



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

8 Maggio 2017

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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Using the tools

For the 2017 edition of the course, two tools have been chosen as the «official» ones:

- Regard 3D: local tool for 3D reconstruction and import/export from MeshLab
 - Culture 3D Cloud: web service for remote processing
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Regard 3D

The tool can be found in the official website (<http://www.regard3d.org/>) that includes a quite good documentation

The processing of data follows the usual workflow of multi-view stereo matching tools:

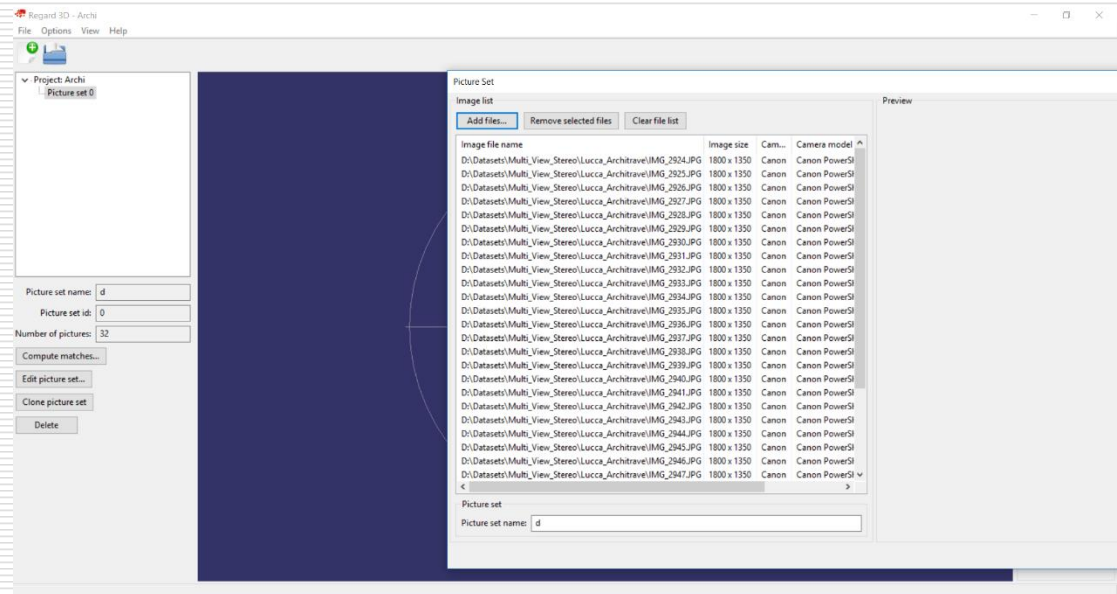
- Create a project
 - Matching image features
 - Calibration and orientation of camera
 - Dense matching
 - (Creation of a textured 3D Model)
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Regard 3D: create the project

- Prepare a folder containing only the images you want to use for reconstruction (preserve the exif file if you process the data!)
 - Launch Regard3D
 - Choose «New project»
 - Select the folder where the images are, and choose a project name
 - Choose «Add picture set» and select the images you want to add
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Regard 3D: create the project

- NOTE: it is crucial that the tool is able to read the camera model and focal, otherwise it won't work.
- Don't remove the EXIF data if you process the images.



