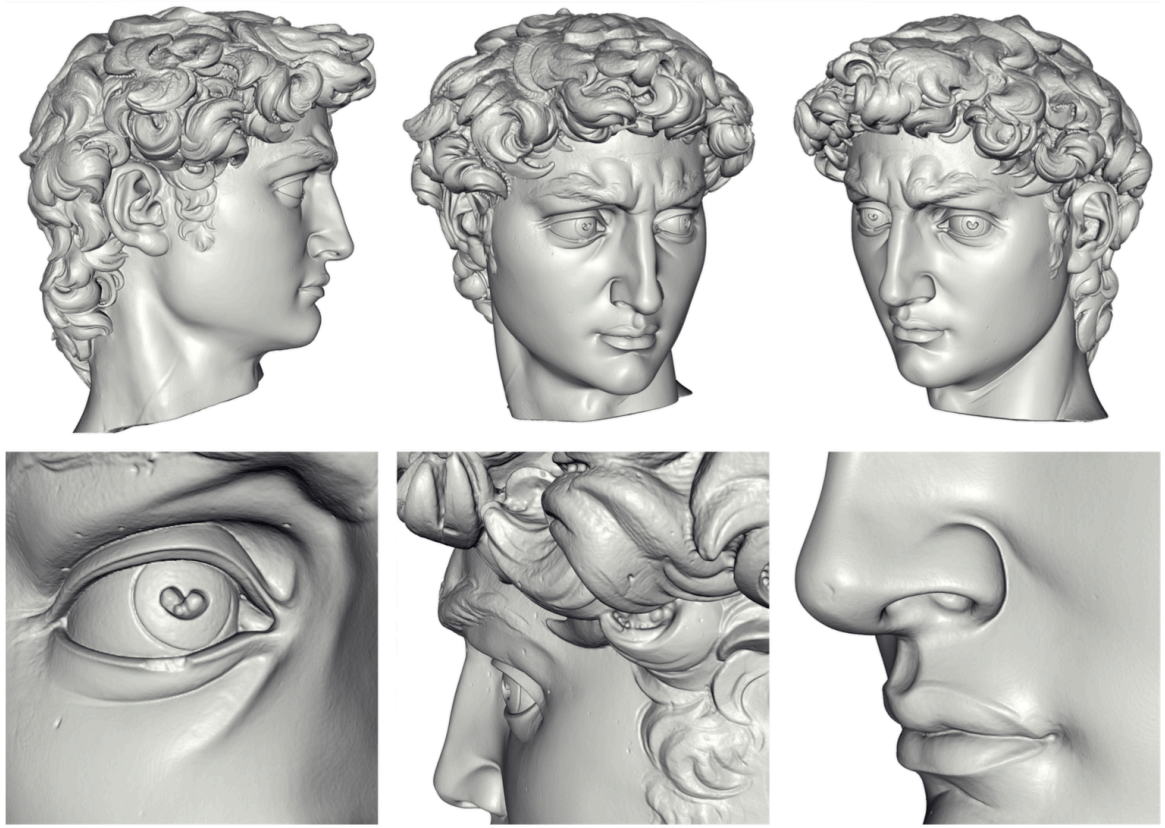


Discussion

3D Reconstruction

Shanchen Jiang

Kazhdan M, Hoppe H. Screened poisson surface reconstruction. ACM Transactions on Graphics (TOG), 2013

