Assignment 2: 3D Reconstruction

Due Date: May 22, 2018

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1. Introduction

In this assignment, you will try your best to accomplish three tasks. The three tasks have different degrees of difficulty. The more tasks you accomplish, the higher score you will get. Here are the basic scores of different tasks:

- Easy task: 50
- Medium task: 30
- Hard task: 20

2. Tasks

2.1 Easy

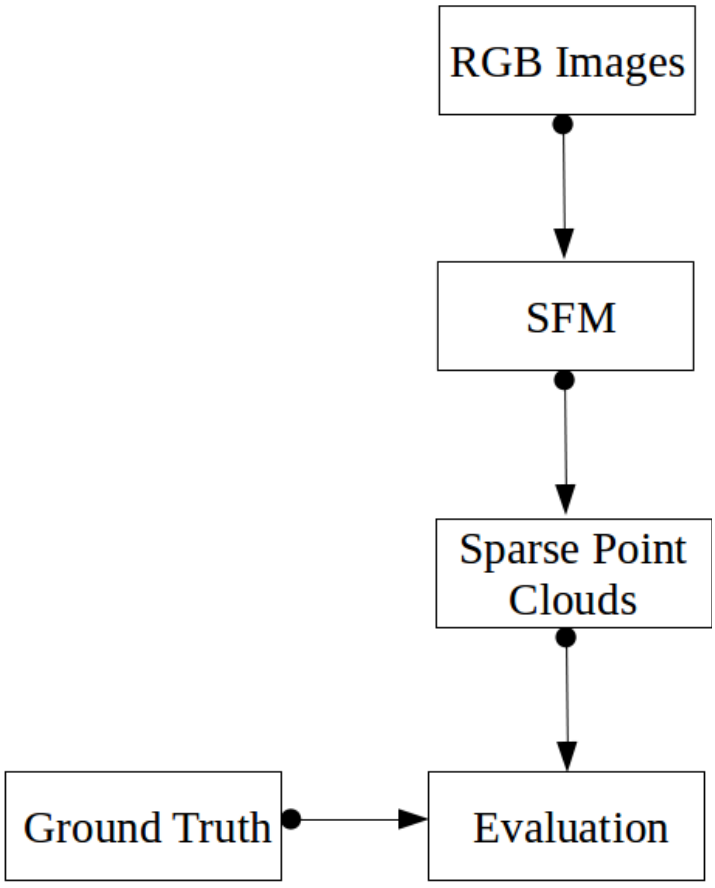

Figure 1: Easy task

In this task, you will compile four softwares for 3D reconstruction and compare the performance of the four different softwares by using specified evaluation methodology.

The whole framework of the implementation for 3D reconstruction is shown in Figure 1, it may serve as a reference for your task.

You need to download the dataset first. The dataset is a subset of MVS data set(Rasmus Jensen, Anders Dahl, George Vogiatzis, Engin Tola, Henrik Aanaes, "**Large Scale Multi-view Stereopsis Evaluation**", CVPR, 2014, http://roboimagedata.compute.dtu.dk/?page_id=36). Considering the size of MVS data set, we use a subset of it. You can download from here:

https://pan.baidu.com/s/1vLph4YRO7RBX1mx3nlC8Ig

password: 72gf

2.1.1 Structure from Motion

Then you need to use following four softwares to get sparse point clouds from RGB images.

- Bundler (code: http://www.cs.cornell.edu/~snavely/bundler/)
- openMVG (code: https://github.com/openMVG/openMVG/)
- colmap (code: https://github.com/colmap/colmap)
- VisualSFM (code: http://ccwu.me/vsfm/)

2.1.2 Modeling

To see the shape of the sparse point clouds, you can use Meshlab (website:http://www.meshlab.net).

2.1.3 Evaluation

In this part, you will compare the quality of different sparse point clouds and models using specified evaluation methodology. The specified evaluation methodology comes from "Koutsoudis A, Vidmar B, Ioannakis G, et al. Multi-image 3D reconstruction data evaluation. Journal of Cultural Heritage, 2014".

We will evaluate the four methods from the following aspects at least.

- efficiency of the software (run time, complexity)
- points number (by Meshlab software)
- shape of the result (by our vision and comprehension)
- completeness of the result (by our vision and comprehension)
- matching degree between the result and ground truth (by CloudCompare software)

2.2 Medium

In this task, **apart from** finishing the **easy task**, you need to do more. See figure 2 to understand better.

