Overview
In this assignment, you will create a printable model from a real-world object. The goal is to exercise some of the methods from the associated lecture. In particular, you should use an image-based 3D reconstruction pipeline to create a model. You may use publically available tools to do so.

Tasks
1. Choose a suitable object
2. Capture the object using a digital camera
3. Reconstruct the object using an SfM/MVS pipeline
4. Reconstruct the surface of the object
5. Clean the object so it is suitable for printing
6. Perform additional modeling tasks as required, e.g., creating a pedestal in a modeling tool as in Assignment #1.
7. Write a report
8. Submit the model for printing

Choosing an object
You are free to choose any object you like. However, for good printing results, it is helpful if you can access the object from several directions. For example, a flat building façade is not a good object because you can only capture one side of it (no access to roof, back, or sides). A statue in a public park is a very good object.

Capture the object
Take images from different angles and distances of the object. Note that for a good reconstruction, usually 50 or more images are needed, but this depends a lot on the object itself and on the quality of the camera.

Reconstruct the object
Feed the images to a suitable combination of structure-from-motion and multi-view stereo algorithms. Recommended choices are:
- MVE (Multi-View Environment) from TU Darmstadt (http://www.gcc.tudarmstadt.de/home/proj/mve/) : includes SfM, MVS (based on [Goesele 2007], and Surface reconstruction (FSSR).
- VisualSFM (http://ccwu.me/vsfm/): includes SfM, and can integrate with PMVS [Furukawa 2007]
- For SfM, you may also try Bundler (http://www.cs.cornell.edu/~snavely/bundler/) [Snavely 2006], the basis of Phototourism.

Note that these tools interact well, i.e., you could use VisualSFM for SfM, and use MVE to do MVS. While VisualSFM allows doing the whole pipeline through the GUI, MVE requires commandline interaction as well. However, the integrated MVS algorithm might be more robust for outdoor acquisition.

Furthermore, you can also try commercial software:

- Agisoft Photoscan (http://www.agisoft.com/) has a trial license that should work well and is very popular in cultural heritage
- Capturing Reality’s RealityCapture (https://www.capturingreality.com/) gives excellent results, but the trial license is very limited.

Reconstruct the surface of the object
The reconstruction tools above usually produce point clouds in the .ply format. To reconstruct a surface, the following tools can be used:

- MVE (as above): the integrated FSSR algorithm is very robust to images of different scales
- Meshlab (http://meshlab.sourceforge.net/) for Poisson surface reconstruction (note that you will need to generate normals first).

Clean the object
Meshlab is the “Swiss Army Knife” of mesh processing. In addition to surface reconstruction, you can use it to perform required cleaning operations, like:

- Removing outliers
- Closing holes
- Mesh smoothing
- Mesh decimation

Modeling tasks
Similar to Assignment #1, use Blender or another modeling tool to create a pedestal if required, or perform other modeling operations. Make sure your model adheres to the same requirements given in Assignment #1.
Report
Write a short report (1-2 pages) that describes the process you used to arrive at your model. Include:

- Description of input (# images, resolution, camera, …)
- Which tools you used
- The major operations performed in the tools
- If you tried different tools (which is encouraged), comment on any perceived quality differences (i.e., if Bundler manages to produce a result but VisualSFM doesn’t, or if one produces more outliers, etc.)

Submit for printing
See Assignment #1

Deadline and submission
The submission deadline is 10.4.2018, 23:59.
Choose a file transfer platform (google drive, dropbox, …), upload the zip-files mentioned in the following, and send an email with the links to: wimmer@cg.tuwien.ac.at

- yourlastname_yourstudentid_assignment2_input.zip: the input images you used
- yourlastname_yourstudentid_assignment2_results.zip: the resulting model, and the report in pdf format

Michael Wimmer
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