2017 GSA: Introduction to Structure from Motion (SfM) Photogrammetry for Earth Science Research and Education short course

864 Chris Crosby November 3, 2017 Structure from Motion (SfM) Photogrammetry 3823

2017 Geological Society of America Annual Meeting Short Course, Seattle, WA

513. High Resolution Topography and 3D Imaging II: Introduction to Structure from Motion (SfM) Photogrammetry

Sat. 21 Oct., 8 a.m.–5 p.m. WSCC, 214

Instructors: Edwin Nissen, Colorado School of Mines; Ramon Arrowsmith & Adam Wade, Arizona State Univ.; Christopher Crosby, UNAVCO

Supported by: UNAVCO & OpenTopography

Abstract: Structure from Motion (SfM), a photogrammetric technique that uses overlapping images to construct 3D surface models, is quickly emerging as a valuable research and education tool in geodesy, geomorphology, structural geology, and related disciplines. Images can be collected with a standard consumer-grade camera, making SfM a low-cost tool that compliments other 3D imaging technologies, such as terrestrial and airborne laser scanning (lidar). SfM can be collected from a hand-held camera or an airborne platform such as an aircraft, tethered balloon, kite, or UAS (unmanned aerial system), enabling 3D imaging of features ranging in size from decimeters to several kilometers. This one-day course will provide faculty, students, and professionals with an introduction to SfM technology, data collection and processing, and examples of science and educational applications. A combination of lectures and hands-on demonstrations of SfM equipment and data processing will be used. This course can be taken alone, or together with "High Resolution Topography and 3D Imaging II: Introduction to Terrestrial Laser Scanning" (course #502) for an introduction to 3D imaging technology that compliments SfM.

Software:

- Agisoft PhotoScan (commercial software, demo/trial version will be used in the course)

- CloudCompare (open source software)

MORNING SESSION

8:00 AM Welcome & Course Introduction

8:30 AM Intro to SfM & scientific motivations – high-resolution topography and 3D imaging

- Science Motivations (Ramon)
- Introduction to SfM Photogrammetry (Ed)
- SfM Applications (Ramon, Ed, Adam)

9:30 AM Break

9:45 AM El Mayor Cucapah earthquake demo activity and discussion (Ed, Ramon)

- EMC EQ 30 image dataset (.zip)
- Video tutorial
- EMC dataset georeferencing tutorial
- EMC GCPs from ALS data (.zip)

10:45 AM Overview of SfM data acquisition concepts (Ed, Ramon)

- SfM platforms (Ed)
- UAS & FAA regulations (Chris)
- Considerations for building SfM processing machines

LUNCH SESSION

12:00 PM Lunch on your own. While out, take some pictures for afternoon session, start moving images off your phone.

AFTERNOON SESSION

1:00 PM Hands-on demonstration of SfM workflow: Participants photograph objects near short course venue, transfer images to computer, process data to simple 3D models using AgiSoft PhotoScan software.

Show and tell of the models

2:30 PM EMC differencing (Ed, Ramon, Chris; CloudCompare)

- Fourmile Canyon 2010 lidar (.las)
- Fourmile Canyon 2014 SfM (.las)
- Tutorial (pdf)

3:45 PM UNAVCO education resources on SfM and related topics (Chris)

- Analyzing High Resolution Topography with TLS and SfM (SERC-hosted resources and curriculum for field education with TLS and SfM)
- UNAVCO Geodesy Field Education resources (links to UNAVCO support resources for field education, including TLS and SfM).

4:15 PM Future trends, computing resources, 3D printing, Afternoon session Q&A and concluding thoughts.

5:00 PM Adjourn

Other Resources:

- UNAVCO Explained in 3 Minutes video
- UNAVCO Structure from Motion manuals:
    - Structure from Motion guide - practical considerations, cameras, collection platforms, software, field methods.
    - Structure from Motion AgiSoft processing guide

Online URL:
https://kb.unavco.org/article/2017-gsa-introduction-to-structure-from-motion-sfm-photogrammetry-for-earth-science-research-and-education-short-course-864.html