Introduction and Framework Overview

- Characterization of the Probabilistic Volumetric Models (PVM) as a new representation for 3-d scene understanding.
- The first evaluation of the performance of several local shape descriptors extracted from the PVM in terms of accuracy for object classification.
- Histogram-based descriptors are of particular interest as they are the most popular and most successful for many image indexing applications.
- The performance of many 3-d shape descriptors has been studied in point cloud data, but it is unclear that their descriptiveness and robustness to noise successfully extends to the diffuse surface probability distributions of the PVM.

Framework Details

Probabilistic Volumetric Model

\[ P^{N+1}(X \in S | I^{N+1}) = P^N(X \in S) \frac{p^N(I^{N+1} | X \in S)}{p^N(I^{N+1})} \]

Sample Data

http://vision.lerns.brown.edu/datasets/aerial-multiview

Evaluation Results

- Top Row: Recall vs. K
- Middle Row: Recall vs. Category
- Bottom Row: Confusion Matrices
- Right Column: Average Running Time per Object

Conclusions

- FPFH obtained high recall while having the advantage of being compact and fast to compute.
- Spin Images under-performed, specially recognizing buildings.
- SVM was the more effective classifier.
- Distribution-based descriptors effectively characterize the shape information in the PVM for object categorization.