3D Reconstruction

GBM

Geometry Based Modeling

DSM

Depth Scanning Modeling

IBM

Image Based Modeling

3D Reconstruction

GBM

Geometry Based Modeling

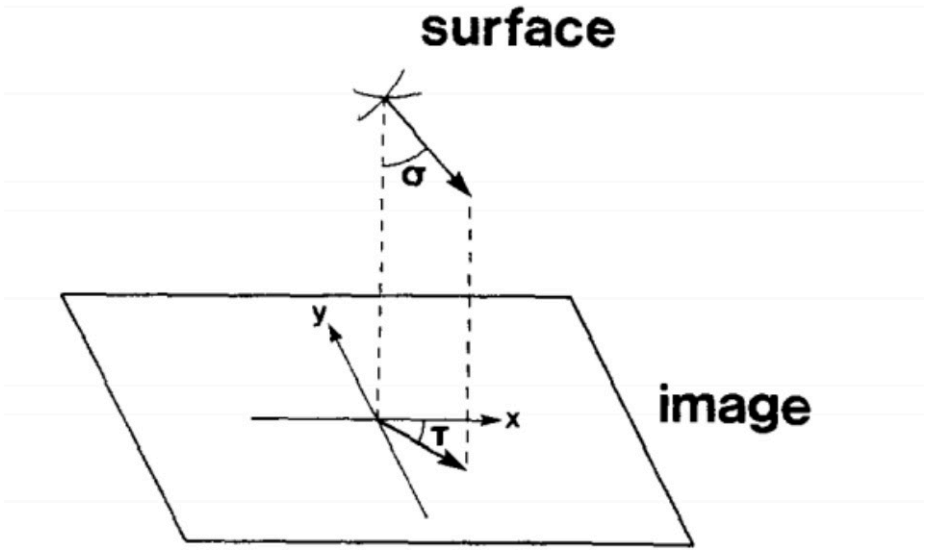
DSM

Depth Scanning Modeling

IBM

Image Based Modeling

Shape from Texture

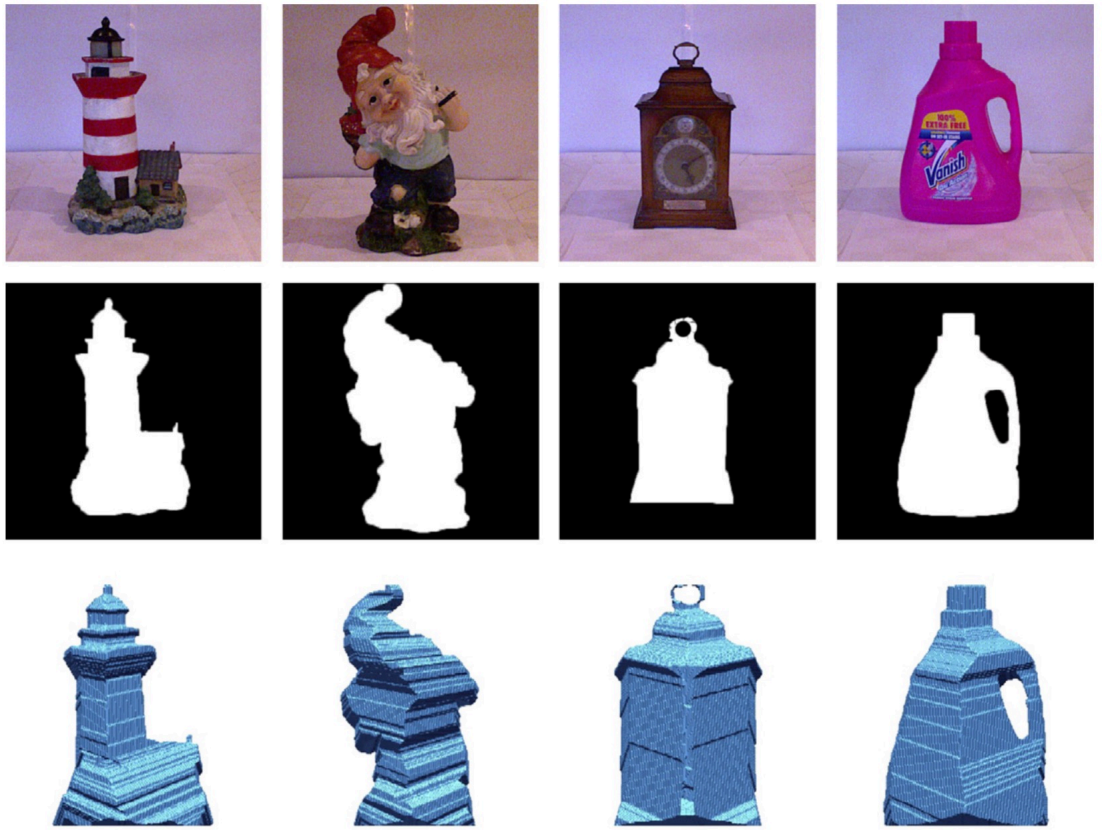


Witkin A P. "Recovering surface shape and orientation from texture." *Artificial intelligence*, 1981.

