

# 3D WATERTIGHT MESH GENERATION WITH UNCERTAINTIES

Laurent Caraffa  
IGN, France

IQmulus, Final Workshop

Bergen, September 21, 2016

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# 3D watertight mesh generation with uncertainties

## IQmulus workshop

Laurent Caraffa, Murat Yirci, Mathieu Brédif, Bruno Vallet

21 Sept 2016

# Watertight mesh reconstruction

## ► Input

- Aerial Lidar  
(SAA - IGN).
- Terrestrial Lidar  
(MATIS - IGN).
- Photogrammetry  
(TS - IGN).

- Watertight surface

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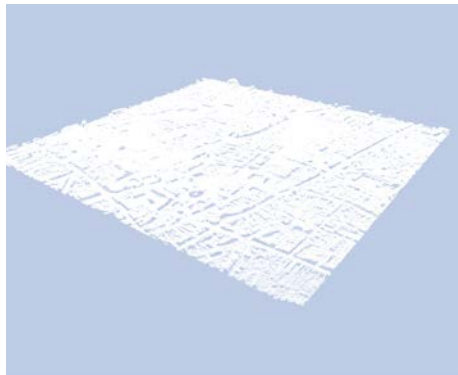
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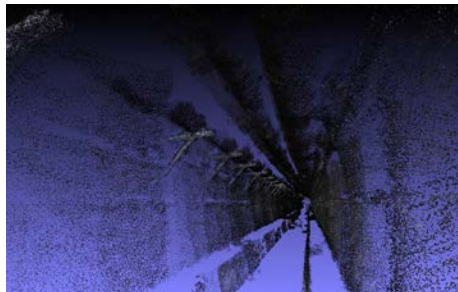
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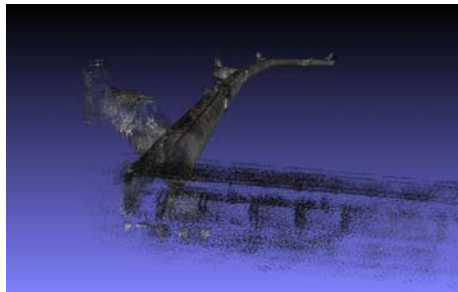


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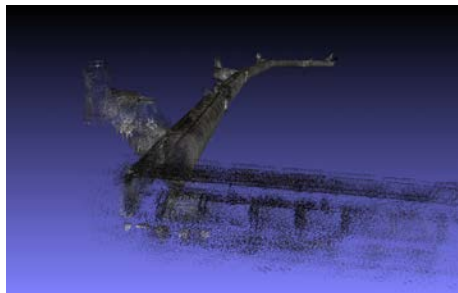


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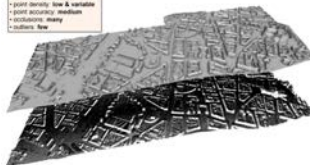
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⇒ Example of state of the art algorithm :

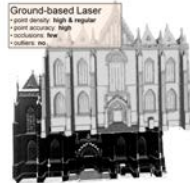
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Airborne Lidar  
• point density: low & variable  
• point accuracy: medium  
• occlusions: many  
• outliers: few



Ground-based Laser  
• point density: high & regular  
• point accuracy: high  
• occlusions: few  
• outliers: no



## ► Output

- Watertight surface

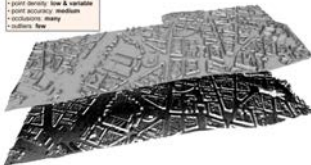
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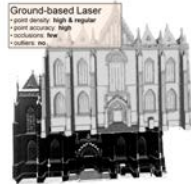
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## ► Output

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→ How to merge?

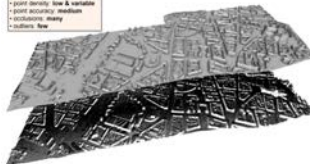
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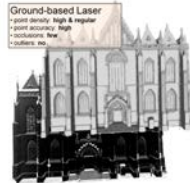
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## ► Output

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→ How to merge?

→ How to scale?



