Module - 7

(2) Procedure for estimating the size of the object using uncalibrated stereo

Correspondences ⇒ Rectangle corners (TL, TR, BL, BR)

Top Left

L (2405.5, 787.7) R (605.3, 811.3)

Top Right

L (3553.3, 779.8) R (1760.9, 795.6)

Bottom Left

L (2413.4, 2244.9) R (597.5, 2276.4)

Bottom Right

L (3553.3, 2244.9) R (1753.1, 2276.4)

Few other correspondences

L (3427.5, 1906.2) R (1627.3, 1937.7)

L (2688.6, 1780.2) R (872.6, 1811.7)

L (3427.5, 1977.1) R (1627.3, 2008.6)

L (2822.2, 2260.7) R (1006.2, 2292.2)

L (2830.1, 2118.9) R (1006.2, 2150.4)

Fundamental matrix (F) Computation

$(x_i, y_i) \leftrightarrow (x_i', y_i')$

$$[x_i x_i', x_i' y_i, x_i', y_i' x_i, y_i' y_i, y_i', x_i, y_i, 1]$$

$$Af = 0$$

$$f \rightarrow F_{norm}$$

$$F = T_R^T F_{norm} T_L$$

$$F \approx \begin{bmatrix} -1.18\times10^{-6} & -8.05\times10^{-7} & 6.72\times10^{-4} \\ 5.98\times10^{-7} & -1.02\times10^{-6} & -1.14\times10^{-3} \\ -6.84\times10^{-4} & 9.93\times10^{-4} & -1.00 \end{bmatrix}$$

Right epipole e' computation:

$$F^T e' = 0$$

$$e' = [-0.00106,\ 0.00306,\ 1.00000]^T$$

Left $\Rightarrow P = [I \mid 0]$

Right $\Rightarrow P' = ([e']_\times F \mid e')$

Skew symmetric matrix of e':

$$[e']_\times \Rightarrow \begin{bmatrix} 0 & -1.0 & 0.00306 \\ 1.0 & 0 & 0.00106 \\ -0.00306 & -0.00106 & 0 \end{bmatrix}$$

Triangulation:

For each $x \Leftrightarrow x'$

$$\begin{bmatrix} xP_3 - P_1 \\ yP_3 - P_2 \\ x'P_3' - P_1' \\ y'P_3' - P_2' \end{bmatrix} X = 0$$

Numeric 3D points

$\Rightarrow$ Projective units

	X	Y	Z
Top left	⇒	(1309.36,	428.63, 0.54431)
Top Right	⇒	(787.34,	172.75, 0.22158)
Bottom left	⇒	(926.88,	862.11, 0.38406)
Bottom Right	⇒	(667.42,	421.62, 0.18783)

Projective Edge Lengths

$$D_{ab}^{Proj} = \|x_a - x_b\|$$

Computed lengths:

- Top edge ⇒ 581.35
- Left edge ⇒ 578.09
- Bottom edge ⇒ 511.23
- Right edge ⇒ 276.25
- Diagonal edge ⇒ 641.98

$W_{real} = 9cm$, $H_{real} = 11.3cm$

$$S_W = \frac{W_{real}}{D_{TL-TR}^{Proj}} = \frac{9}{581.35} \approx 0.01548 \text{ cm/unit}$$

$$H = S_W \cdot D_{TL-BL}^{Proj} \approx 0.01548 \times 578.09 \approx 8.95cm$$

$$S_H = \frac{H_{real}}{D_{TL-BL}^{Proj}} = \frac{11.3}{578.09} \approx 0.01955 \text{ cm/unit}$$

$$W = S_H \cdot D_{TL-TR}^{Proj} \approx 0.01955 \times 581.35 \approx 11.37cm$$

Estimated ⇒ h = 8.95cm, w = 11.37cm