Image based modeling

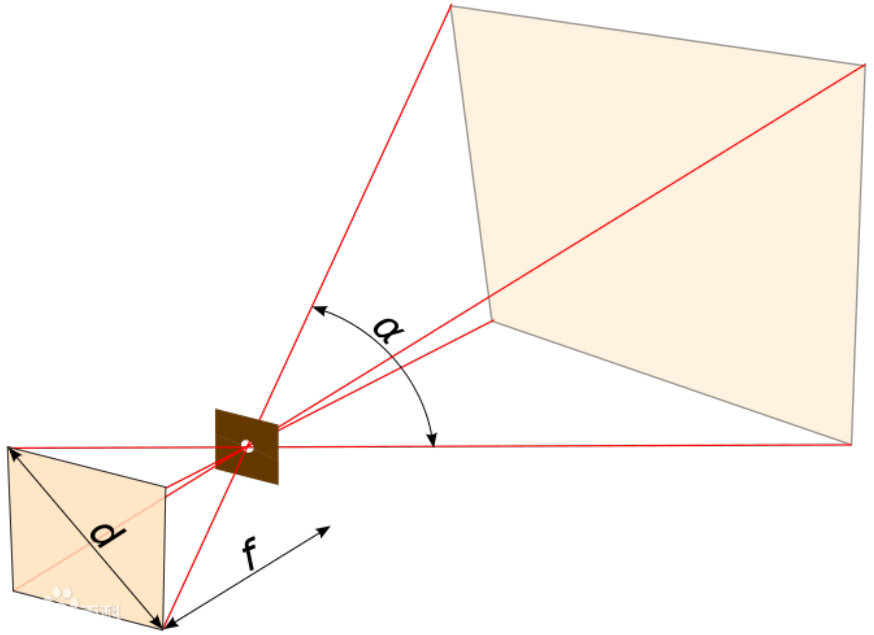
Shape from Silhouettes

Divide the three-dimensional space into voxels



Martin W N and Jagdishkumar K A. "Volumetric descriptions of objects from multiple views." *IEEE transactions on pattern analysis and machine intelligence*, 1983.

Shape from Focus

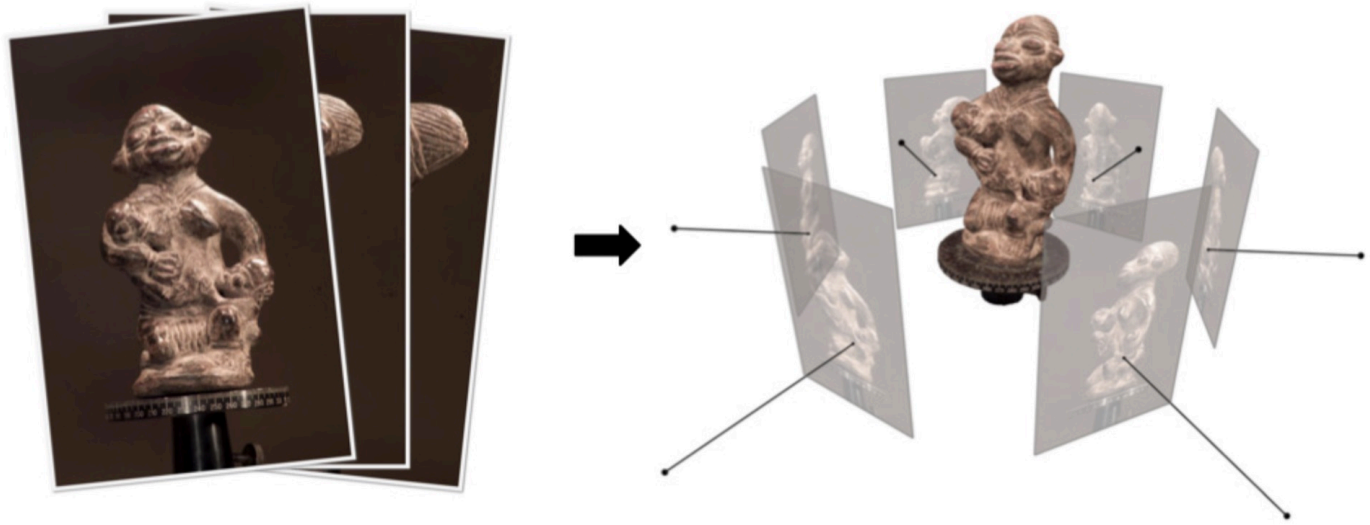


Rajagopalan A N and Subhasis C. “Optimal selection of camera parameters for recovery of depth from defocused images.” *CVPR*, 1997.

Comparison

Method		Complexity	Automation	Result	Applied range
Monocular	shade	bad	good	bad	bad
	stereo	bad	normal	normal	bad
	texture	bad	good	bad	bad
	silhouette	normal	good	normal	normal
	focus	bad	bad	good	bad
	motion	good	good	good	good
Binocular		good	good	good	good

Multi-view stereo



1.Collect images
2.Compute camera parameters
3.Reconstruct the 3D geometry of the scene from the set of images and corresponding camera parameters
4.Optionally reconstruct

