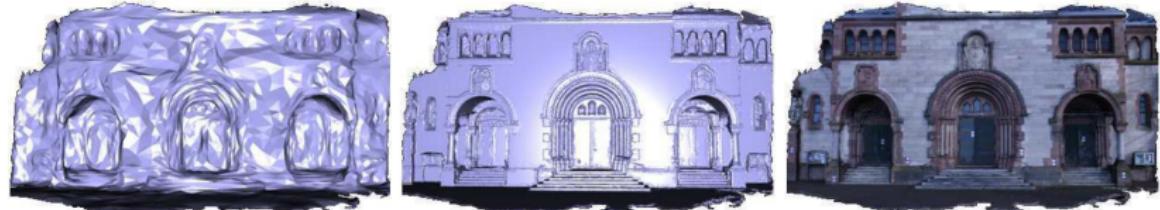


A hybrid multi-view stereo algorithm for modeling urban scenes

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Overview

1 Introduction: meshes and primitives

2 Hybrid model: 2-step strategy with iterative refinement

- Step 1: Mesh-based surface segmentation
- Step 2: Stochastic hybrid reconstruction

3 Conclusions

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Introduction

- Urban scenes are difficult to analyze
 - Structures are very different within the same scene...
 - ... but created with man-made rules (piecewise planar, shape repetition)
- Urban scene reconstruction: 2 approaches
 - Meshes
 - 3D primitive arrangements

Introduction: Meshes

- **Meshes:** set of vertices, edges and faces that defines the shape of polyhedral objects
- Several methods for generating a mesh from multi-view stereo images
 - Region growing based methods
 - Fusing a set of depth maps
 - Variational methods
 - 3D Delaunay triangulations
- **Pro:** highly detailed scene reconstruction
- **Cons:**
 - Regular structures not optimally modeled
 - Semantic not taken into account

Introduction: 3D-primitive arrangements

- **3D primitives:** planes, spheres, cylinders, cones and tori
- Exploit the **Manhattan-world assumption**
 - Predominance of three mutually orthogonal directions in the scenes
- **Pro:**
 - particularly well adapted to describe urban environments
 - Semantic taken into account
 - Easy to store and render
- **Cons:** Fail to model fine details and irregular shapes

Solution: hybrid (meshes + primitives) model approach!

Overview

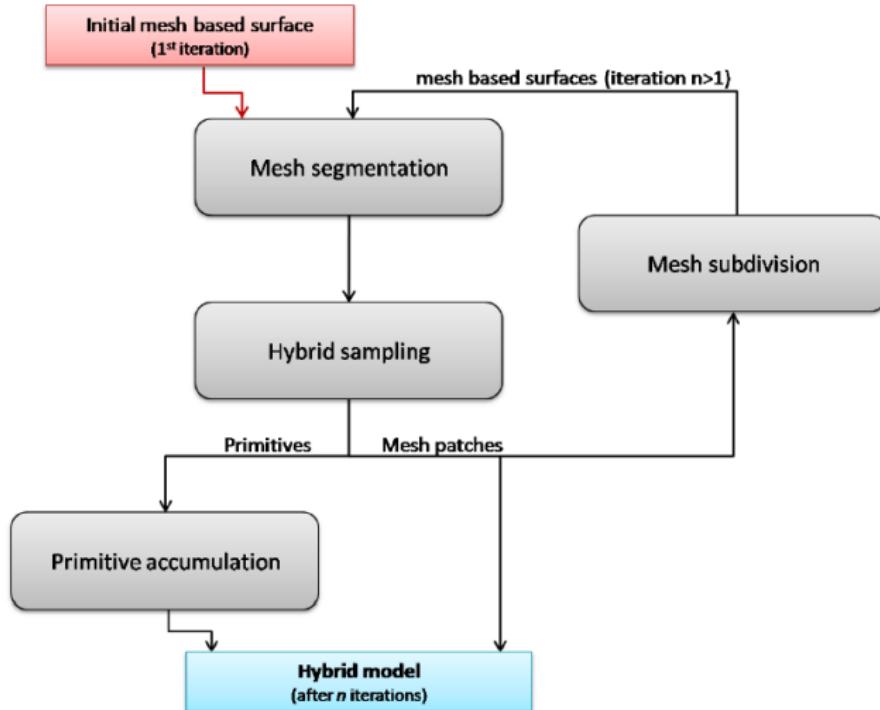
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Hybrid model: pipeline

