2016 GSA: Introduction to Structure from Motion (SfM) Photogrammetry for Earth Science Research and Education short course

859 Chris Crosby September 27, 2016 Structure from Motion (SfM) Photogrammetry 3490

Geological Society of America Annual Meeting Short Course, Denver, CO

525. Introduction to Structure from Motion (SfM) Photogrammetry for Earth Science Research and Education

Sat., 24 Sept., 9 a.m.–5 p.m., CCC, Room 110

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

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.

Software:

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

- CloudCompare (open source software)

MORNING SESSION

9:00 AM Welcome & Course Introduction

9:15 AM Intro to SfM & scientific motivations – high-resolution topography and 3D imaging (Ed, Ramon)

10:15 AM Break

10:30 AM El Mayor Cucapah earthquake demo activity and discussion (Ed, Ramon)

- EMC EQ 30 image dataset (.zip)
- Video tutorial

11:15 AM Overview of SfM data acquisition concepts (including platforms, FAA regulations), applications examples (Ed, Ramon, Chris)

LUNCH SESSION

12:00 PM Provided lunch and walk about and 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, 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
- Advanced Geographic Research Agisoft Photoscan Crash Course
- Prompt 3D mapping of the earthquake-triggered landslide in Minami-Aso, Kumamoto, Japan

Online URL:
https://kb.unavco.org/article/2016-gsa-introduction-to-structure-from-motion-sfm-photogrammetry-for-earth-science-research-and-education-short-course-859.html