Assignment

Structure from Motion

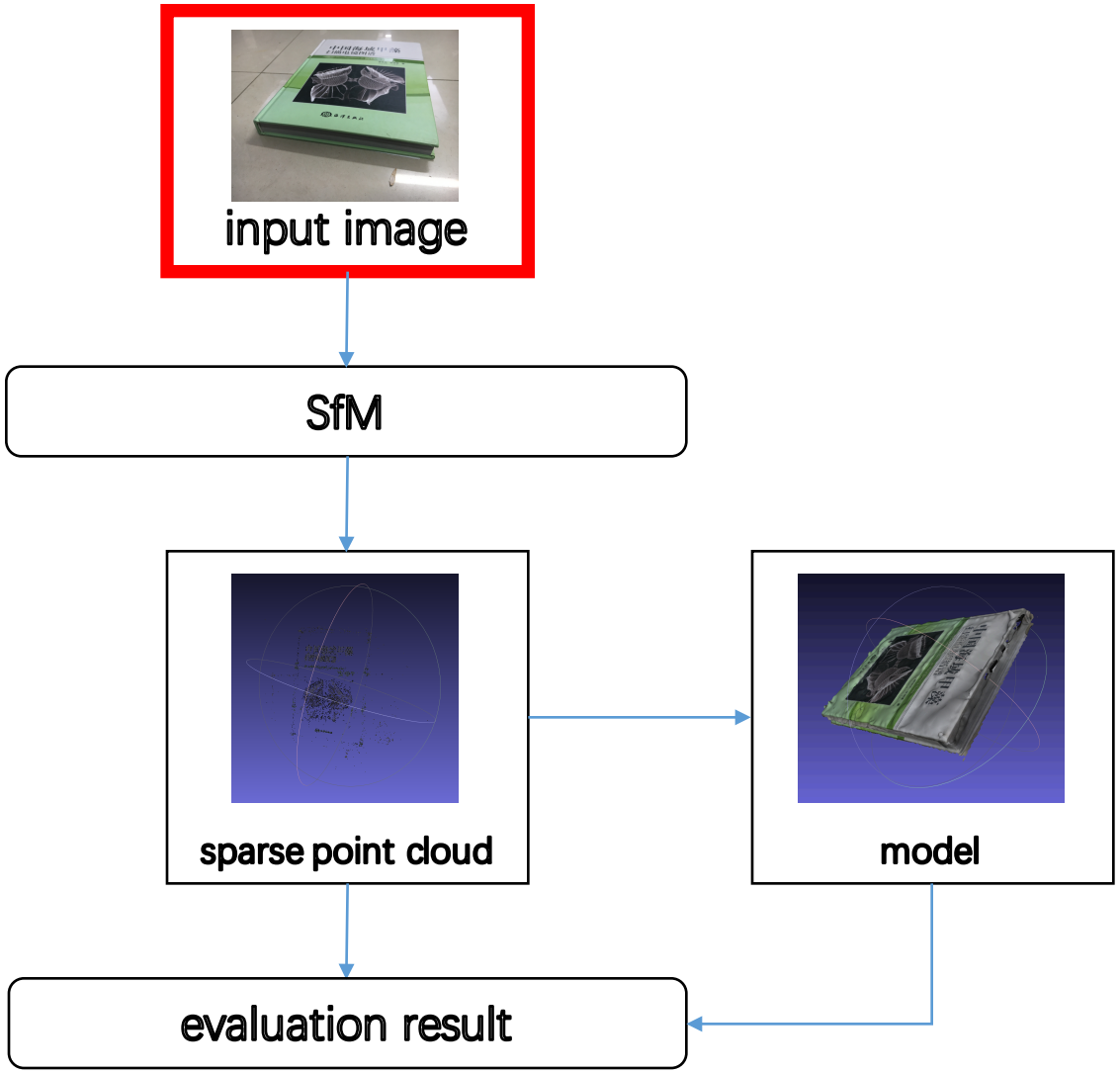
two-dimensional image sequences

three-dimensional structures

Structure from motion

- **Detect 2D features in every input image**
- **Match 2D features between images**
- **Construct 2D tracks from the matches**
- **Solve for the SfM model from the 2D tracks**
- **Refine the SfM model using bundle adjustment**

