Lab 05. SfM and MVS with COLMAP

Introduction to Computer Vision, Lab 05.

Today

- COLMAP-SfM（作业）
- COLMAP-MVS（如果有CUDA可以尝试）
- 作业要求

COLMAP

- 文档：https://colmap.github.io
- 简介：COLMAP is a general-purpose Structure-from-Motion (SfM) and Multi-View Stereo (MVS) pipeline with a graphical and command-line interface. It offers a wide range of features for reconstruction of ordered and unordered image collections.
- 下载说明：如果mac安装最新版有问题，请使用3.5版本 https://github.com/colmap/colmap/releases/tag/3.5

COLMAP-Data

在文件夹下提供了一组航拍数据1109_MMW_DJIAir2S_0003/*.jpg

COLMAP-SfM-命令行

构建项目文件夹，将图片导入

```
DATASET_PATH=/path/to/lab5
mkdir $DATASET_PATH/images
cp -r /path/to/*.jpg $DATASET_PATH/images/
```

特征提取（SIFT）

```
colmap feature_extractor \ --database_path $DATASET_PATH/database.db \
--image_path $DATASET_PATH/images
```

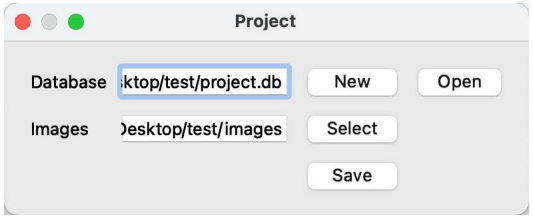
特征匹配

```
colmap exhaustive_matcher \ --database_path $DATASET_PATH/database.db
```

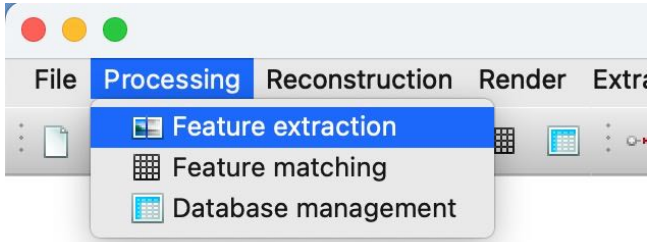
稀疏重建

```
mkdir $DATASET_PATH/sparse
colmap mapper \ --database_path $DATASET_PATH/database.db \ --image_path
$DATASET_PATH/images \ --output_path $DATASET_PATH/sparse
```

