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MayaMVG

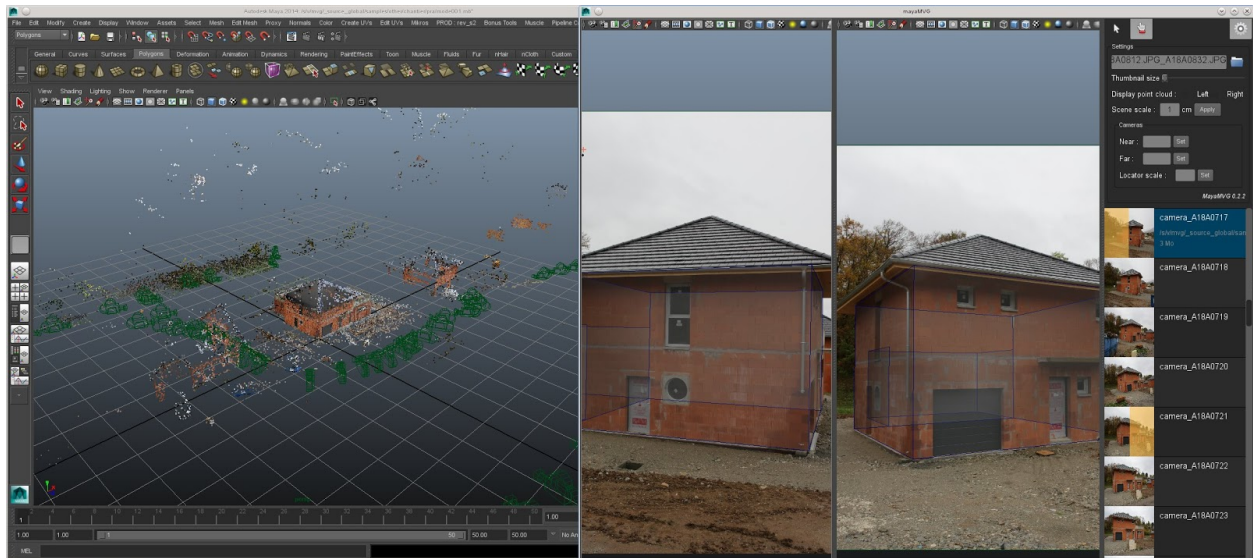
<https://github.com/mikrosimage/mayaMVG>

Introduction

The ambition of this deliverable is to release a fully functional version of MayaMVG. MayaMVG brings up a coherent solution based on the automatic calibration created with OpenMVG to provide guided modeling into Maya (by Autodesk) with an export for texturing in Nuke and Mari (by The Foundry).

MIK has started the development of MayaMVG plugin some time before before POPART, but the ambition here is to address all the major issues to put it in production.

MIK now used it on small productions and the software is ready, on the software side, for an open-source release. The official public release will be done later when it will be the most appropriate for the communication of the POPART Previz Solution.





Implementation details






Different modes for scene editing

MayaMVG provides tools to assist the user during the creation of 3D meshes. It also allows the user to modify the 3D points in the scene (moving, removing, adding), always maintaining a coherence with respect to the underlying camera geometry: for example, if a 3D point is added, its 2D projections in the camera images must satisfy the photometric and the epipolar constraint.

In the following we present the different editing modes and their behaviours in all cases.



This icon represents the MayaMVG context in the UI. It contains the following manipulators:

-  New face creation that fit the Point Cloud.
-  New face creation by face extension that fit the Point Cloud.
-  Triangulation mode: place the same point in multiple views so it can be placed precisely in 3D.
-  Move an existing point or segment and it completely refit the Point Cloud.
-  Move an existing point or segment while keeping the computed 3D plane.

Scene orientation

OpenMVG reconstructs the static structure of the scene that is detected in the input images. This doesn't contain any information about how the world should be oriented. So first of all, MayaMVG allows you to reorganize the data: define the center, the vertical and the scale of the world.

