

A MeshLab Primer



MARCO CALLIERI

VISUAL COMPUTING LAB

ISTI-CNR PISA, ITALY

LUND – 19/3/19

Who am I?

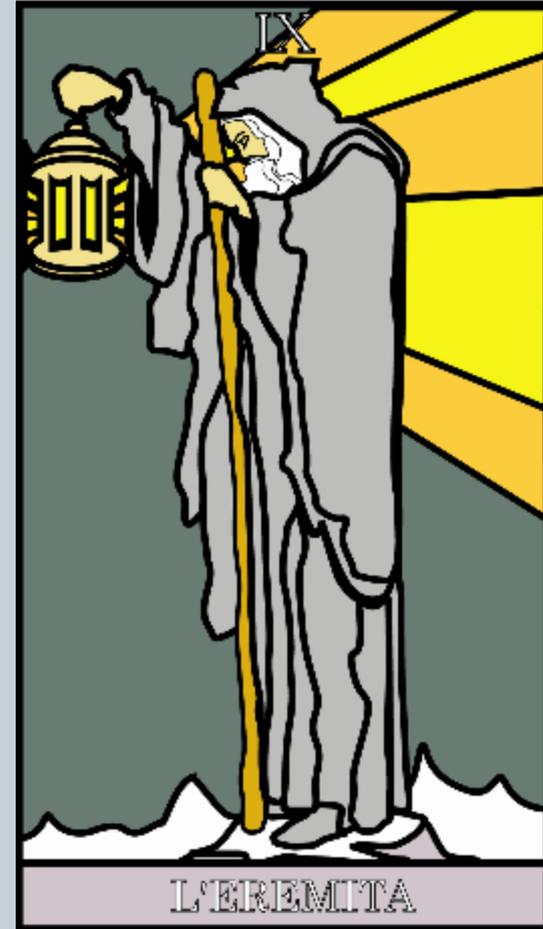


Marco Callieri

- Master degree & PhD in computer science
- Researcher at the Visual Computing Lab, ISTI-CNR, in Pisa
- I work on 3D data manipulation and rendering... lot of experience in 3D scanning and data processing
- Most of my activities are in the field of cultural heritage

<http://vcg.isti.cnr.it/~callieri>

callieri@isti.cnr.it



Beside this:

an eclectic artisan, an avid gamer, a former biker, a good cook, an incorrigible geek... and much more

Visual Computing Lab



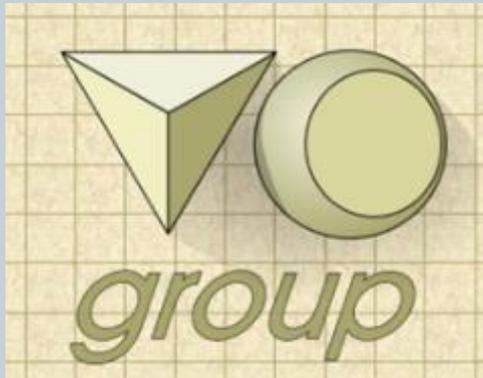
Research group working on **3D computer graphics**

part of:

Institute of Science and Technologies of Information (**ISTI**)

part of:

Italian National Research Council (**CNR**)



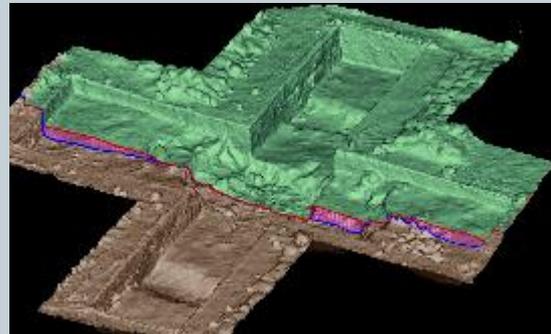
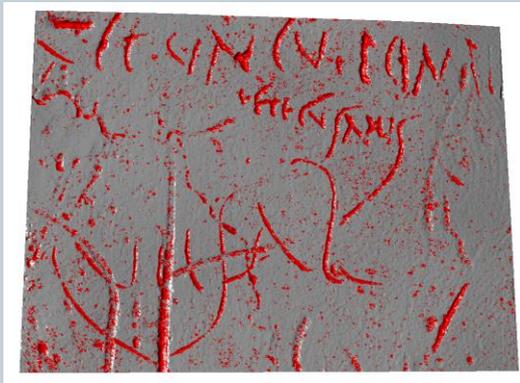
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Visual Computing Lab



