Stereo Calibration

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1. Task 1 - Camera Calibration

The left camera calibration is as follows:

$$M_L = \begin{bmatrix} 1703.0456 & 0.0 & 319.9077 \\ 0.0 & 1705.3842 & 253.5271 \\ 0.0 & 0.0 & 1.0 \end{bmatrix} \quad (1)$$

with distortion parameters

$$\begin{bmatrix} -0.5426 \\ 1.9696 \\ 0.0015 \\ 0.0012 \\ -22.8490 \end{bmatrix} \quad (2)$$

The right camera calibration is as follows:

$$M_R \begin{bmatrix} 1711.0962 & 0.0 & 327.6985 \\ 0.0 & 1714.8268 & 229.4433 \\ 0.0 & 0.0 & 1.0 \end{bmatrix} \quad (3)$$

with distortion parameters

$$\begin{bmatrix} -0.5692 \\ 6.8437 \\ 0.0024 \\ 0.0038 \\ -130.6472 \end{bmatrix} \quad (4)$$

2. Task 2 - Stereo Calibration

2.1. Test Images Calibration

The stereo calibration for the test images provided resulted in:

$$E = \begin{bmatrix} 0.0080 & 1.6494 & -0.3234 \\ -1.1973 & -0.1606 & 11.6160 \\ 0.1976 & -11.5643 & -0.1889 \end{bmatrix} \quad (5)$$

$$F = \begin{bmatrix} 6.4486e-08 & 1.3303e-05 & -0.0063 \\ -9.6606e-06 & -1.2972e-06 & 0.1115 \\ 0.0040 & -0.1113 & 1.0 \end{bmatrix} \quad (6)$$

$$R = \begin{bmatrix} 0.9992 & -0.0124 & -0.0387 \\ 0.0130 & 0.9998 & 0.0152 \\ 0.0385 & -0.0157 & 0.9991 \end{bmatrix} \quad (7)$$

$$T = \begin{bmatrix} -11.5623 \\ -0.3486 \\ -1.6443 \end{bmatrix} \quad (8)$$

2.2. Baseball Catcher Calibration

The stereo calibration for the baseball catcher resulted in the following parameters:

$$E = \begin{bmatrix} 0.0019 & -1.0392 & -0.0756 \\ 1.2662 & -0.2838 & 20.2972 \\ 0.1111 & -20.3098 & -0.2878 \end{bmatrix} \quad (9)$$

$$F = \begin{bmatrix} 0.0000 & -0.0001 & 0.0075 \\ 0.0001 & -0.0000 & 1.9285 \\ -0.0057 & -1.9364 & 1.0 \end{bmatrix} \quad (10)$$

$$R = \begin{bmatrix} 0.9999 & 0.0026 & -0.0111 \\ -0.0025 & 0.9999 & 0.0141 \\ 0.0111 & -0.0141 & 0.9998 \end{bmatrix} \quad (11)$$

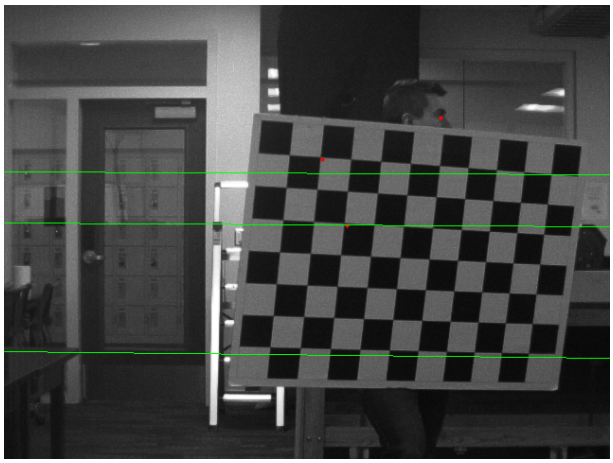
$$T = \begin{bmatrix} -20.3121 \\ -0.0610 \\ 1.0402 \end{bmatrix} \quad (12)$$

3. Task 3 - Epipolar Lines

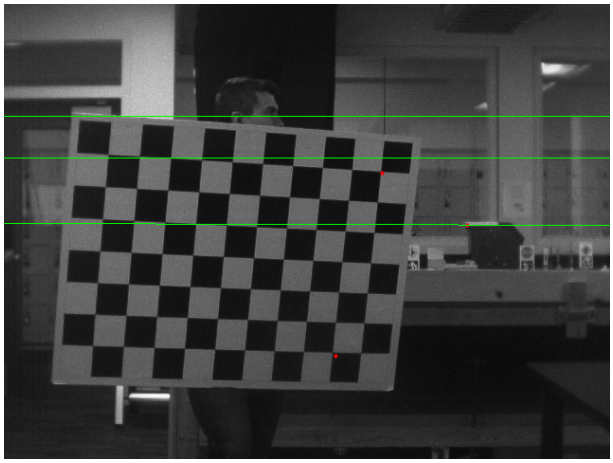
Figure 1 shows the points and corresponding epilines from the right and left images.