# Approach

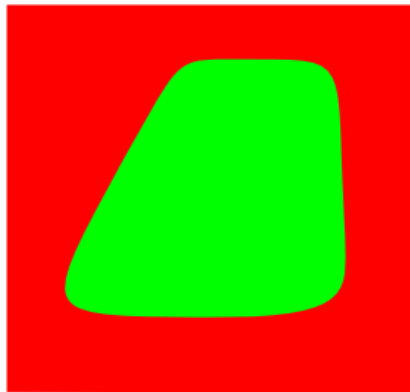
## 3D segmentation

- ▶ Binary segmentation (Inside / Outside) of the 3D space.
- ⇒ The surface is the interface between inside and outside area.
- ▶ Local descriptor computation.
- ▶ Space discretization.
- ▶ Delaunay triangulation.
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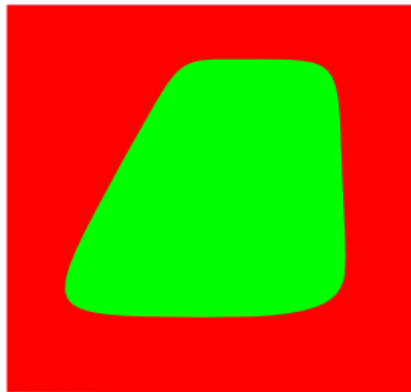
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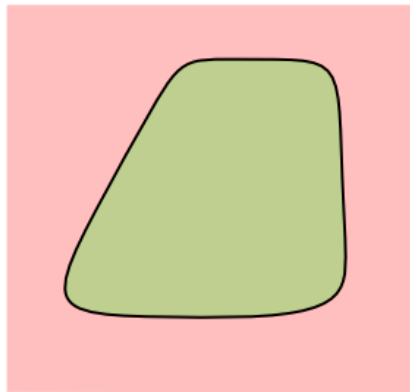
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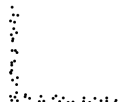
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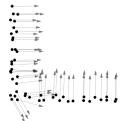
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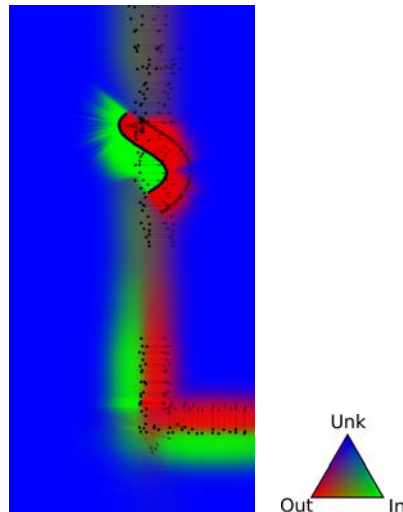
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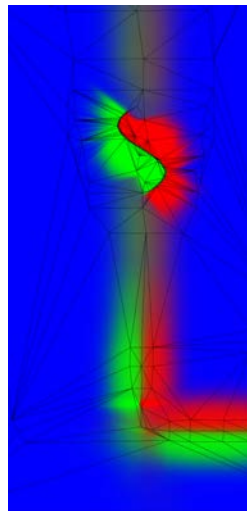
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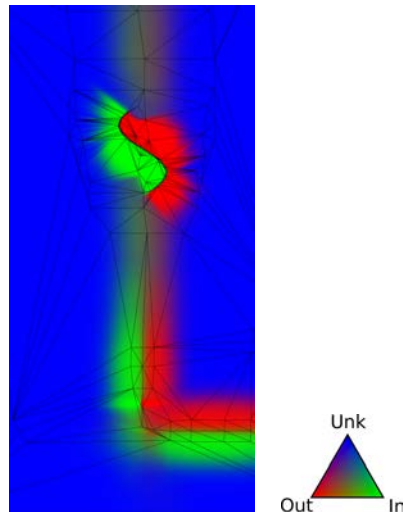
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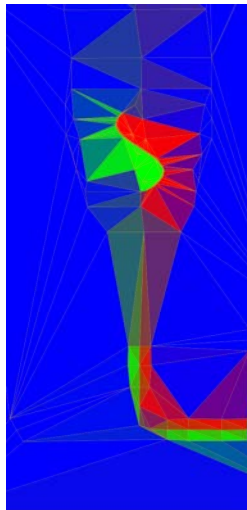
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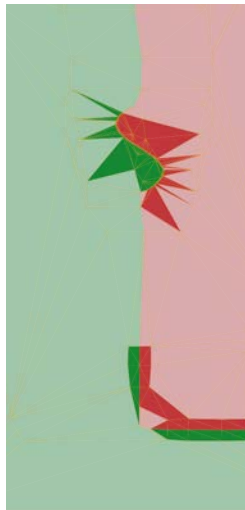
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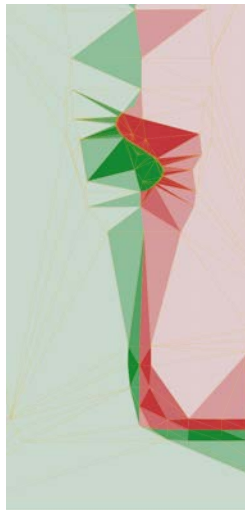
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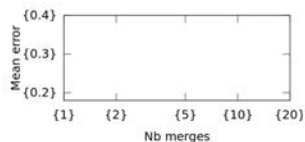
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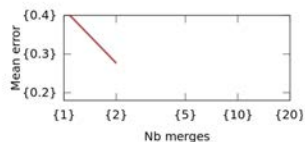
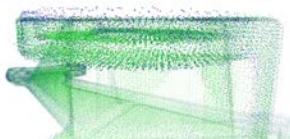
## Results