Regard 3D: compute matches

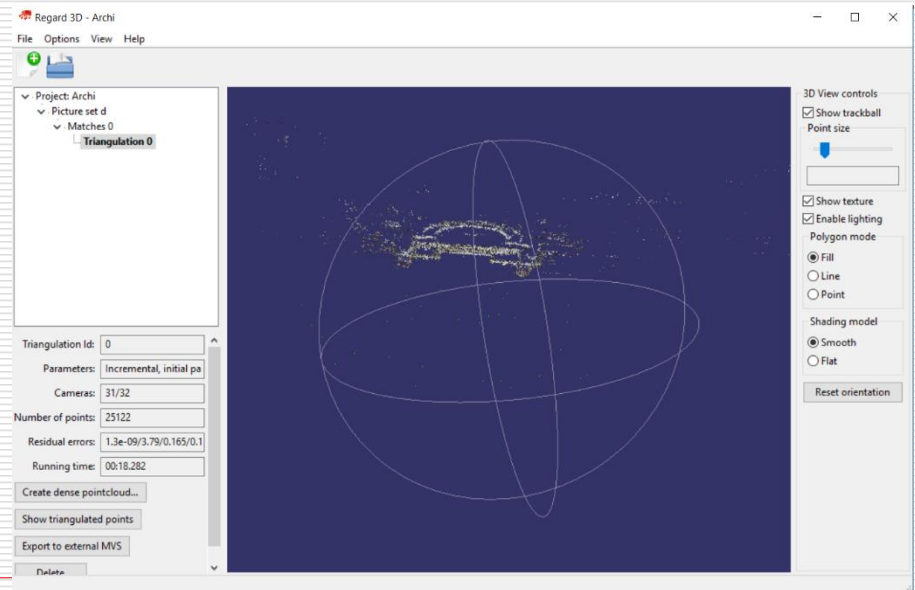
- Choose «compute matches»
 - Two parameters are available: «sensitivity» and «matching ratio»: in the case of difficult dataset you may try to reduce the sensitivity to extract more keypoints
 - At the end, with «show matching results» it's possible to see how much stuff has been matched
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Regard 3D: triangulation

- Choose «triangulation»
 - Two possible approaches are available: «incremental» and «global»
 - The «incremental» is the classic mode: the only control by user is to define the initial pair, which is by default the one with the highest number of matches
 - The «global» works only when the focal length stayed the same throughout the acquisition
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Regard 3D: triangulation

- NOTE: the incremental triangulation usually works, but nobody prevents you from trying both and see if any difference can be seen.
- Every operation in the project is stored independently, so you can decide from which output you can go on.



Regard 3D: dense matching

- Choose «create dense point cloud»
 - Two possible approaches are available: «pmvs» and «mve»
 - These are two algorithms that produce dense cloud: in general MVE produces denser clouds, but both reconstruction should be tried
 - In both cases this is the longest step of computation!
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Regard 3D: dense matching

- MVE reconstruction can be tuned with two parameters: «scale» and «filter width»
 - «Scale» is related to the detail that is reconstructed. The smaller the better, but the smaller the longer it will take to process
 - «Filter width» is related to the quality of the final reconstruction. The higher the better, but the higher the longer it will take to process
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Regard 3D: dense matching

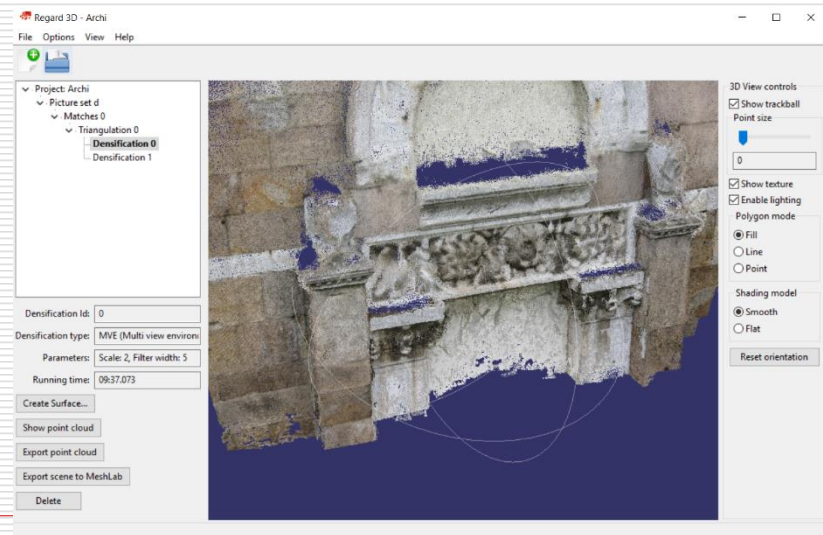
- PMVS reconstruction can be tuned with two parameters: «level» and «cell size»
 - «Level» is related to the detail that is reconstructed. The smaller the better, but the smaller the longer it will take to process
 - «Cell size» is related to the quality of the final reconstruction. The higher the better, but the higher the longer it will take to process
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Regard 3D: exporting data

