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Sheet 6

①
$pw = 1$ milimeter

$u^l = [-3, -10, -28]$ $d = u^t - u^l = [33, 20, 25]$

$u^r = [30, 10, -3]$

$T = 10$ cms

$f = 2$ cms $= 20$ pixels

$$Z = \frac{T \cdot f}{[33, 20, 25]} = \frac{200}{d} \cong [6.06, 10, 8]$$ #

② a) $E = [Tx] R = \begin{bmatrix} 0 & -10 & 0 \\ -10 & 0 & -10 \\ 0 & 10 & 0 \end{bmatrix}$

$$S = E^T E = \begin{bmatrix} 400 & 0 & 100 \\ 0 & 200 & 0 \\ 100 & 0 & 100 \end{bmatrix} \rightarrow (S - S^T) = 0$$

P, k, i $U = \begin{bmatrix} 0 & -S_{21} & S_{13} \\ S_{21} & 0 & -S_{32} \\ -S_{13} & S_{32} & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 100 \\ 0 & 0 & 0 \\ -100 & 0 & 0 \end{bmatrix}$

$U(S - S^T) = 0$

b) $el = [0]$, $er = [0]$

c) $l_r = E \cdot [X, Y, Z]^T$

$l_r = \begin{bmatrix} -30 \\ -50 \\ 30 \end{bmatrix}$

d) $F = K_r^{-T} E K_l^{-1}$

$$= \begin{bmatrix} 0 & -\frac{1}{5000} & \frac{1}{25} \\ -\frac{1}{5000} & 0 & \frac{1}{50} \\ \frac{3}{40} & \frac{3}{20} & -\frac{15}{2} \end{bmatrix}$$

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e) $e'_l \cdot K_l \cdot el = \begin{bmatrix} 0 \end{bmatrix}$

$e'_r \cdot K_r \cdot e_r = \begin{bmatrix} 0 \end{bmatrix}$

f) $l_l = F \cdot x_r$

$= F \cdot \begin{bmatrix} 100 \\ 50 \\ 1 \end{bmatrix} \cdot \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 25500 \\ 12875 \\ 1 \end{bmatrix}$

$25500x + 12875y + 1 = 0$

$m = -1.98 \qquad , \quad b = -c/b = -0.000077 \ A$

③

$F = \begin{bmatrix} 0 & -t_z & 0 \\ t_z & 0 & -t_x \\ 0 & t_z & 0 \end{bmatrix}$

$\begin{bmatrix} x_r & y_r & 1 \end{bmatrix} \cdot F \cdot \begin{bmatrix} x_l \\ y_l \\ 1 \end{bmatrix} = 0$

$= -t_z \cdot x_r \cdot x_l - t_x \cdot y_r x_l + t_z x_r \cdot y_l + t_x \cdot y_r \cdot y_l = 0$

only need 1 point from r & one from l

④ Center Right $= \begin{bmatrix} 75, 80 \end{bmatrix}^T$

Center left $= \begin{bmatrix} 100, 70 \end{bmatrix}^T$

Average distance $= 20$ pixel in left & 50 in right

a) $T = \begin{bmatrix} 1 & 0 & -C_x \\ 0 & 1 & -C_y \\ 0 & 0 & 1 \end{bmatrix}$, $S = \begin{bmatrix} \frac{1}{d} & 0 & 0 \\ 0 & \frac{1}{d^x} & 0 \\ 0 & 0 & 1 \end{bmatrix}$

$T_l = \begin{bmatrix} 1/20 & 0 & -100 \\ 0 & 1/20 & -70 \\ 0 & 0 & 1 \end{bmatrix}$, $T_r = \begin{bmatrix} 1/50 & 0 & -75 \\ 0 & 1/50 & -80 \\ 0 & 0 & 1 \end{bmatrix}$

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b) $\vec{F} = \vec{T_r}^T \cdot \vec{F_i} \cdot \vec{T_\ell}$

$$F = \begin{bmatrix} 0 & -7.5\times10^{-5} & 0.1245 \\ -7.5\times10^{-5} & 0 & 0.15 \\ 0.378 & 0.37 & -1290 \end{bmatrix}$$

(5) Left Scan-line: 100, 150, 90, 140, 200
Right Scan-line: 90, 105, 145, 130, 210

(a)

Index left	1	2	3	4	5
Intensity left	100	150	90	140	200
Matched Intensity	105	145	90	145	210
Matched Index	2	3	1	3	5
Disparity	1	1	-2	-1	0

Pixel 3 in Right is matched to 2 points

b)

I left	1	2	3	4	5
In left	100	150	90	140	200
Matched In	105	145	/	130	210
Matched I	2	3	/	4	5
Disparity	0	0	/	0	0

Smoother solution

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