Mesh confidence



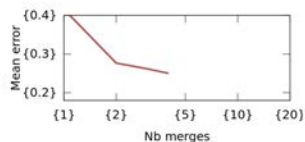
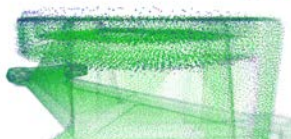
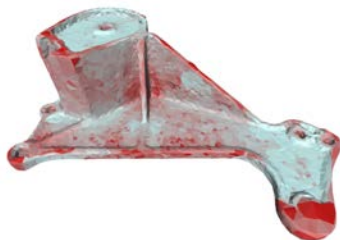
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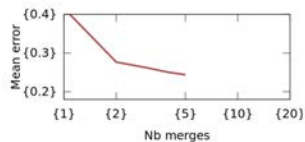
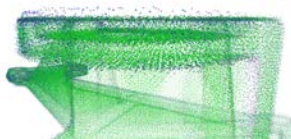
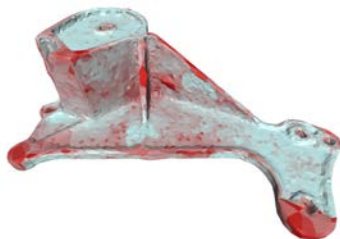
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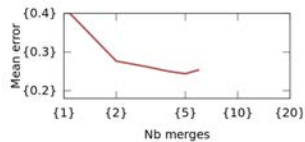
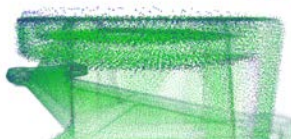
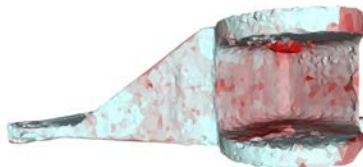
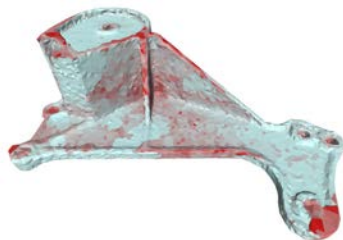
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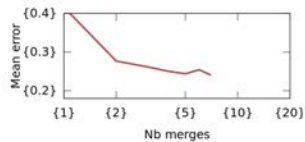
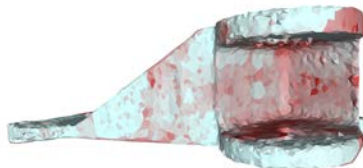
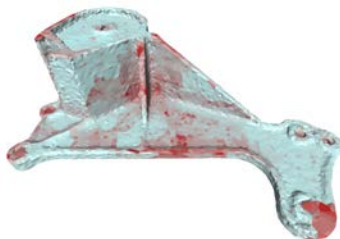
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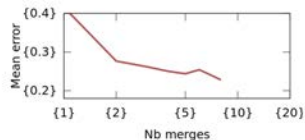
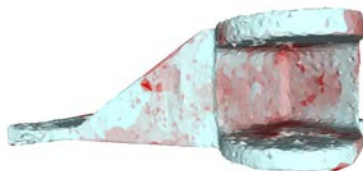
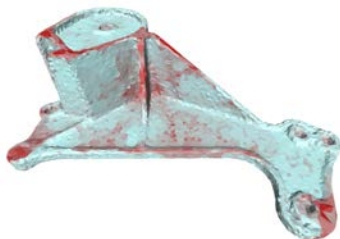
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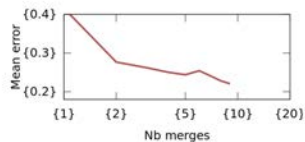
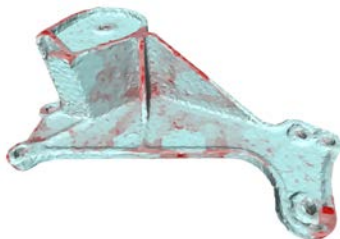
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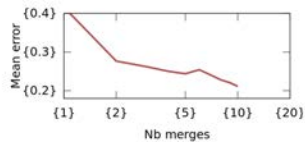
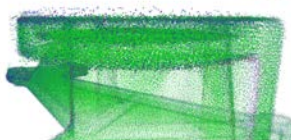
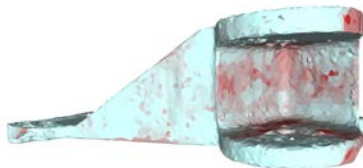
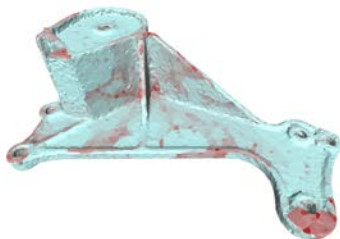