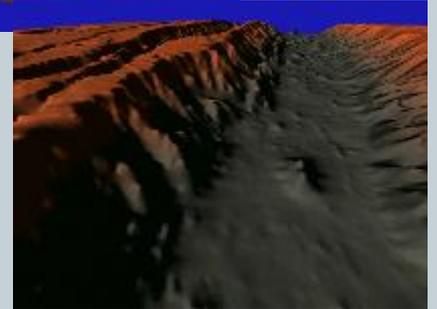
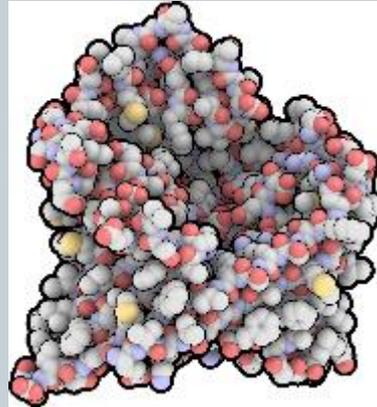
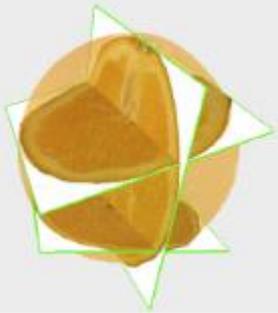
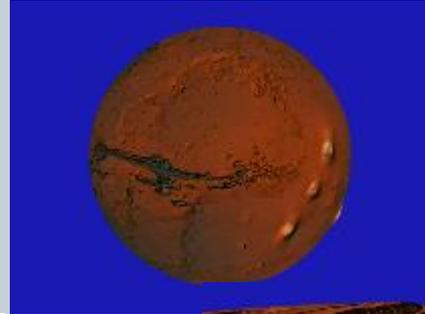
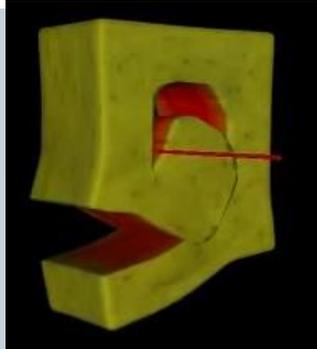
Cultural Heritage



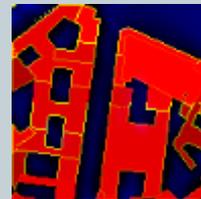
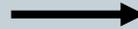
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Realtime



