

# Toolkit for registration and evaluation for 3D laser scanner acquisition

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# Motivations and goal

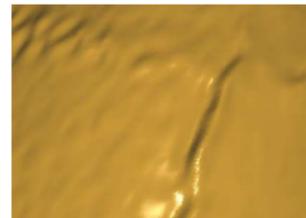
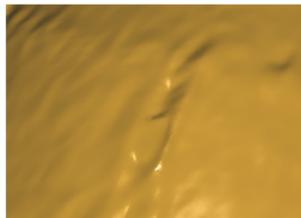
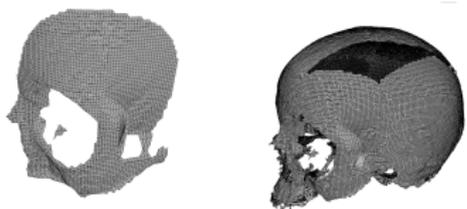
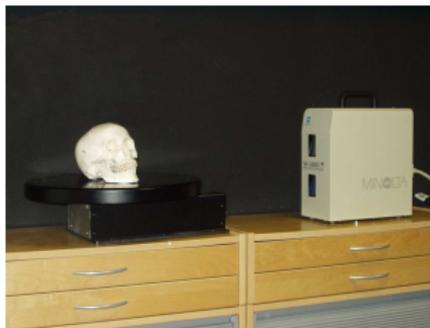
## Motivations :

- Scanner laser acquisition of fragile and damaged objects
- Control of the reconstruction adequacy with the physical object
- Softwares/libraries to reconstruct objects exist but are of limited interest for our application: confined to appearance improvement, restricted precision, high cost

## Our goal :

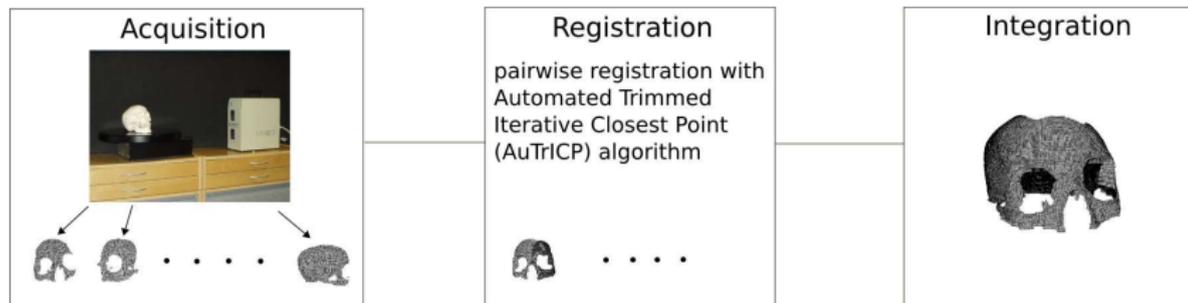
- Elaborate a software suite for the complete reconstruction process
- Final reconstruction with precision under control





# Outline

- 1 Introduction
- 2 Software toolkit presentation
  - Model package
  - Registration package
  - Evaluation package
- 3 Examples and results
  - Registration evaluation
- 4 Conclusion and perspectives



- **Model package** : contains data structures and primitives to manipulate mesh elements
- **Registration package** : contains icp-like methods to pairwise register range images
- **Evaluation package** : contains methods to evaluate geometrically and topologically the model

## Two data structures :

- vef\_model
  - a set of vertices, edges and faces
  - object boundary explicitly defined
  - topological characteristics extracted in constant time
- hash\_model
  - a set of vertices and faces
  - edges are not explicitly stocked
  - compact in memory
  - less efficient for algorithms exploiting mesh traversal request

## Input/output from various data formats :

- OFF, PLY, PGN, VRML, OBJ, VEF

We have to deal with overlapping range images.



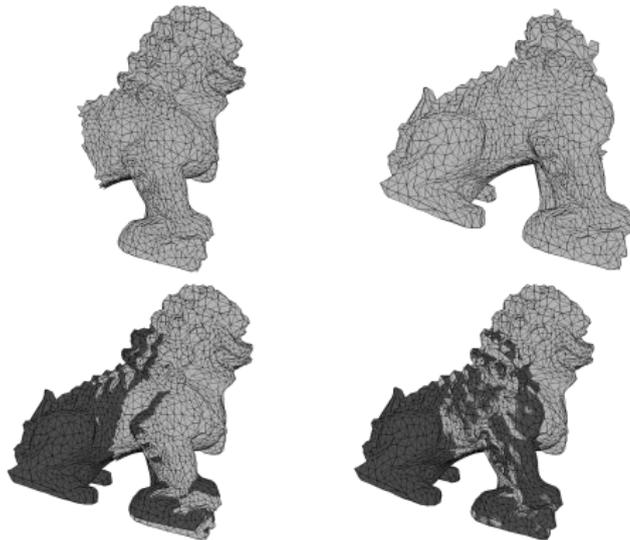
We develop a variant, called Automated Trimmed Iterative Closest Point (AuTrICP) to register this type of ranges images :

- automatic computation of the overlapping rate
- registration of the range images

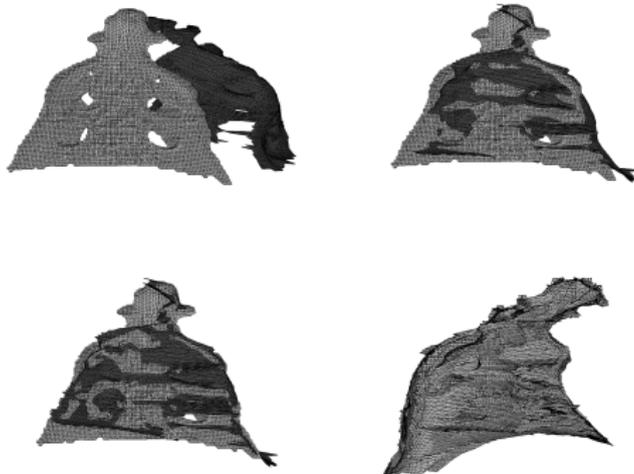
## Evaluation of the final mesh model :

- With respect to known criteria for mesh quality :
  - Geometrical evaluation : valency, triangle aspect ratio, Mean Ratio Metric...
  - Topological evaluation : number of holes, number of connected components...
- With respect to the adequacy to the physical object

On a synthetic model :



On an acquired model :



# Conclusion :

Presentation of a software toolkit which :

- Registers range images from a laser scanner acquisition
- Registration automation, initialization for the integration
- Evaluation as a mesh model

# Perspectives :

- Volume integration
- Adequacy evaluation between numerical representation and physical object
- Build and maintain the libraries using the autotools thus making them available as an open source package

