MAPPINGMATTERS

YOUR QUESTIONS ANSWERED

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

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QUESTION:

Question 1: If an accurate digital elevation model (DEM) is already available, can frames collected without orientation angle information be accurately triangulated and processed at a lower overlap (20-30%) than the normal Structure from Motion (SfM) program recommendations of 75% overlap or more? Please consider the systems to be metric and internally calibrated with a post-processed, kinematic and "fixed" Global Navigation Satellite System (GNSS) solution.

Question 2: Is there a significant difference in determining the Exterior Orientation (EO) parameters from SfM-based programs as compared to traditional approaches? Does having an accurate internal calibration when beginning processing make much difference?

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Dr. Abdullah, Question 1: Experience has shown us that measured sensor orientation angles are not critical to the photogrammetric process if the acquired imagery is processed through a triangulation routine. An inertial measurement unit (IMU) is used to measure sensor orientation. These measured orientation angles—whether roll, pitch, heading or omega, phi, kappa—are crucial to processing the imagery, if the intent is to bypass the imagery triangulation process by utilizing the direct orientation approach. Having said that, it is worth mentioning that although the use of IMU is not necessary, having measured sensor orientation angles can benefit the processing software. If used correctly with traditional photogrammetric or SfM-based software, these angles provide value during the initial estimation of tie, pass or key point selection. Now, you also asked about whether the excessive imagery overlap is necessary for processing the imagery if you have an accurate DEM to use for the orthorectification process. Increased overlap is beneficial

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to the two main imagery processing steps: the triangulation of the imagery to determine the accurate geometry of the imagery block, i.e. network; and, most importantly, to the production of clean and reliable point clouds. If you are not concerned about the quality of the point cloud, then you can decrease the amount of overlap between the imagery given the figures you provided, assuming you meant this overlap ratio is between imagery taken from adjacent flight lines—or what we traditionally call "sidelap." You do not need to decrease the overlap ratio between imagery taken along a flight line, also known as "forwardlap," as it does not save on the acquisition time and therefore does not affect airplane fuel efficiency. Increasing the amount of forwardlap results in more images but, considering the digital workflow everyone is using today in processing imagery, this added number of images has very little impact on the manual labor budget of a project and it only increases computer processing time. The traditional photogrammetric process uses 60% forwardlap and 30% sidelap. Based on my experience, this reduced overlap also works in SfM-based software if the intent is not to produce refined point clouds. A forwardlap ratio of 60% or more is always needed if the imagery will be used for stereo map compilation. Therefore, it is a good planning strategy to assume that the imagery may eventually be used to set up stereo pairs for map compilation and not just for the production of orthos, since you never know when the need for stereo compilation may arise.

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Dr. Abdullah, Question 2: The thing we need to understand here is that SfM is a matching technique that is more efficient that than the typical auto-correlation we used in photogrammetry. Whether traditional photogrammetric or SfM-based, all software needs to establish image geometry at the instant of exposure. In other words, all software needs to accurately determine the orientations and positions of images relative to each other. Once that is done, the collinearity condition is used to intersect rays to generate point clouds. Besides its efficient image matching technique, SfM-based software provides more flexibility in dealing with imagery that does not have absolute georeferencing information to start with, as compared to the traditional photogrammetric approach where you need at least an approximate camera position and orientation. Having accurate internal camera parameters are beneficial, but not absolutely required, for both approaches—especially if you are going to process the data through the standard workflow. Having a known geometry of internal camera parameters helps the software in

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the initial modeling and estimation stages of processing. However, most if not all software optimizes the initial camera parameters based on their modeled and refined block geometry. This is especially true for processing imagery from an unmanned aircraft system (UAS) due to the consumer-grade cameras UAS use. Most of these cameras come without a calibration report and do not hold firmly to their internal geometry during operations. Even if you have a metric photogrammetric camera that provides an accurate calibration report, you will find the software alters the calibrated camera parameters slightly to give you the best product from the imagery. I would say it is always good practice to provide software with accurate internal camera parameters, but it is not absolutely necessary if the software has the capability to refine these parameters through a process that is referred to in traditional photogrammetric practices as "camera self-calibration."

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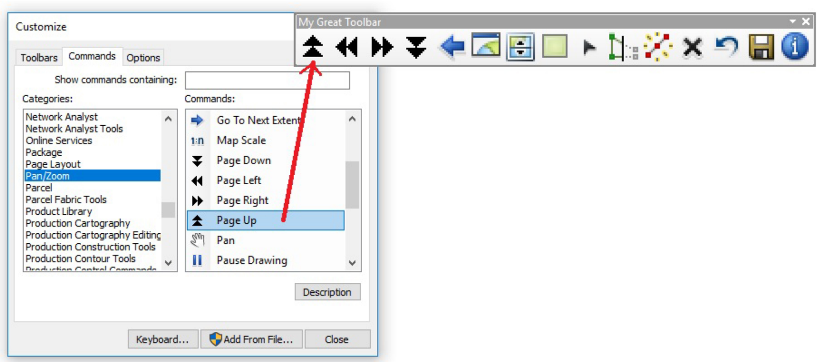
Step 3 - In the Customize window, select the Commands tab. Search for different tools using the 'Show commands containing:' search box or by navigating through the Categories list. Then, drag-and-drop your favorite tools into the new, blank toolbar.



When the "Customize" mode is active, you can add new tools to a toolbar or rearrange the icons by simply dragging them to a new position. To delete an icon (tool) just drag it away from the toolbar and release it. Of course, the icon is still available to be chosen from the Commands menu and your new toolbar will be saved with your map document. It is really that easy to make your own custom toolbars.

Toolbar customizations are unlimited in diversity. Please feel free to share yours with us. Send your questions, comments, and tips to GISTT@ASPRS.org.

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