3D

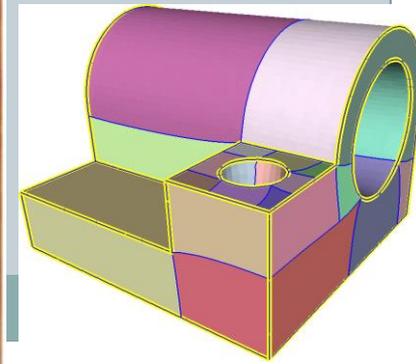
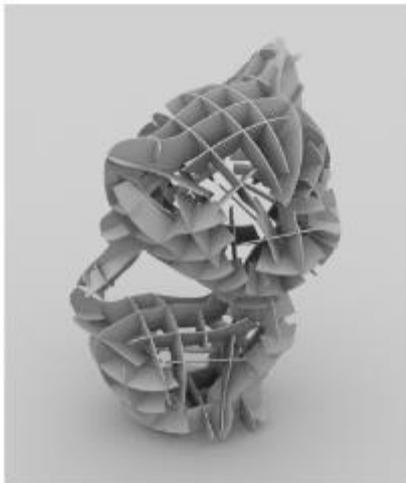
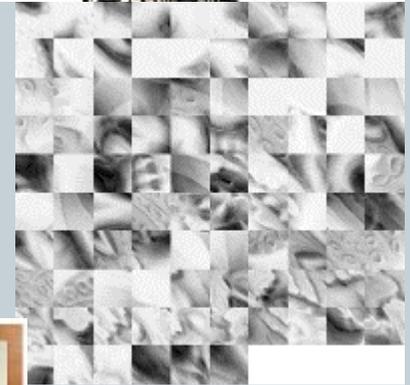
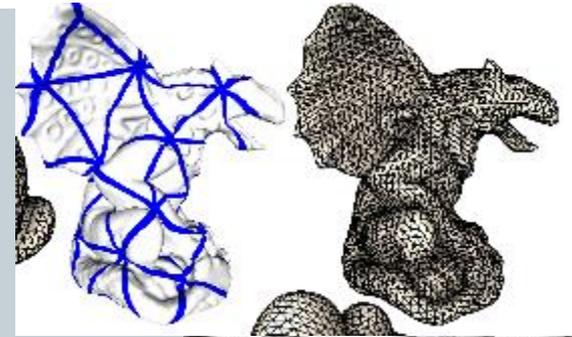
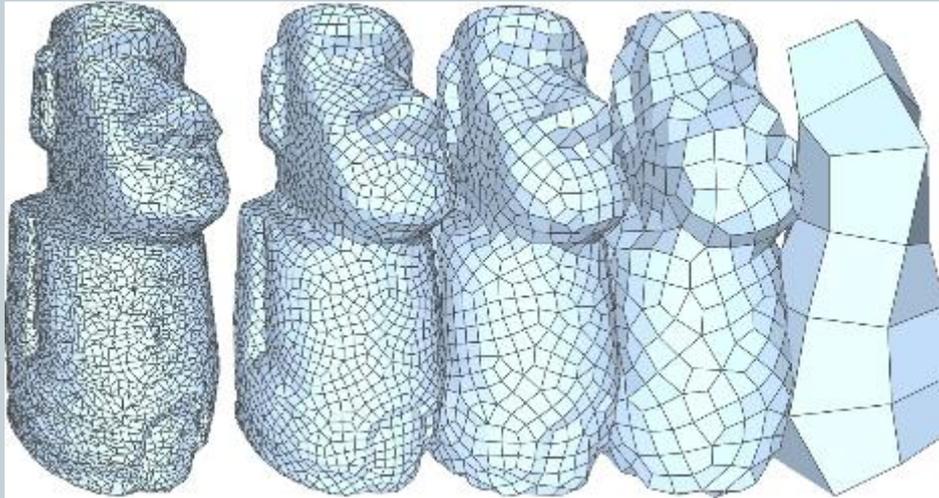


Texture encoding

Visual Computing Lab



Geometry Processing



Our Lab



We work in different practical projects (especially in CH), but we are computer scientists... So, beside methodologies, we work on software tools...

Beside custom tools for one-shot or internal use, we maintain set of tools for the community:

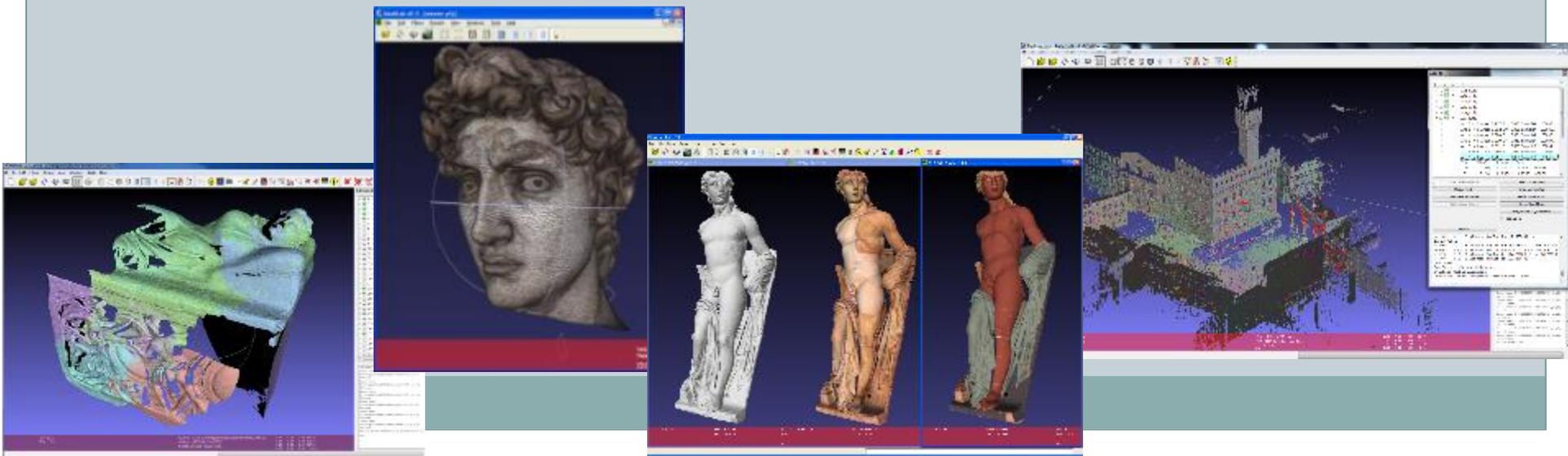
- **VCG Lib:** open source C++ library for 3D data structures management
- **MeshLab:** open source tool for 3D mesh processing, editing and visualization
- **3DHOP:** open source tool for 3D visualization on the web

