



Grafica 3D per i beni culturali: Multiview stereo matching, making the model

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Image-based 3D Reconstruction

□ Advantages:

- Automatic
- Fast (relatively to manual built)
- Good scalability (both small and huge model can be acquired)
- Non-expert users can create his/her 3D model.
- Cheap!

□ Disadvantages:

- Accuracy (not so accurate)
 - Not all the objects can be acquired
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Model creation with MeshLab

After the 3D model is exported in MeshLab, there's a procedure to enhance it a bit and have a final result:

- Cleaning and normal estimation
 - Sampling
 - Poisson reconstruction
 - Poisson Model cleaning
 - Vertex Color Transfer
 - Cleaning
 - Scaling
 - Saving!
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Model creation: Cleaning (1)

The exported mesh (or point cloud) usually depicts portions of the space which are not the target one.

For this reason, it is better to remove these parts (using mainly the triangle, or points, selection), and reduce the total amount of data.

Model creation: Normal estimation

The exported mesh (or point cloud) usually has the normals per vertex.

If it doesn't have them (i.e. Output of Arch3D service!) you have to estimate them.

The way to do that is to use the

Normals, curvature and orientation->Compute normals for point sets filter.

Model creation: Normal estimation

The filter is quite easy to use. If you have a reference position of acquisition you can indicate it in the “flip normals” option.

Usually, the origin is near where the images have been taken, so if you have a nearly planar surface you should be ok!

You need to check the normals using the

[Render->Show normals and curvature](#)

Decorator.

Model creation: Sampling

The remeshing operation (Poisson) which will be launched in next step needs only a point cloud (with normals)

A possibly useful operation is to reduce the number of points using the

[Sampling->Mesh Element Subsampling](#)
filter.

Usually reducing the n. of points to one half is ok.

NOTE: Check if [Render->Color->per Vertex](#) is on, if you don't see the color on the newly created layer!!!

Model creation: Poisson reconstruction

The remeshing operation (Poisson) re-builds the geometry removing some of the typical initial noise. As usual, it's necessary to find the right value for the parameters...

Following the Poisson reconstruction, a cleaning stage is always necessary.

A simple but effective operation for the areas with big triangulation is the selection of a "seed" triangle and the use of

[Selection->Dilate Selection](#)

NOTE: Check if [Render->Color->per Vertex](#) is on, if you don't see the color on the newly created layer!!!

Model creation: Vertex Attribute Transfer

The remeshing operation (Poisson) doesn't preserve the vertex color attribute

It's possible to retrieve it using the [Sampling->Vertex Attribute Transfer](#) filter.

In this way, you should have created a better 3D model!

NOTE: Check if [Render->Color->per Vertex](#) is on, if you don't see the color on the newly created layer!!!

Model creation: scaling issue

If you want to scale the model to its real size, you need to have a measurement of a known element, and the corresponding measurement in MeshLab.

The scaling factor to be applied (using the Transform:Scale filter) is:

$$\text{ScaleFactor} = \text{RealMeasure} / \text{MeshLabMeasure}$$

Then you use the filter

Normals, curvatures and orientation->Transform: Scale

Model creation: composing different acquisitions

It's possible to put together different acquisitions of portions of the same object.

The pipeline is the same as scanning (alignment and merging) but you need to take into account the scaling! For this reason you need to:

- 1) Scale the different portions individually (see previous slide)
and/or
 - 2) Use the alignment tool with the "allow scaling" options (put a lot of correspondences!)
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Next in line...

Next lesson:

- Complex stuff in MeshLab, interchange with other tools

Contacts:

Matteo Dellepiane

c/o ISTI-CNR Via G. Moruzzi 1

56124 Pisa (PI)

Tel. 0503152925

E-Mail: dellepiane@isti.cnr.it

Personal website: <http://vcg.isti.cnr.it/~dellepiane/>

VCG website: <http://vcg.isti.cnr.it>
