User Guide
3D Mapping of Outdoor Scenes Using Stereo Imagery
TSBB11 - Images and Graphics, Project course CDIO

Mattias Carlsson, matca525
Max Gefvert, maxge869
Björn Kernell, bjoke388
Johan Lind, johli887
Sebastian Parborg, sebpa892

December 16, 2016
version 0.1

1   Installation

The system is built on previously developed modules. The following GitHub repositories and programs need to be downloaded and installed:

ORB-SLAM2
https://github.com/raulmur/ORB_SLAM2

SPS-Stereo
https://github.com/vbodlloyd/StereoSegmentation

3drecon
https://github.com/brianfactor/3drecon

stereo-calibration
https://github.com/sourishg/stereo-calibration

PCL, installed with "tools"
http://www.pointclouds.org/downloads/linux.html

Blender
https://www.blender.org/download/

All repositories, except for PCL and Blender, are included in our repository. In order for them to work, their respective dependencies also need to be installed. See the documentation on each projects GitHub page for more information.

To clone and install outr repository, type the following:

```
git clone --recursive https://github.com/DarkDefender/TSBB11.git
cd TSBB11
./build.sh
```

The system is tested on Linux. It should be possible to install on OS X, the only problem is ORB-SLAM2. Currently, ORB-SLAM2 can not be compiled with the latest stable version of Clang. It needs to be compiled with GCC. Therefore we do not currently expect the user to have ORB-SLAM2 installed/compiled. So, if everything else is installed on OS X, the current version of the pipeline skips the part that uses ORB-SLAM2 and requires a pre-generated camera path (that we usually generate with ORB-SLAM2) to be supplied.

2   Recording

Make sure that the camera is not too close or too far from the object, between one and ten meters. Try to always keep the object in frame during the recording session. Walk around the object in normal pace and make sure to record atleast a full lap around the object. When you are done recording you should have two video files. One for the left camera and one for the right.

3 Calibration

In order for the pipeline to work, the camera parameters need to be known. To calibrate, record a short sequence of a checkered board. The board needs to be flat and the size of the squared need to be known. Rotate the board in different orientation. Try to move around the board so that it has traversed all corners of the cameras field of view and that it is visible for both cameras.

The recorded calibration sequence should be saved as two video files. One file for the left camera and one for the right.

To perform the actual calibration, simply run the calibration script with the left and right sequence, the size of the squares in meters, the width and height of the board (meaning the number of midpoints). For example:

```
./calib_stereo.sh left.avi right.avi 0.035 8 6
```

4 Main Run Script

When building and calibration is done, run the binary "run.sh" with the path to the left and right camera files and the calibration file, e.g:

```
./run.sh left.avi right.avi data/calib/stereo_cam.yml
```