MeshLab



MeshLab is an Open Source mesh processing tool, oriented to the management of dense triangular meshes and 3D data coming from 3D scanning devices...

Started as final project for a university course in 2005, it evolved into a powerful and advanced tool for mesh visualization and editing.



MeshLab Facts



- **Open Source:** all code distributed with GPL licence, the main repository is on GitHub
- **Multiplatform:** installers available for Win64, and MacOS; officially supported by Ubuntu and other Linux distributions as packages (thanks to external help)
- **Plugin based:** modular structure for easier addition of new features, lots of state-of-the art algorithms, often implemented by the authors themselves

MeshLab Facts



- Hundreds of universities and research centres around the world are using MeshLab.
- MeshLab is used in many fields: Computer graphics labs, CH operators, biological/medical/physics research centres, government offices, forensic analysis, military, manufacturing industry and more...
- Many independent 3D scanner, printers and specialized 3D hardware producers suggest MeshLab as viewer/processing tool

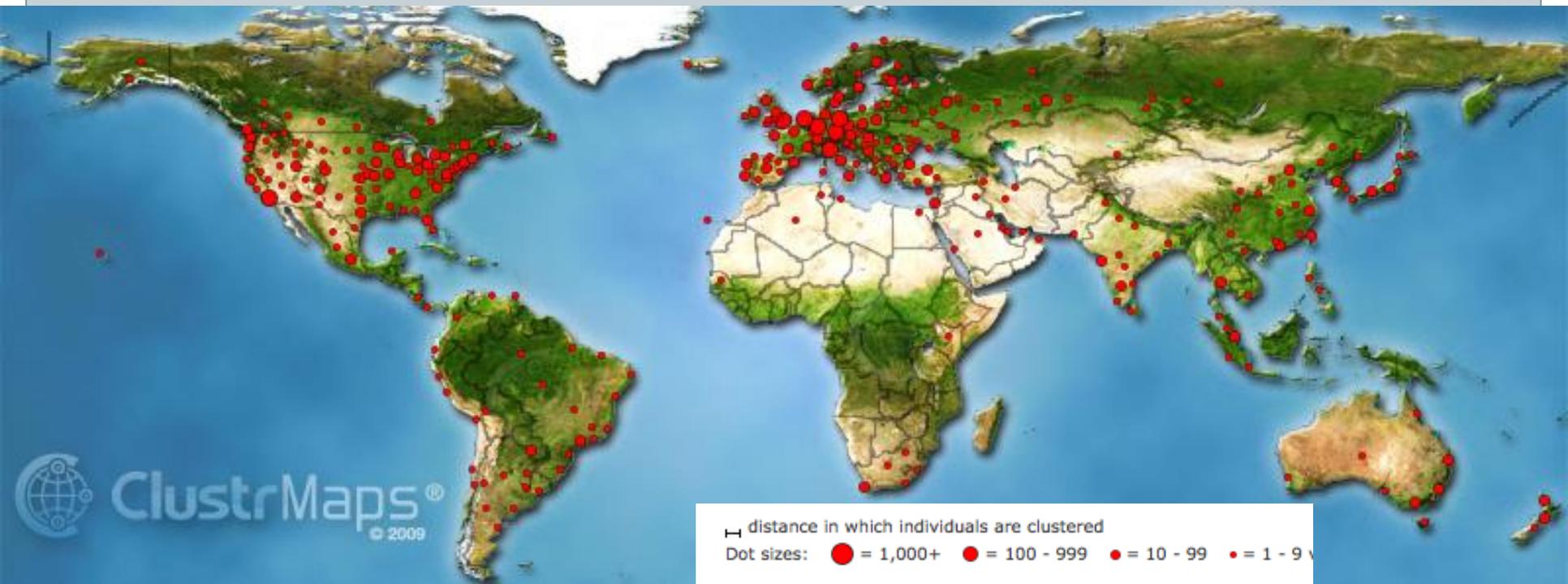
Last but not least: **we are using it for real things!**

