

Introduction

Francesco Banterle, Ph.D.

francesco.banterle@isti.cnr.it

Who

- Dr. Francesco Banterle
 - Researcher at Visual Computing Laboratory (ISTI-CNR)
 - Expertise: 2D/3D imaging, Computer Graphics
 - E-mail: francesco.banterle@isti.cnr.it

Who

- Dr. Gianpaolo Palma
- Researcher at Visual Computing Laboratory (ISTI-CNR)
- Expertise: 3D scanning, Mesh Processing, Computer Graphics
- E-mail: gianpaolo.palma@isti.cnr.it

Appointment: Francesco Banterle

- Where:
 - On the Internet
- When:
 - send an e-mail to confirm an appointment:

ONLY using your e-mail: @studenti.unipi.it

Appointment: Francesco Banterle

- Communication about exams:
- Send me an email to this email:

francesco.banterle@isti.cnr.it

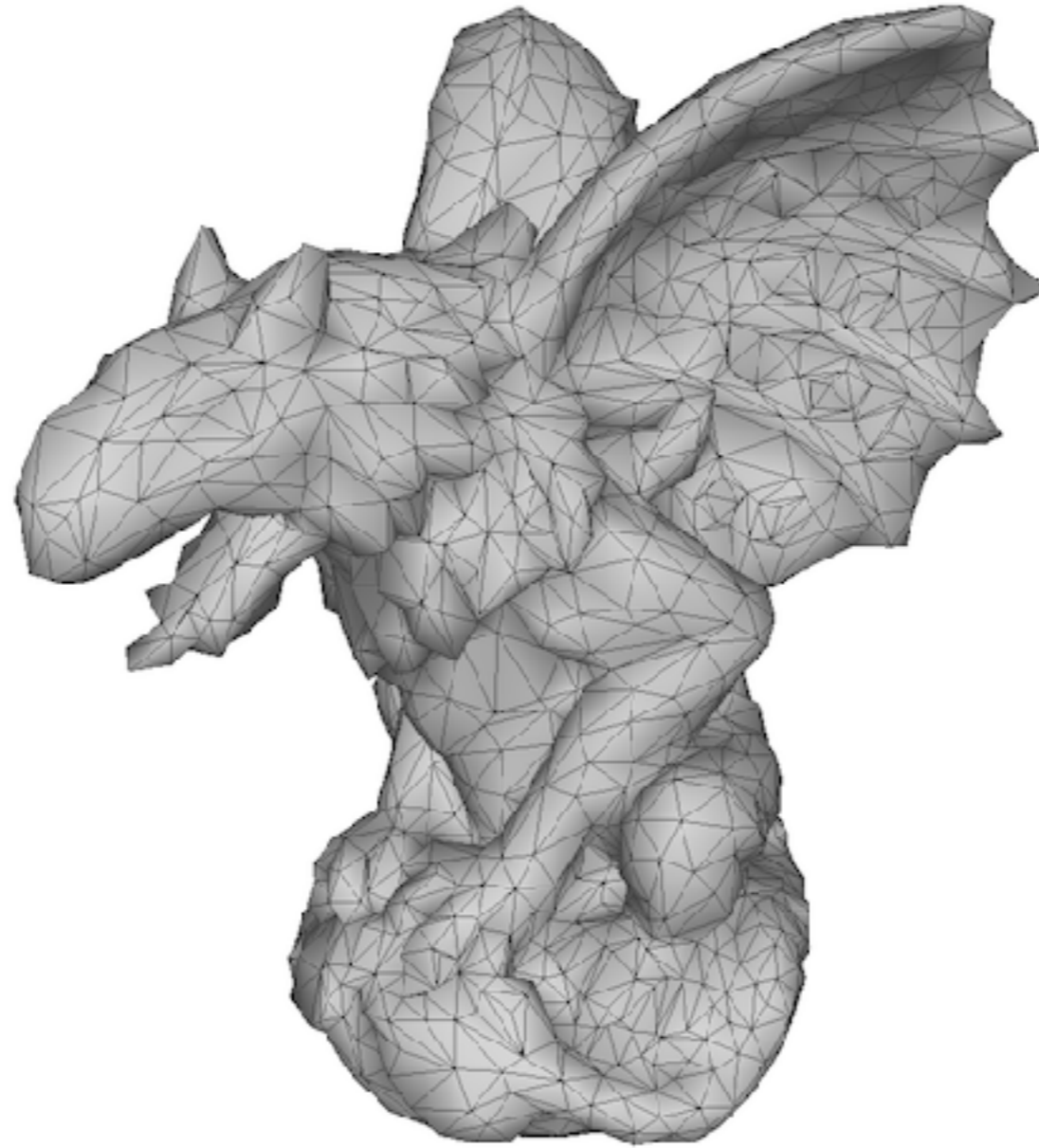
- Put Dr. Palma in CC:

