MAPPINGMATTERS

YOUR QUESTIONS ANSWERED

The layman's perspective on technical theory and practical applications of mapping and GIS

BY Qassim A. Abdullah, Ph.D., PLS, CP**

QUESTION:

Question: I'm conducting an experiment to see how different methods of surveying vary when used to estimate volumes. Does ASPRS put out standards of accuracy for using photogrammetry to determine volumes? I'm also trying to determine if there's a way to truly test the accuracy of these data. On another note, to your knowledge, is there a smartphone application that uses photos to determine volume? I know Pix4D has an application for such a thing, but it requires a smartphone with lidar capability, such as the iPhone 12 and 13. I am trying to find one that does not require the lidar capability, only a camera, to estimate volume. What are your thoughts?

Jordan Aikins, Lumos & Associates, Carson City Nevada

Dr. Abdullah: The simple answer to your question about whether ASPRS has a standard for volume computation accuracy is no, we do not have one. However, we are considering developing a standard for 3D modeling and oblique imagery that will touch on the topic you raised. As for volume computations, there are a few parameters that contribute to the quality of volume assessment besides positional accuracy. Those that come to mind are point cloud density and the different methods of modeling terrain, such as the more widely used, polygon-based Regular Triangulated Networks (RTNs) and Triangulated Irregular Networks (TINs), versus options like Voxel-based networks. Terrain modeling and volume computation quality are sensitive to whether the software represents the point cloud as a TIN, a gridded surface or an RTN. If it is an RTN, then you must consider what post spacing that grid needs to be created with. Here, I would like to elaborate on point density, since it is the most important contributor to

> **"Point density is the most important contributor to the quality of modeling terrain."**

the quality of modeling terrain. In many instances, users of lidar data for example focus on point cloud accuracy as specified by sensor manufacturers, ignoring an important aspect of the terrain modeling quality: the data density and how it varies according to the terrain smoothness. Figure 1 clearly illustrates this problem. While the point cloud was acquired to a positional vertical accuracy of 10cm, the lack of point density caused the modeling software to estimate the vertical position of Point A to be at Position A', resulting in a vertical error in the digital terrain model (DTM) of 2m or even more depending on the terrain undulation. To remedy this situation and obtain an accurate representation of the terrain, the point cloud needs to be acquired at a higher

> **"Totally smooth or flat terrain can be accurately modeled using a point cloud with nominal post spacing (NPS) of a few meters or coarser."**

density. In the case of the terrain in Figure 1, higher point cloud density is the only way to accurately represent the terrain shape. If the terrain contains a high-frequency undulation, using a low-density point cloud results in substantial inaccuracy in the volume estimation no matter what software or modeling algorithms are used. This high-density requirement is not necessary if the terrain does not fluctuate rapidly and is flat or smooth. Totally smooth or flat terrain can be accurately modeled using a point cloud with nominal post spacing (NPS) of a few meters or coarser.

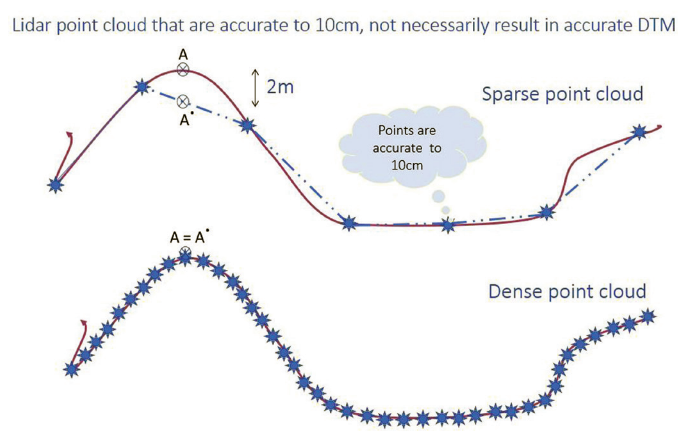

Figure 1: Terrain roughness and point cloud density.

