Geometric Edge and Surface Differentiation with Semi-Sparse Matching for Transparent Object Pose Estimation

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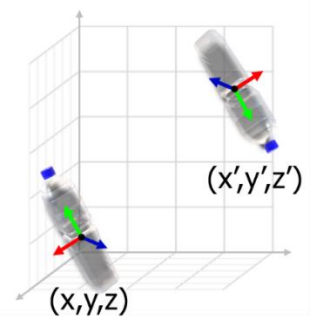
Background

Application

- Robot Assistant
- Lab Automation
- Sorting & Recycling
- ……





Challenges

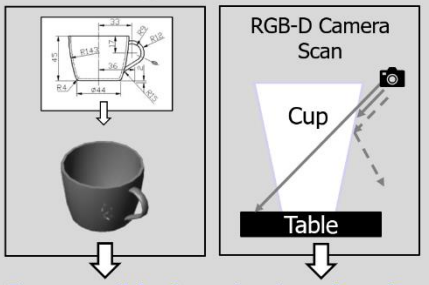
① Hard to use texture information

Reflection & **Refraction**

⇩

Background & light influence the appearance

② Hard to get 3d model



Inaccessible for **every** object

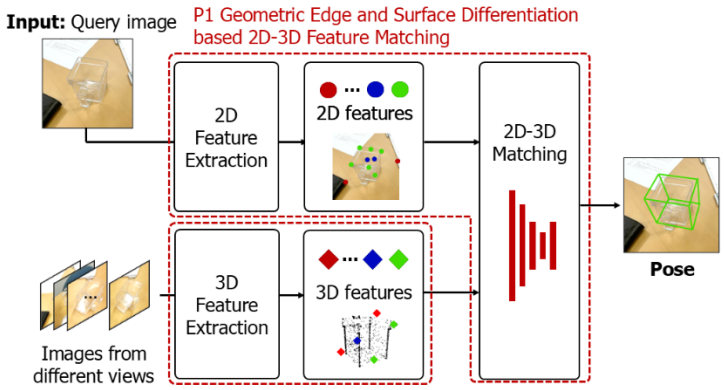
Losing **depth** information

Target

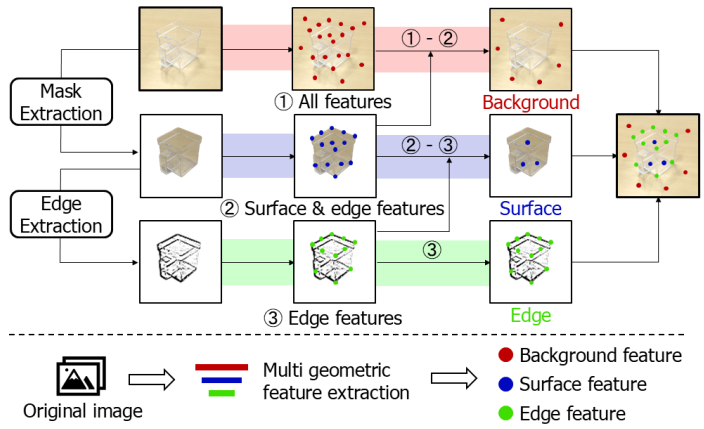
Achieve a success rate of 75% for transparent object pose estimation.

Proposals

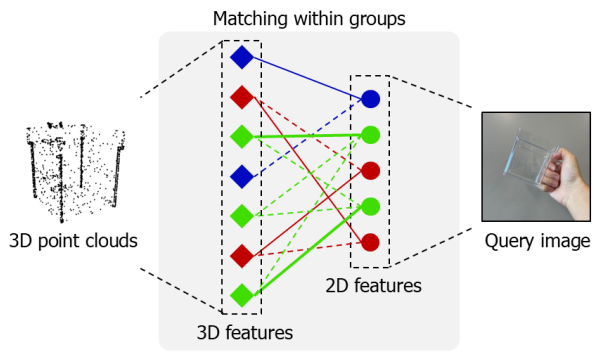
Overall Framework



P1.1 Geometric Feature Classification Method

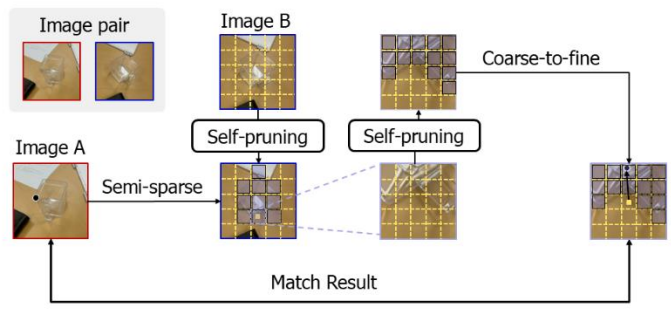


P1.2 Geometric Differentiation based 2D-3D Matching



- Enhanced matching results from edge features
- Reduced matching errors for non-geometric similar features

P2 Geometric Structure Incorporating Semi-sparse Paradigm based Matching



- Higher matching efficiency
- More robustness on background changes

Experiment Results

Metric	Method	Object ID									
		S1	S2	S3	M1	M2	M3	L1	L2	L3	Avg.
8 cm-8 deg	Baseline	12.78	7.63	15.35	14.22	21.57	36.51	17.54	21.89	40.71	20.91
	+P1	51.25	30.17	49.63	45.10	52.94	61.35	56.47	44.52	64.38	50.65
	+P1&P2	81.15	65.82	73.98	75.30	83.74	80.28	74.85	69.23	81.22	76.17

Conclusion

- The proposed methods achieve an improvement in accuracy, increasing from 20.91% to 76.17% under the 8cm-8deg metric, demonstrating their effectiveness and robustness in addressing the complexities of transparent object pose estimation.

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