gianpaolo.palma@isti.cnr.it

Prerequisites

- Linear Algebra and Geometry
- Calculus
- 1D/2D Filters (Signal Processing)
- Basic programming in MATLAB

The Main Goal



Goals

- To know and to understand theory and practice for generating 3D models:
 - Techniques and algorithms
 - Acquisition processes
 - Existing open source software

Why 3D Models?

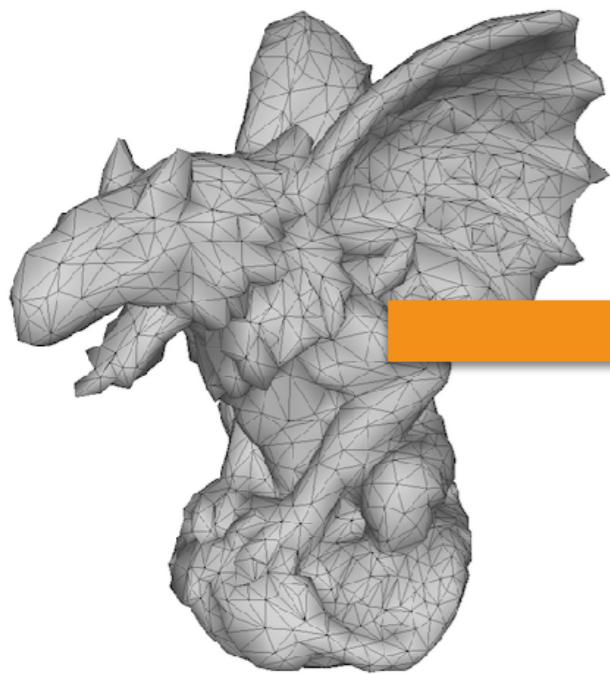


Simulation for training (VR OR by 3D Systems)

Why 3D Models?

- As they are:
 - reference/teaching
 - simulations: VR, AR, and classic visualization
 - remote/accurate real-life surgeries

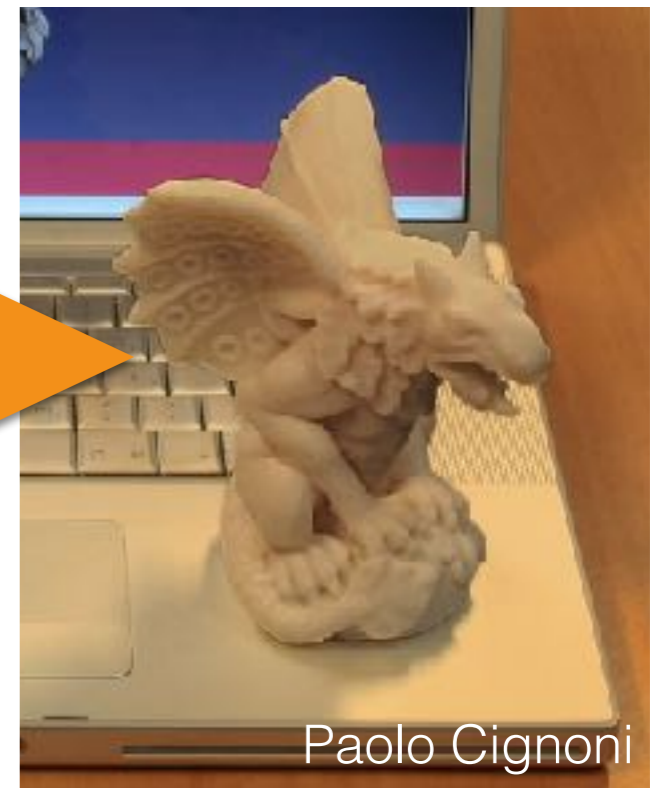
Why 3D Models?