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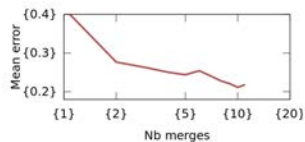
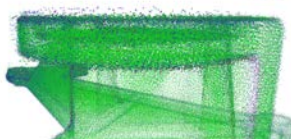
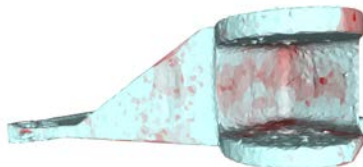
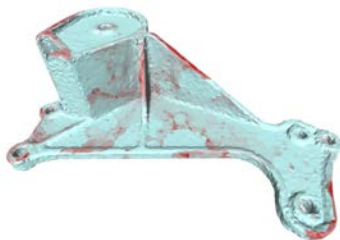
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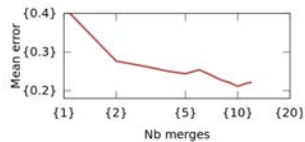
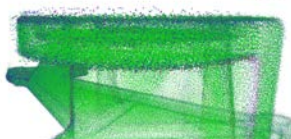
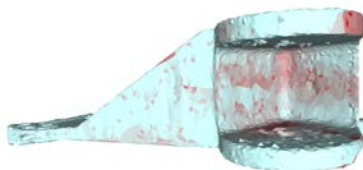
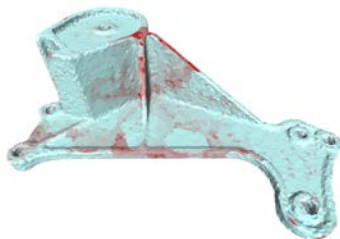
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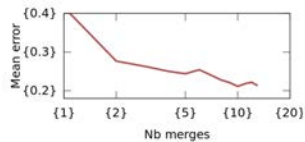
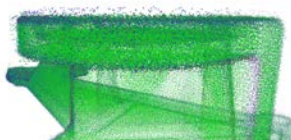
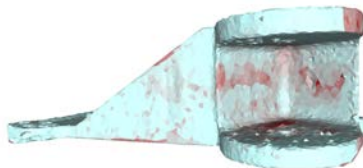
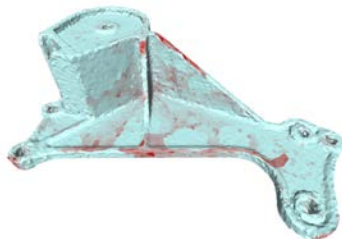
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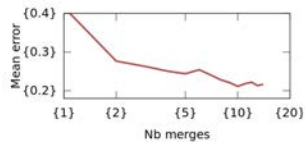
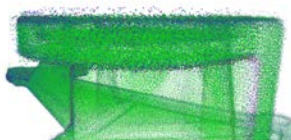
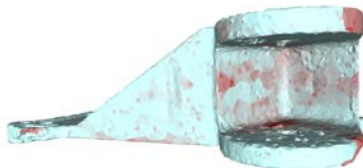
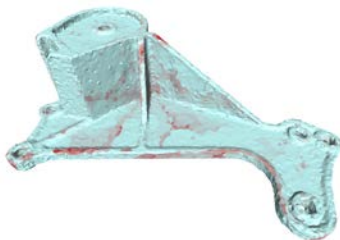
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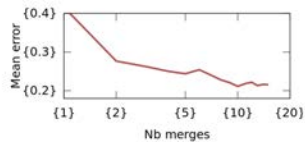
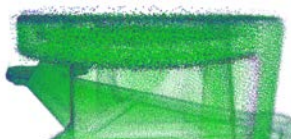
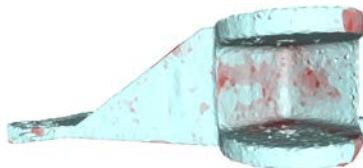
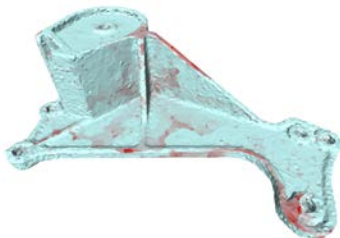
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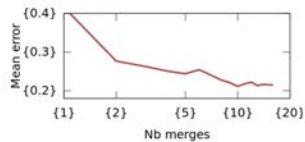
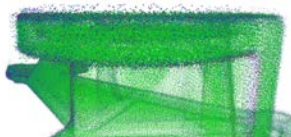
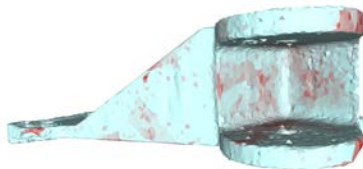
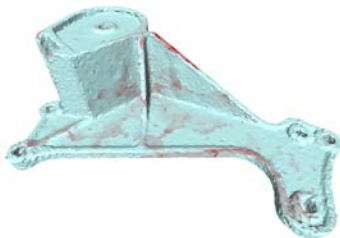
## Results