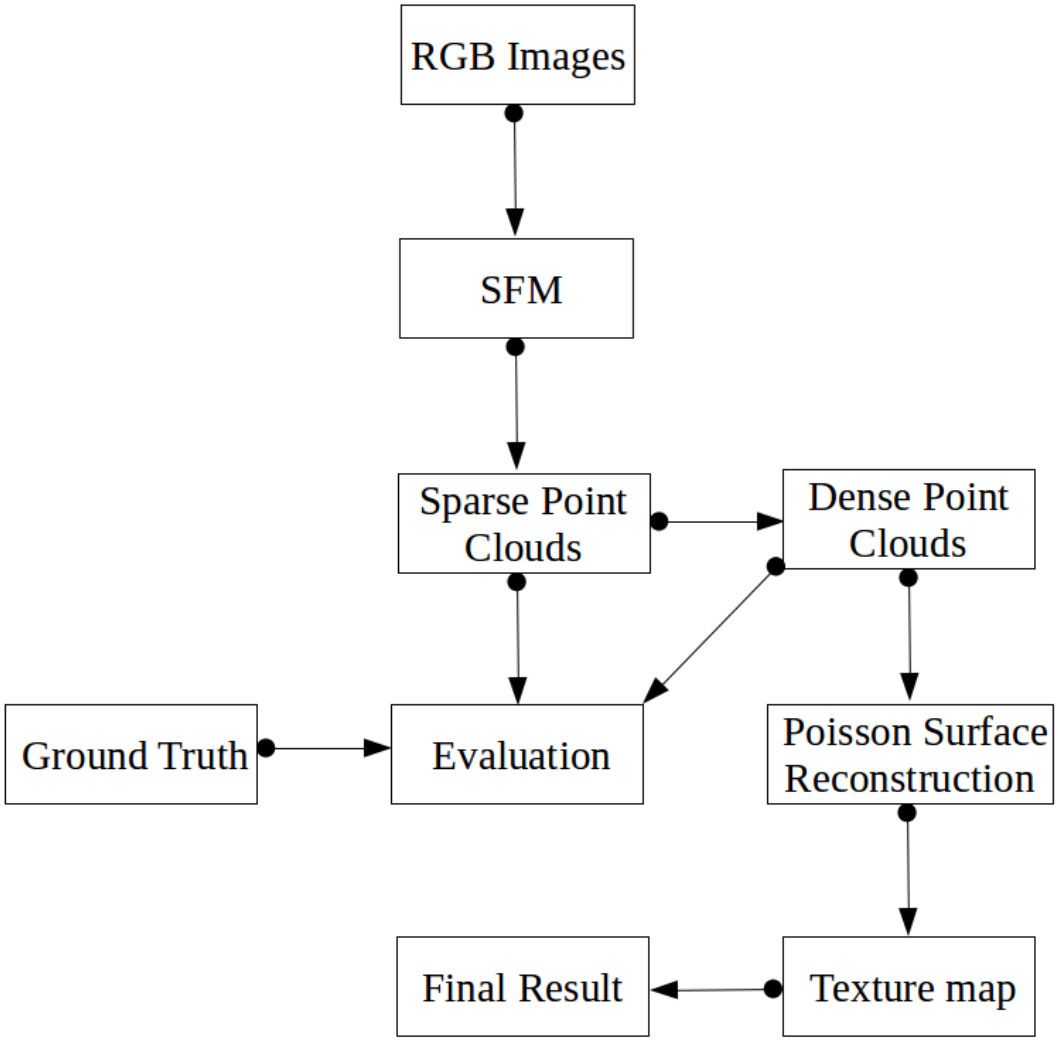

Figure 2: Medium task

2.2.1 Dense Reconstruction

Use PMVS2 (code:http://www.di.ens.fr/pmvs/) to reconstruction dense point clouds from sparse point clouds got from the **easy task**.

2.2.2 Surface Reconstruction

Then use Poisson Surface Reconstruction to reconstruct the surface. Poisson Surface Reconstruction can be found in Meshlab software.

2.2.3 Texture Map

After surface reconstruction, you need to use texture map to accomplish the final reconstruction. Texture map can also be found in Meshlab software. You need to show your final 3D reconstruction result using meshlab.

2.2.4 Evaluation

You need to evaluate the dense point clouds and the final result using the methodology in the easy task.

2.3 Hard

In this task, **apart from** finishing the **easy task** and the **medium task**, you also need to take pictures by yourself and reconstruct 3D models based on your own pictures. When you take pictures, you should notice the features correspondence and non-Lambertian problem. Show your final results.

3. Submission

- Your code.
- Your results.
- A report with your methods, results and analysis of SFM.

Zip all your files and submit your assignment to ouceecv@163.com with the subject: YourName_Assignment2.zip. The name of your zip file should be the same as the email subject.