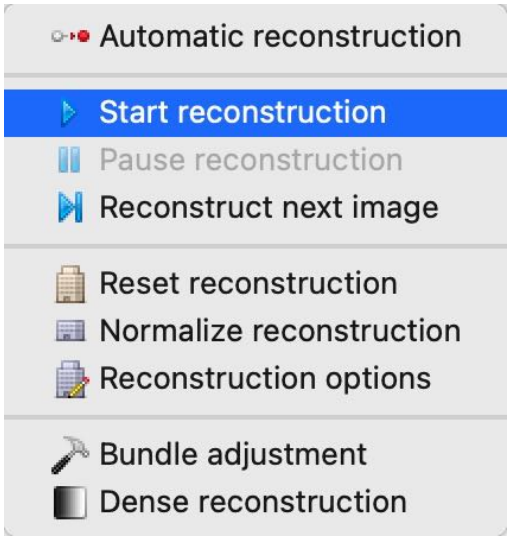
COLMAP-SfM-图形化



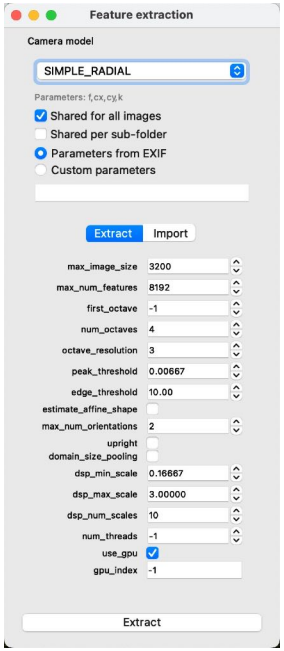
1.初始化工程



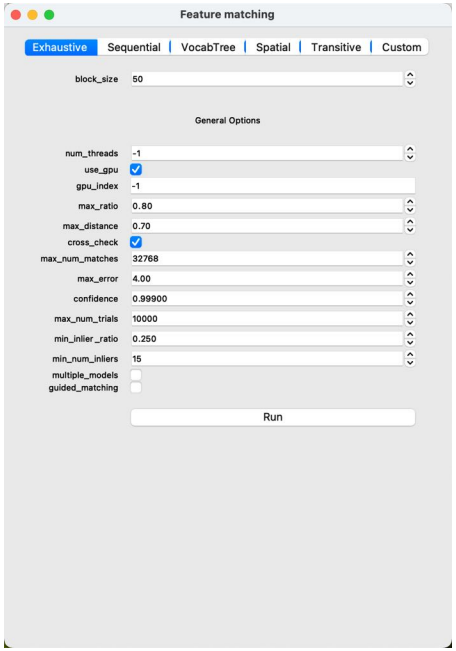
2. 特征提取和匹配



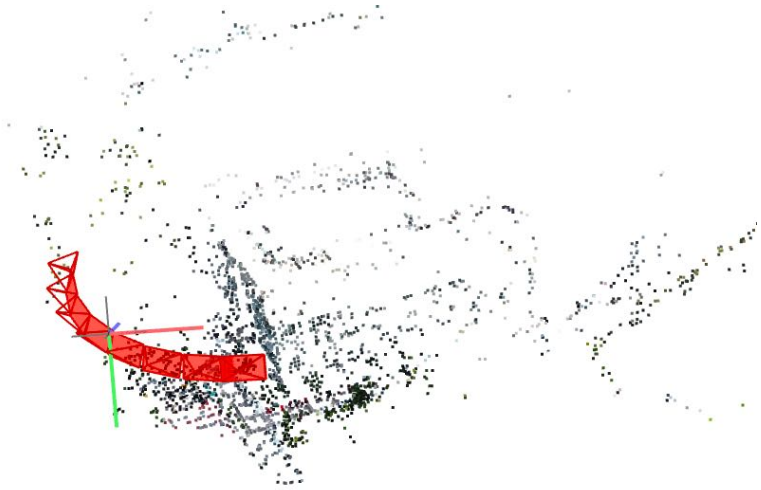
3. 稀疏重建



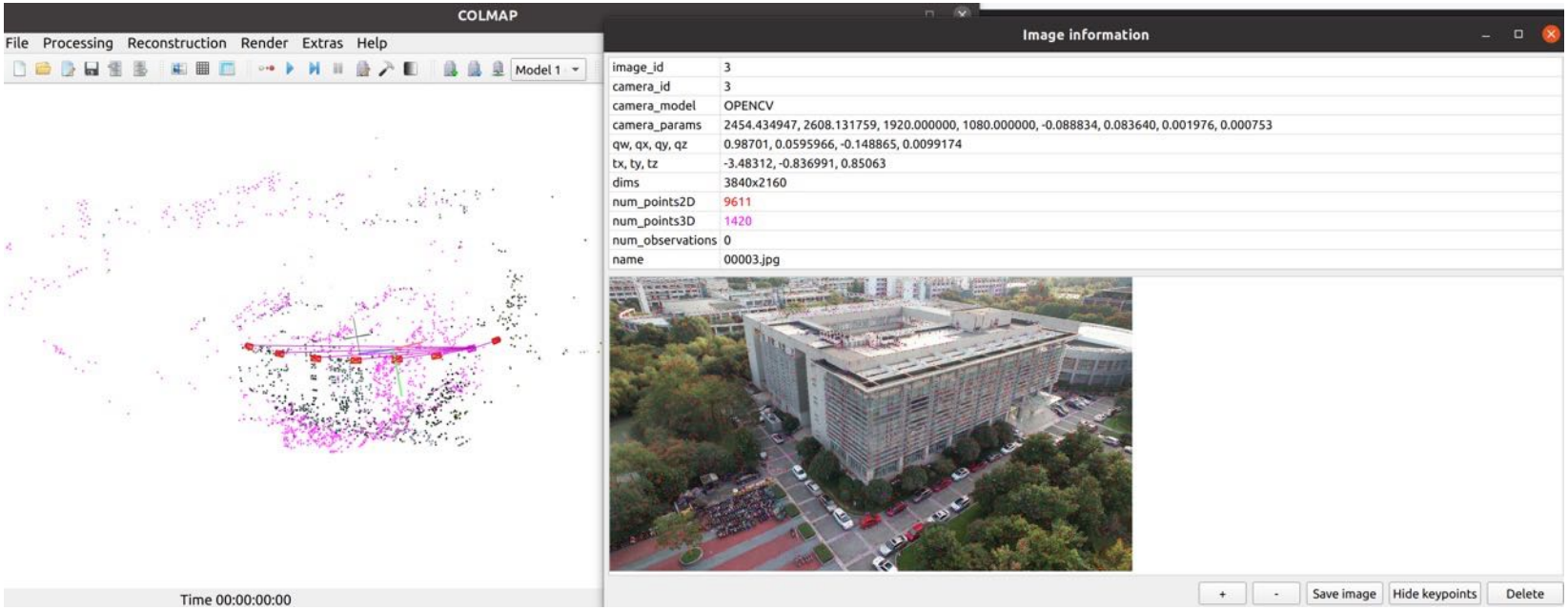
提取



匹配



COLMAP-SfM


COLMAP
File Processing Reconstruction Render Extras Help
Model 1
Time 00:00:00:00
Image information
image_id 3
camera_id 3
camera_model OPENCV
camera_params 2454.434947, 2608.131759, 1920.000000, 1080.000000, -0.088834, 0.083640, 0.001976, 0.000753
qw, qx, qy, qz 0.98701, 0.0595966, -0.148865, 0.0099174
tx, ty, tz -3.48312, -0.836991, 0.85063
dims 3840x2160
num_points2D 9611
num_points3D 1420
num_observations 0
name 00003.jpg
+
-
Save image
Hide keypoints
Delete

Today

- COLMAP-SfM（作业）
- COLMAP-MVS（如果有CUDA可以尝试）

COLMAP-MVS

- **需要CUDA才能执行，不记入作业。可以自行尝试。**

重新校正图片

```
mkdir $DATASET_PATH/dense
colmap image_undistorter \ --image_path $DATASET_PATH/images \ --
input_path $DATASET_PATH/sparse/0 \ --output_path
$DATASET_PATH/dense \ --output_type COLMAP \ --max_image_size 2000