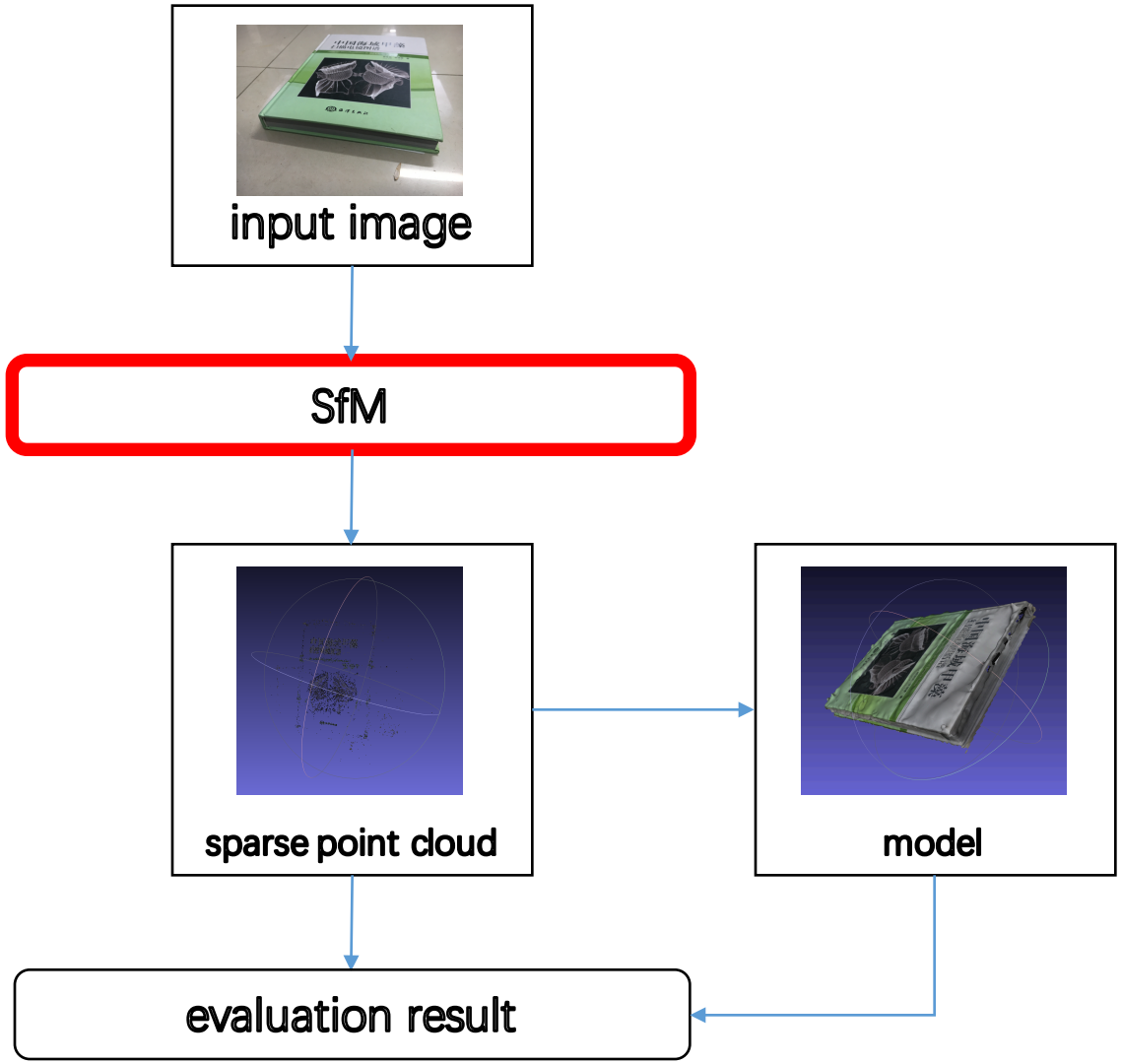
Assignment



MVS Data Set – 2014

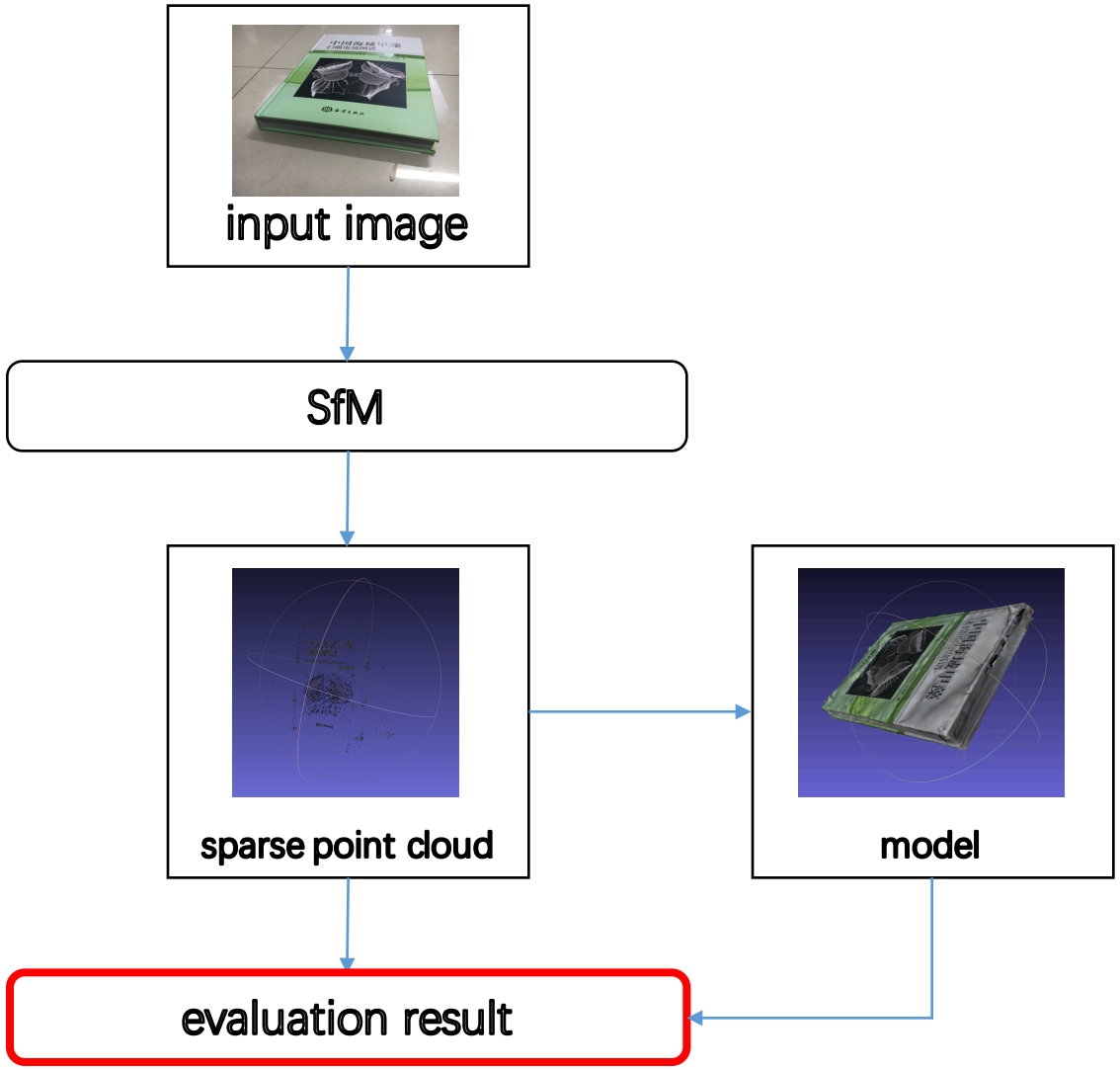
The data set consist of 124 different scenes, where 80 of them have been used in the evaluation of their paper. The scenes include a wide range of objects in an effort to span the MVS problem. At the same time, the data set also include scenes with very similar objects, e.g. model houses, such that intra class variability can be explored.

