

From Correspondences to Pose:

Non-minimal Certifiably Optimal Relative Pose without Disambiguation

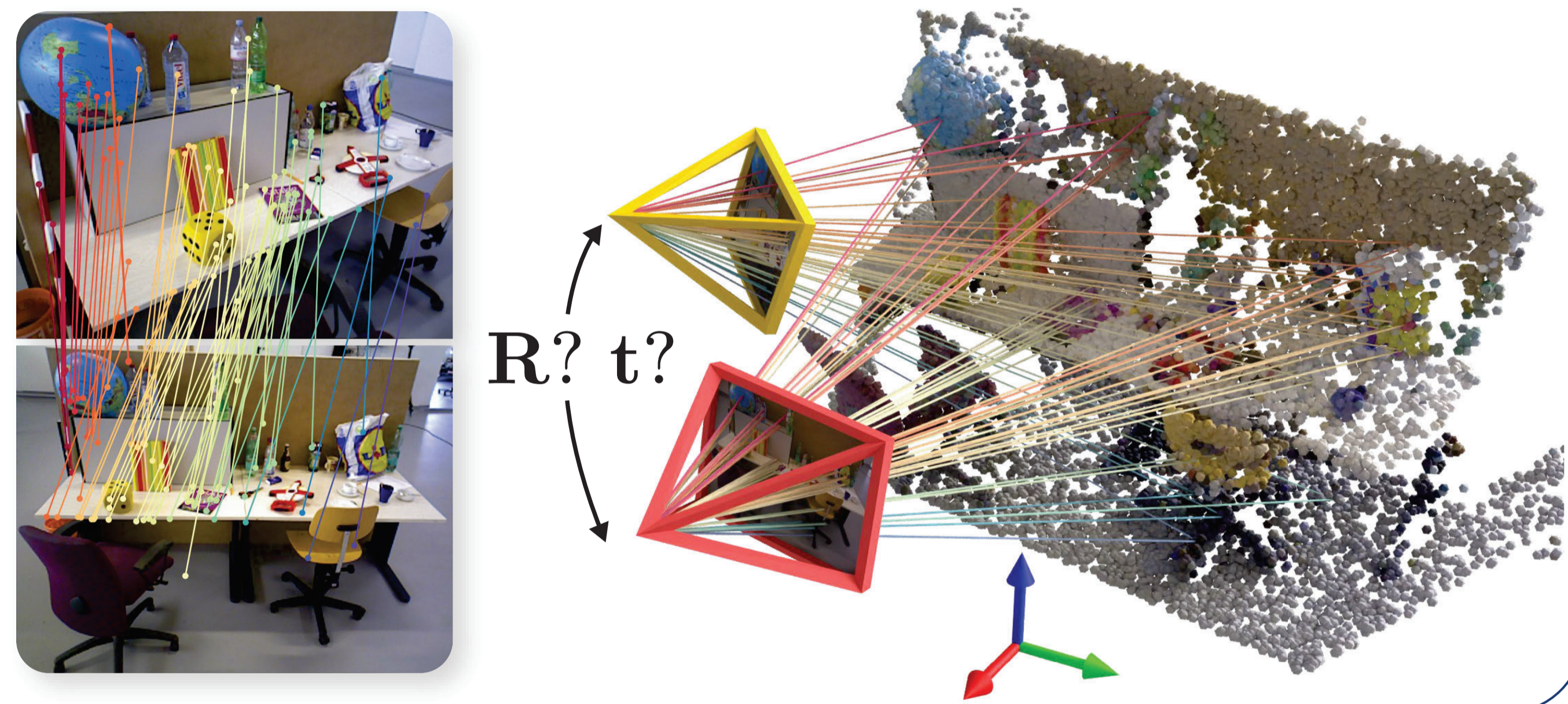
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`pip install nonmin-pose`
github.com/javrtg/C2P

