3DSM: Work in progress

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5th user committee meeting
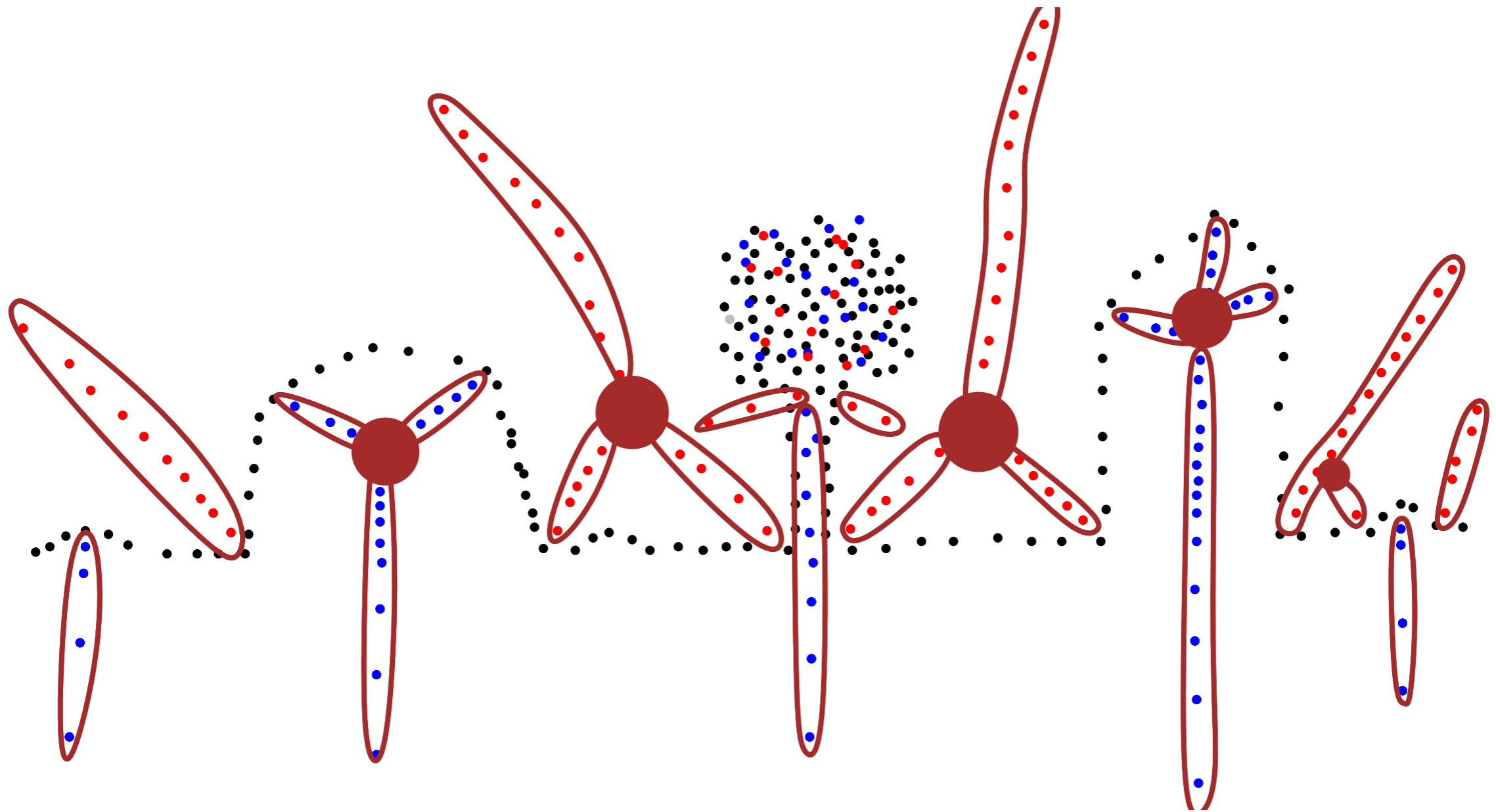2016-11-09
Delft