Photogrammetric Engineering & Remote Sensing
Vol. 88, No. 6, June 2022, pp. 359-360.
0099-1112/22/359-360

doi: 10.14358/PERS.88.6.359

As for processing software, you should be able to do photogrammetric computations in Pix4D using smartphone imagery. I am not sure that you can run Pix4DMapper on a smartphone, but you can import and process imagery acquired by a smartphone into a desktop or cloud processing engine of Pix4DMapper. Using smartphone imagery, Pix4DMapper can generate a point cloud, perform feature removal to create a DTM, compute volume and export contours. Other software on the market, such as SimActive's Correlator3D, Agisoft Metashape, Trimble UASMaster and others, can perform similar processing.

***Dr. Abdullah is Vice President and Chief Scientist at Woolpert, Inc. He is also adjunct professor at Penn State and the University of Maryland Baltimore County. Dr. Abdullah is ASPRS fellow and the recipient of the ASPRS Life Time Achievement Award and the Fairchild Photogrammetric Award.*

The contents of this column reflect the views of the author, who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the American Society for Photogrammetry and Remote Sensing, Woolpert, Inc., NOAA Hydrographic Services Review Panel (HSRP), Penn State, and/or the University of Maryland Baltimore County.

STAND OUT FROM THE REST

EARN ASPRS CERTIFICATION

ASPRS congratulates these recently Certified and Re-certified individuals:

CERTIFIED LIDAR TECHNOLOGIST

Melissa Martin, Certification #R038LT
Effective February 4, 2022, expires February 4, 2025

RECERTIFIED PHOTOGRAMMETRIST

Crystal Childress, Certification #R1529CP
Effective May 9, 2022, expires May 9, 2027

Chris Miwa, Certification #R1612CP
Effective March 23, 2022, expires March 23, 2027

Terry Keeton, Certification #R1213CP
Effective May 20, 2022, expires May 20, 2027

Kevin Fowkes, Certification #R1482CP
Effective March 4, 2021, expires March 4, 2026

Jay Drake, Certification #R1524CP
Effective April 7, 2022, expires April 7, 2027

Thomas Jordan, Certification #R1308CP
Effective September 6, 2021, expires September 6, 2026

Daniel Marsh, Certification #R1019CP
Effective May 20, 2022, expires May 20, 2027

Ngwa Godlove Ntumngia, Certification #R1618CP
Effective May 30, 2022, expires May 30, 2027

Debra Taylor, Certification #R1539CP
Effective December 19, 2022, expires December 19, 2027

CERTIFIED PHOTOGRAMMETRIST

Scott Williams, Certification #CP1665
Effective March 7, 2022, expires March 7, 2027

Jan Lee Van Sickle, Certification #CP1667
Effective March 31, 2022, expires March 31, 2027

RECERTIFIED MAPPING SCIENTIST GIS/LIS

Kevin May, Certification #R251GS
Effective March 12, 2022, expires March 12, 2027

RECERTIFIED MAPPING SCIENTIST – REMOTE SENSING

Debasish Chaudhuri, Certification #R249GS
Effective January 17, 2022, expires January 17, 2027

Daniel Marsh, Certification #R155RS
Effective October 18, 2022, expires October 18, 2027

CERTIFIED MAPPING SCIENTISTS UAS

Jason San Souci , Certification #UAS038
Effective April 6, 2022, expires April 6, 2027

CERTIFIED MAPPING SCIENTIST LIDAR

Grant Twilley, Certification #L072
Effective March 25, 2022, expires March 25, 2027

Nick Chandler, Certification #L073
Effective March 12, 2022, expires March 12, 2027

RECERTIFIED MAPPING SCIENTIST LIDAR

Karen Schuckman, Certification #R013L
Effective May 11, 2022, expires May 11, 2027

ASPRS Certification validates your professional practice and experience. It differentiates you from others in the profession. For more information on the ASPRS Certification program: contact **certification@asprs.org**, visit **https://www.asprs.org/general/asprs-certification-program.html.**

COUNCIL OF ENGINEERING AND SCIENTIFIC SPECIALTY BOARDS CESB 1990

asprs THE IMAGING & GEOSPATIAL INFORMATION SOCIETY