Task: Relative Camera Pose

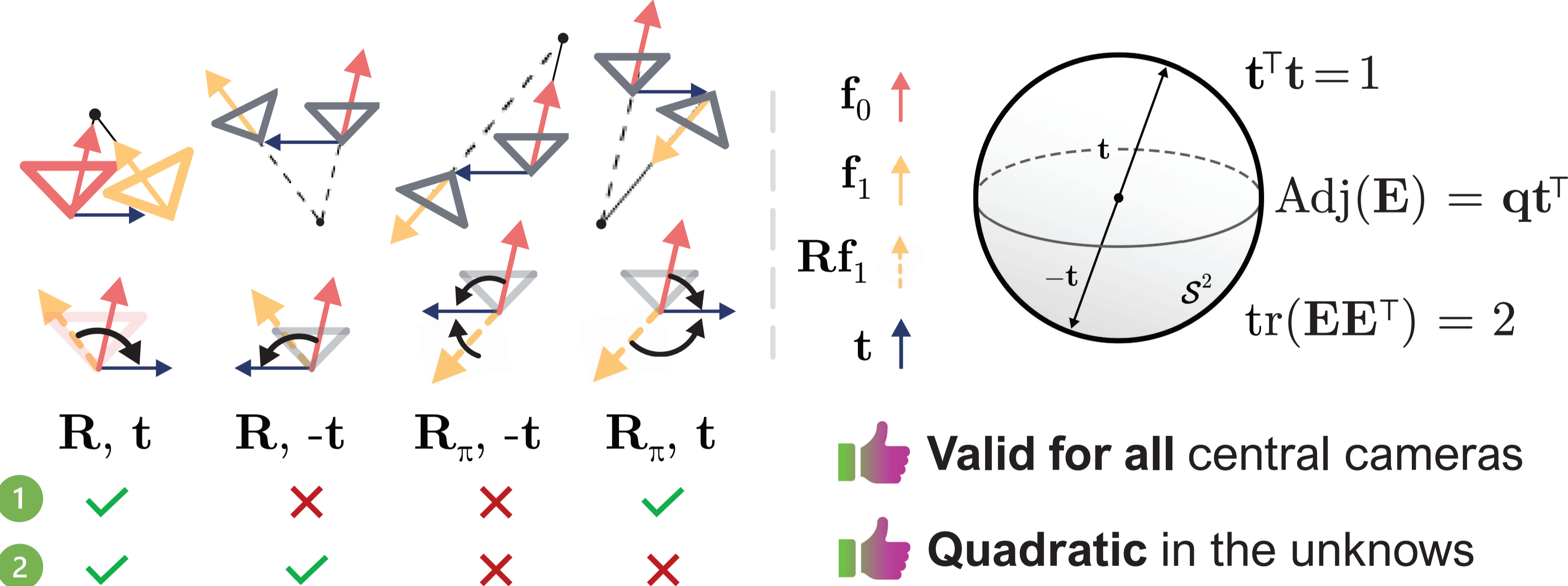
Given $n > 5$ 2D-2D matches, relative rotation \mathbf{R} and translation \mathbf{t} between the cameras?



Necessary and Sufficient Constraints

Global optimization with **geometric** and **manifold** constraints:

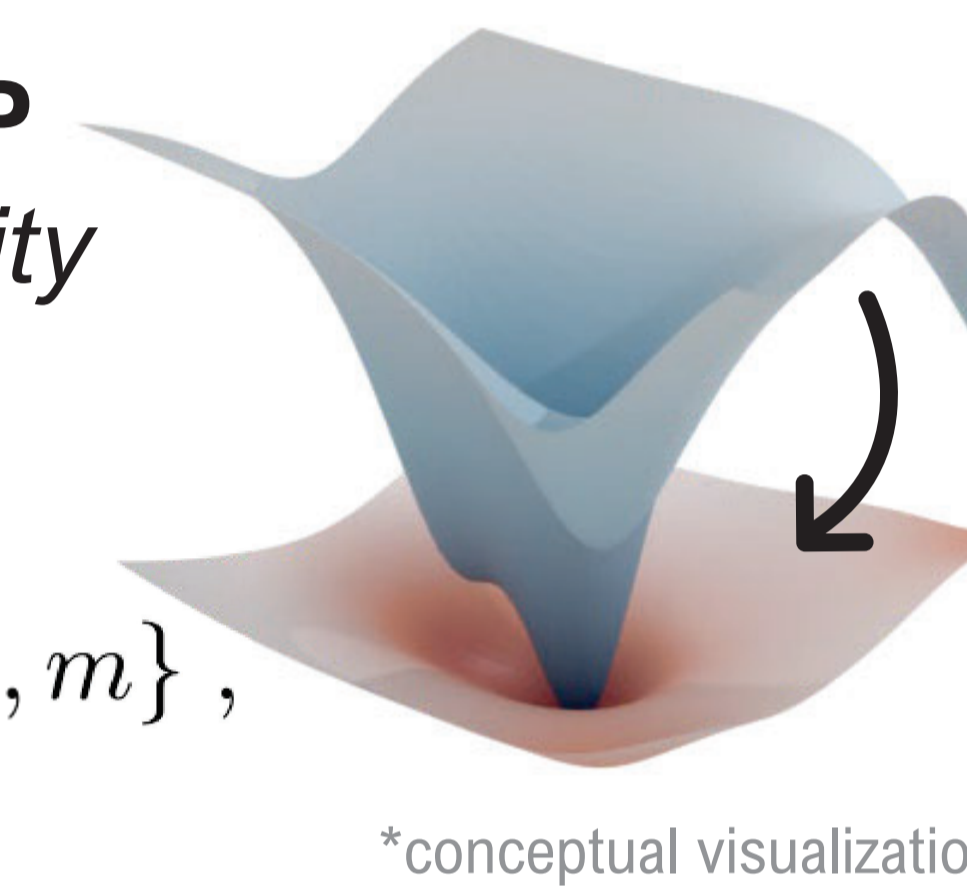
- 1 To disambiguate \mathbf{t}
 $\mathbf{f}_0^T \mathbf{t} - (\mathbf{R} \mathbf{f}_1)^T \mathbf{t} \geq 0$
- 2 To disambiguate \mathbf{R}
 $(\mathbf{t} \times \mathbf{f}_0) \cdot (\mathbf{t} \times \mathbf{R} \mathbf{f}_1) > 0$
- 3 4 5 Ensure $\mathbf{E} \in \mathcal{M}_{\mathbf{E}}$
Ensure $\mathbf{t}, \mathbf{q} \in \mathcal{S}^2$



