Estimating Parameters of Revolute Joints from Observation

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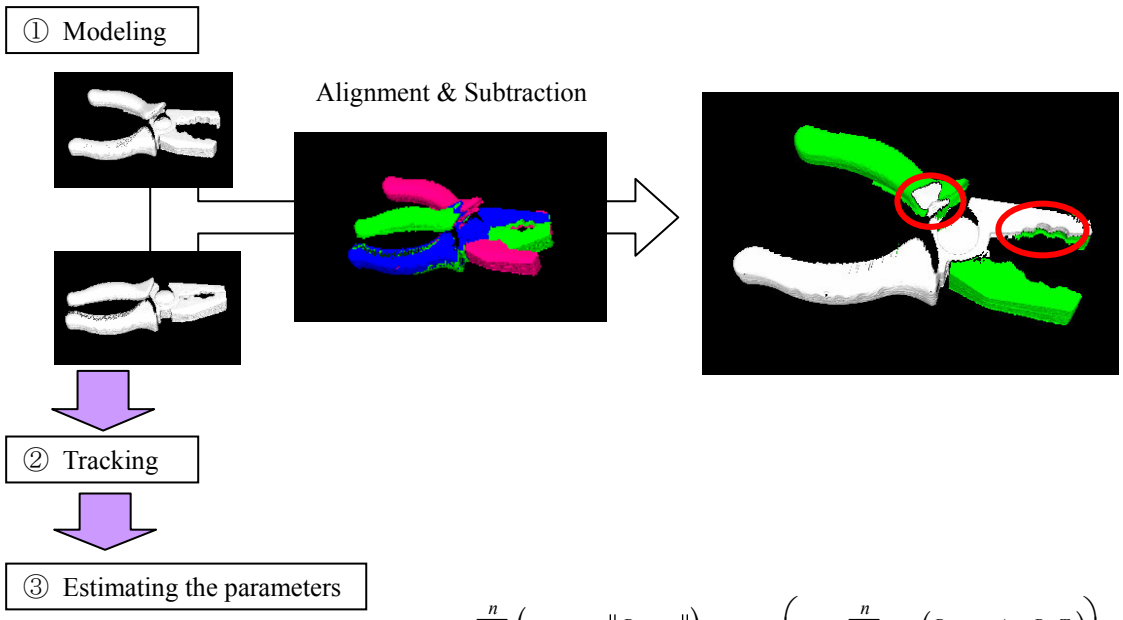
Our goal is to easily generate a robot program to manipulate linkages connected by a revolute joint. The generation enables a robot to perform various everyday tasks, for example, opening a door, turning on a water tap, milling coffee beans using a coffee mill, and so on.

Although one needs to set up joint parameters that are essential to manipulate linkages which are connected by the joint, one has to manually set up them in the conventional method. That causes difficulty in the generation. Therefore, we propose a novel method for estimating the parameters of a revolute joint from observation, including vision errors.

Publication

1. Y. Sato, J. Takamatsu, H. Kimura, and K. Ikeuchi: "Separating the reflection components with the use of polarization and determining the reflection parameters," Proc. of IEEE Int. Conf. on Multisensor Fusion and Integration for Intelligent Systems (MFI), 2003.



Axis direction: $\min_{{}^{A}\mathbf{l},{}^{B}\mathbf{l}} \sum_{i}^{n} \left(1-\cos\left\| {}^{B}\Theta_{A}^{i} \right\|\right) = \min_{{}^{A}\mathbf{l},{}^{B}\mathbf{l}} \left(n - \sum_{i}^{n} \mathrm{Tr}\left({}^{B}\Theta_{A}^{i}\, {}^{A}\mathbf{l}\, {}^{B}\mathbf{l}^{T} \right) \right)$

$$\sum_{i}^{n} \left(\mathbf{A}_{i}^{T}\mathbf{A}_{i} \right) \begin{pmatrix} {}^{A}\mathbf{c} \\ {}^{B}\mathbf{c} \end{pmatrix} = \sum_{i}^{n} \mathbf{A}_{i}^{T}\, {}^{B}\mathbf{t}_{A}^{i} \qquad \left(\mathbf{A}_{i} = \begin{pmatrix} -{}^{B}\Theta_{A}^{i} & \mathbf{I} \end{pmatrix} \right)$$

~ Estimation Result ~