Mesh confidence



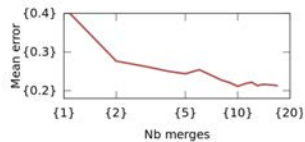
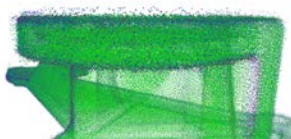
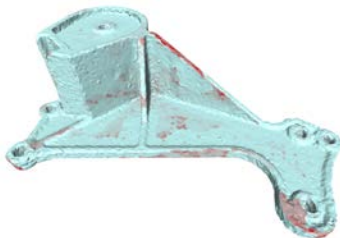
## Results

Mesh confidence



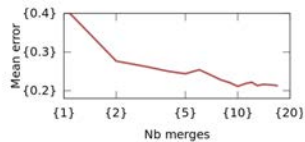
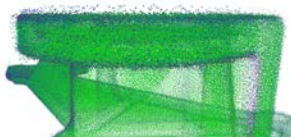
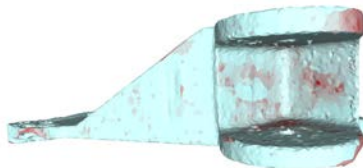
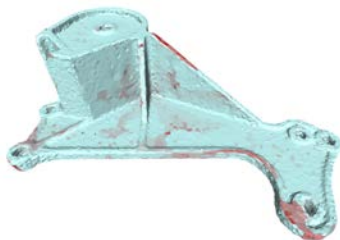
## Results

Mesh confidence



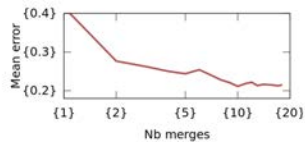
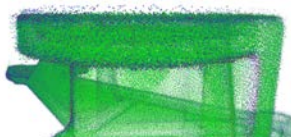
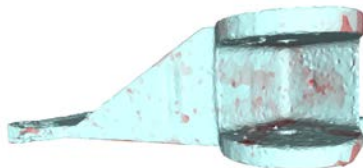
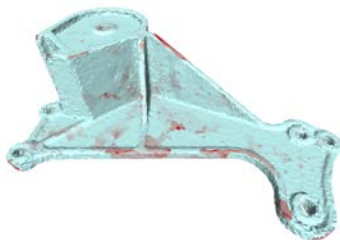
## Results

Mesh confidence




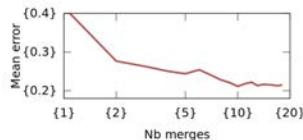
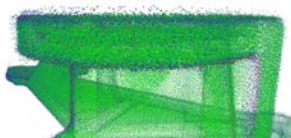
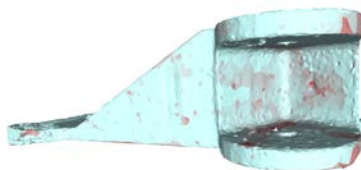
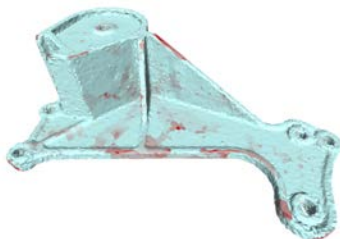
## Results

