

1. Overview

- -Goal: Jointly Object Detection and Shape Recovery
- -Novel Depth-Encoded formulation for classical Hough voting-based detector.
- -Shape recovery from a single uncalibrated image.
- Improve detection performance given:
 - depth in training depth depth both in training and testing.

-Applications: 6 degree of freedom (DOF) pose estimation plausible 3D reconstruction of the object

2. Depth-Encoded Hough Voting

Hough voting-based detector



-Object Hypothesis: object candidate O, location x

-Image Patch Attributes: patch index j, appear feature f, scale s, position *l*, depth d

Our formulation

V(O, x |D)
$$\sum_{j,i} \int p(x|O, C^{i}(f_{j}), s_{j}, I_{j}) p(O|C^{i}(f_{j})) p(s_{j})$$

-Feature Quantization: Random forest codeword C, tree index i -Patch scale & depth relation: p(s|l,d)













Depth-Encoded Hough Voting for Joint Object Detection and Shape Recovery

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Intuition Image patch tightly encloses a part of the object with radius r Equations











 $|\mathbf{I}_j, \mathbf{d}_j| \mathbf{d}_j$



Voting Space

5. Depth & Detection Interaction



w/o depth in detection: False positive (blue) due to votes from patches with wrong scale



w depth in detection: False positive weakened since votes from wrong scale are removed

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