SDP Relaxation

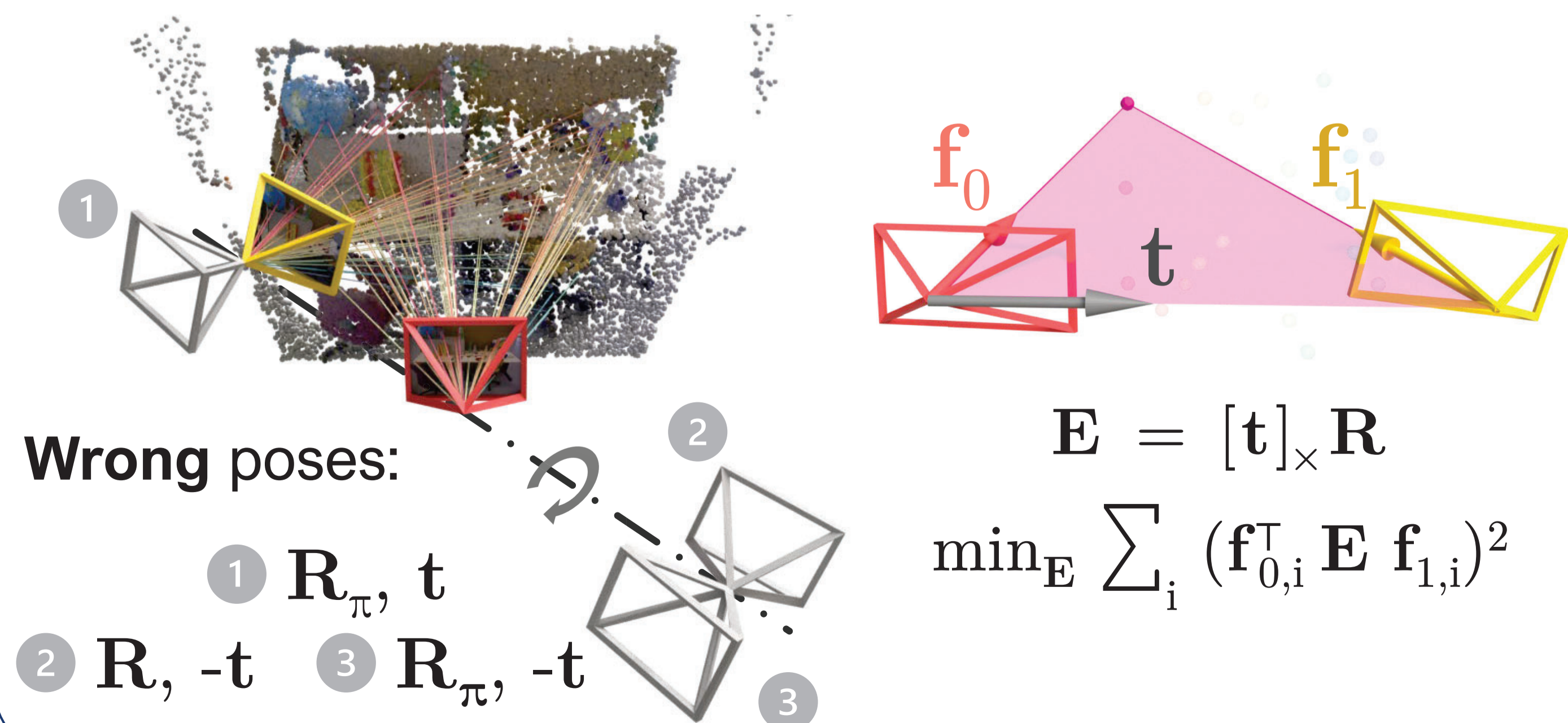
Our QCQP leads to a **tight SDP**
→ solvable with *global optimality*

