



Grafica 3D per i beni culturali: I tool per multi-view stereo matching

Lezione 14: 17 Aprile 2014

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
-

Stereo matching tools, three philosophies

- ❑ Webservice approaches: automatic, no need for powerful hardware, no control on parameters
 - ❑ Local approaches: control on parameters, need for powerful hardware
 - ❑ Hybrid solutions
-

Tool 1: Photosynth Toolkit

- ❑ This toolkit is produced by a small community of photographers. It's an hybrid solution.
 - ❑ <http://www.visual-experiments.com/demos/photosynthtoolkit/>
 - ❑ It uses the code which was released by two different research projects: Photosynth (the heir of PhotoTourism) and PMVS.
 - ❑ MeshLab is indicated as the "official" tool for the processing of the 3D data!
-

Photosynth Toolkit

- The input of the toolkit is a web address of the reconstruction provided by Photosynth
 - To use Photosynth: sign in, download the upload tool, upload the images, go and have a look at the corresponding page.
-

Photosynth Toolkit

- ❑ To use the Photosynth toolkit:
 - ❑ 1) Create a folder for the data
 - ❑ 2) Download Synth: use the photosynth URL
 - ❑ 3) Put images in distort folder: just do that! Skip the "Watch PhotoSynth output2 step
 - ❑ 3) Prepare For PMVS2 : use the photosynt URL. A launch .bat file is created
 - ❑ 4) Prepare For CMVS : use the photosynt URL. A launch .bat file is created
 - ❑ 5) Launch the reconstruction (PMVS2 or CMVS). The final result will be a .ply file in models subdir
-

Photosynth Toolkit

- ❑ The options for PMVS are well explained at
 - ❑ <http://grail.cs.washington.edu/software/pmvs/documentation.html>
 - ❑ But the most important parameters are:
 - ❑ *Level: the subsampling rate of images: (0=full resolution)*
 - ❑ *Csize: density of reconstruction (the lower the denser)*
 - ❑ *minImageNum: min number of images sharing a point in 3D (similar to count in Arc3D)*
 - ❑ *CPU: support for multi-core systems*
-

Photosynth Toolkit

- ❑ PMVS reconstruction will create a `pmvs_options.txt.ply` file in the `pmvs/models` folder
 - ❑ CMVS reconstruction will create several `pmvs_options.txt.ply` files in the `pmvs/models` folder. You need to load all of them in the same MeshLab context, and then apply a Flatten Visible Layers filter. Remember to check the “keep unreferenced vertices” options, or everything will be removed!
-

Photosynth Toolkit: final comments

- ❑ Photosynth is more robust than Arc3D in reconstruction, but since it's not fully integrated in MeshLab, you have less control on the production of the model
 - ❑ The points produced by PMVS are a bit more "sparse" than Arc3D, but if you play with the parameters maybe you can improve the results
 - ❑ The reconstruction is fully local, so it's necessary to have adequate hardware...
-

Tool 2: Arch3D Service

- ❑ This webservice is maintained by University of Siena.
 - ❑ It's focused on Cultural Heritage (the maintainers check the images!)
 - ❑ It's based on a popular reconstruction pipeline (Apero+MicMac)
 - ❑ The input is a bit different: not more than 7 images.
 - ❑ The processing is semi-automatic, and it gives back a dense point cloud (without normals).
-

Tool 2: Arch3D Service

- ❑ Website: <http://www.arch3d.org/>
 - ❑ You need to acquire the images and upload them using WeTransfer
 - ❑ Check the instructions to take photos here: <http://www.arch3d.org/>
 - ❑ And the tutorial here: <http://www.arch3d.org/shoot.html>
 - ❑ Since only 7 images are needed, you'll need to change a bit the way you acquire complex objects.
-

Tool 3: 3DF Zephyr Pro

- ❑ A Local solution
 - ❑ Commercial software, at disposal for didactic use (ask me for the key!)
 - ❑ Permits to make all the steps of reconstruction, with the possibility of tuning the parameters
 - ❑ Tutorials available:
<http://www.3dflow.net/technology/documents/3df-zephyr-tutorials/>
 - ❑ Exports also 3D Models, not only point clouds!
-

Next in line...

Next lesson:

- Multi-View Stereo Matching: creating the model

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>