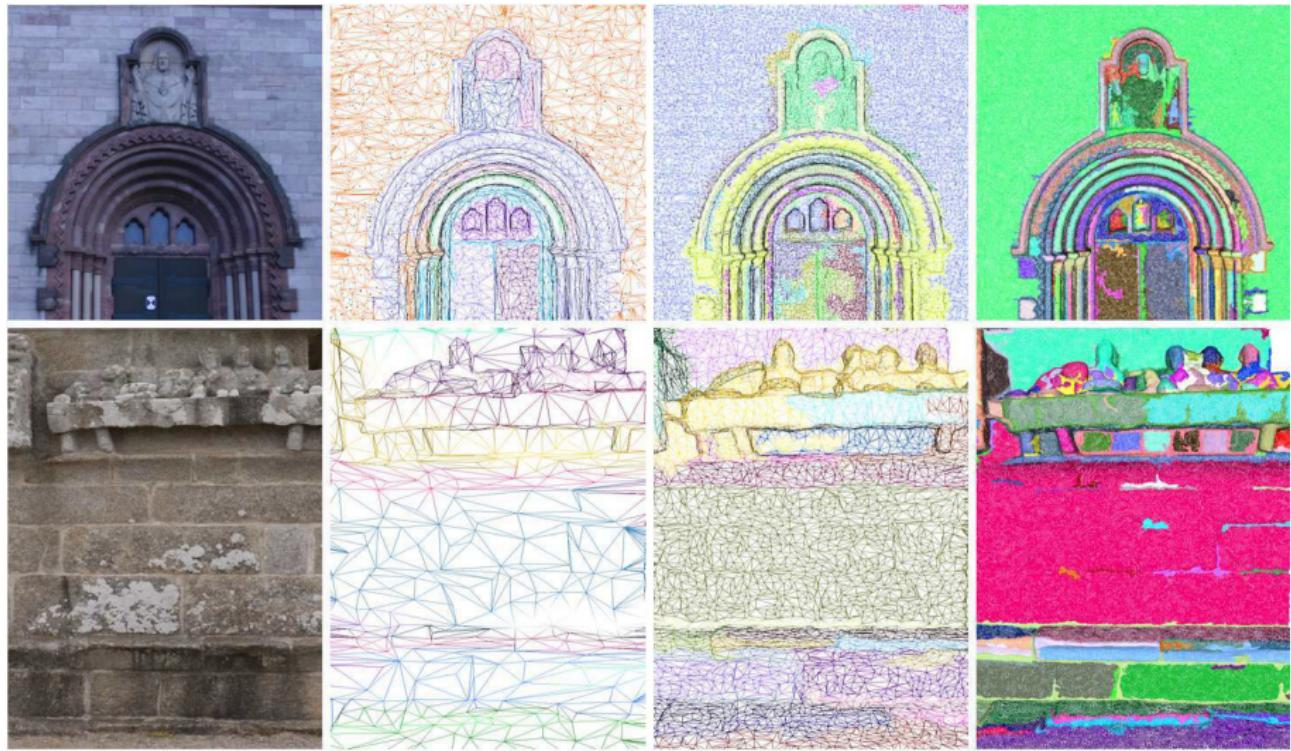


Preliminary segmentation: reduces the complexity of the problem
The procedure stops when the generated facets become too small

Step 1: Mesh-based surface segmentation

- Segmentation problem formulated with a Markov Random Field
 - Vertex set and edge adjacency as in the mesh
- Label for each vertex
 - Planar, developable convex, developable concave, non developable
- Quality of a label configuration: energy
 - Energy given by curvature distributions, label homogeneity and edge preservation
- Subdivision into clusters (using label as discriminant)

Step 1: Mesh-based surface segmentation



Step 2: Stochastic hybrid reconstruction

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Thanks for your attention!

Questions?