Perception module for robotics applications with OpenCV.

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Steps

- Calibration
- Unwrapping
- Detection

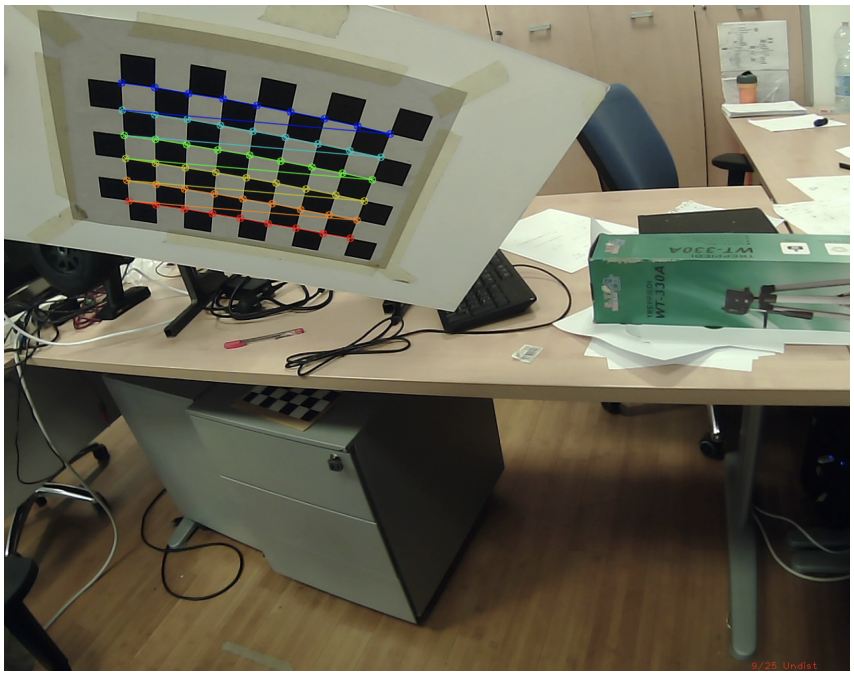
Calibration

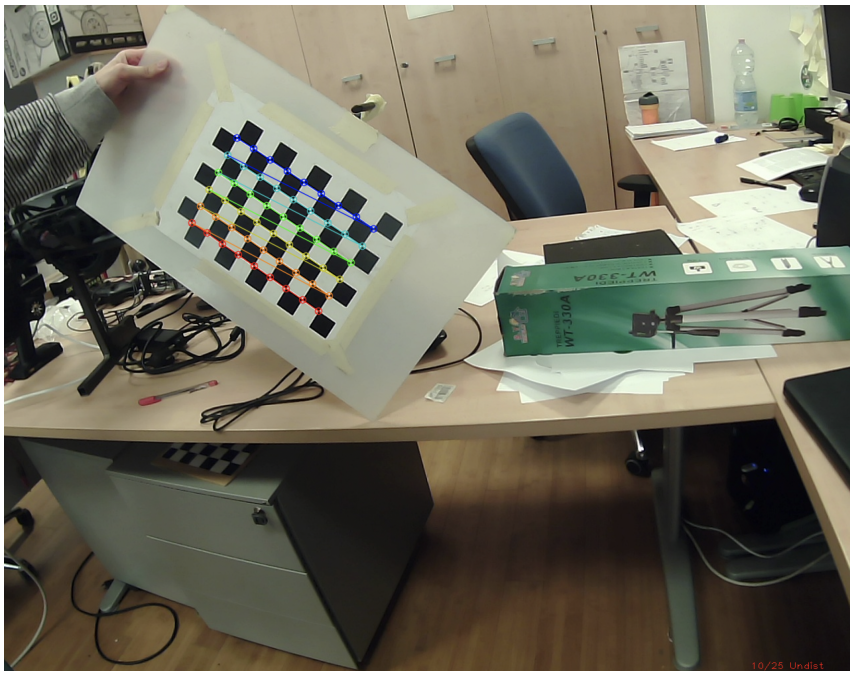
Given a set of pictures taken with a camera, the object of this step is to find the camera matrix A and the distortion coefficients $\dot{d}$.

$$A = \begin{bmatrix} f_x & 0 & c_x \\ 0 & f_y & c_y \\ 0 & 0 & 1 \end{bmatrix}$$

