3D Digitalization Techniques Applied to Cultural Heritage
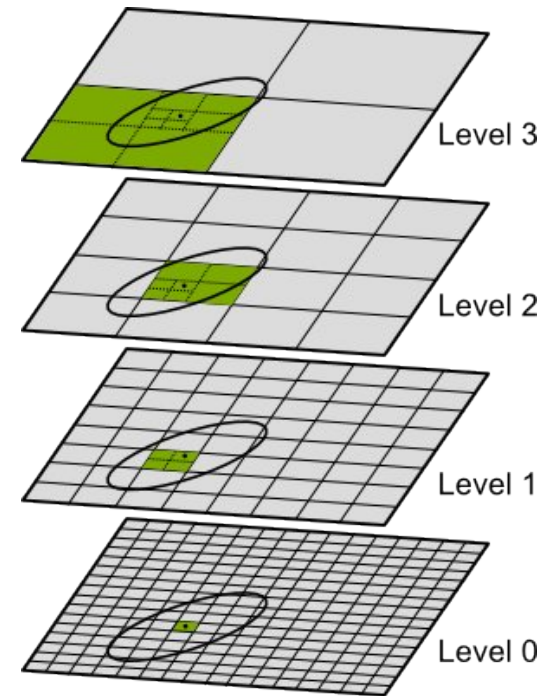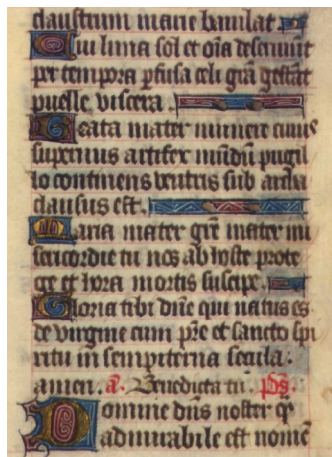
Ricardo Marroquim

17 March, 2010

part I

postdoc at the VCL - Pisa

a little background
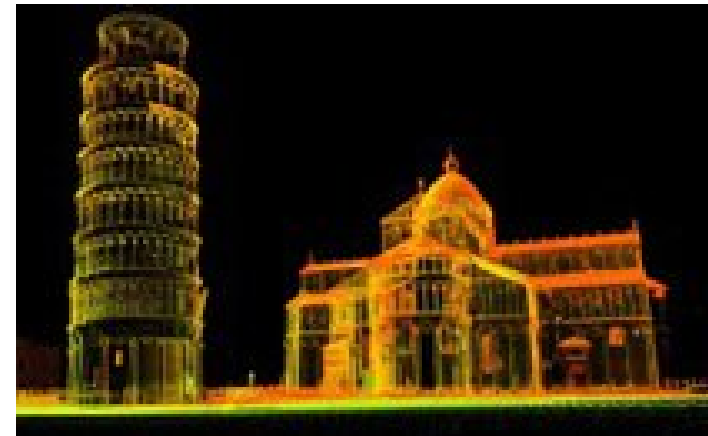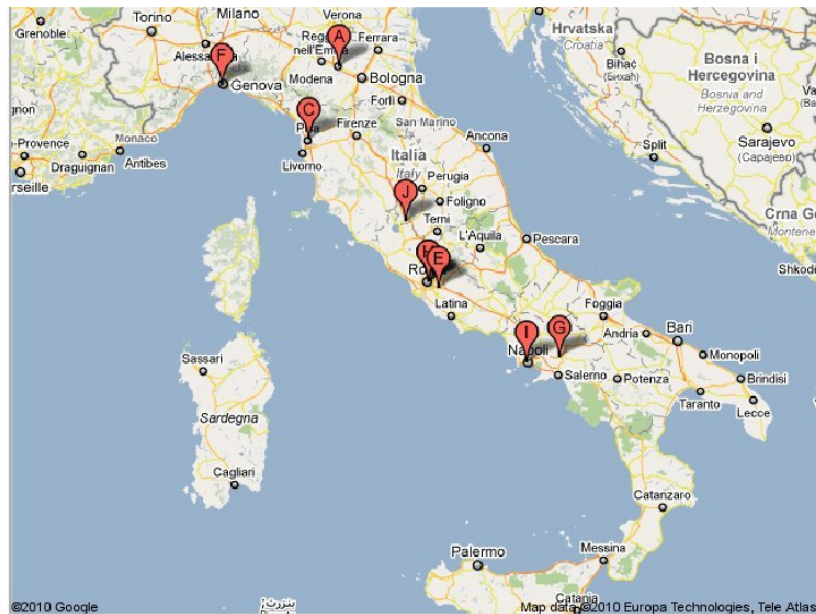
- doctorate
  - interactive point based rendering