4. Task 4 - Rectification

Figure 2 shows the original stereo camera set, Figure 3 shows the same images rectified, with horizontal lines across. Figure 4 shows the absolute difference between the original and rectified images for the stereo setup.

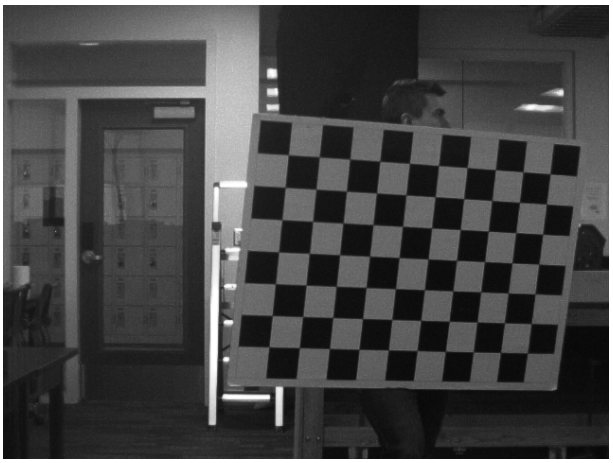


(a) Left Points in red and epilines corresponding to right points

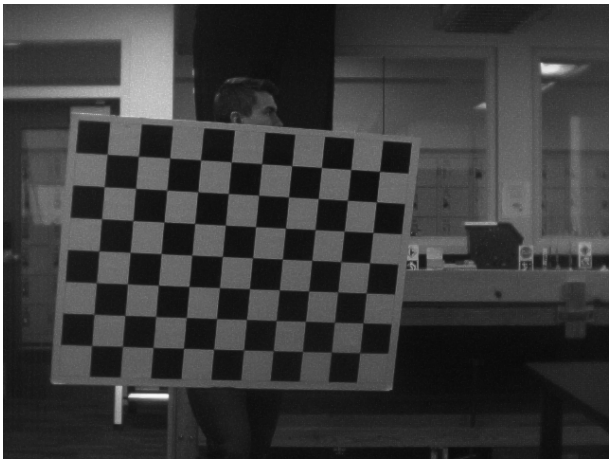


(b) Right points in red and epilines corresponding to left points

Figure 1. Epilines

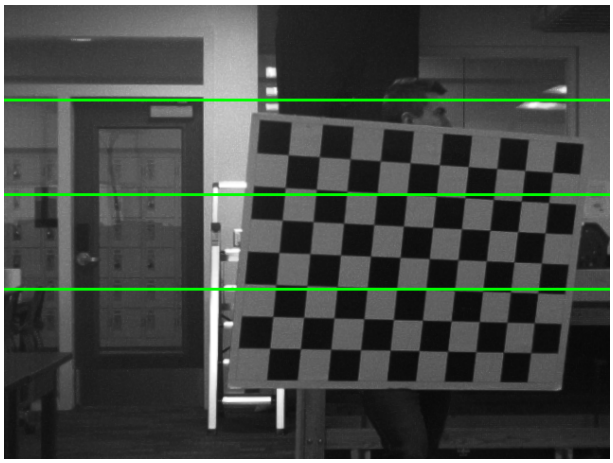


(a) Left Stereo Image

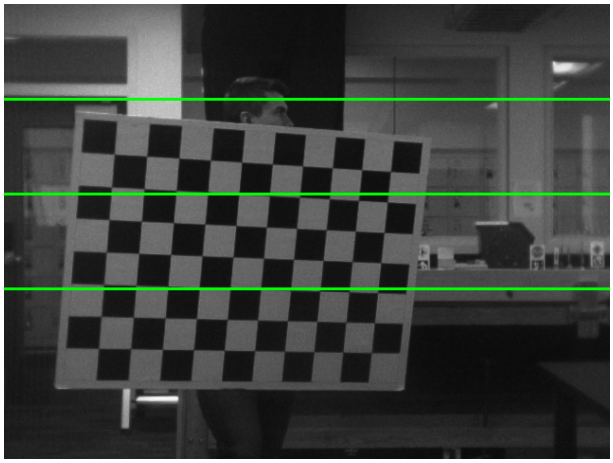


(b) Right Stereo Image

Figure 2. Original Images



(a) Left Rectified



(b) Right rectified

Figure 3. Rectified Images

(a) Left AbsDiff

(b) Right AbsDiff

Figure 4. Absolute Difference