Point Pair Features Based Object Detection & Pose Estimation Revisited

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1. Introduction

**Problem**
- Robustly locate objects and estimate 3D 6DOF pose

**Challenges**
- Noisy Images
- Clutter and Occlusions
- Inaccurate CAD Models
- Lack of descriptive 3D features

**Existing Framework [1]**
- **PROS**
  - Operates directly on point clouds (not even meshes)
  - Robust to occlusions
  - Can find multiple instances of the model
  - Reduced search space (votes for angle and model point)
  - No plane assumption is made
- **CONS**
  - Can not handle low detail surfaces
  - Requires ICP verification
  - Combinatorial pairing

**Contribution**
- We augment the entire pipeline
- No modifications to 3D feature
- No plane assumption
- Requires ICP verification
- Reduced dependency on ICP
- Integrated hypothesis verification
- Robust to large scenes with small objects

2. Method

2.1. Method Details

**Hypothesis Verification**
- **Model**
  - On 3D Data
  - PPF, SHOT, MeshHOG etc.
  - Designed for RGBD

**Runtime**
- Components are indicated in green.

**Training**
- Components are indicated in red.

3. Results & Evaluation

**Results on ACCV3D Dataset [2]**

<table>
<thead>
<tr>
<th>Object</th>
<th>LineMod</th>
<th>Drost et al.</th>
<th>Ours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ape</td>
<td>42.88%</td>
<td>65.54%</td>
<td>81.95%</td>
</tr>
<tr>
<td>cam</td>
<td>68.78%</td>
<td>84.92%</td>
<td>91.00%</td>
</tr>
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<td>cat</td>
<td>35.62%</td>
<td>87.30%</td>
<td>95.76%</td>
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<td>driller</td>
<td>51.52%</td>
<td>81.06%</td>
<td>81.22%</td>
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<tr>
<td>iron</td>
<td>35.22%</td>
<td>87.06%</td>
<td>93.92%</td>
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<tr>
<td>Average</td>
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<td>81.18%</td>
<td>88.77%</td>
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<tr>
<td>Avg. Runtime</td>
<td>119ms</td>
<td>6.3s</td>
<td>2.9s</td>
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4. References