- European Research Consortium for Informatics and Mathematics

- ERCIM "Alain Bensoussan" Fellowship Programme (postdoc)

- 12 months in one institution + 2 short visits (~one week each)

- 18 months in two (9 months each)

- many European institutes
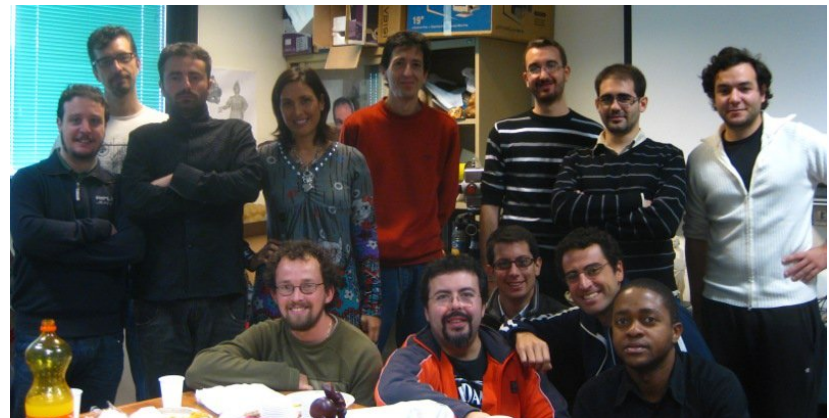
Visual Computing Lab

Visual Computing Lab

- strong background in 3D digitalization

    - cultural heritage

Visual Computing Lab

- the group:

  - not only scanning people

  - lots of meshing research

  - virtual environments

  - huge model rendering

  - lightning methods

- 1 big boss

- 1 tech boss

- ~ 4 permanent researches

- ~ 3 PostDocs

- ~ 4 PhD Students

- ~ 3 Laurea (graduate)

- ~ 1 secretary

Research in Italy

- grant
  - scanning services
  - European projects**

- payroll
  - few are permanents
  - project money
    - others
    - PhD students

Visual Computing Lab

- life of a post-doc at the lab
    - research only
    - relaxing ambient
    - Pisa : small but very nice (3 universities)
    - very good food!
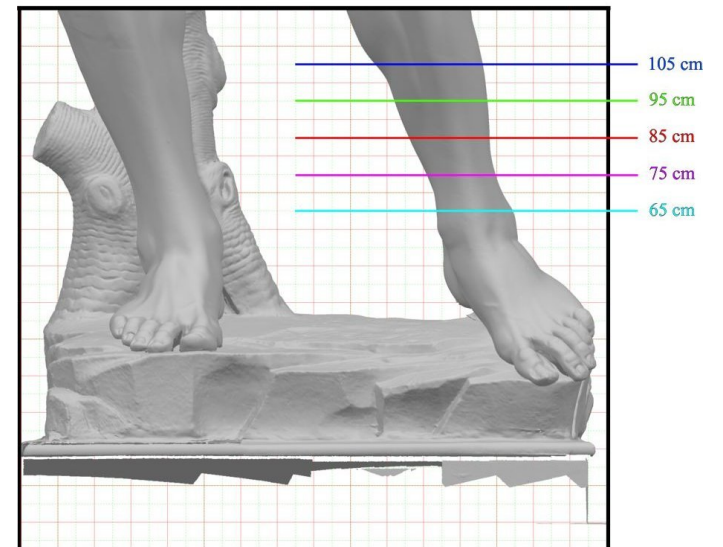
part II