3D Model



3D Printer
(UltiMaker)



3D Print

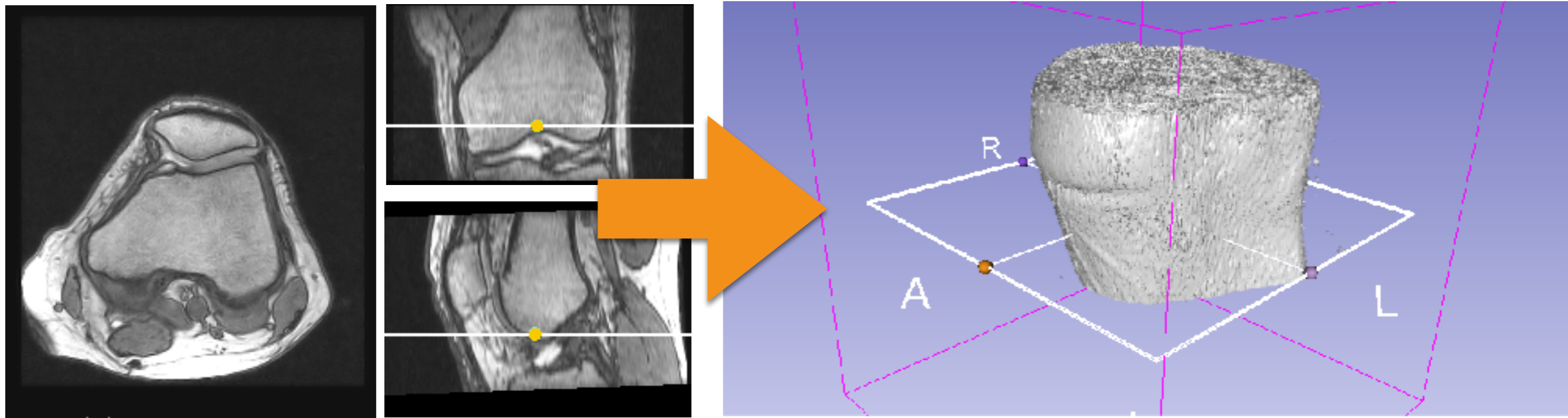
Why 3D Models?

- 3D printing uses:
 - reference
 - prototyping
 - orthopedic cast custom designed
 - prosthetics custom designed

Course Overview

- Part I: 3D models from medical images
- Part II: 3D models from photographs
- Part III: 3D models from range sensors