Assignment



SfM：
1.Bundler
2.openMVG
3.colmap

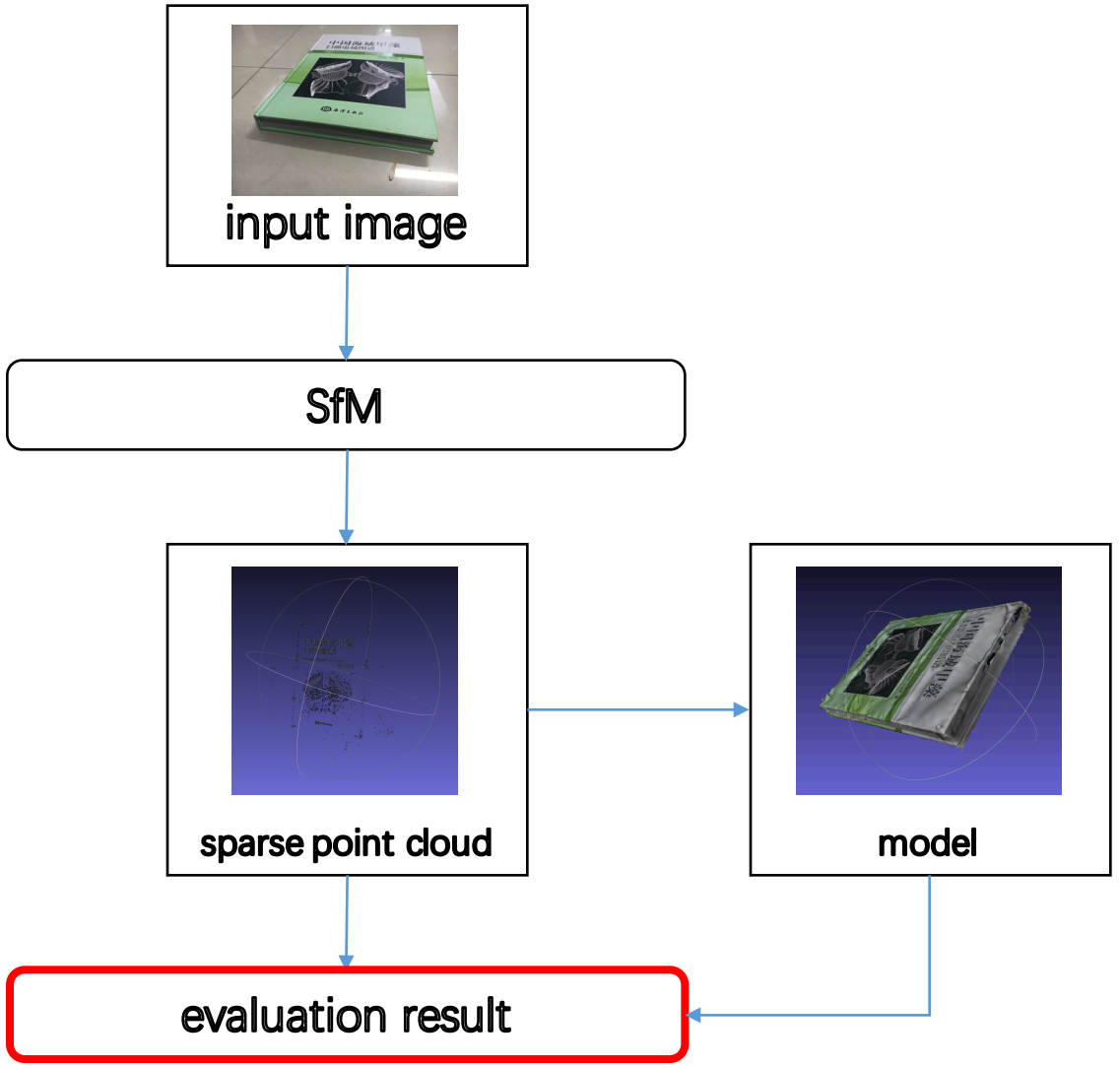
Assignment



Evaluation

1.efficiency of the software (run time, complexity)
2.shape of the result (by human eye)
3.completeness of the result (by human eye)
4.matching degree between the result and ground truth (by CloudCompare software)

Assignment



Submission

1. Your code.
2. Your results.
3. A report with your methods and results of explanation and analysis.

Zip all your les and submit your assignment to *ouceecv@163.com* with the subject: *YourName_Assignment5.zip*. The name of your zip file should be the same as the email subject.

Evaluation

No true model

True model

No true model

Reconstruction error[1]

Integral error[2]

3D Gini coefficient[3]

[1] Alliez P, Saboret L. "Surface Reconstruction from Point Sets." , CGAL User and Reference Manual, 2010.
[2] Andrea A, *et al*. "Multigrid time-accurate integration of Navier-Stokes equations." *CFDC*, 1993.
[3] Song R, *et al*. "An evaluation method for multiview surface reconstruction algorithms." *3DIMPVT*, 2012 .

True model

Shape error[1]

Resolve Method[2]

Phase moments[3]

[1] Jin H, Soatto S and Anthony J. “Multi-view stereo reconstruction of dense shape and complex appearance.” *IJCV*, 2005.
[2] 张雯 等, "三维模型几何质量评价方法.” , *测绘通报* , 2014.
[3] 公明 等, "相位矩不变量用于评价基于图像的三维重建结果." , *计算机辅助设计与图形学学报*, 2013

Software

CapturingReality

Fullbody Scanning

3D human scanning for medicine and computer graphics. Create high resolution 3D models.

Cultural Heritage

Combine laser scans and images to create accurate 3D reconstructions. Process thousands of objects quickly.

Image-based Modeling

Create accurate and textured 3D models using images. Perfect for architecture visualizations, computer games and more.

Paintings Reconstruction

Reconstruct paintings, stitch hundreds of images to produce a single accurate high resolution image.

Mapping and Measuring

Create accurate georeferenced 3D maps, orthophoto projections and digital surface models. Measure volumes and distances.

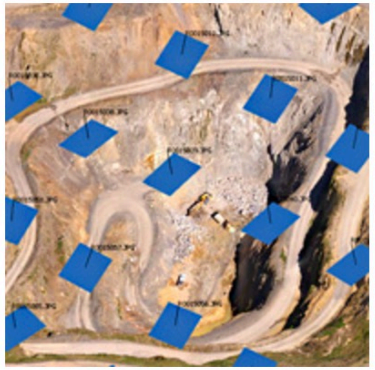
Large-scale Projects

Create city-scale 3D models, combine tens of thousands of images and laser scans. RealityCapture is the best choice for creating virtual reality content.