TUDelft
3Dgeoinfo
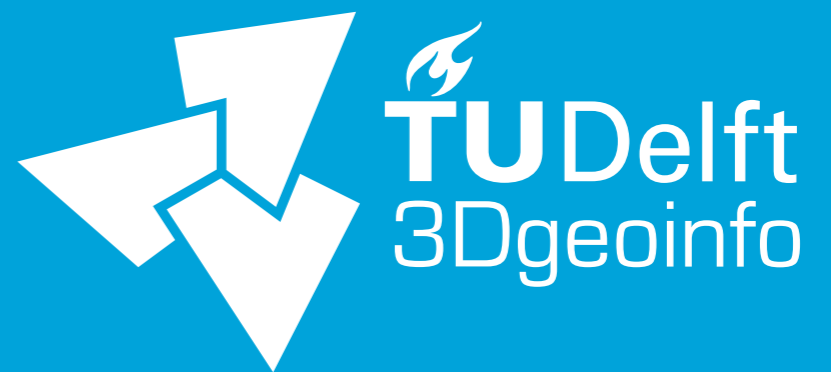
MAT construction

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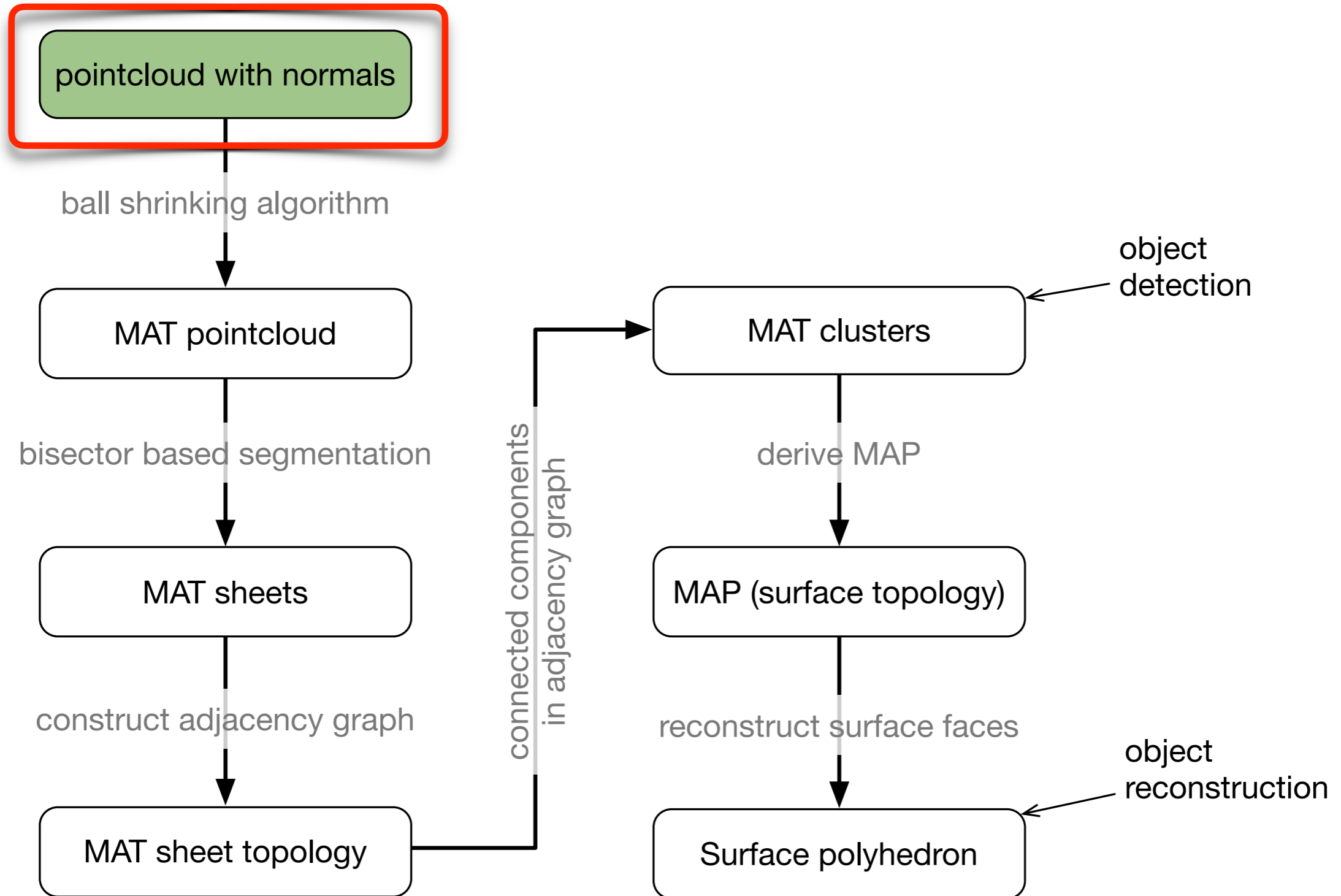algorithm
(Ma et al., 2012)
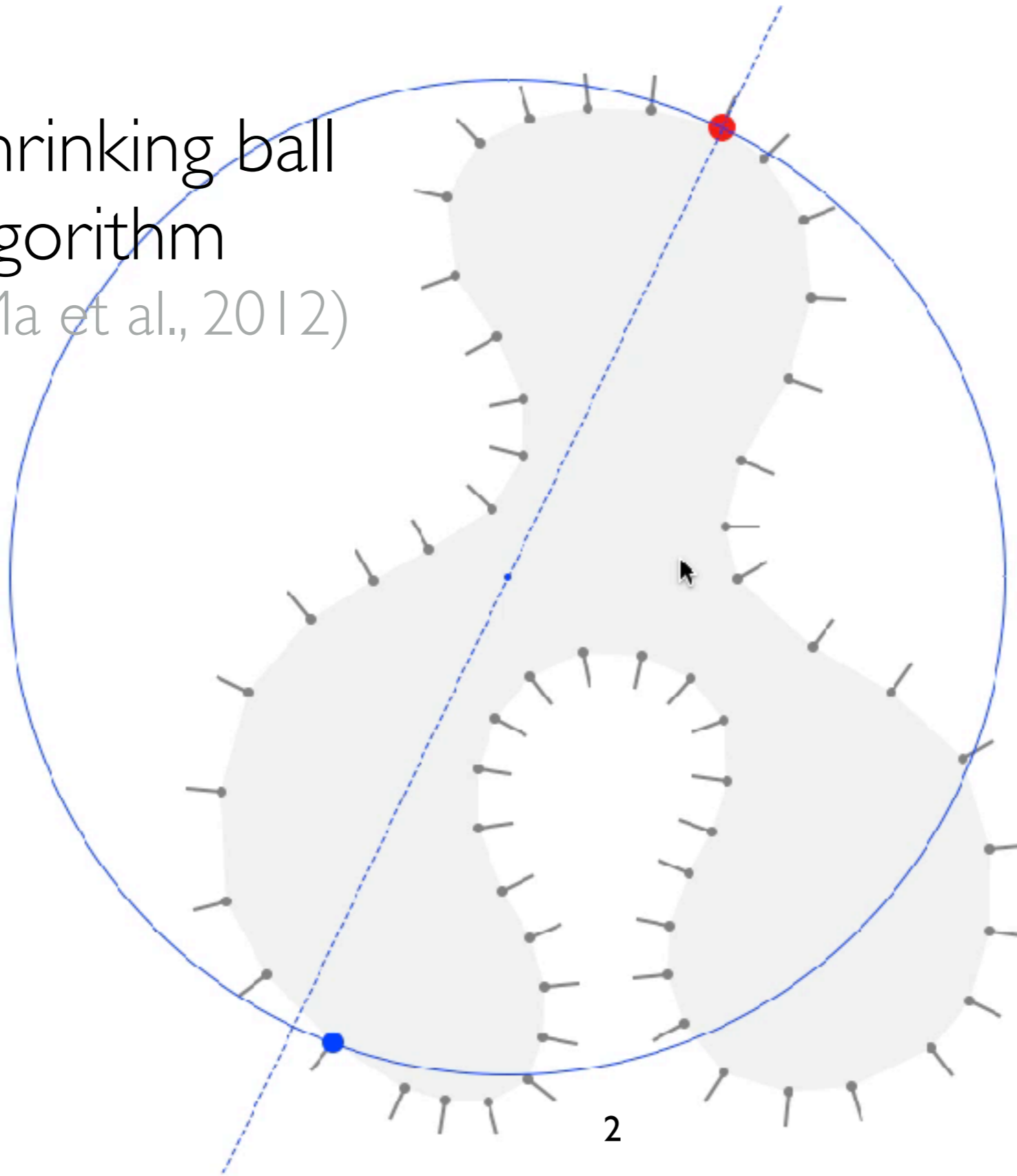
Topology

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

connected components in adjacency graph

object detection

MAT clusters

derive MAP

MAP (surface topology)