Mesh confidence



## Results

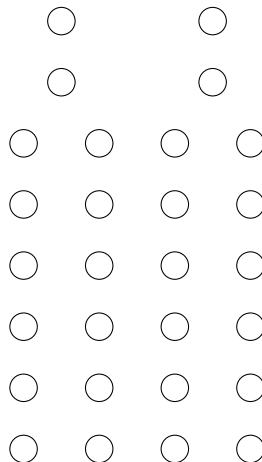
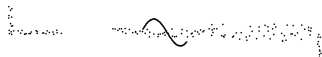
Mesh confidence 



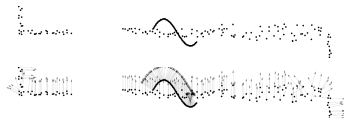
⇒ Accepted in ACCV16 : *3D watertight mesh generation with uncertainties from ubiquitous data.*



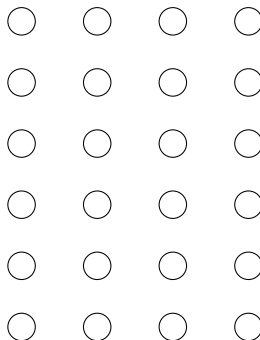
## Out-of-core approach



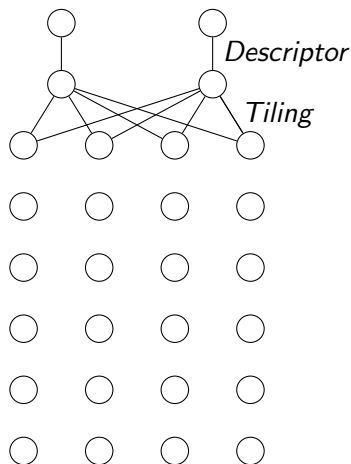
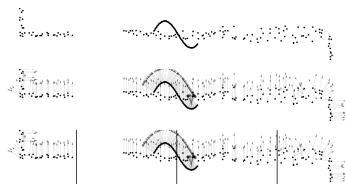
# Out-of-core approach



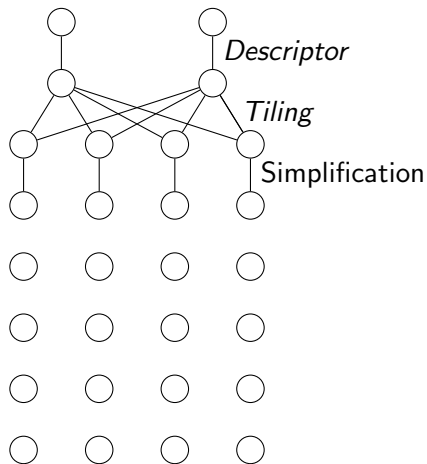
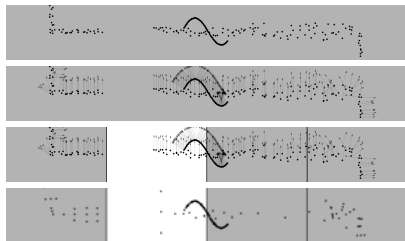
*Descriptor*



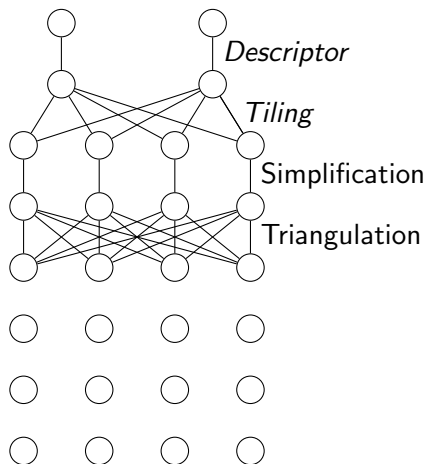
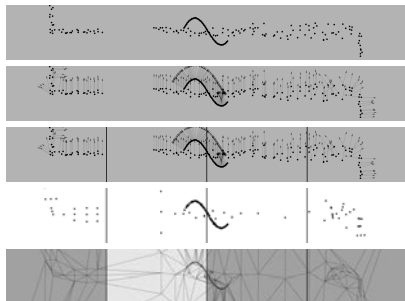
# Out-of-core approach



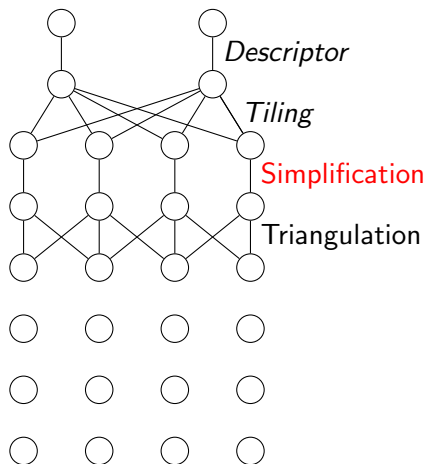
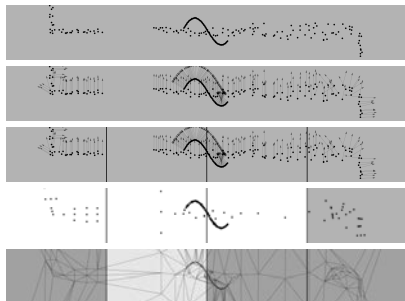
# Out-of-core approach



