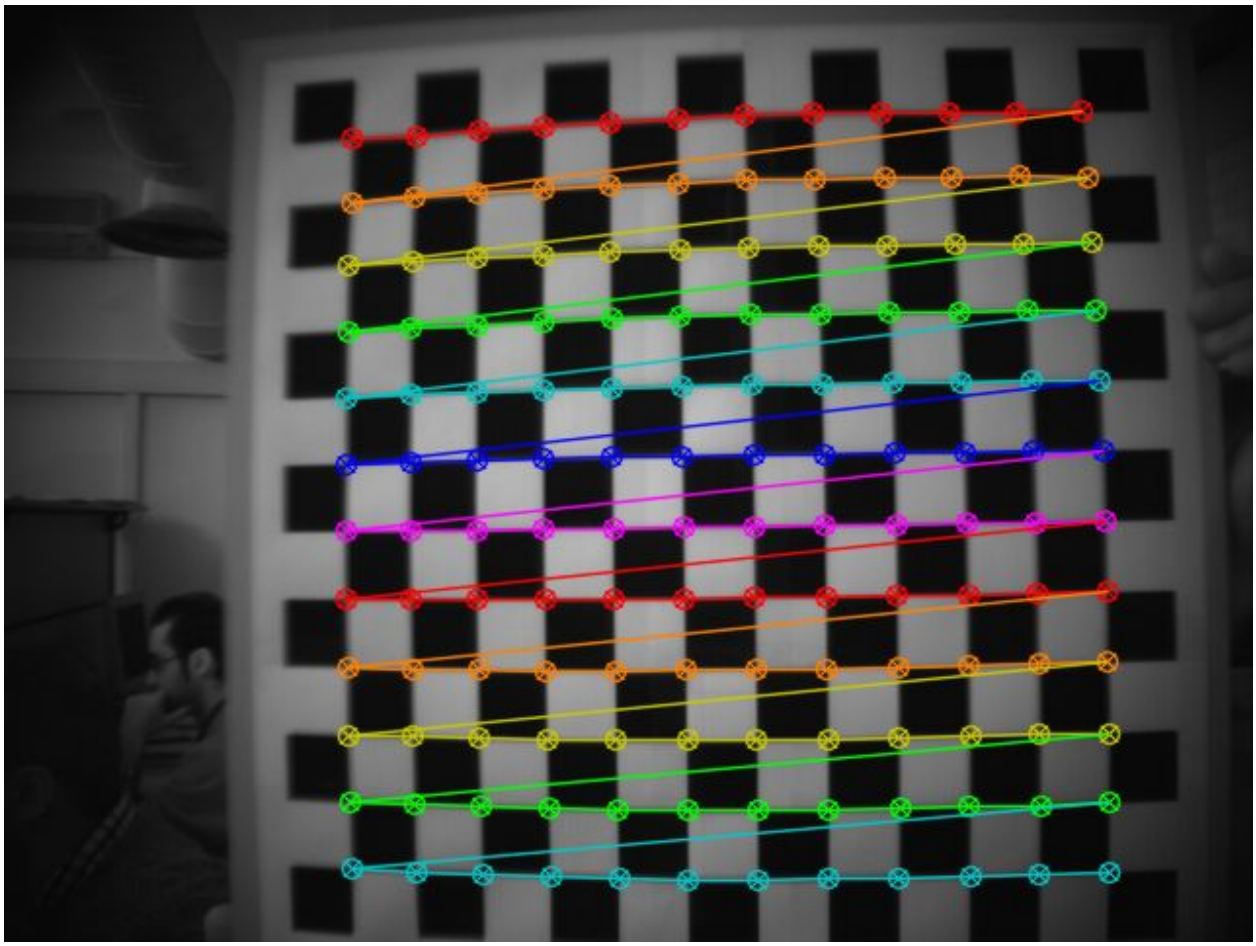
Question 2: Camera Calibration

Reference:

https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_calib3d/py_calibration/py_calibration.html#



Intrinsic Parameters:

fx	*skew*	*Cx*
0	*fy*	*Cy*
0	*0*	*1*

Where:

fx: focal length in x-direction
fy: focal length in y-direction
skew: skew of projection
Cx, Cy: principal point coordinates

Obtained Intrinsic Parameters:

520.50093059	0	331.27313151
0	522.28303196	250.40207273
0	0	1

skew = 0
focal_length_x = 520.50093059; focal_length_y = 520.50093059
principal_point = (331.27313151, 250.40207273)

Extrinsic Parameters:

Rotation Matrix:

(([[0.04651224], [-0.83384593],
[-0.02929038]]), array([[-0.15428907],
[0.4093003],
[0.96731841]]), array([[0.45272136],
[0.55900683],
[1.5089509]]), array([[-0.23684227],
[0.43034636],
[0.07839514]]), array([[0.48976437],
[-0.20861855],
[1.34446489]]), array([[0.00932233],
[-0.007239],
[0.01471408]]), array([[-0.20847336],
[0.31976325],
[-0.04681211]]), array([[0.37317927],
[0.83607496],
[1.54023201]]), array([[-0.01358618],
[0.30243307],
[-0.03744226]]), array([[-0.03402348],
[0.09050057],
[-0.00479995]]), array([[-0.03264965],
[0.07786117],
[-0.01546584]])