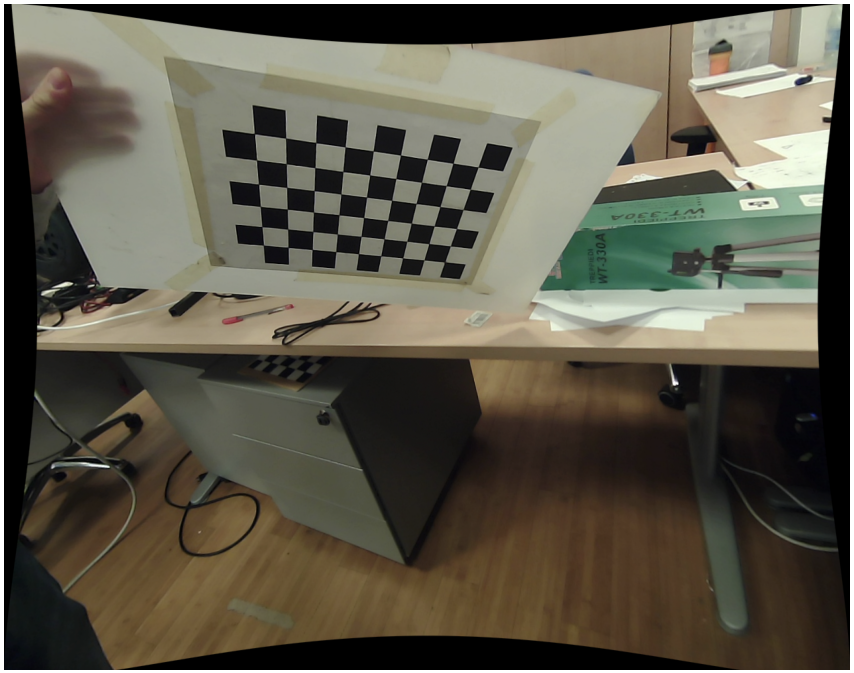
$$\begin{aligned} x_{distorted} &= x\left(1 + k_1 r^2 + k_2 r^4 + k_3 r^6\right) \\ y_{distorted} &= y\left(1 + k_1 r^2 + k_2 r^4 + k_3 r^6\right) \\ x_{distorted} &= x + \left[2p_1 xy + p_2\left(r^2 + 2x^2\right)\right] \\ y_{distorted} &= y + \left[p_1\left(r^2 + 2y^2\right) + 2p_2 xy\right] \\ \dot{d} &= (k_1, k_2, p_1, p_2, k_3) \end{aligned}$$

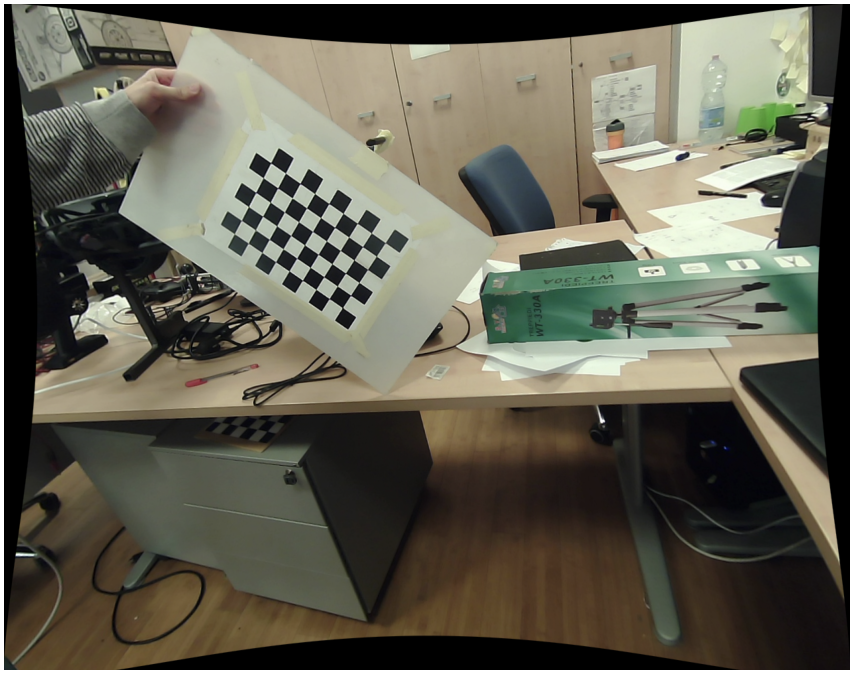
Calibration





Calibration





$$A = \begin{bmatrix} 8.4247565095622963 \times 10^2 & 0 & 6.3709750745251142 \times 10^2 \\ 0 & 8.4247565095622963 \times 10^2 & 4.9404840840221556 \times 10^2 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\dot{d} = (-2.5214446354851400 \times 10^{-1}, 7.2467634259951161 \times 10^{-2},$$

$$-3.7212601356153754 \times 10^{-3}, 4.3313659139950872 \times 10^{-4}, 0)$$