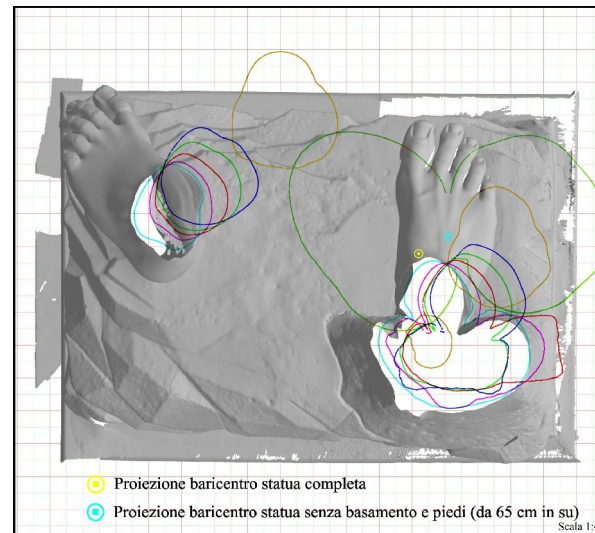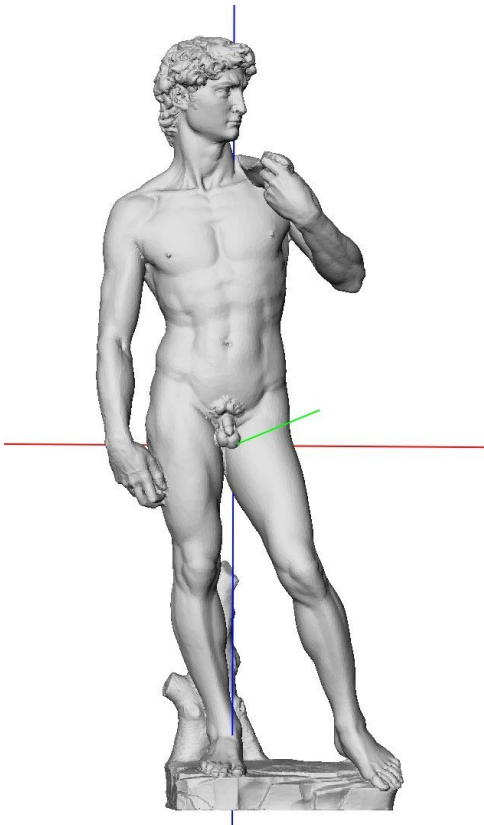## applications to cultural heritage

Minerva restoration

- Digital Minerva - The Restoration of the "Minerva di Arezzo"

01

David restoration

- measurements using 3D model

  - volume, barycenter, surface area, mass ...

Proiezione baricentro statua completa
Proiezione baricentro statua senza basamento e piedi (da 65 cm in su)
Scala 1:4

105 cm
95 cm
85 cm
75 cm
65 cm

David restoration

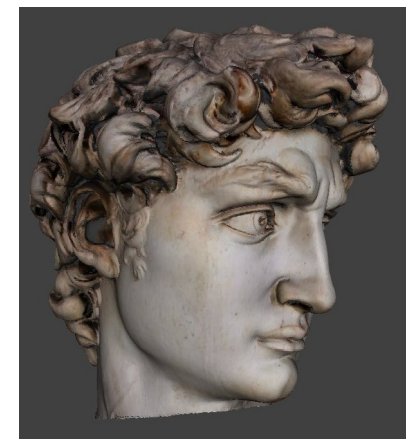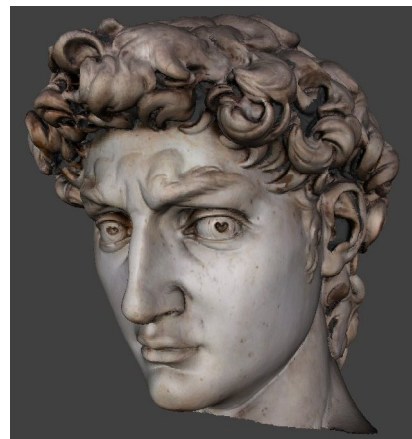- simulation : fall of contaminants
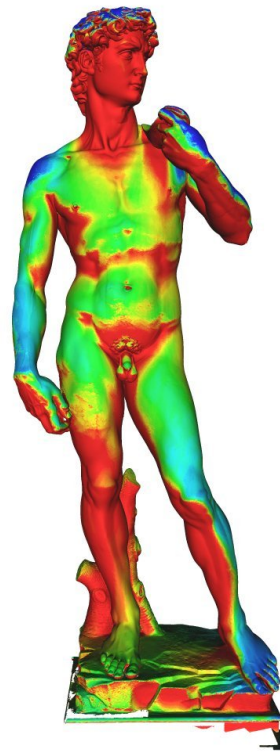
David restoration

- documentation (tool for the restorer)