ImageCache

We use the ImagePlane object provided by Maya on the Camera objects, but unfortunately there is no specific memory management done by Maya. So MayaMVG has to load and unload explicitly the cameras we need to use. This is why we created a cache mechanism to avoid reloading images when frequently switching between few cameras because loading large images takes time and slowdown the user interaction.

Snapping

The first approach in MayaMVG to create faces is to snap this face on the Point Cloud. When you have already created and adjusted a face, you have a new information that you can use to create connected faces.

With the contribution of SRL, we added a new constraint to the face extension that fits the Point Cloud but with the initial constraint of the connected edge. That greatly improves the quality of the snapping.

Undo/Redo

Providing a complete undo/redo support is a major requirement to set up in production.

Part of the Maya API is directly undoable, but many commands are not and there is no automatic way to create groups of commands. So we had to create many commands manually and check all cases.

It has also implied some changes in the way we manipulate the graph to allow undo/redo. The solution is to use Maya "tweak" nodes.

N-views Triangulation

We have added the possibility to set as many 2D points as you want. It is no more restricted to 2 images.

Blind Data

To do the triangulation, we need to store some data per 3D point. We changed the internal representation to use Maya "Blind Data" in order to have storable and undoable data.

Custom Shortcuts

There is no turnkey solution to manage shortcuts for a plugin in Maya. Maya provides a way to create or remove shortcuts... but you have to register/unregister yourself manually and keep the user values into the settings, etc. with a lot of particular cases.

UX

We have interacted with end-users to refine the workflow. Thanks to their feedback, we can now provide a fully effective and user-friendly tool. Moreover, we have already identify many improvements and extensions that could be useful.

Performance issues

We faced many performance issues. So we have added a way to enable/disable the meshes and done some caching during the user interaction.

Mesh selection

We have faced performance issues. One of them is simply due to the presence of huge meshes in the real-world scene that are not used by MayaMVG. So we have added a way to enable/disable meshes. By default, all meshes not created by MayaMVG are disabled and graphic artists can enable them to do specific editing.

Selection synchronization

We have added the synchronization between the selection in MayaMVG and the native Maya selection. That allows the graphic artist to choose a camera in 3D to set it directly into MayaMVG.

Automatic view selection regarding the perspective camera

The selection synchronization feature was a huge improvement in the workflow allowing the user to work much faster. A straightforward improvement was the selection of the closest camera: thanks to this new feature the user can select the point of view in the perspective camera and automatically switch to the point of view of the closest reconstructed camera available. The motion of the perspective camera is listen by MayaMVG using the Maya graph (DAG) invalidation. This feature is already available and it will be further improved as the current performance issues are being addressed.

Export to Nuke/Mari (by The Foundry)

We added an option to export the selected meshes and cameras in Alembic format. Then we created a Nuke importer script to load it in Nuke and directly create a graph to project all images onto the geometry.

Changes regarding the proposal

As decided in the “D4.1 API definition”, we have clearly splitted to photo-modeling tool from the reconstruction tool. So all stuff regarding the update of the reconstruction onset has moved into another tool developed in D3.2 which will be deliver in June 1.

During the T3.1, we also created a prototype in collaboration with a group of students from IRT:

<http://oeufsdepie.github.io/MATRIX/index.html>

<https://github.com/OeufsDePie/MATRIX>

This prototype retrieves the thumbnails from the camera, allows to select the photos and download them. Once the pictures are downloaded, their GPS positions are displayed on a map so that the user can further refine the selection of the pictures to use for the reconstruction. The tool then provides an interface to launch an OpenMVG reconstruction on the subset of pictures.

We have also implemented some prototyping to check and test the different technical challenges:

<https://github.com/poparteu/mockupMVG>

Validation in production

We have successfully installed and used the plugin in production on real-world datasets. We had a lot of feedbacks and we made many changes in the interaction. We now have new requests to align meshes or to extend it to other kind of modeling than architecture with new manipulators.

Download

The MayaMVG tool will be released as open source as soon as it has been prepared with tests and detailed documentation. For review, a snapshot of the tool can be downloaded here:

<https://drive.google.com/file/d/0B2hIFTMY0omueV9IT2lBMkFJUzg/view?usp=sharing>