Bundle Adjustment

corrections

img pixel.

distortion parameters,

$$ {}^{a}x'_{ij} + {}^{a}\hat{v}_{x_{ij}} = \hat{\lambda}_{ij}\ {}^{o}\hat{P}_{j}(x_{ij}, p, q)\ \hat{X}_{i} $$

3D point.

Projection Matrix.

Scale factor.

intrinsic, extrinsic parameters.

A real 2D point observation.

i = point observed

j = image

a = arbitrary frame

$$ \underbrace{\ldots \text{with } \Sigma_{x_{ij}, x_{ij}} \quad \begin{matrix} i = 1,2 \ldots I \\ j = 1,2 \ldots J \end{matrix}}_{} $$

points

images

Right hand side of the equation is the reprojection of the 3D points to 2D. Let it be X_o o = object

${}^{a}x'_{ij} - X_o$ = distance between the reprojection and real 2D points, ${}^{a}\hat{v}_{x_{ij}}$.

- We can remove the scale factor by moving from homogeneous to euclidean coord. system.

Unkowns:

- 3D locations of new points $\hat{X}_i$.
- 1D scale factor $\hat{\lambda}_{ij}$.
- 6D exterior orientation, (R, T).
- 5D projection parameters, (Intrinsic).
- Non-linear distortion parameters, q.

$$ {}^{a}x'_{ij} + {}^{a}\hat{v}_{x_{ij}} = \hat{\lambda}_{ij}\ \hat{K}(x_{ij}, \hat{p}, \hat{q})\ \hat{R}_{j}(I_3 | -\hat{X}_{o_j})\ \hat{X}_{i} $$

Intrinsic

Rotation

Translation