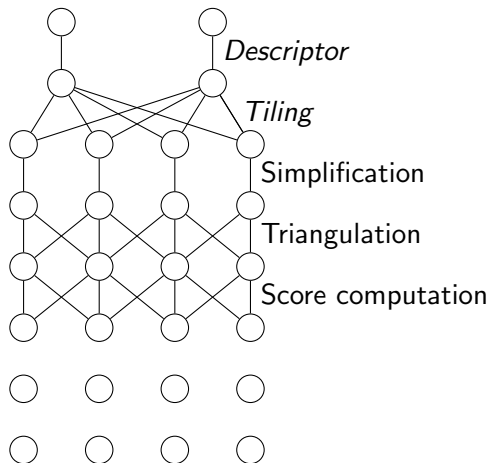
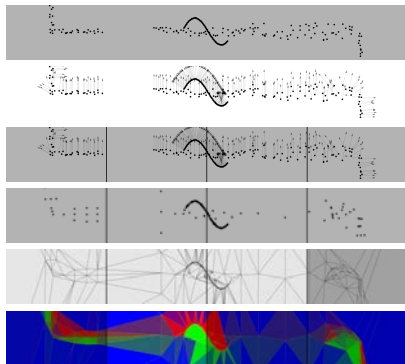
# Out-of-core approach



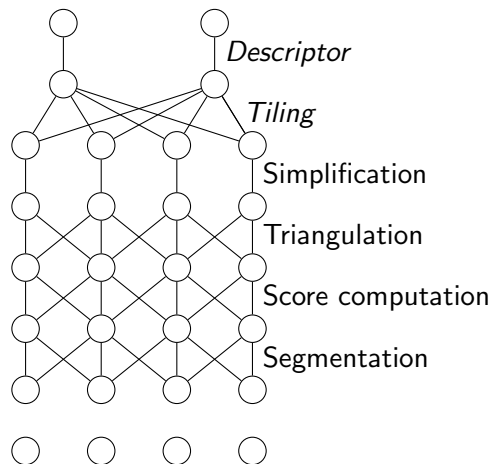
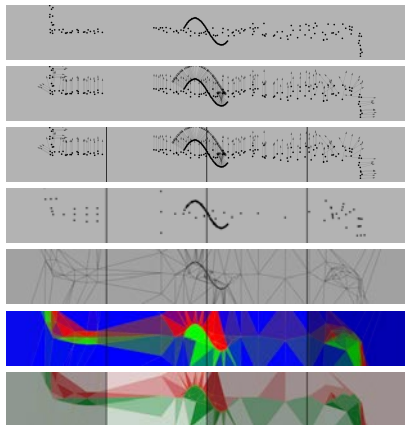
# Out-of-core approach



# Out-of-core approach

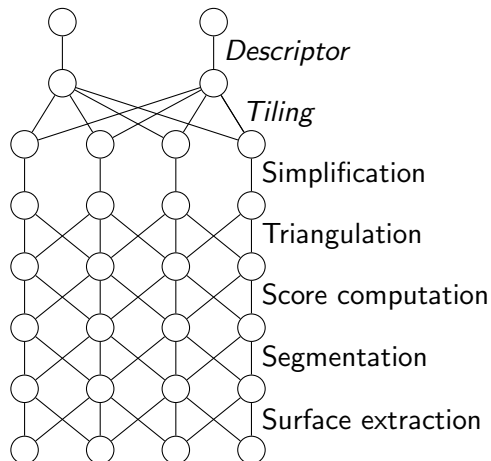
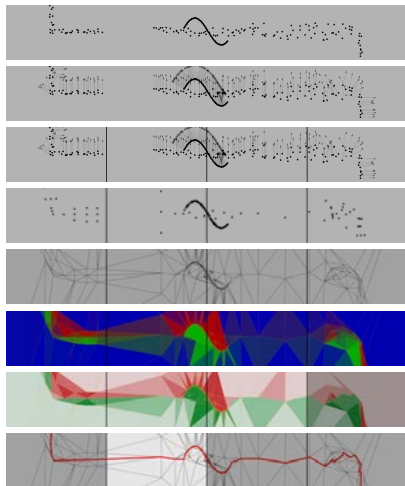


