3-D Object Recognition
From Shape

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The Problem

3-D Model (database) 3-D Scene

Difficult Problem

Scene

3-D scanner

Cloud of points

Pose Estimation

Recognition

Recovering

Recognition

Surface Matching using local “features”
Surface Matching

- Search for candidate ‘point correspondences’ between the model and scene that are geometrically consistent. (use distance measure in the “space of local features”).
- Generate a set of potential matches (groups of 3 or more correspondences).
- Keep the match that produces the best alignment between Surface meshes (rotation matrix and translation).

Local Features

Spin Signature Generation

Local descriptors of shape
Pose invariant
Robust to clutter and occlusion

Spherical Spin Images (SSI)
Recognition using SSI

Qualitative Results

Results % Improvement

Tested four methods ~ 4000 experiments

- Standard Spin Images vs Spherical Spin Images. (SI vs SSI)
- SI with PCA vs SSI with Random Projections (SIC + SSIC)

<table>
<thead>
<tr>
<th></th>
<th>RO</th>
<th>RC</th>
<th>LO</th>
<th>LC</th>
<th>Time</th>
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<tbody>
<tr>
<td>SSI vs SI</td>
<td>3.36</td>
<td>4.24</td>
<td>4.74</td>
<td>6.68</td>
<td>76.11</td>
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<tr>
<td>SSIC vs SIC</td>
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<td>25.41</td>
<td>22.2</td>
<td>33.13</td>
<td>16.12</td>
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Current Research

- Recognition of well defined classes of objects based on 3-D shape.
- Use techniques from statistical learning theory (support vector machines) and knowledge from the physiology of learning in humans to achieve categorization, detection and recognition of shape classes.