3DSM: Work in progress

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5th user committee meeting
2016-11-09
Delft
MAT construction

Shrinking ball algorithm
(Ma et al., 2012)
Topology
Topology

Essential for ‘high level’ applications such as

• *object detection*,
• *object matching*, and
• *object reconstruction*. 
Workflow overview

- pointcloud with normals
  - ball shrinking algorithm
  - MAT pointcloud
  - bisector based segmentation
  - MAT sheets
  - construct adjacency graph
    - MAT sheet topology
    - derive MAP
      - reconstruct surface faces
        - Surface polyhedron
  - connected components in adjacency graph
Bisector based segmentation

MAT 

Object surface

Medial bisector
Demo
corner gabled house
Workflow overview

pointcloud with normals → ball shrinking algorithm → MAT pointcloud

MAT pointcloud → bisector based segmentation → MAT sheets

MAT sheets → construct adjacency graph → MAT sheet topology

MAT clusters → derive MAP → MAP (surface topology)

MAP (surface topology) → reconstruct surface faces → Surface polyhedron

object detection → object reconstruction
Demo
Rotterdam harbour
Medial Axis Polyhedral Map (MAP)

A datastructure that is ‘dual’ to both the sheets of the MAT and the faces of the polyhedron.

Thus mapping the MAT topology back to the surface
Constructing the MAP

Connect half-nodes that support the same face
Object reconstruction: planes
Object reconstruction: edges
Object reconstruction: vertices
Workflow overview

Pointcloud with normals
  \rightarrow ball shrinking algorithm
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MAT clusters
  \rightarrow derive MAP
  \rightarrow object detection
  \rightarrow reconstruct surface faces
  \rightarrow object reconstruction

Surface polyhedron
Demo

simple gabled house
Example
Strengths

• works for every polyhedron
• no ‘footprints’ required
• plane fitting uses points that we know are on the plane (ie. high quality fit and no RANSAC needed)
• watertight surfaces
• correct face orientation (normals) for ‘free’
Limitations

• ideally **well-sampled & fully 3D** surface point cloud needed
Other sources than LiDAR

• 2.5D acquisition nature of aerial LiDAR hampers effectiveness of MAT

• What about photogrammetry?
Demo

Photogrammetric building model
Thank you!