- Once that dense reconstruction is finished, two things can be done: export the point cloud or export a MeshLab project
 - In the case of MeshLab export, a sceneMeshLab.mlp file will be created, and two folders (images and model) containing the images and the dense model. The project can be directly loaded in MeshLab
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Final notes regarding Regard 3D

- Regard 3D contains also an additional step to create a triangulated version of the model, and also a texturing
- In the context of the course, this is demanded to MeshLab, since cleaning and better texturing can be obtained with this tool.



Culture 3D cloud

The webservice can be accessed from here <http://cchum-kvm-c3dc-m001.in2p3.fr/gui/> , ask for the login details via mail

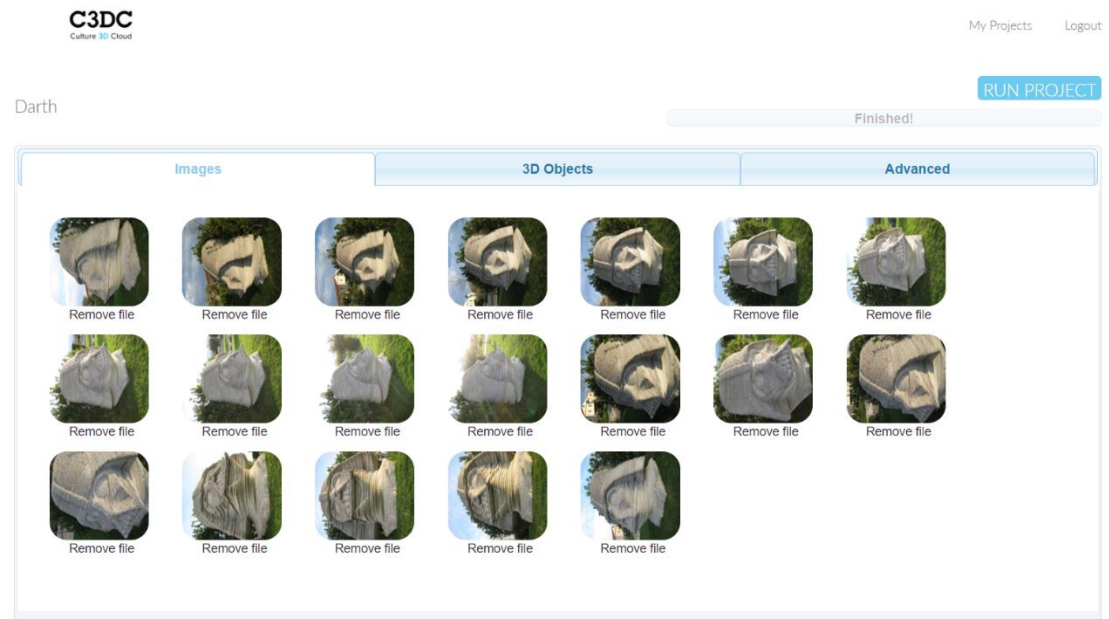
The processing of data follows the usual workflow of multi-view stereo matching tools:

- Create a project
 - Upload images
 - Set preferences
 - Wait
 - Download results
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Culture 3D cloud: preparing the project

To create a project, just choose «Create project», choose a name.