reconstruct surface faces

object reconstruction

Surface polyhedron

Bisector based segmentation

MAT

Medial bisector

Object surface
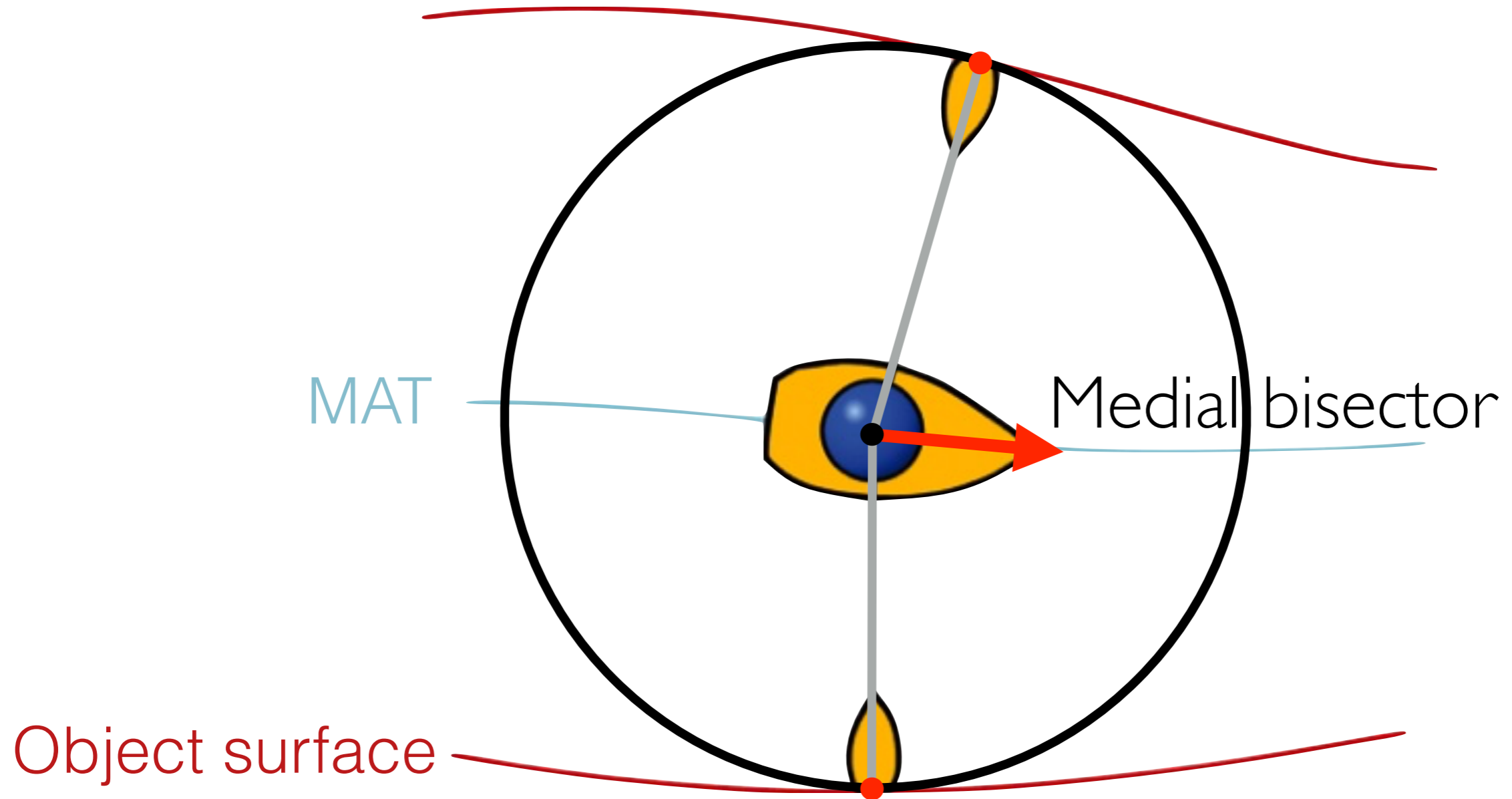
Demo

corner gabled house

Workflow overview

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connected components in adjacency graph

MAT clusters

object detection

derive MAP

MAP (surface topology)