At the end of the script, Blender will open. There, you will need to manually cut out the relevant part of the mesh and make sure there are no holes in it. If it is the first time running Blender, you need to add an add-on. To do this, go to "User Preferences" under "file".
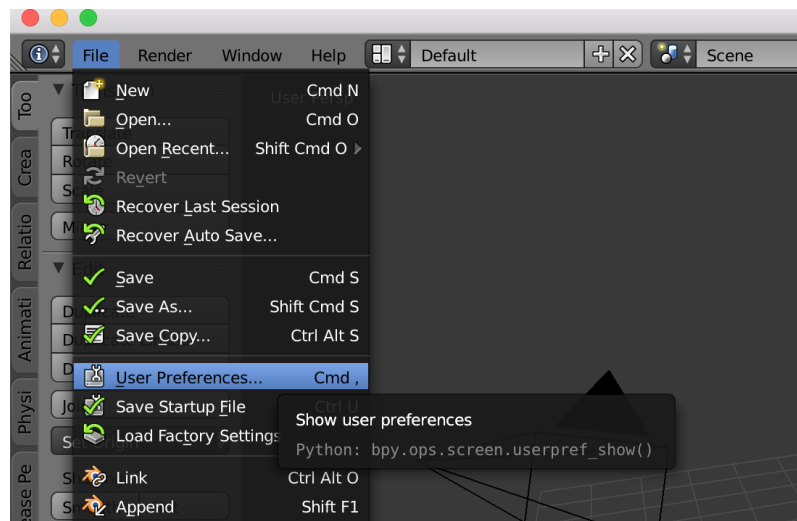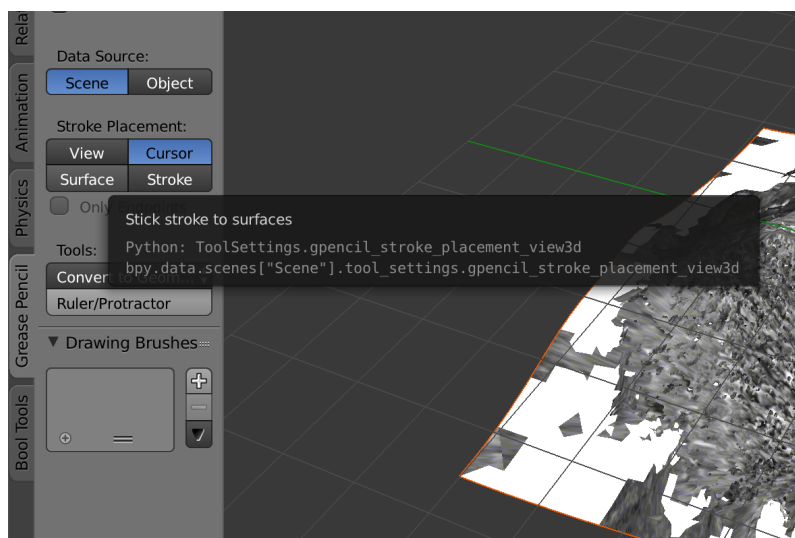

Then go to the "Add-ons" tab and search for "bool". Check the box next to "Object: Bool Tool" and press "Save User Settings". This only needs to be

done once.
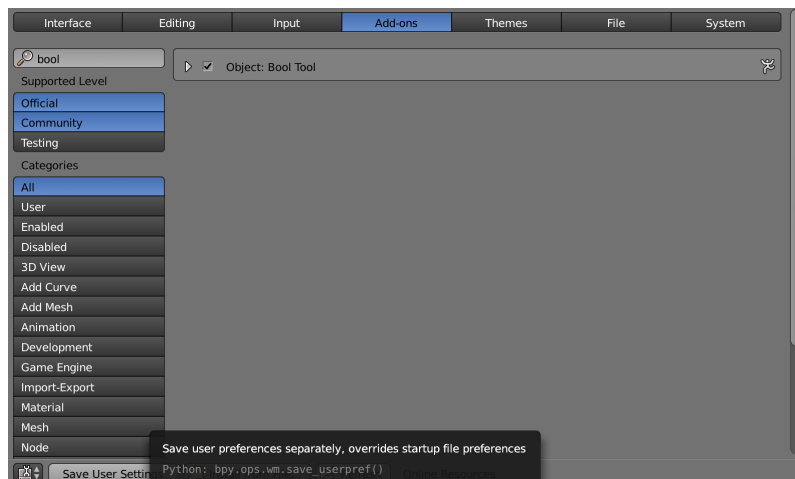
To cut out the relevant part of the mesh, follow these steps:

1. Select the "Grease Pencil" tab and make sure "surface" is selected under "Stroke placement".

2. Select the "Bool Tool" tab. Make sure you have a good view of the area you want to cut. Click on the "Draw Poly Brush" then select, in order, the path that you want to use to cut the mesh. You do not have to manually close the path. The start and end point will be connected automatically. Press the enter key when you are done. (Esc key if you want to cancel).
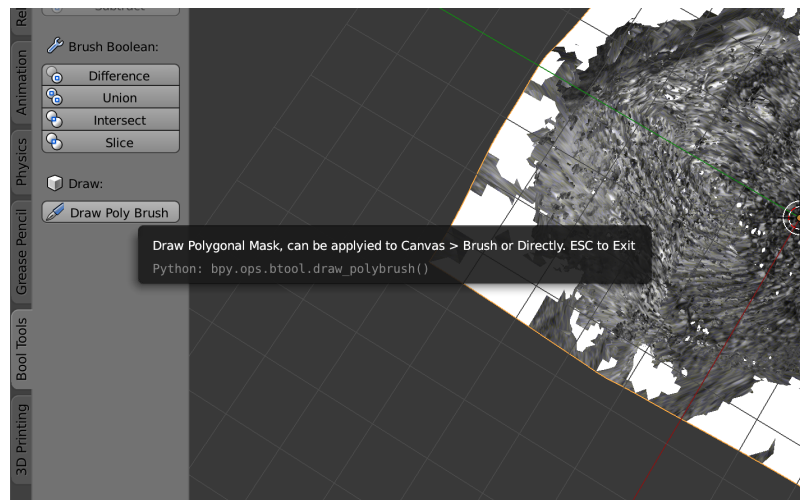
Now you should have created a mesh. You will use it to remove everything outside of it. If you need to make the mesh higher. Select it (right click) and you can the tweak the height of it in the toolbar to the left. (Under "Properties" and change "size")
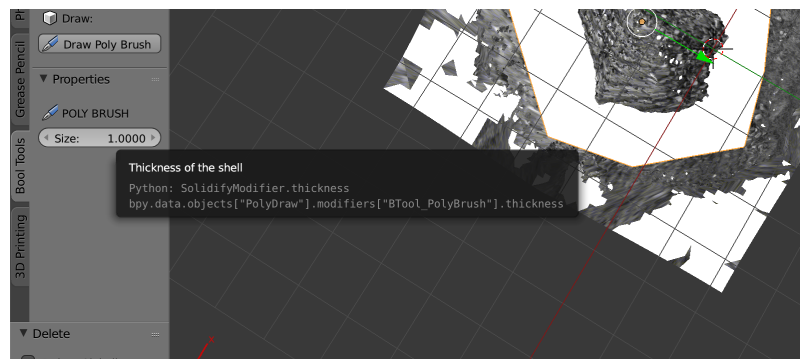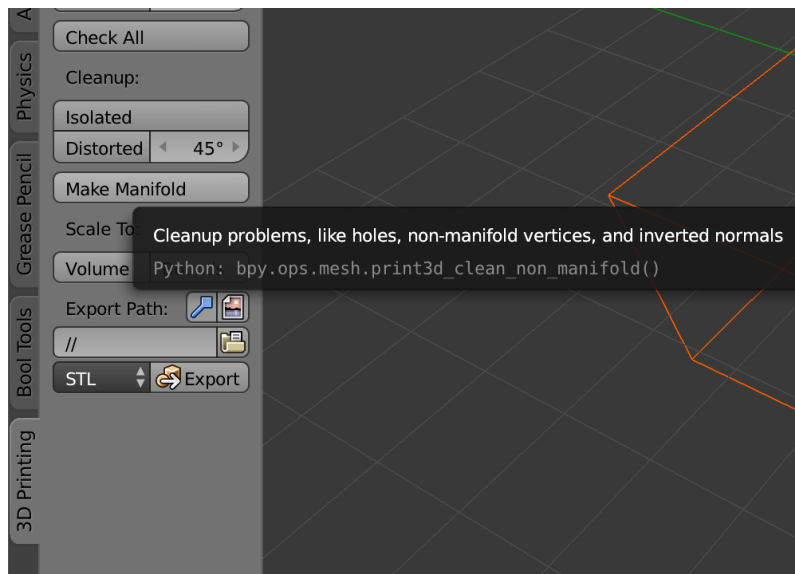