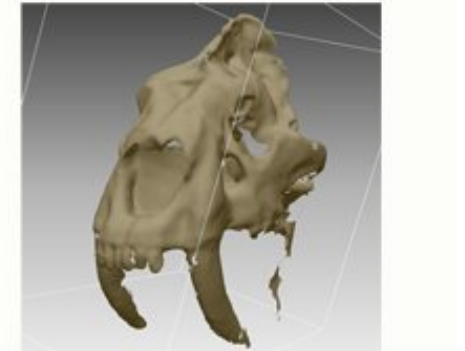ultra-violet

San Gimignano Tower

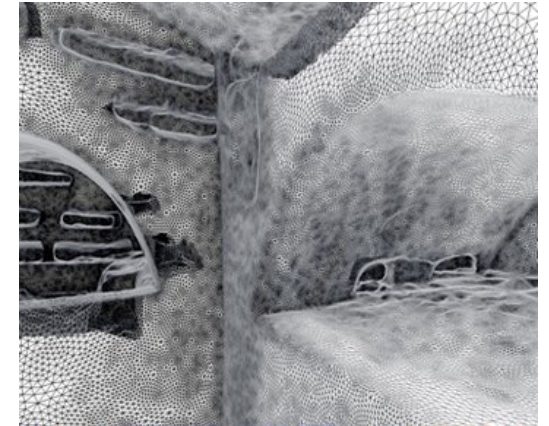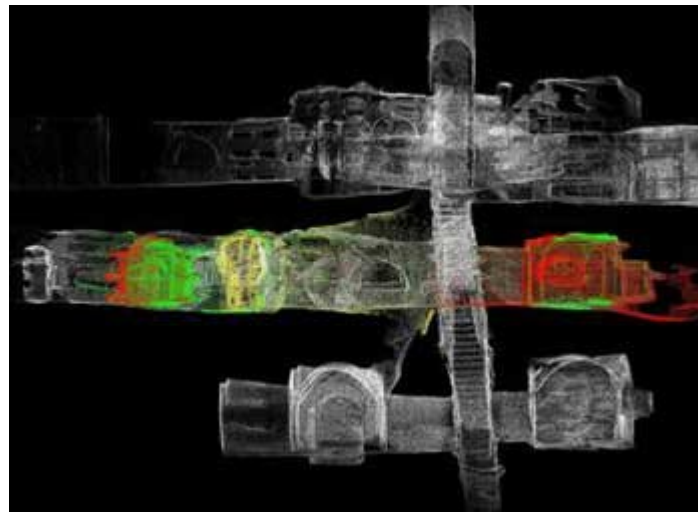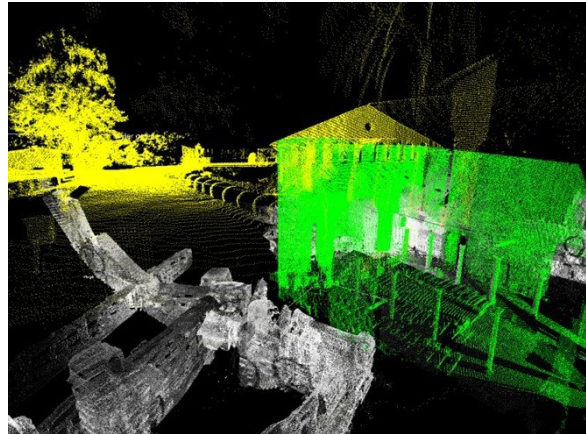- structural analysis
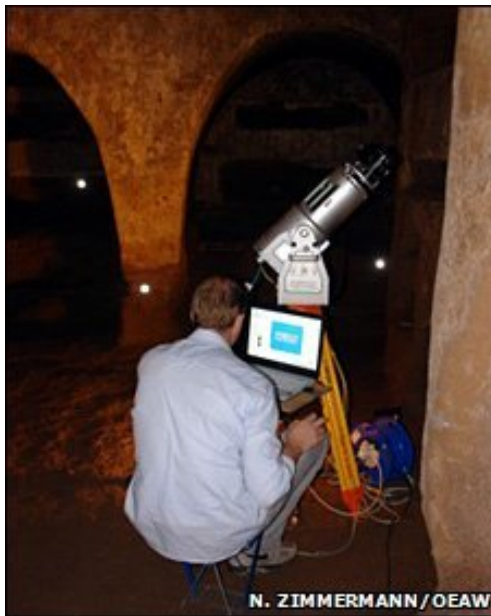