reconstruct surface faces

Surface polyhedron

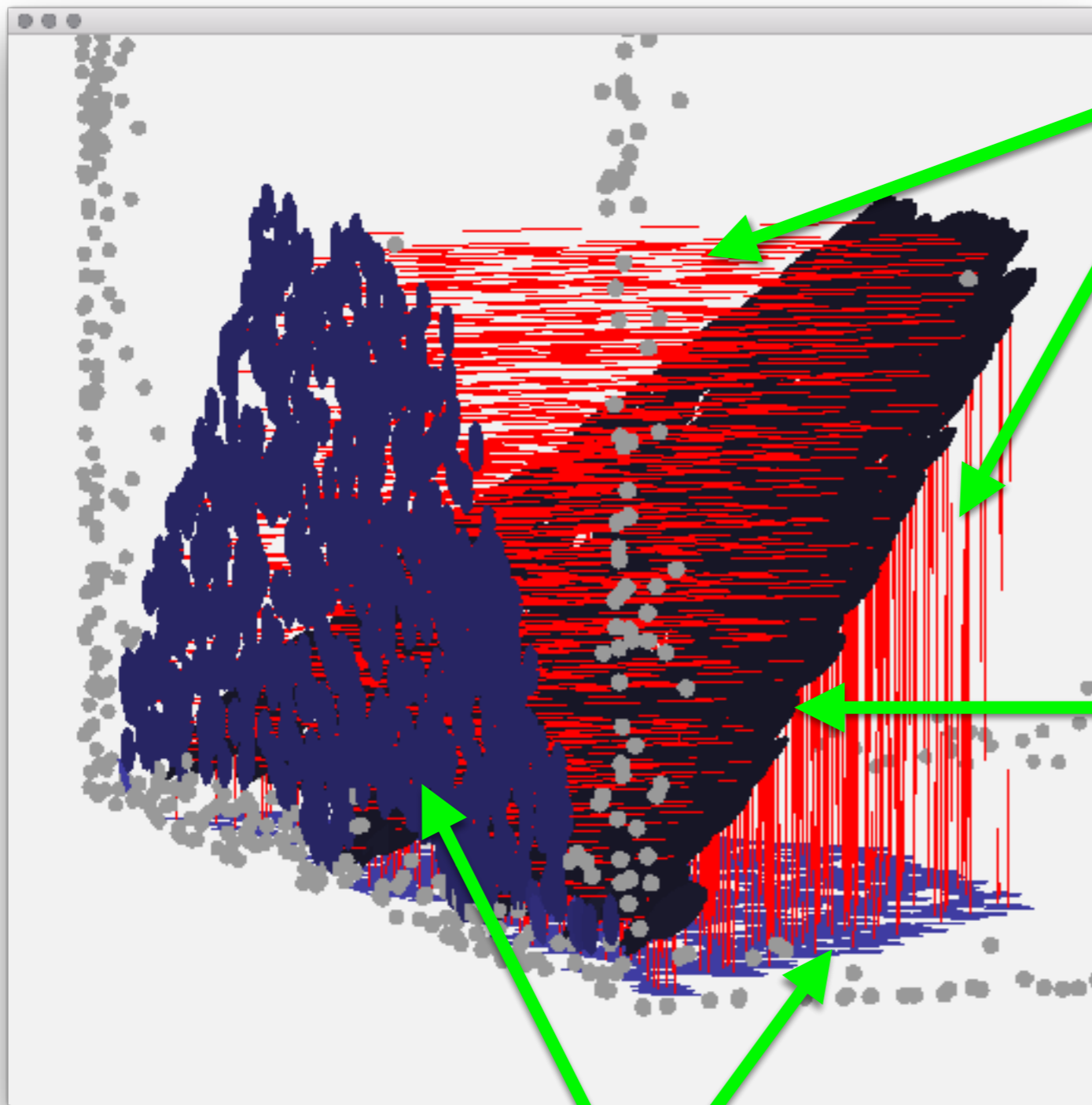object reconstruction

8
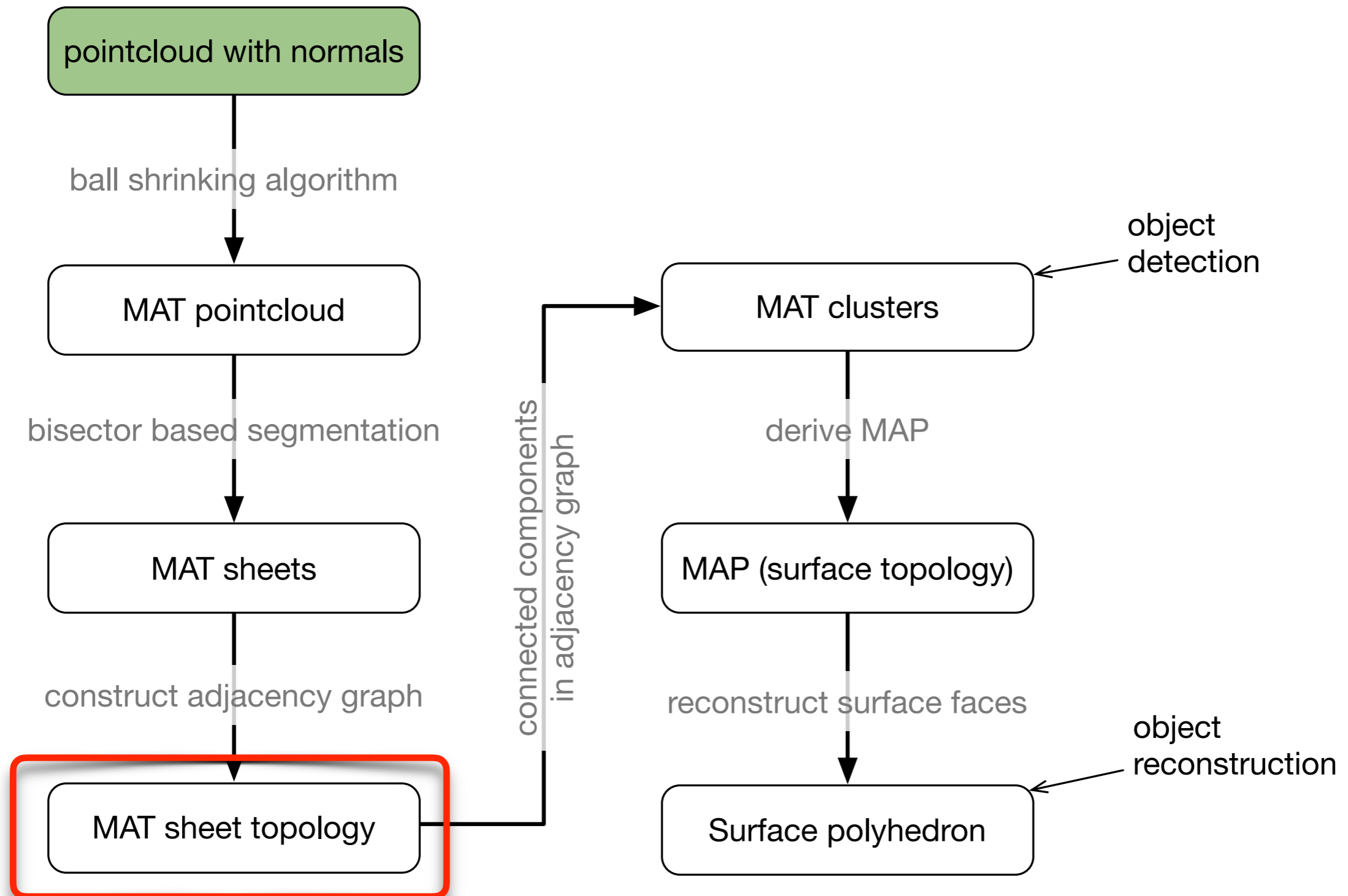
Demo

Rotterdam harbour

Medial Axis Polyhedral Map (MAP)

A datastructure that is '*dual*' to both