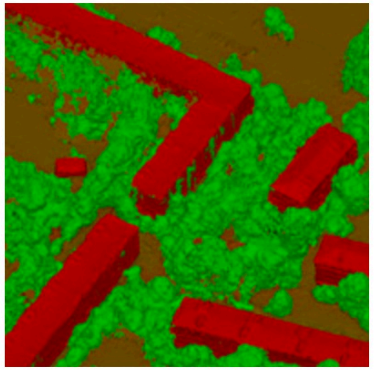
Software

Agisoft

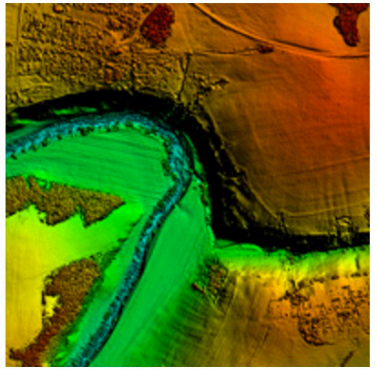
Photogrammetric triangulation



Dense point cloud: editing and classification



Digital elevation model: DSM/DTM export



Georeferenced orthomosaic export

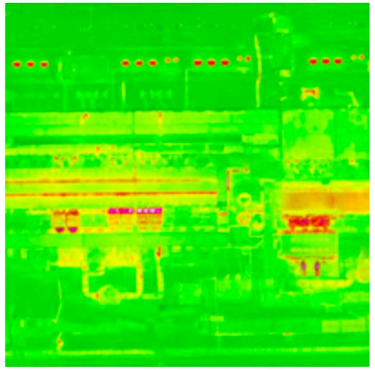
Measurements: distances, areas, volumes

Ground control points: high accuracy surveying

Python scripts: customize processing workflow

```
>>> import PhotoScan
>>> doc =
PhotoScan.app.document
# open PhotoScan project
>>> doc.open('project.psz')
True
>>> chunk = doc.activeChunk
# build 3D model
>>> chunk.buildModel()
True
# measure 3D model volume
>>> chunk.model.volume()
842.1499049271656
```

Multispectral imagery processing

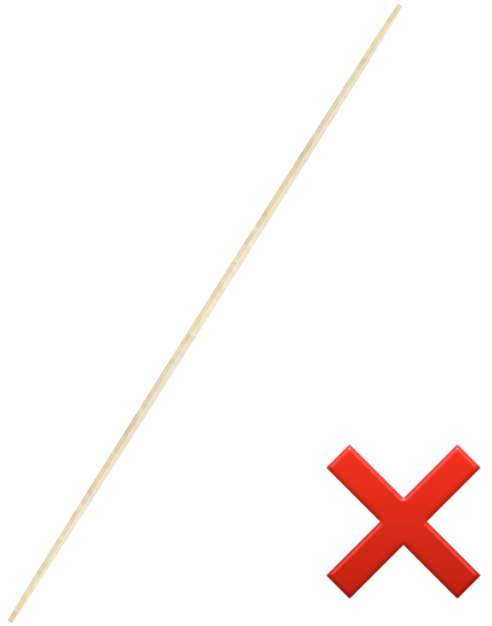


Limitation

Lack of texture

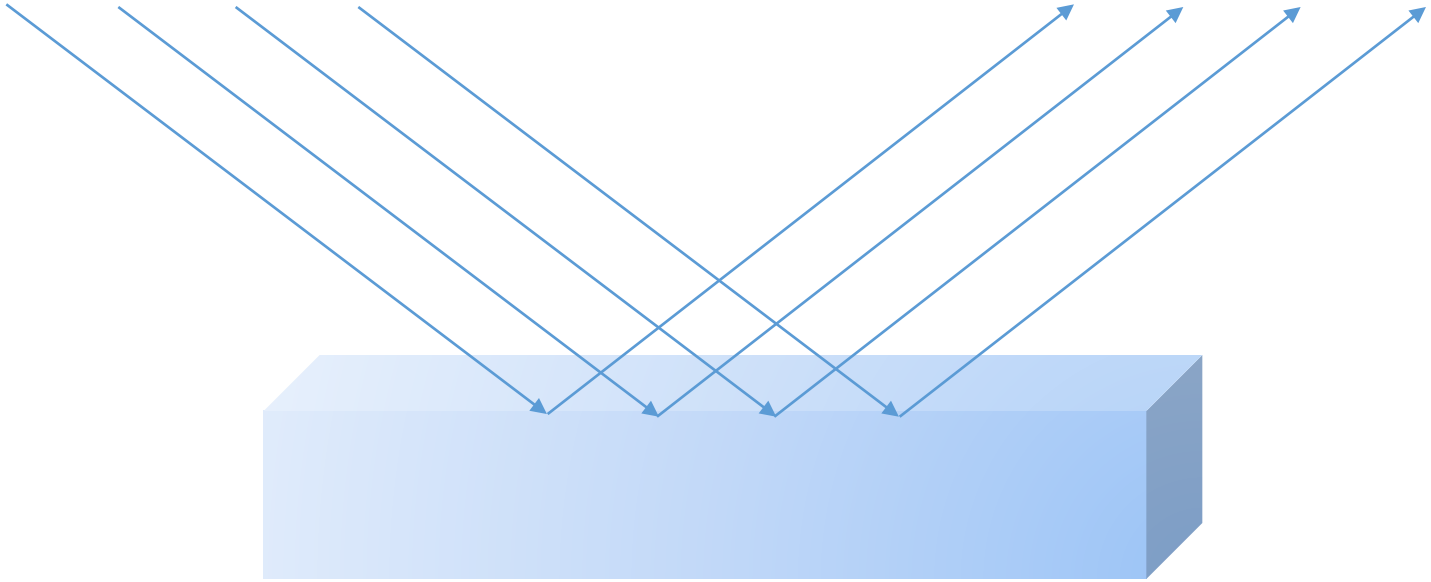
Limitation

Thin structures



Limitation

Non-Lambertian surfaces



Future

1. Nonrigid object
2. Large-scale scene
3. Tiny scene
4. Understanding