Add images by dragging them in the first tab of the newly created project



Culture 3D cloud: setting parameters

A few parameters can be set before launching the reconstruction:

- Processing type: better choose «random»
- Mode: better choose «multi-view»
- Density
- Produce: for the course you may uncheck «model»

The screenshot shows the C3DC Culture 3D Cloud interface. At the top, the logo 'C3DC Culture 3D Cloud' is on the left, and 'My Projects' and 'Logout' are on the right. Below the logo, the project name 'Darth' is displayed. A blue 'RUN PROJECT' button is visible in the top right corner. The interface is divided into three tabs: 'Images', '3D Objects', and 'Advanced'. The '3D Objects' tab is currently selected. Under this tab, there are three sections: 'Select processing type' with a dropdown menu set to 'Random'; 'Select mode' with a dropdown menu set to 'multi-view'; and 'Select density' with a dropdown menu set to 'high'. To the right of these, under the 'Produce' section, there are three checkboxes: 'Preview' (checked), 'PointCloud' (checked), and 'Mesh' (unchecked). Below these settings, there is a section titled 'Available results:' with three expandable items: 'Preview', 'Pointset', and 'Mesh'. At the bottom, there is a section titled 'Available logs:' with a list of log types: 'Metadata', 'Tapioca', 'Tapas', 'Apericloud', and 'C3DC'. A small note at the bottom left says 'In case of any problem, please read the FAQ'. A 'Clean Project' button is located at the bottom right.

Culture 3D cloud: Run project

Click «Run project» and wait!

Results will be made available in the 3D Object and Advanced tabs.

The screenshot displays the C3DC Culture 3D Cloud web interface. At the top left is the C3DC logo with the tagline 'Culture 3D Cloud'. At the top right are links for 'My Projects' and 'Logout'. Below the logo, the project name 'Darth' is shown next to a 'Finished!' status bar and a blue 'RUN PROJECT' button. The interface features three tabs: 'Images', '3D Objects' (which is active), and 'Advanced'. Under the '3D Objects' tab, there are settings for 'Select processing type' (set to 'Random'), 'Select mode' (set to 'multi-view'), and 'Select density' (set to 'high'). To the right, under the 'Produce' section, there are three checkboxes: 'Preview' (checked), 'PointCloud' (checked), and 'Mesh' (unchecked). Below these settings, the 'Available results:' section lists three items: 'Preview', 'Pointset', and 'Mesh', each with a right-pointing arrow. At the bottom left, the 'Available logs:' section lists several log types: 'Metadata', 'Tapioca', 'Tapas', 'Apericloud', and 'C3DC'. A small note below the logs reads 'In case of any troubles, please read the FAQ'. At the bottom right is a 'Clean Project' button.

Culture 3D cloud

NOTE: the service is still under development, the project may fail, but you can try launching it a couple of times before giving up.

The screenshot displays the C3DC Culture 3D Cloud web interface. At the top left is the C3DC logo with the tagline 'Culture 3D Cloud'. At the top right are links for 'My Projects' and 'Logout'. Below the logo, the project name 'Darth' is shown. A blue 'RUN PROJECT' button is visible in the top right corner of the main content area. A progress bar indicates the project is 'Finished!'. The interface has three tabs: 'Images', '3D Objects' (which is selected), and 'Advanced'. Under the '3D Objects' tab, there are two sections: 'Select processing type' with a 'Random' dropdown, and 'Select mode' with a 'multi-view' dropdown and 'Select density' with a 'high' dropdown. To the right of these is a 'Produce' section with three checkboxes: 'Preview' (checked), 'PointCloud' (checked), and 'Mesh' (unchecked). Below these settings is an 'Available results:' section with three expandable items: 'Preview', 'Pointset', and 'Mesh'. At the bottom left is an 'Available logs:' section with a list of log types: 'Metadata', 'Tapioca', 'Tapas', 'Apericloud', and 'C3DC'. A note below the logs says 'In case of error, enter troubles, please read the FAQ'. At the bottom right is a 'Clean Project' button.

Next in line...

Next lesson:

- Making the model in MeshLab

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