$$\begin{aligned} \min_{\mathbf{X} \in \mathcal{S}^d} \quad & \text{tr}(\mathbf{C}_0 \mathbf{X}), \\ \text{s.t.} \quad & \text{tr}(\mathbf{A}_i \mathbf{X}) = b_i, \quad i \in \{1, \dots, m\}, \\ & \mathbf{X} \succeq 0. \end{aligned}$$



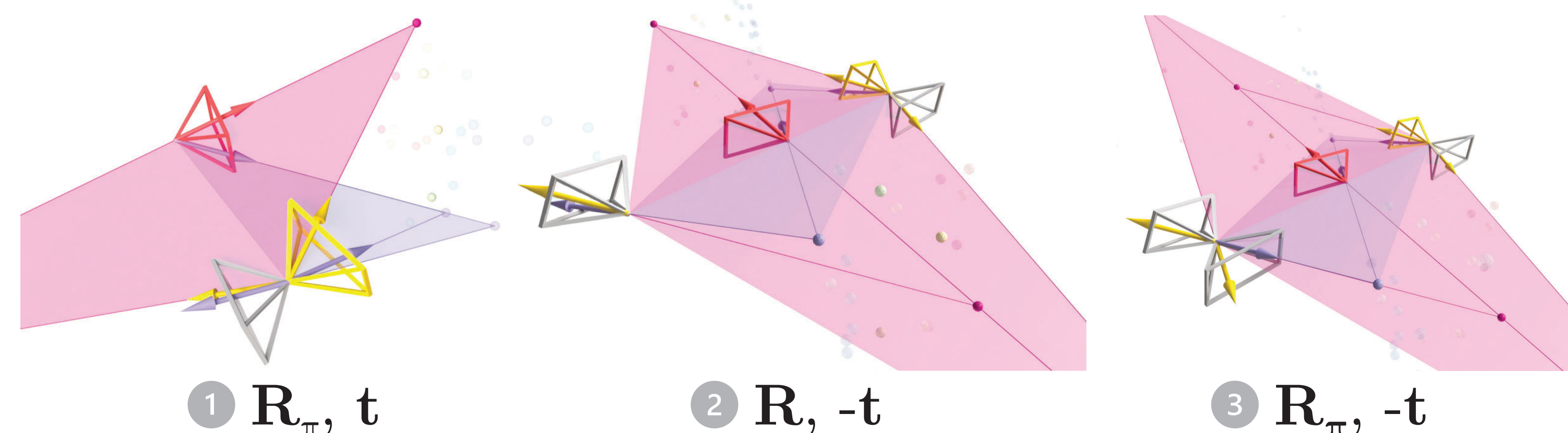
Problem: four-fold ambiguity

Standard approaches minimize **epipolar errors**



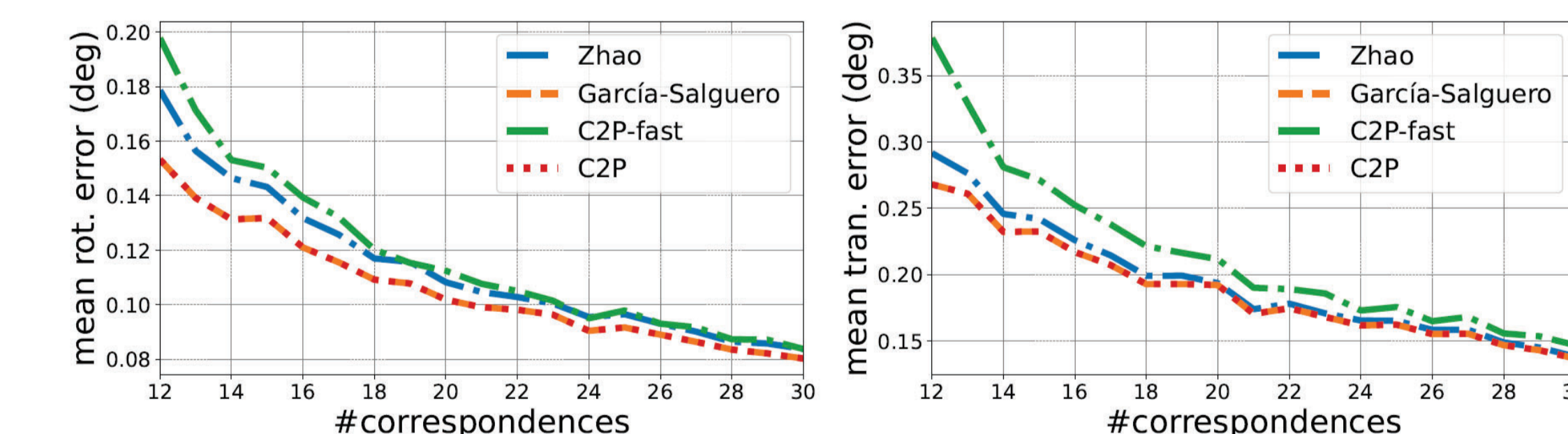
Why three wrong relative poses?