the **sheets of the MAT** and
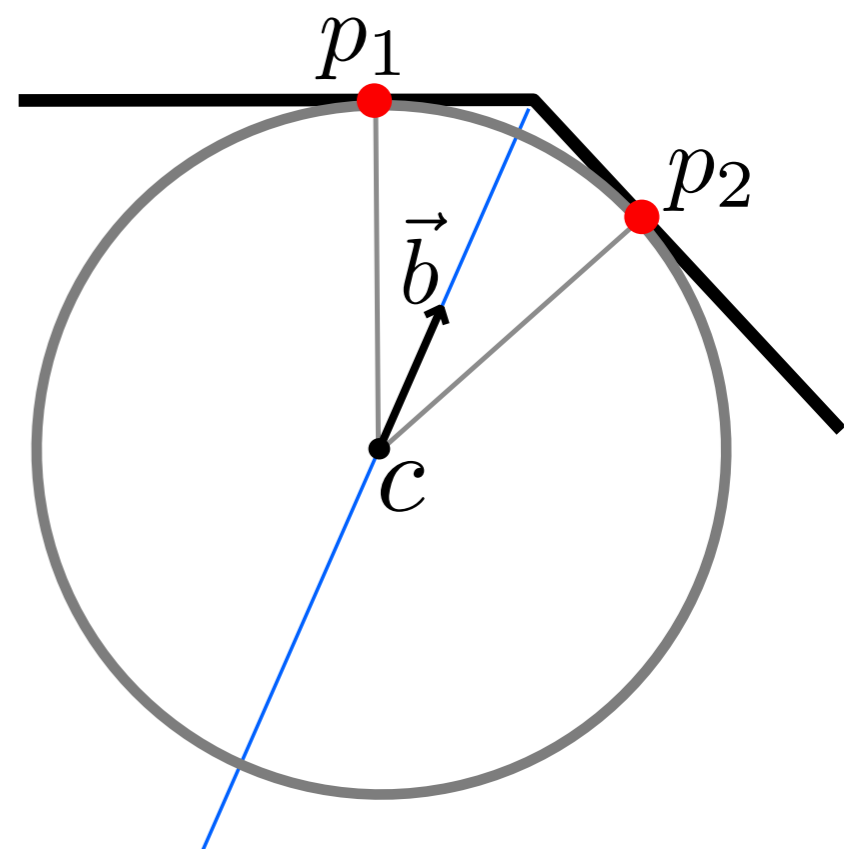the **faces of the polyhedron**.

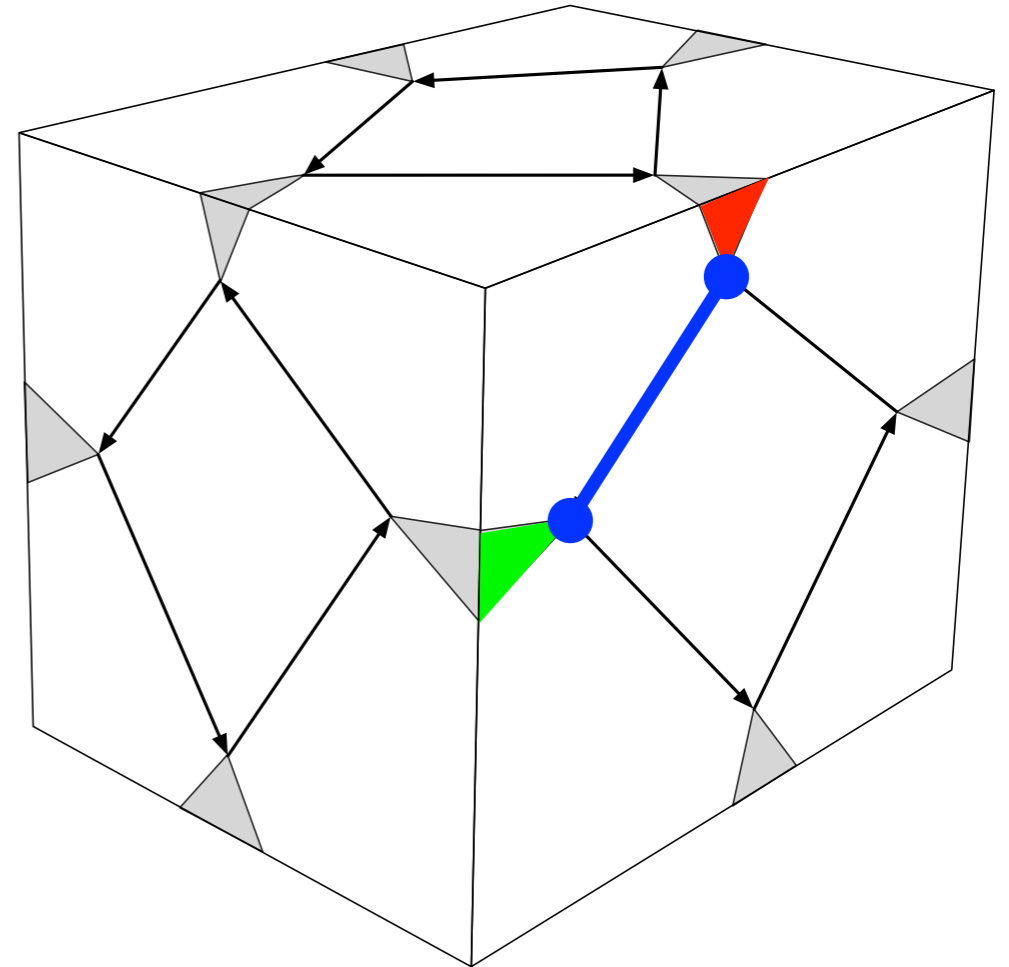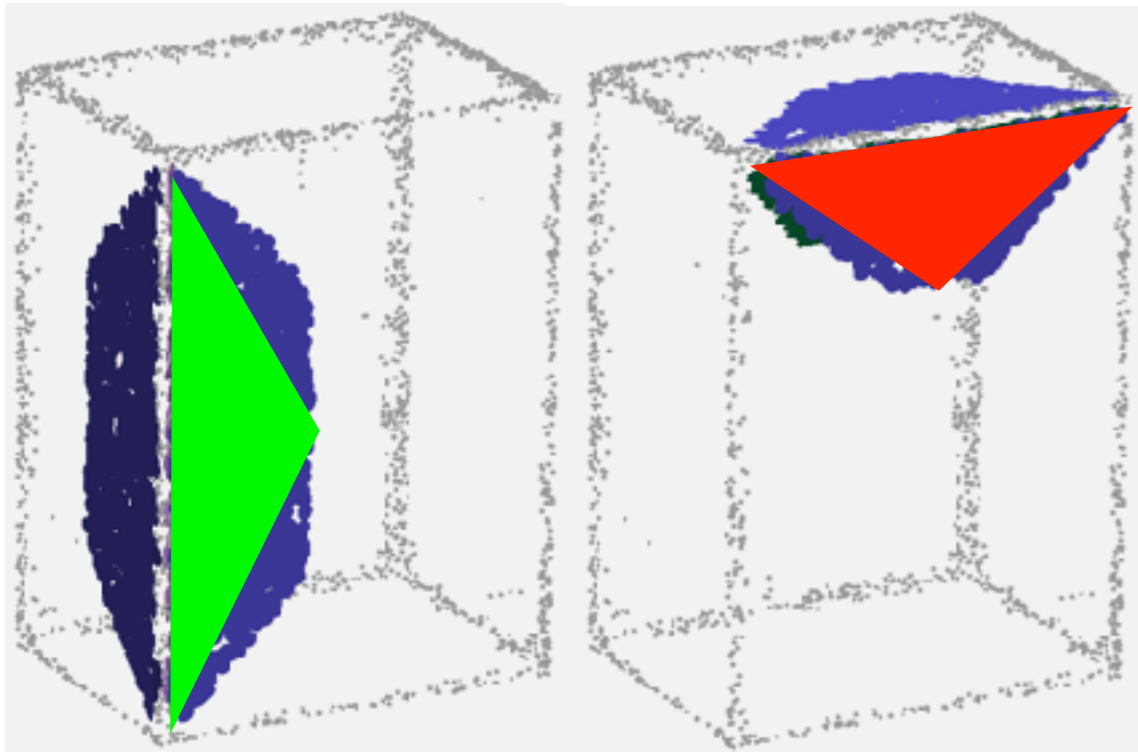Thus mapping the MAT topology back to the surface

