



Grafica 3D per i beni culturali: Complex acquisitions, making the model

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A generic example

This pipeline shows how to deal with two portions of the same object that have been acquired in different stages.

- If you have only one project, just skip the alignment part, and start from step five (but remember to scale the project, step two!)
 - There must be a bit of alignment between the two projects
 - The projects are represented by two mlp files (one.mlp and two.mlp) containing the point cloud (respectively one.ply and two.ply) and the associated registered images.
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Step one: cleaning

The point cloud may contain parts that are not of interest, or parts that are too noisy: remove them using the selection and removal tools.

NOTE: remember first to save the cleaned clouds, and then to save the mlp (both with different names possibly)

Step two: scaling

The point clouds are in a different unity of measure, the best way is to scale them to a common unity of measure.

NOTE: mm is a better choice because some of the filter involved work better with models in mm.

NOTE: if you have a few distances for scaling, you can also use one point cloud (previously scaled in mm) as a reference for the others.

Step two: scaling

One way to make the scaling is to use the georef tool  , selecting the «scale reference» tab.

You need to have one or more measures taken on the real object.

The procedure is:

- Load the mlp file
 - Push «Esc» to switch to navigation and position the model
 - Choose «Add new distance»
 - Select the distance and then click «pick current Point A»
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Step two: scaling

- Double click on the point in the model
 - Select the distance and then click «pick current Point B»
 - Double click on the point in the model
 - Automatically the scaling factor is calculated and written on the dialog (you can also use more than one distance)
 - Write the scaling factor somewhere!
 - Click apply and the point cloud will be scaled accordingly
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Step two: scaling

- Now close the georef tool and call for «filters->cameras->Scale cameras or set of cameras»
 - Tutorial:
<https://www.youtube.com/watch?v=1E1exs7RdTk&index=7&list=PL60mCsep96Je1bzGrWnK-nL9pi95r7UqI>
 - Use the scale factor stored before
 - Now freeze di matrix for the point cloud (right klik on the model in layer dialog -> Matrix: freeze current matrix -> apply
 - Save the point cloud, then save the project
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Step three: alignment

Once that you scaled all the project to a common unity of measure, you have to align them.

- Open two.mlp
 - Import one.ply in the project
 - Using the alignment tool (<https://www.youtube.com/watch?v=4g9Hap4rX0k&list=PL53FAE3EB5734126E&index=1&t=11s> and related) align the two point clouds
 - Remember to set one.ply as base mesh (check this https://www.youtube.com/watch?v=UrJqKIF_tAc&list=PL53FAE3EB5734126E&index=3)
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Step three: alignment

- Delete one.ply
 - Now call for the transform set of cameras filter (https://www.youtube.com/watch?v=N_VFpgQACJo&index=8&list=PL60mCsep96Je1bzGrWnK-nL9pi95r7UqI) to align the cameras as well
 - Freeze matrix and save two.ply
 - Save two.mlp
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Step four: merging the projects

Now the two projects are aligned and you can directly load them in the same context and save a unique project

- Load one.mlp (the one scale in mm)
 - Select file->append project to current... And choose the last version of two.mlp
 - The two point clouds should be aligned, and all the images present and aligned
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Step four: merging the projects

- Right click on any model layer and choose «Flatten visible layers»
 - NOTE: remember to select «keep unreferenced vertices» before applying!
 - Save the new point cloud and the project
 - Now you have a unique final projects with all the images aligned!
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Step five: creating the model

- Now that you have the final point cloud, you may want to clean it a bit before reconstruction
 - All the steps from now on are iterative: if the reconstruction is not perfect, you may step back to improve cleaning, for example!
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Step five: creating the model

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...

Check the tutorial:

<https://www.youtube.com/watch?v=fZI925P1aXw&t=393s&list=PL53FAE3EB5734126E&index=5>

A cleaning operation may be needed afterwards! Now check the slides about preparation of the model, so that you can clean/decimate/smooth the geometry until you like it

Step six: projecting the color

Once that you have a cleaned geometry, you can try to project the color information from the images to the 3D model.

First of all, you can refine the image alignment using this filter:
Filter->Camera-> Image registration: global refinement...

Set the parameters like this:

- Rendering mode -> color per vertex
- Maximum number of min. Steps -> 0
- Pre-alignment step -> checked

Save the project afterwards, so that you will have better aligned images

Step six: projecting the color

Parameterization

Filters->Texture-> Parameterization + Texturing from images

<https://www.youtube.com/watch?v=OJZRuIzHcVw&list=PL60mCsep96JdC8Y7NQvLIMxx8XzXCT3iK&index=4>

Usage:

- 1) Define texture name and resolution
- 2) Apply
- 3) Save model with texture



Step six: projecting the color

After the first parameterization has been completed, you may also try the alternative color projection filter:

Filters->Camera->Project active raster color to current mesh, filling the texture

<https://www.youtube.com/watch?v=iLs5IIYE4F8&list=PL60mCsep96JdC8Y7NQvLIMxx8XzXCT3iK&index=3>



Step six: projecting the color

Since now color is stored both in the vertices and in the texture, it's better to set the mesh color to white in order to have a more realistic appearance.

Go to

Filters->Color -> Per vertex color function

Set r,g, and b values to 255 and apply

Step six: projecting the color

NOTES: Remember that you can select a subportion of the images to be projected by making them active/inactive

There is also the possibility to manually choose the quality of images by creating a transparency channel

If the projection is not possible because the model is not manifold check this

https://www.youtube.com/edit?o=U&video_id=oDx0Tgy0UHo

Step seven: done?

Almost: now you have to align the model to the reference system (check the slides about model preparation), and if necessary create the multi-resolution version for web visualization.

But then it's done!

Next in line...

Next lesson:

- VR and wrap-up!

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