Group 45
Lab 4

EX 4.6

The residual vector between the re-projected points and known points.

We have 3 unknown variables in U= $\begin{pmatrix} x \\ y \\ z \end{pmatrix}$

The camera equation is $P_i = \begin{pmatrix} X \\ 1 \end{pmatrix} = \begin{pmatrix} \leftarrow a_i \rightarrow \\ \leftarrow b_i \rightarrow \\ \leftarrow c_i \rightarrow \end{pmatrix} \begin{pmatrix} x \\ y \\ z \\ 1 \end{pmatrix}$ .....(1)

We can see that each camera has 3 equation and one extra unknown, so we need 2 view for every on. Hines, we rewrite (1)

$$P_i = \begin{pmatrix} a_i1 & a_i2 & a_i3 & a_i4 \\ b_i1 & b_i2 & b_i3 & b_i4 \\ c_i1 & c_i2 & c_i3 & c_i4 \end{pmatrix}$$

$$U_i = \begin{pmatrix} x_i \\ y_i \end{pmatrix}$$

$$\mathrm{ri(U)} = \begin{pmatrix} (a_i * U) \,/\, (c_i * U) \\ (b_i * U) \,/\, (c_i * U) \end{pmatrix} - \begin{pmatrix} x_i \\ y_i \end{pmatrix}$$

EX 4.8

Formulas for the partial derivatives in the Jacobian of $\bar{r}$.

Suppose

$$u = u(x, y, z)$$
$$v = v(x, y, z)$$
$$w = w(x, y, z)$$

(x, y, z) to (u, v, w)

$$J(\frac{u, v, w}{x, y, z}) = \frac{d(u, v, w)}{d(x, y, z)}$$

$$J = \begin{vmatrix} du/dX & du/dY & du/dZ \\ dv/dX & dv/dY & dv/dZ \\ dw/dX & dw/dY & dw/dZ \end{vmatrix}$$

In our case we have

$$J = \begin{vmatrix} dr[1,x]/dX & dr[1,x]/dY & dr[1,x]/dZ \\ dr[1,y]/dX & dr[1,y]/dY & dr[1,y]/dZ \\ \vdots & \ddots & \vdots \\ dr[n,x]/dX & dr[n,x]/dY & dr[n,x]/dZ \\ dr[n,y]/dX & dr[n,y]/dY & dr[n,y]/dZ \end{vmatrix}$$

$$dr(i,x)/dX = (a_i1 * c_i * U - c_i1 * a_i * U)/(c_i * U)\text{^}2$$
$$dr(i,x)/dY = (a_i1 * c_i * U - c_i1 * a_i * U)/(c_i * U)\text{^}2$$
$$dr(i,x)/dZ = (a_i1 * c_i * U - c_i1 * a_i * U)/(c_i * U)\text{^}2$$

$$dr(i,y)/dX = (a_i1 * c_i * U - c_i1 * a_i * U)/(c_i * U)\text{^}2$$
$$dr(i,y)/dY = (a_i1 * c_i * U - c_i1 * a_i * U)/(c_i * U)\text{^}2$$
$$dr(i,y)/dZ = (a_i1 * c_i * U - c_i1 * a_i * U)/(c_i * U)\text{^}2$$