Spokes

Medial sheet
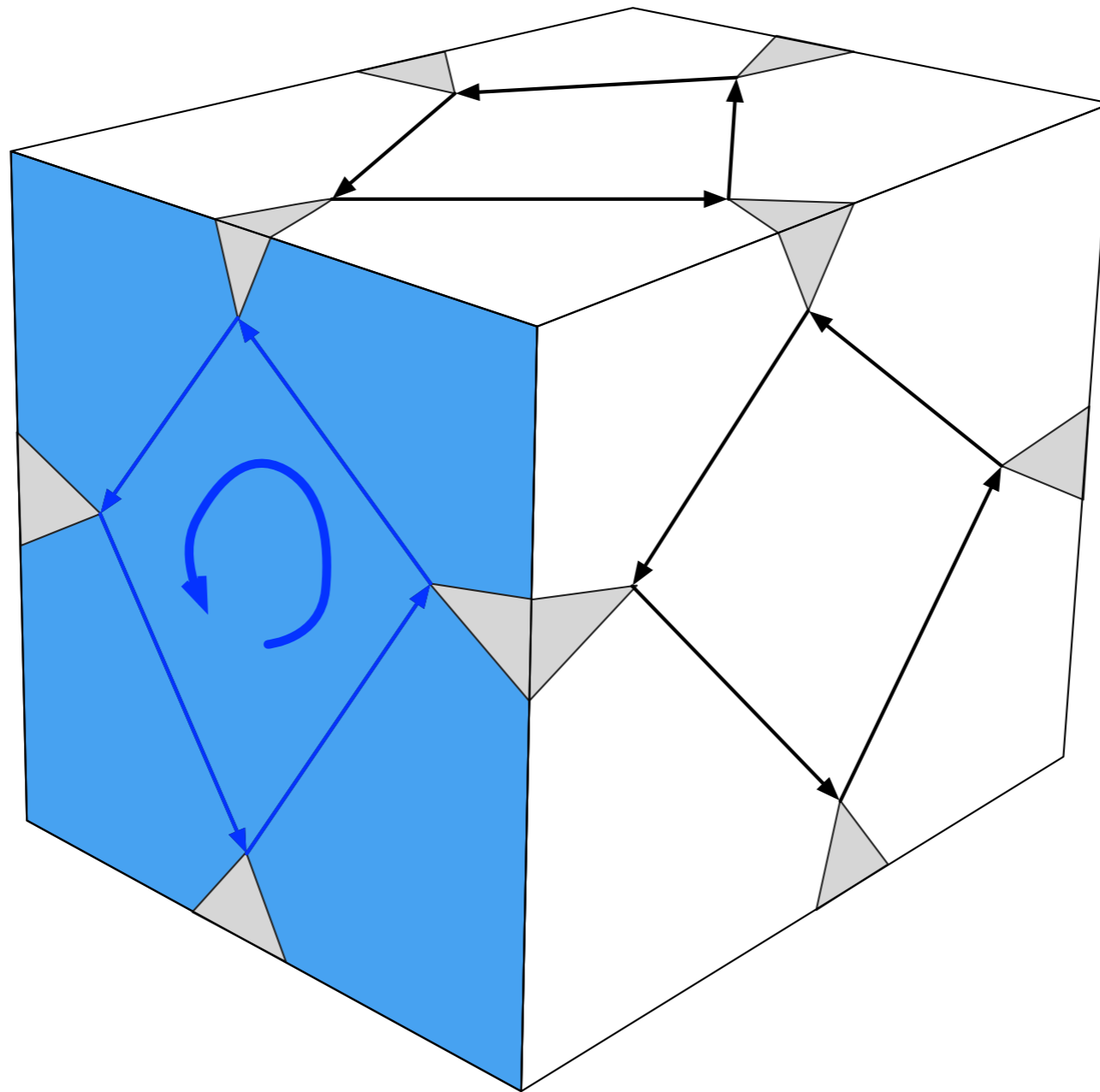
Surface points

p_1

p_2

$\vec{b}$

c

Constructing the MAP

Connect half-nodes that support the same face

Object reconstruction: *planes*

Workflow overview

```
┌─────────────────────────────┐
│   pointcloud with normals   │
└─────────────────────────────┘
              │
      ball shrinking algorithm
              │
              ▼
┌─────────────────────────────┐                    ┌─────────────────────────────┐
│        MAT pointcloud       │                    │         MAT clusters        │ ←── object
└─────────────────────────────┘                    └─────────────────────────────┘      detection
