

3D Scanning



Visual Computing Group

3D scanning technologies make possible the acquisition of very precise digital models of the shape and color of real objects, and are especially suited to Cultural Heritage applications.

The Visual Computing Group of C.N.R. (Pisa, Italy) has developed:

1. A low cost optical scanner

The VCG 3D scanner is based on consumer electronic technology (a video projector and a digital photcamera), and it is capable to acquire both *shape* and *surface attributes* (color).

The videoprojector casts structured light patterns on the object to be scanned, and then images are taken with the photcamera to acquire the distorted patterns (from which geometry is reconstructed) and the color reflected under different illumination conditions (from which the illumination-invariant color, or "albedo", of the object surface is reconstructed).

2. Software tools for 3D scanning

A suite of tools developed for the complete management of a 3D scanning session, encompassing the following tasks:

Acquisition of multiple range maps:

all the object's surface is sampled, larger is the object and more are the resulting range maps;

Registration and merge of range maps:

all the range maps are registered in the same space (i.e. mutually aligned), and then a single triangulated surface model is built;

Mesh Editing:

to remove possible anomalies in the resulting triangulated surface and to enhance data quality;

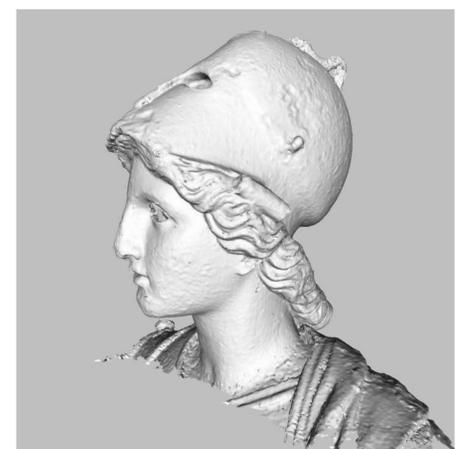
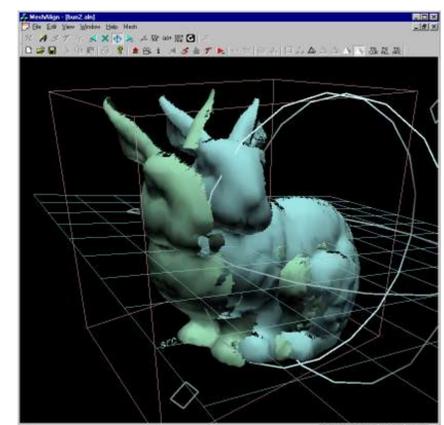
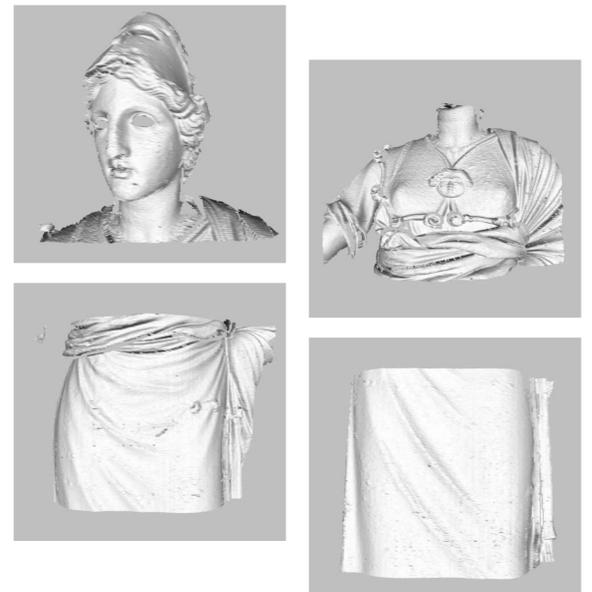
Geometry simplification:

3D scanning devices produce huge meshes (from 10M faces up to 1G faces), which have to be simplified to become easily usable in standard PC-based applications.

The simplification tool allows to manage surfaces which are larger than the current RAM memory size, is fast and supports the preservation of detail information via the synthesis of texture maps (both color and bump maps);

Capturing appearance:

digital acquisition of surface attributes, such as color, is crucial in Cultural Heritage applications. This means that a 3D scanning system has to support: color acquisition, color registration on the scanned geometries, color-preserving simplification, conversion in texture-based representation and mapping to the surfaces.



PARTICIPANTS

The Visual Computing Group is a joint research initiative of both CNUCE/C.N.R. and I.E.I. /C.N.R. Institutes.

COLLABORATIONS

Max Plank Institute (Germany), Stanford University (USA), INOA (Firenze), Soprint. Archeologica della Toscana, Soprint. ai BC di Firenze e Pisa.

INFORMATION

Further information and most of the papers concerning our research can be found at the VCG web site <http://vcg.iei.pi.cnr.it/>

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