Course Overview: 3D from Volumes



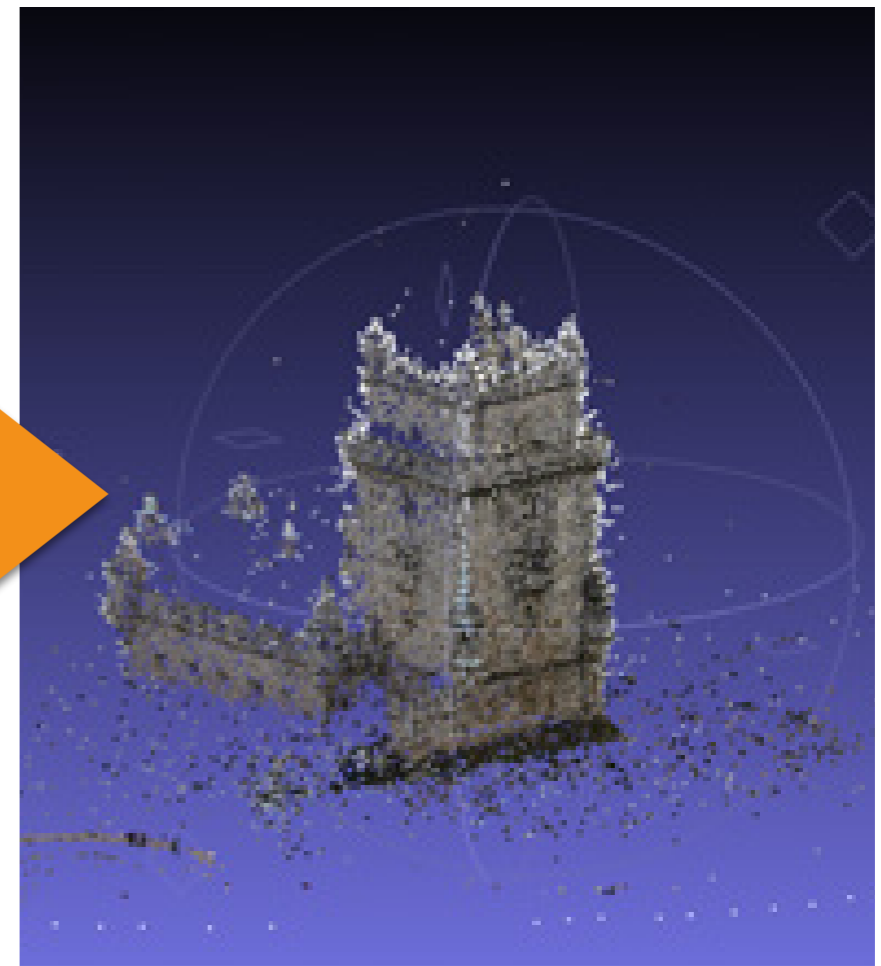
MRI stacks

3D Model

Why?

- 3D volumes are the main source of 3D data in the medical domain.
- They capture the geometry, but NOT the appearance of the model!

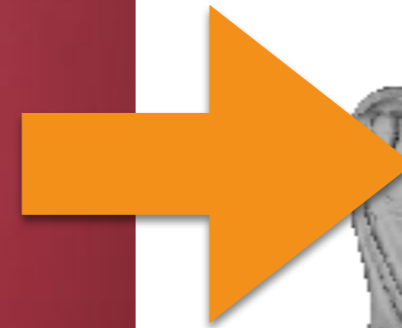
Course Overview: 3D from Photographs



Course Overview: 3D from Range



Range scans



3D Model

Why?

- Both 3D from Photographs and 3D from Range can be also used in the medical domain.
- Why?
 - 3D from Range capture the surface at high resolution adding the extra details to make the surface to look good.
 - 3D from Photographs captures well the appearance; i.e., material optical properties of the person/object to scan.
 - For example, these may be important for creating prosthetics for a face that has been very damaged due acid attacks, car accidents, bomb blasts, etc.

The Exam

- A written (theory) exam.
- An interview-style (practice) exam at computer:
 - 3D Slicer
 - 3D Reconstruction
 - Meshlab

The Exam

- What to do for being admitted to the exam:
 - Online registration
 - Be there on time with an ID

Books

- Digital Image Processing for Medical Applications:
 - <http://www.cambridge.org/it/academic/subjects/engineering/biomedical-engineering/digital-image-processing-medical-applications?format=HB&isbn=9780521860857#a6LCHeY5fSWYmBC8.97>
- **Extra:** Image Processing for Radiology:
 - <http://www.springer.com/gp/book/9783540259152>

Books

- Computer Vision: Algorithms and Applications:
 - <http://szeliski.org/Book/>
- Polygon Mesh Processing:
 - <https://www.crcpress.com/Polygon-Mesh-Processing/Botsch-Kobbelt-Pauly-Alliez-Levy/p/book/9781568814261>

Tools

- MATLAB/Octave: please read “MATLAB Primer” (just google it) or :
 - www.math.toronto.edu/mpugh/primer.pdf
- MeshLab:
 - <http://www.meshlab.net/>
- 3D Slicer:
 - <https://www.slicer.org/>

Tools

- VisualSFM:
 - <http://ccwu.me/vsfm/>
- Regard3D
 - <http://www.regard3d.org/>

Course Material

- Slides will be uploaded at:

http://www.banterle.com/francesco/courses/2020/be_3drec/

- Mailing list:

sviluppodimodelli3d@gmail.com

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