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)

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

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

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

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)

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

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

In our case we have

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

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

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