«*In The Name Of GOD*»

[HW-01-Report]

[3D COMPUTER VISION]

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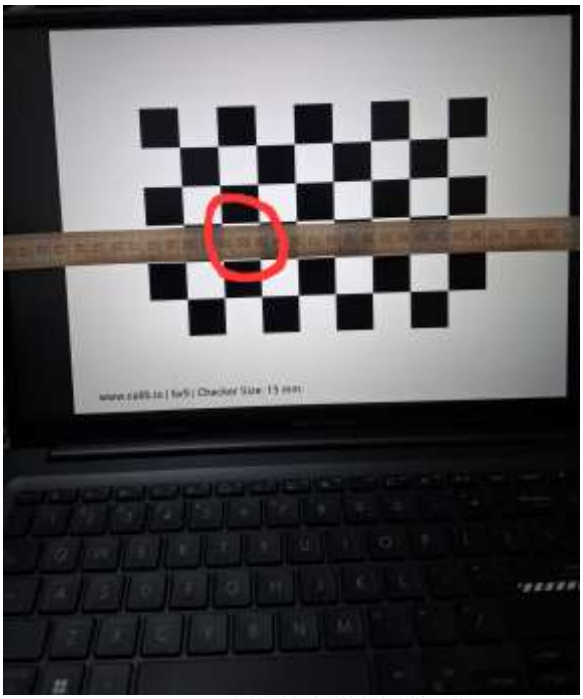
3D Computer Vision –Hands-on Camera Calibration



- به جای استفاده از تصویر پرینت‌شده، از صفحه لپتاپ استفاده شد و با خط‌کش اندازه مربع‌ها بدست آمده است. (طبق تصویر طول و عرض هر مربع حدود ۲/۱ سانتی متر می‌باشد و با این مقدار در کد استفاده شده است.)

1. Corner Detection

- **Pattern Size**: (8, 5)

- **Square Size**: 0.021 m

- **Number of Successful Detections**: 10 out of 10 images. (100.00%)

2. Calibration

Camera matrix K:

[[2.93136305e+03 0.00000000e+00 1.55154260e+03]

[0.00000000e+00 2.92201288e+03 2.08731650e+03]

[0.00000000e+00 0.00000000e+00 1.00000000e+00]]

Distortion coefficients [k1, k2, p1, p2, k3]:

[[2.05480589e-01 -5.55604718e-01 2.30435228e-03 -1.98641481e-04

-2.44732689e-01]]

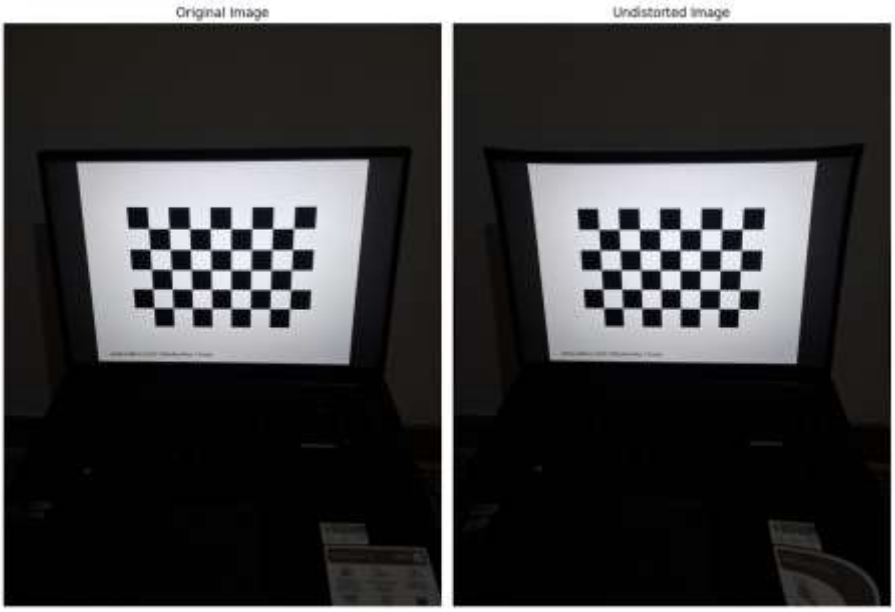
Mean reprojection error: 0.07010120341222845

3. Undistortion

In the undistorted image, the changes compared to the original are very subtle, but the top edge of the laptop appears slightly straighter and is shifted slightly upward.

This small difference results from correcting a minor amount of lens distortion and remapping the image based on the estimated calibration parameters.

As a result, the undistorted image has a more geometrically accurate appearance, even if the improvement is visually subtle.



4. Reprojection Check

The reprojected points (blue X) align almost perfectly with the detected corners (red circles), confirming the accuracy of the estimated intrinsic and extrinsic parameters.

The small residual error is likely due to noise from image acquisition, such as minor lens imperfections, motion blur, or inaccuracies in the physical square size.