3. Select the cutout mesh and the mesh from the 3d scan (shift + right click). Then press the "intersect" button in the "Bool tool" tab.
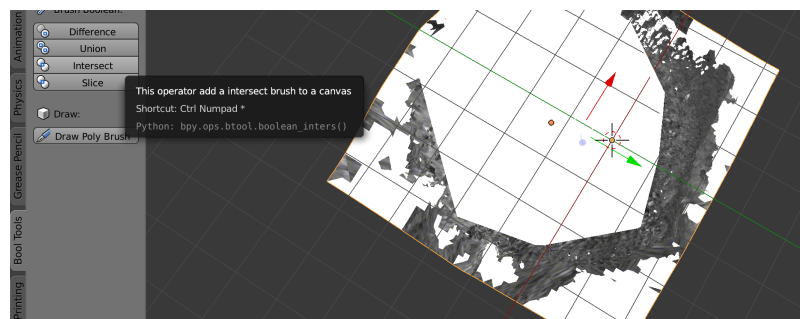
Now select the "modifier tab" (the one with the wrench icon on the left) and from top to bottom, click apply on each modifier.
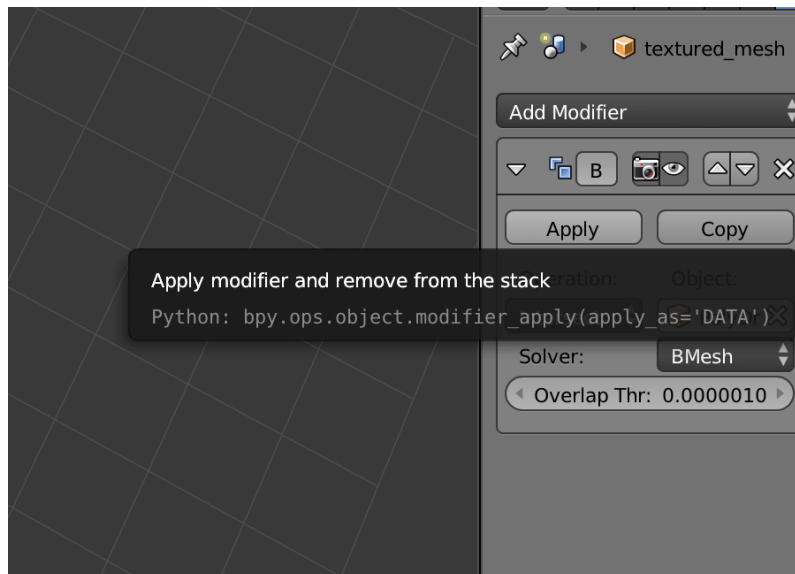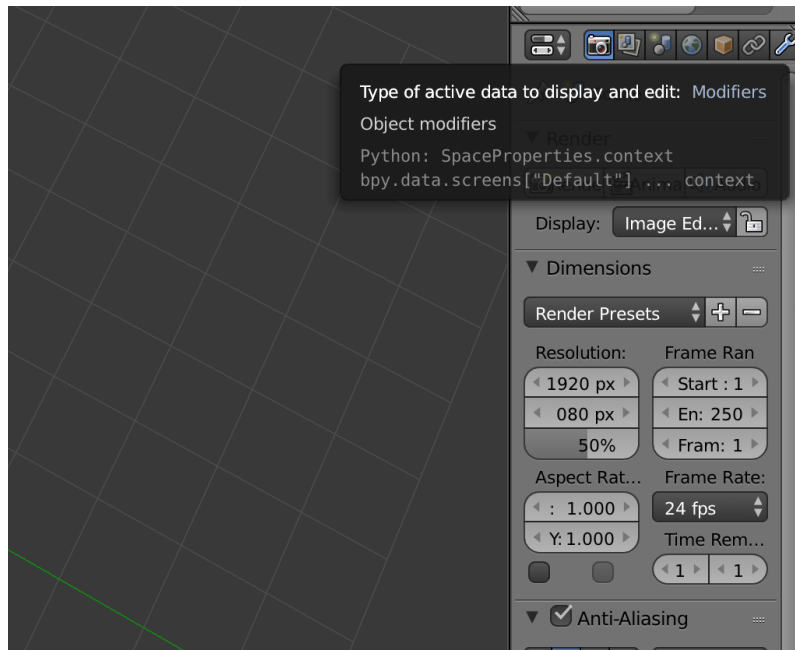
4. Select the "3d Print" tab and select the mesh (right click). Now click the "Make manifold" button to close any mesh holes.

5. Lastly click the "volume" button and the calculated volume should be printed at the bottom of the "3d Print" tab.