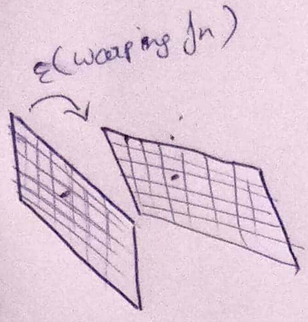

$$\min \left\| \sum r^2 \right\|$$

r = Image residual

$$= \left(I_t(u) - I_{t1}\left(\pi(K T_m \pi^{-1}(u, p_t))\right)\right)^2$$

Using taylor series for linearization

$$r_i(\varepsilon^{(t)} + \delta\varepsilon) = r_i(\varepsilon^t) + \frac{\delta r(\varepsilon)}{\delta \varepsilon}$$

$$\frac{\delta r_i(\varepsilon)}{\delta \varepsilon} = \frac{\delta r_i}{\delta x_i} \frac{\delta x_i}{\delta X_i} \frac{\delta X_i}{\delta \varepsilon}$$

gebra)

$$\frac{\delta r_i}{\delta x_i} = \frac{\delta I(T(\varepsilon, x))}{\delta \varepsilon} = \frac{1}{2}\left(\nabla I_c(x_i) + \nabla I_r(x_i)\right)$$

(ESM scheme)

$$\frac{\delta x_i}{\delta X_i} = \begin{bmatrix} f_u/z_i & 0 & -f_u x_i/z^2 \\ 0 & f_v/z_i & -f_v y_i/z^2 \end{bmatrix}$$

(derivative of projection function π)

1) Photo consistency assumption

$$I_{k+1}(x) = I_k(T(\hat{G} x))$$

→ transformation b/w frames

$$G \in SE(3)$$

$$\xi = (\omega_1, \omega_2, \omega_3, v_1, v_2, v_3) \in R^6$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix}_\times = \begin{bmatrix} 0 & -z & y \\ z & 0 & -x \\ -y & x & 0 \end{bmatrix}$$ (skew symmetric matrix)

$$\xi = \begin{bmatrix} [\omega]_\times & v \\ 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & -\omega_3 & \omega_2 & v_1 \\ \omega_3 & 0 & -\omega_1 & v_2 \\ -\omega_2 & \omega_1 & 0 & v_3 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$ (Represented in lie algebra as twist)

$$G(\xi) = e^{[\xi]_\wedge}$$ (lie algebra to lie group mapping)

→ matrix exponential

$$G(\xi) \rightarrow \begin{bmatrix} R & T \\ 0 & 1 \end{bmatrix}$$

$R \in SO(3)$, $T \in R^3$
(Lie group)