They also lead to bearings that lie on their epipolar planes

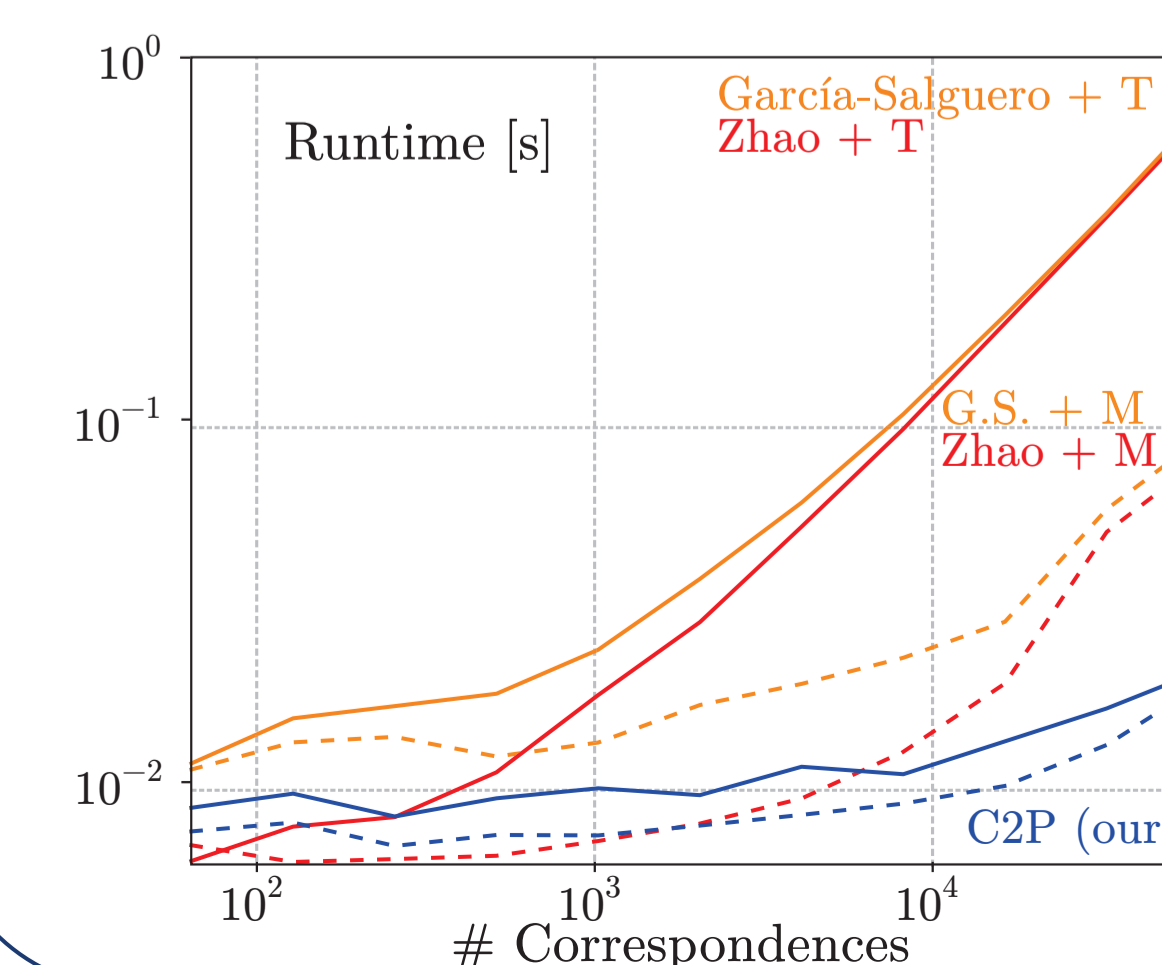


Experiments

Highest accuracy
among globally-optimal alternatives



Better scaling as $n \uparrow$



Same conclusions on real data

