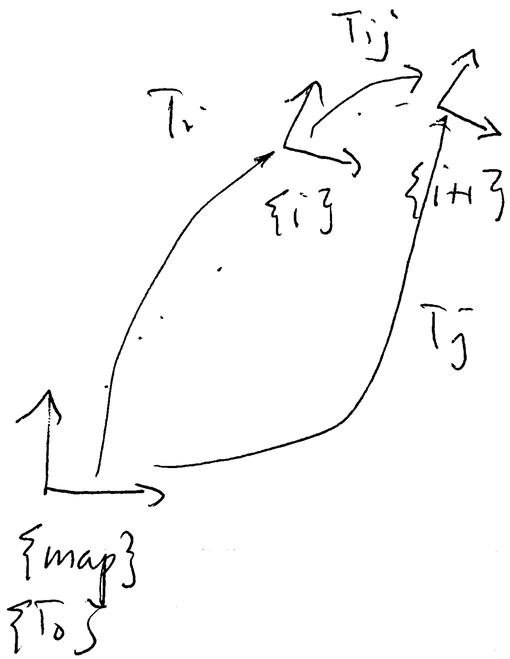

$T_{ij} = [R_{ij}, t_{ij}]$

$\{j+1\}$ with respect to $\{i\}$ from odometry

T_{ij} can be measured with sensor

T_i, T_j cannot be measured directly

Given T_{ij}'s T_0, $\rightarrow T_i$, $i = 1 \cdots n$

posegraph SLAM

$T_i = [R_i \; t_i]$ $\quad T_j = [R_j, t_j]$

Given T_i, T_j, we can compute T_{ij}

$$T_{ij} = T_i^{-1} T_j$$

$$= [R_i \; t_i]^{-1} [R_j, t_j]$$

$$= [R_i^T \; -R_i^T t_i] [R_j, t_j]$$

$$= [R_i^T R_j, \; R_i^T t_j - R_i^T t_i]$$

$$= [R_i^T R_j, \; R_i^T (t_j - t_i)]$$

$$\underbrace{R_{ij}}_{\text{measurable}} = \underbrace{R_i^T R_j}_{\text{unknown}} \qquad \underbrace{t_{ij}}_{\text{measurable}} = R_i^T \underbrace{(t_j - t_i)}_{\text{unknowns}}$$

When $j = i+1$, odometry

When $j \neq i+1$, loop closure

$$x_k = \{T_i, T_j\}$$

$$z_k = \{R_{ij}, t_{ij}\} = \{T_{ij}\}$$

"$h(x_k) - z_k$"

R part: $\| (R_{ij})^{-1} (R_i^T R_j) \|_\Omega$

t part: $\| t_{ij} - R_i^T (t_j - t_i) \|_\Omega$