## Out-of-core approach

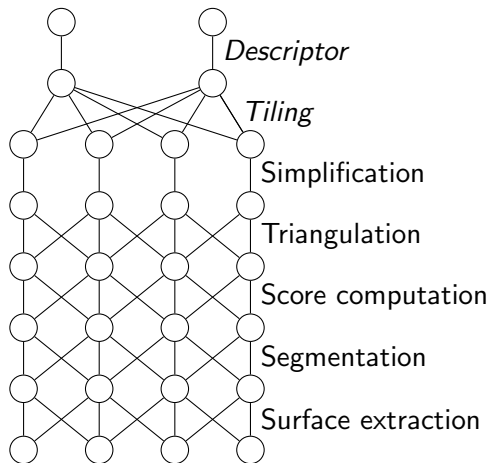
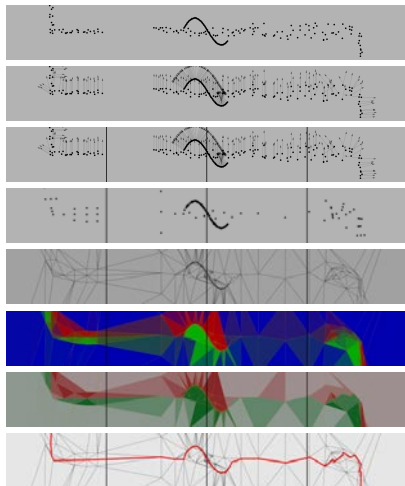




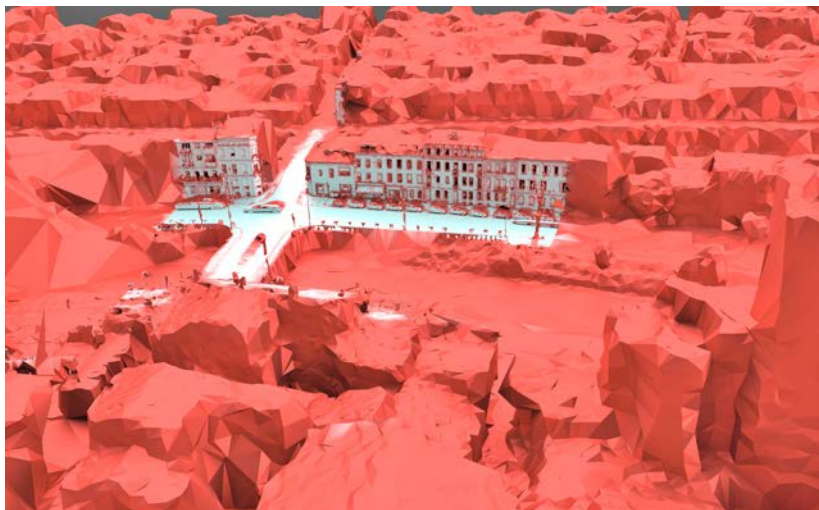
## Out-of-core approach



## Out-of-core approach



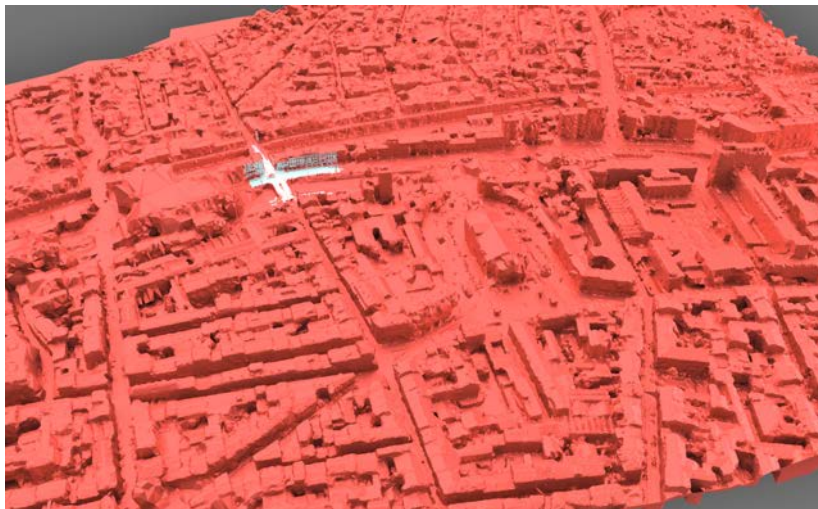
## Results



## Results



## Results



Thank you.

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