              │                                                 │
    bisector based segmentation                           derive MAP
              │                                                 │
              ▼                                                 ▼
┌─────────────────────────────┐                    ┌─────────────────────────────┐
│         MAT sheets          │                    │     MAP (surface topology)  │
└─────────────────────────────┘                    └─────────────────────────────┘
              │                                                 │
    construct adjacency graph                      reconstruct surface faces
              │                                                 │                    object
              ▼                                                 ▼                reconstruction
┌─────────────────────────────┐                    ┌─────────────────────────────┐
│      MAT sheet topology     │                    │      Surface polyhedron     │ ←──
└─────────────────────────────┘                    └─────────────────────────────┘
```
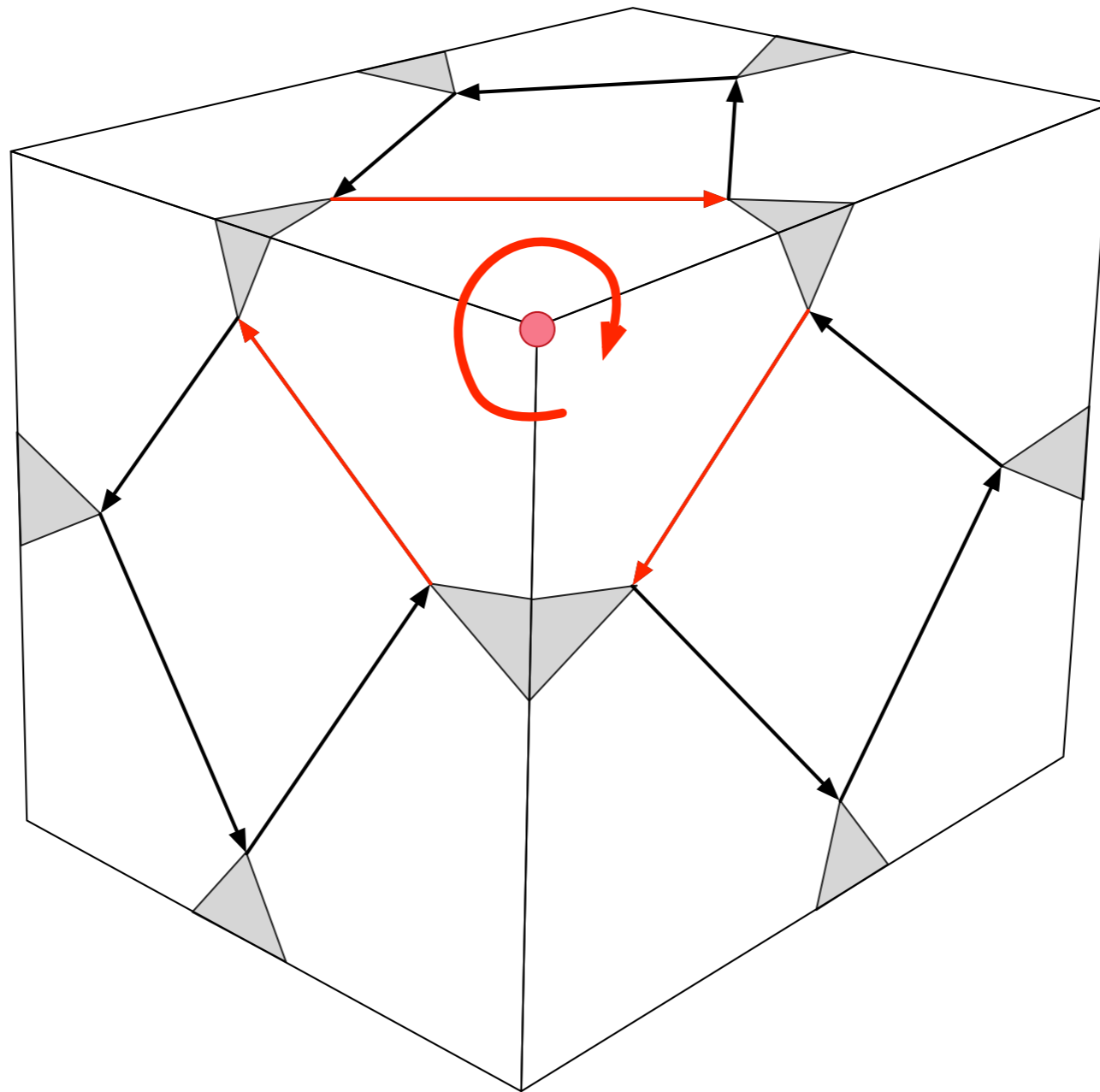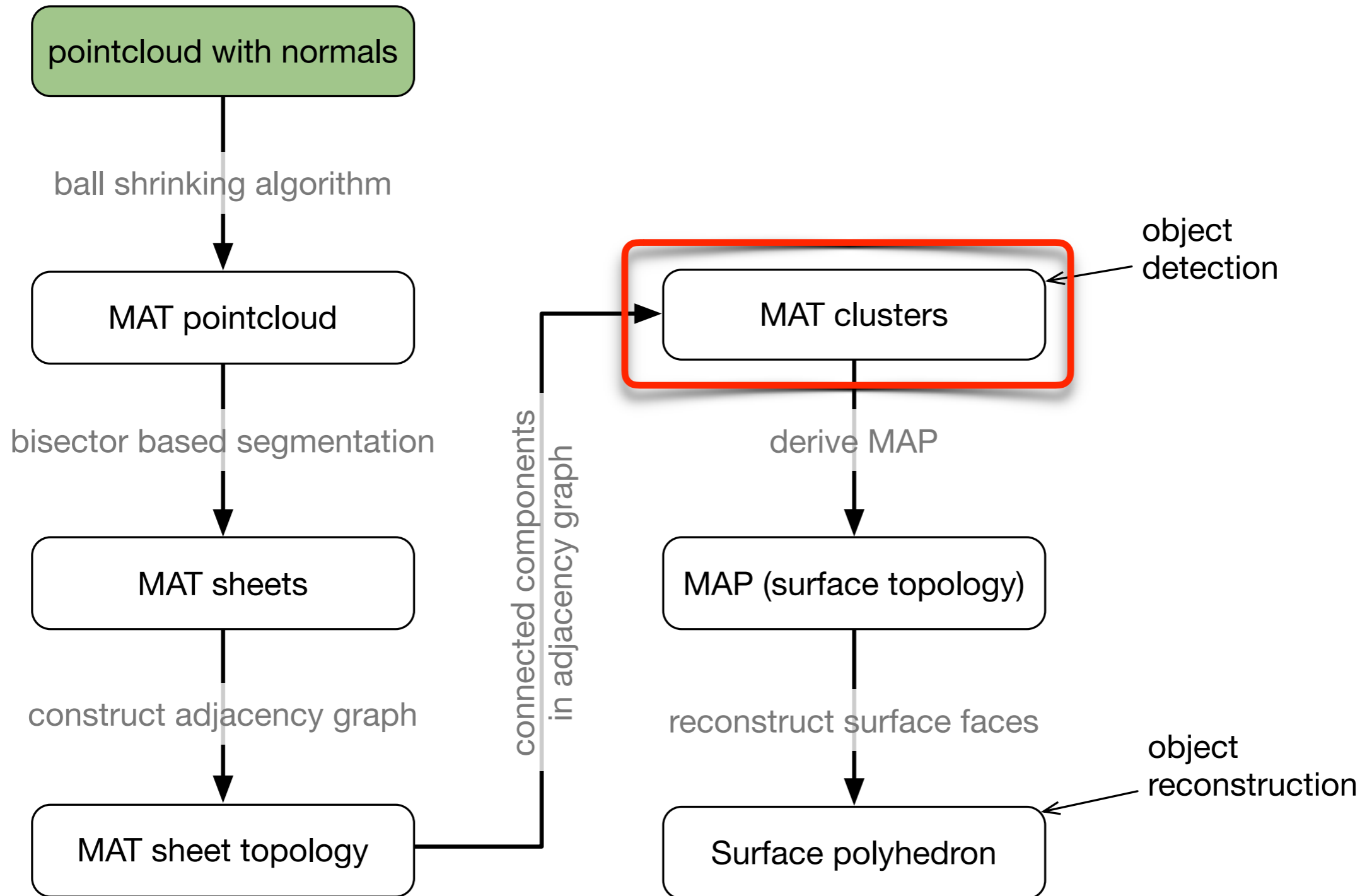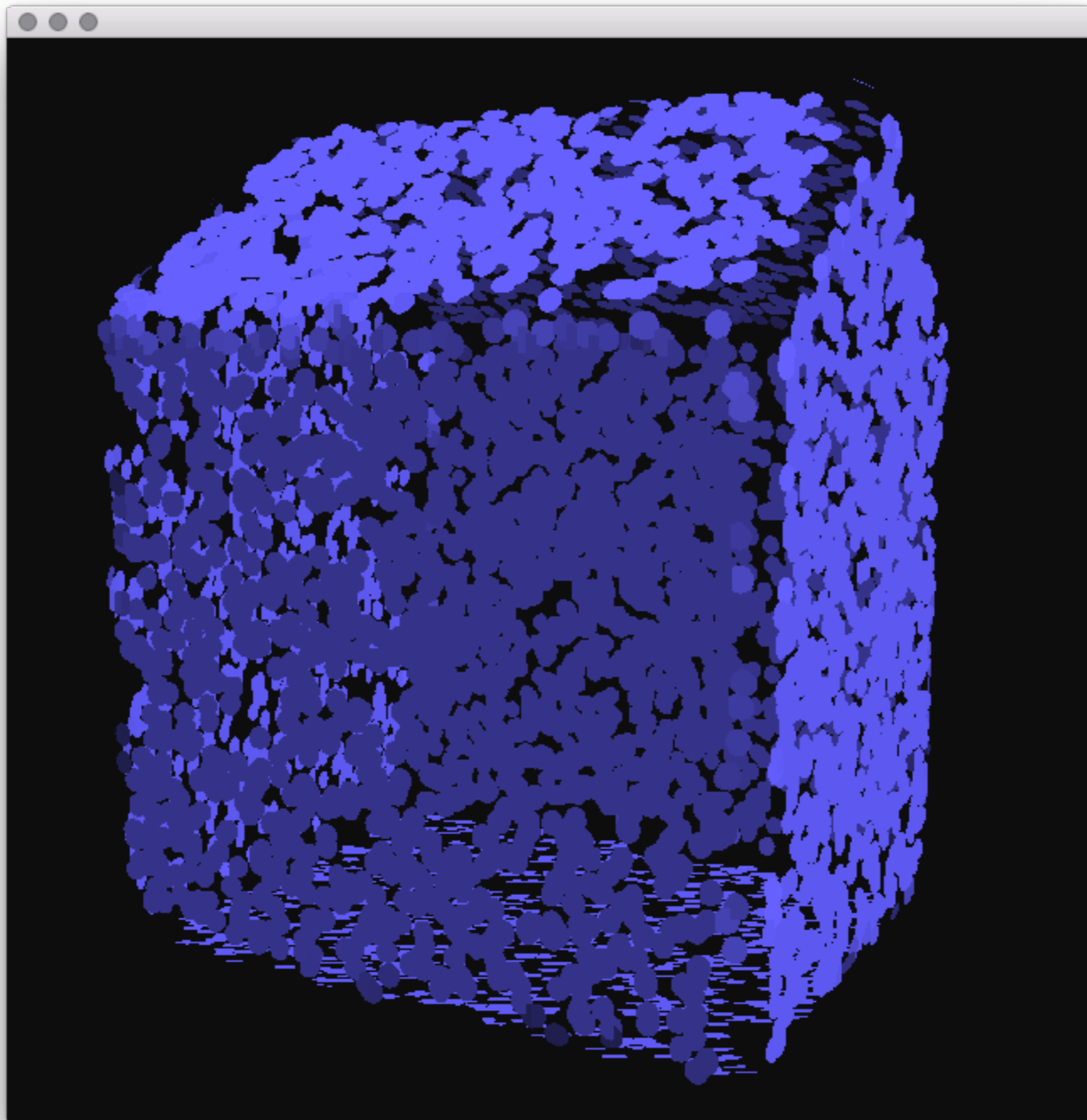
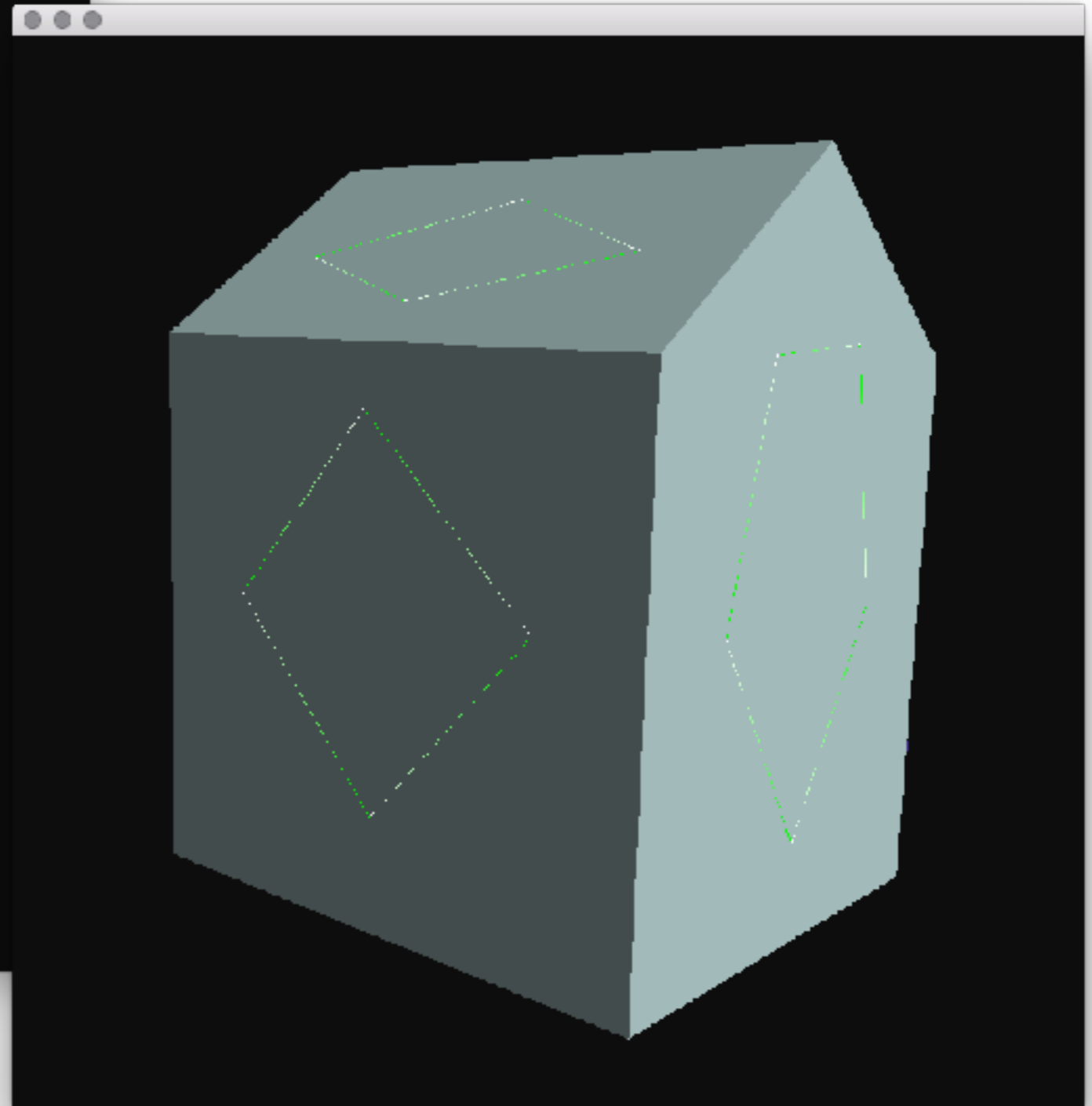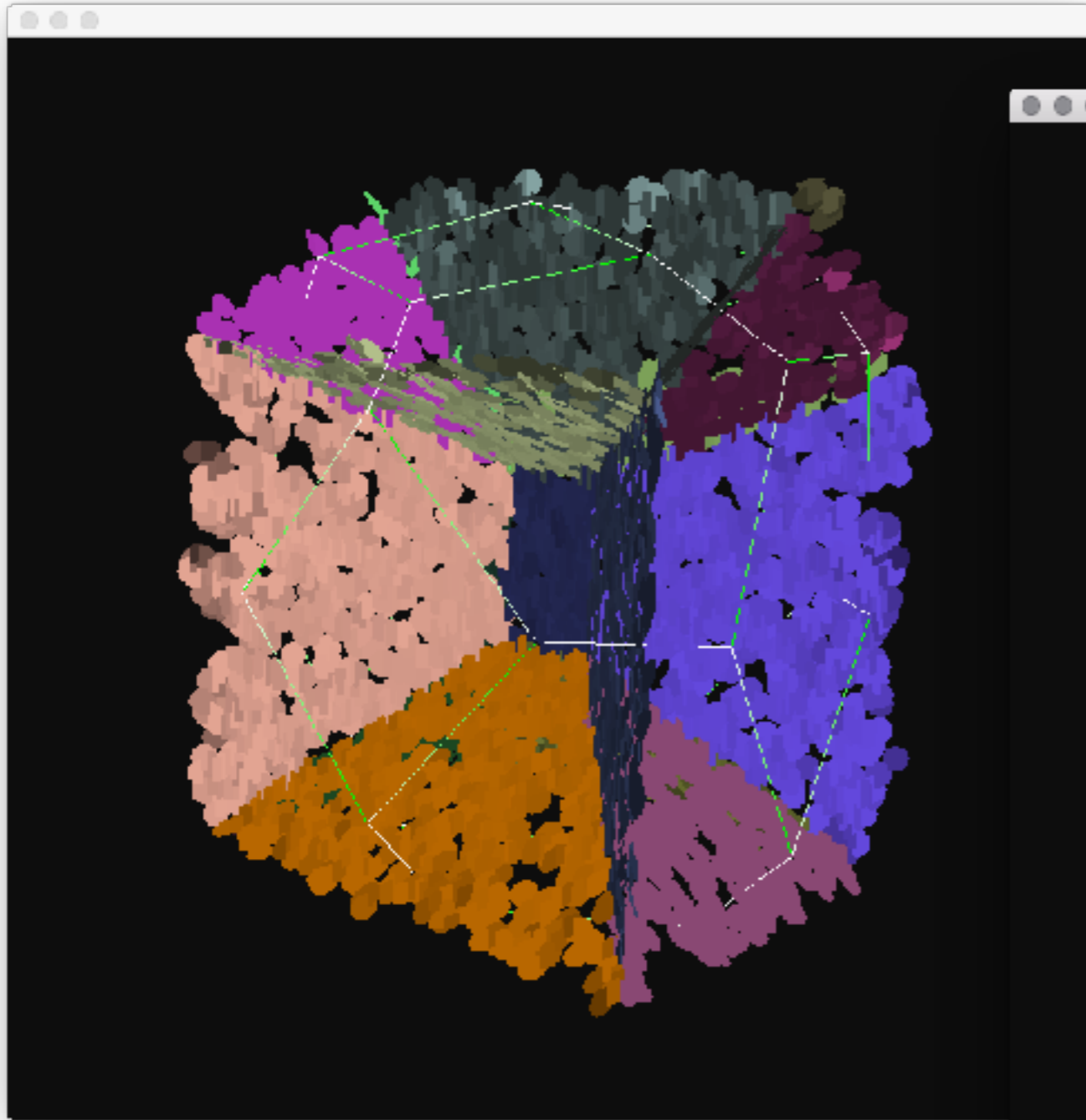connected components in adjacency graph
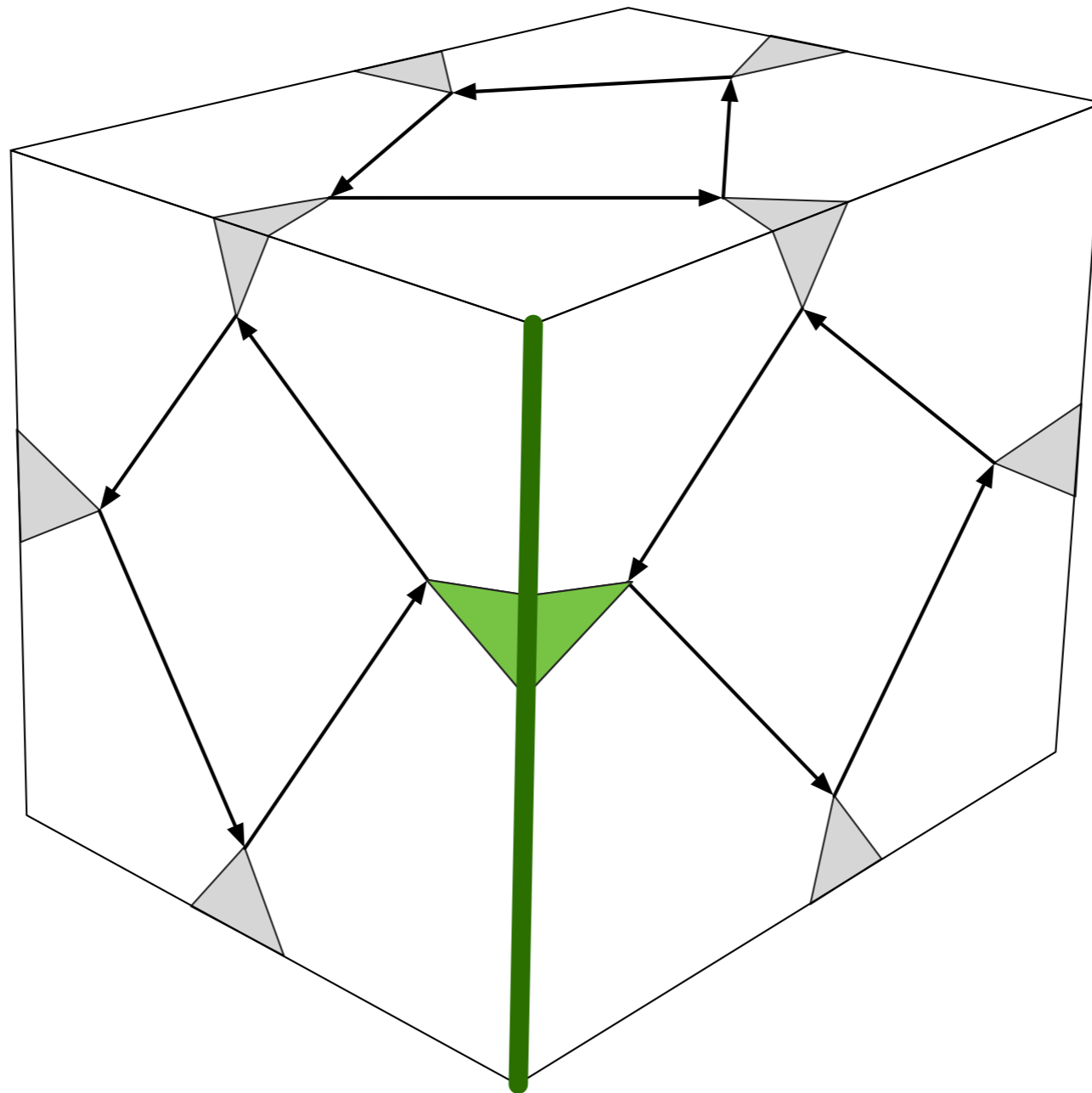
Demo

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!