02

INT – Museu Nacional

- digitalization project

Rome - catacombs

- 15 km

- ~1 billion points

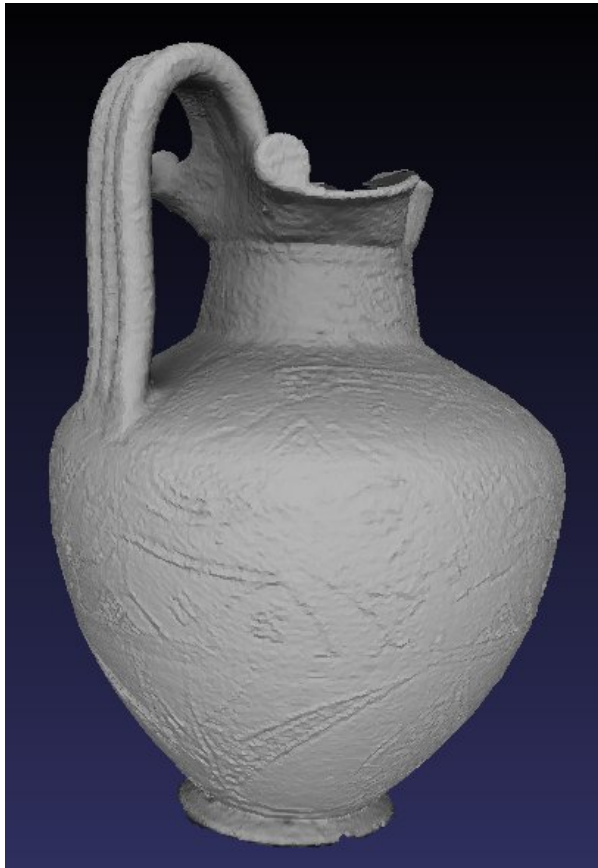N. ZIMMERMANN/OEAW
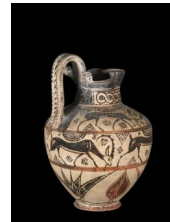
part III

mapping image-to-geometry

image-to-geometry mapping

Geometry

+

9 high resolution images

image-to-geometry mapping

- problem sources:
  - involves manual process
  - "guess" camera parameters
  - distortion & noise
  - non-controlled illumination
  - different resolutions
  - on-site : position equipment, poor illumination, access ...
- all that results in:
  - misalignments between images mapped to geometry
  - only a few pixels can cause problems

rendering with quality information

03

same PBR algorithm + quality information
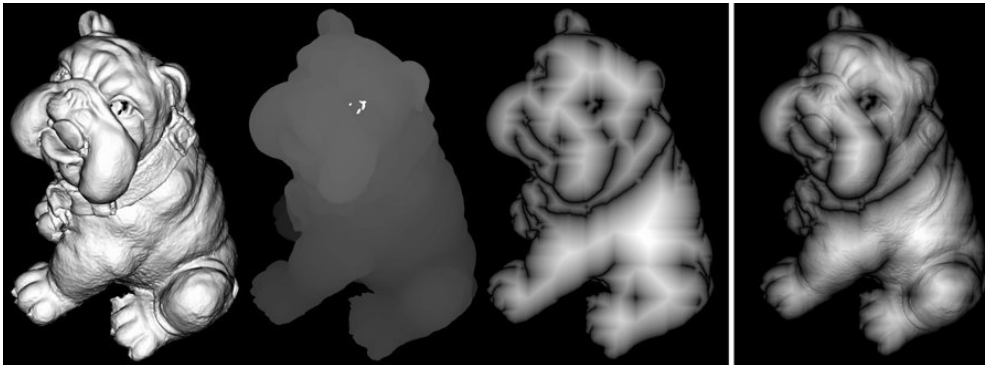

Meshlab Plugin

rendering with quality information

- still ... doesn't align

04

blending images

- blend images

  - masks:

    - angle, border, depth

Masked Photo Blending: mapping dense photographic dataset on high-resolution 3D models
Marco Callieri, Paolo Cignoni, Massimiliano Corsini, Roberto Scopigno
Computer & Graphics, volume 32, num 4, Aug 2008

blending images

- improvements:

blending images

- however … misalignments causes:
  - blurring, ghosting artifacts

proposed method

- following slides will be available when the method is published, sorry ...

thank you!

questions