Translation Matrix:

[array([[-1.6825254],
[-5.78857796],
[16.38258765]]), array([[2.34744419],
[-8.3078271],
[21.72423102]]), array([[13.12991685],
[-3.71275371],
[25.13413261]]), array([[-1.58121239],
[-4.21820571],
[29.01761038]]), array([[7.20510734],
[-4.42771736],
[16.48775372]]), array([[-10.75973309],
[3.55835415],
[51.51328759]]), array([[-1.24059346],
[0.08754813],
[43.93179863]]), array([[8.94159457],
[-0.6696646],
[35.34631917]]), array([[-3.25808179],
[-5.85039661],
[18.00960797]]), array([[-4.99498883],
[-5.44454226],
[15.71214696]]), array([[-4.61383289],
[-5.45500831],
[14.88898231]])]

Distortion Coefficients:

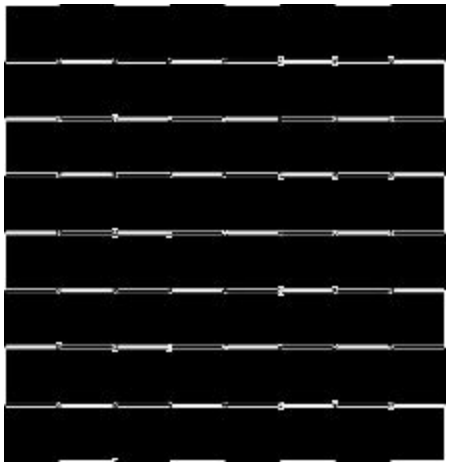
[-0.3098103 0.85072165 0.00559315 0.00218328 -1.31839869}

Reprojection Error: 2.5670002624475696

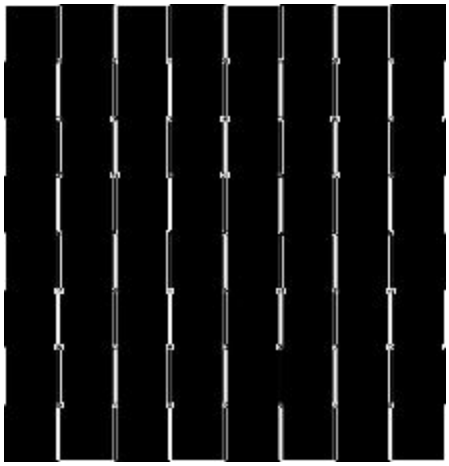
Mean error: 0.23336366022250632

<u>Question 3</u>: Harris Corner Detection

Sobel Output:

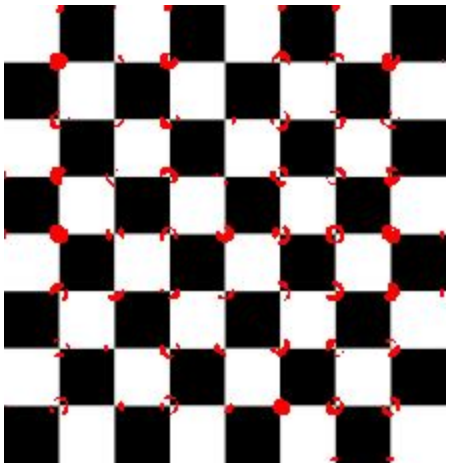


Vertical

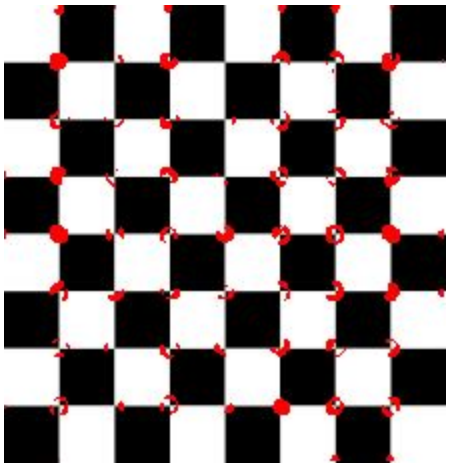


Horizontal

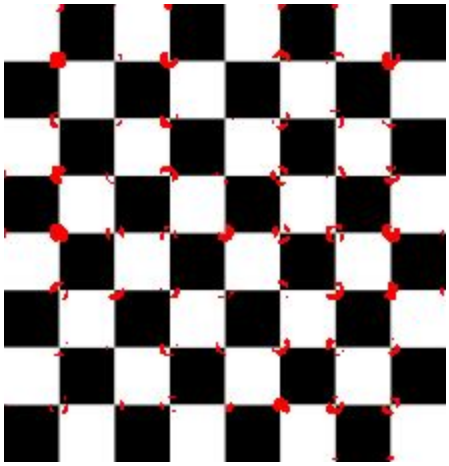
Results:



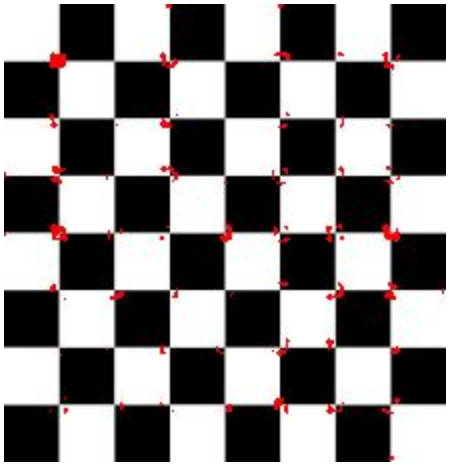
Lambda = 0.01



Lambda = 0.001



Lambda = 0.04

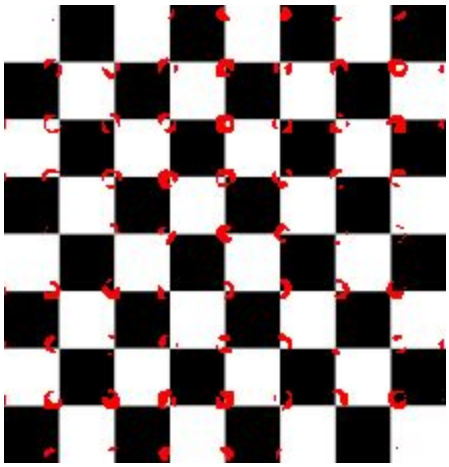


Lambda = 0.08

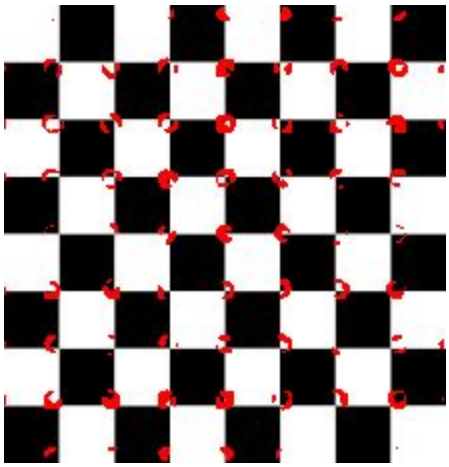
Observation: Upon increasing lambda value lesser corner points are recorded.

Inference: This is because of the higher threshold value.

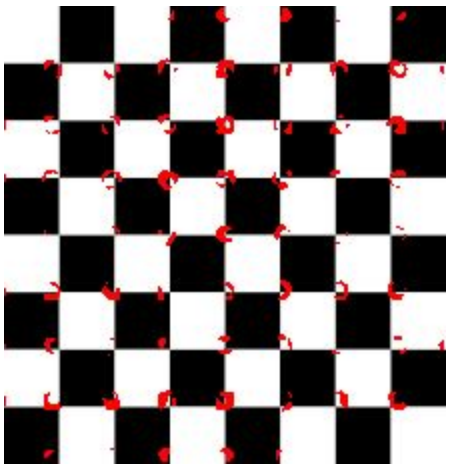
Rotated Image (90 degrees)



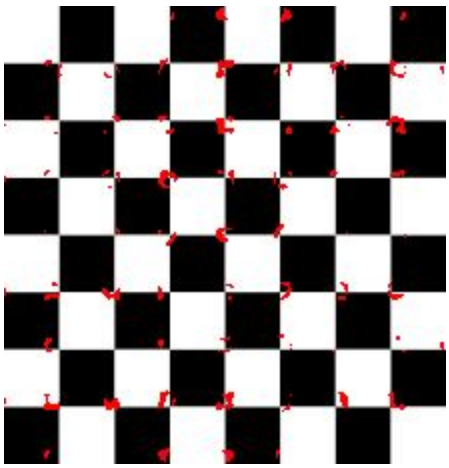
Lambda = 0.01



Lambda = 0.001



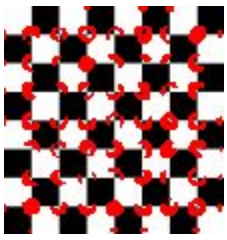
Lambda = 0.04

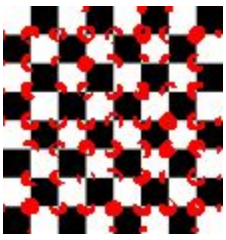


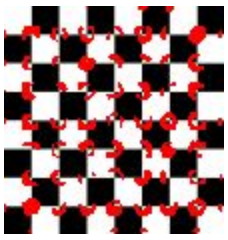
Lambda = 0.08

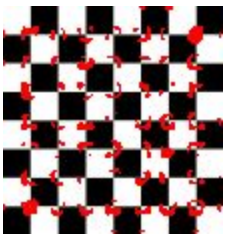
Observation: Corners points are a little off in comparison to the original image.

Image Compressed by a factor of 2:


Lambda = 0.01


Lambda = 0.001


Lambda = 0.04


Lambda = 0.08

Observation: Better corner detection

Inference: This is probably because of the small size of the image, which results in greater gradient values and thus, better corner detection by the algorithm.