MeshLab Facts



MeshLab had more than **3.000.000** downloads (2016), with 30-40K downloads per month.

We have a raising trend, with thousands of regular power users...
(people with more than 1k mesh processed).



MeshLab Philosophy



MeshLab provides a series of self-contained, independent operations, often offering different alternative methods for the same task.

This lets the user choose the best tool for the job...

Just like a **Swiss-Army Knife**...

Unfortunately, this means that, sometimes, you will need to try a lot of blades, until you find the correct one 😊



An ongoing effort



The current version



Last official released **MeshLab 2016.12**

We have new beta(s):

- macOS installer
- Win64 «live» folder
- Linux code

<https://github.com/cnr-isti-vclab/meshlab/releases/>

However, may be still a bit unstable

The current version



When you try to install it, you will receive lots of warnings, because the executable is not yet «signed»

You always have to ask for more info, then accept...

Resources



MeshLab Resources



Where can I download MeshLab?

<http://www.meshlab.net>

<https://github.com/cnr-isti-vclab/meshlab>

Where can I get info about MeshLab?

meshlab.sourceforge.net/wiki/index.php/MeshLab_Documentation
(warning! discontinued)

www.facebook.com/MeshLab

A lot of user-uploaded tutorials and how-to... just search the web. BE CAREFUL WITH THE VERSION!

Mr P. MeshLab Tutorials



Mr P. is a silent but invaluable companion in our travels... He is also an expert MeshLab user...

On YouTube, there is a channel with various video tutorials on MeshLab usage....

The tutorials cover the basics and most of the most useful features of the tool; new tutorials are uploaded (almost) regularly



Mr P. MeshLab Tutorials



www.youtube.com/user/MrPMeshLabTutorials

The screenshot shows the YouTube channel page for 'Mister P.'s MeshLab Tutorials'. The channel name is 'Mister P.'s MeshLab Tutorials' with the subtitle 'Il canale di MrPMeshLabTutorials'. The page is subscribed to ('Iscritto'). Navigation tabs include 'Tutto', 'Video caricati', and 'Playlist'. A search bar is present with the text 'Cerca caricamenti'. The video grid contains 18 items:

Video Title	Views	Time
Cleaning: Basic filters	841 visualizzazioni	6:26
Cleaning: Triangles and Vertices Removal	838 visualizzazioni	4:46
MeshLab Basics: Preview and Help	878 visualizzazioni	4:19
Mesh Processing: Decimation	738 visualizzazioni	6:04
Arc3D and MeshLab: Part Two	808 visualizzazioni	7:53
Arc3D and MeshLab, Part One	1,005 visualizzazioni	7:07
MeshLab basics: Snapshot	638 visualizzazioni	6:49
MeshLab Basics: on screen information	389 visualizzazioni	6:11
Special: The Undo Functionality	378 visualizzazioni	0:09
MeshLab Basics: Selection, part two	718 visualizzazioni	6:26
MeshLab Basics: Selection, part one	1,016 visualizzazioni	6:11
MeshLab Basics: Lighting	829 visualizzazioni	6:28
MeshLab Basics: Navigation	2,004 visualizzazioni	6:49
3D Scanning: merging with Poisson filter	1,220 visualizzazioni	8:24
3D Scanning: merging using VCG filter	858 visualizzazioni	8:40
3D Scanning: Alignment	1,180 visualizzazioni	12:49

HOW ?



From ground up...



MeshLab is not the friendliest tool you will find around... So, in order to learn how to use it, better start from the basis

MeshLab can be useful even just as a **free viewer/converter** for yourself, you partners, your clients...