```

Stero算法（PatchMatch）

```
colmap patch_match_stereo \ --workspace_path $DATASET_PATH/dense \ --
workspace_format COLMAP \ --PatchMatchStereo.geom_consistency true
```

Stereo Fusion算法

```
colmap stereo_fusion \ --workspace_path $DATASET_PATH/dense \ --
workspace_format COLMAP \ --input_type geometric \ --output_path
$DATASET_PATH/dense/fused.ply
```

COLMAP-MVS

泊松重建

```
colmap poisson_mesher \ --input_path $DATASET_PATH/dense/fused.ply \ --output_path $DATASET_PATH/dense/meshed-poisson.ply
```

德劳内重建

```
colmap delaunay_mesher \ --input_path $DATASET_PATH/dense \ --output_path $DATASET_PATH/dense/meshed-delaunay.ply
```

COLMAP-MVS

稠密点云

COLMAP-MVS

泊松重建mesh

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lab5要求

1. 查阅相关文档，完成稀疏重建

   得到稀疏模型（cameras.bin，images.bin，points3D.bin）

2. 提取00001.jpg的二维关键点、特征描述子。在图片上可视化二维关键点

   参考read_write_model.py（或其他COLMAP Python帮助脚本）

   https://github.com/colmap/colmap/tree/dev/scripts

3. 在matplotlib中可视化三维稀疏模型点云，将和00001.jpg关联的关键点用特别的颜色标出

4. 将截图与回答填写到lab5_name_id.docx上传pdf

- End-of-the-slides