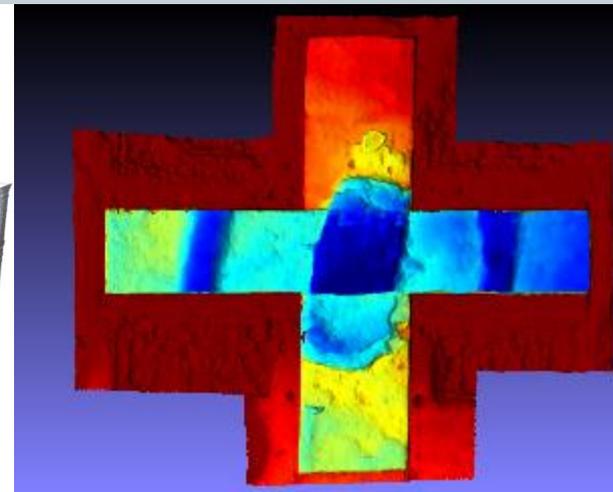
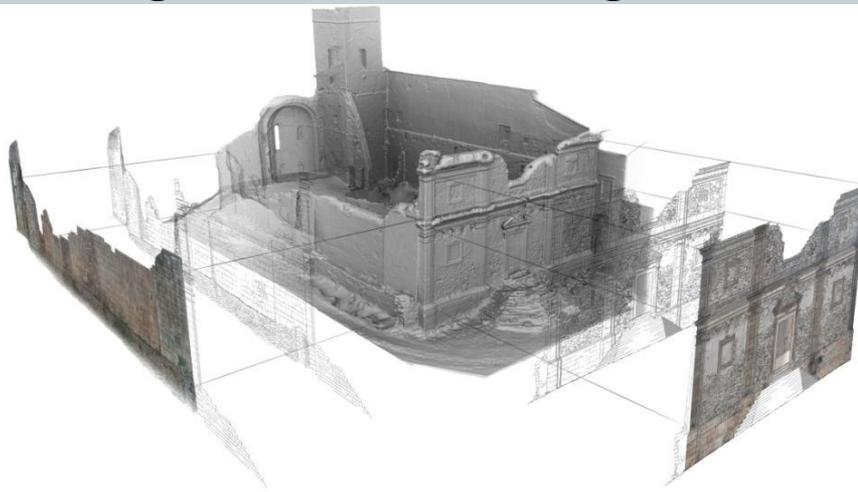
- Many input/output formats
- Free, multiplatform
- Efficient rendering, simple model navigation

One step further



Advanced visualization: study and document your model

- **View control:** predefined views, save viewpoints
- **Measuring:** size, distances, colour mapping of info
- **Decorators:** add elements showing measures, axis and other info
- **Rendering:** controlling light, rendering modes, shaders
- **Screenshots:** high resolution image creation, referenced



Not just visualization



MeshLab is also an editing tool; you may start by using some of the general-purpose editing operations:

- **Simplification:** reduce geometric complexity of triangulated mesh and pointclouds
- **Basic editing:** automatic and manual selection of parts, to delete them or split the object
- **Automatic filtering:** remove topological errors, parametric modification of geometry, smoothing,
- **Transformations:** rotates, translate, scale, center, re-orient

More complex stuff



Then, move on to more complex processes, involving manual input and chain of operations:

- **Scanning Pipeline:** going from raw 3D data to a usable model
- **Colour mapping:** map colour from photos, generate and edit texture or per-vertex encoding
- **3D Model optimization:** strongly modify the geometry of your meshes or pointclouds

MeshLab Server



MeshLab can also operate as a command line tool, for batch processing:

- define a filter “chain”
- Save the script
- Invoke meshlabserver executable on your input files

Useful for batch convert, cleaning, or to setup remote processing services. Some limitations on the available filters, but still flexible.

The winding road



You do need a specific feature?

Write your own plugin 😊

MeshLab is open source, and it is possible to compile it with free tools. MeshLab source is on *GitHub*, tutorials on how to build it are available. Standard C++, plus some dependencies

Let us start



THANKS FOR YOUR ATTENTION...

callieri@isti.cnr.it

www.meshlab.net

www.facebook.com/MeshLab

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