

Conventional Photogrammetry versus UAV-Photogrammetry

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The term photogrammetry has various meanings for different application areas and over time, it has changed its definitions depending on the technological stage of its development. Currently, the most adequate definition is to consider it as the methodology for modelling 3D space from 2D images generated by digital sensors. In the beginning, it was just photogrammetry which became Analog Photogrammetry, Analytical Photogrammetry and finally, Digital Photogrammetry, which is being replaced by two competing terms which are conventional photogrammetry and UAV-photogrammetry. The question here is whether they are sufficiently different to deserve two distinct denominations.

At first glance, the main point of differentiation is that the so-called UAV-photogrammetry refers to 3D space modelling based on image sensors embedded in unmanned aerial vehicles, whereas the conventional photogrammetry is based on classic manned aerial platforms. But are platforms the only element that differentiates them? of course not, mainly because, strictly speaking, they cannot be considered as distinct technologies for 3D space modelling. Both are based on the same analytical and geometric concepts, the same photogrammetric measurement system and the same field practices to produce reliable geospatial data. So, why are they seen as two different technologies by many professionals?

To clarify this issue, it is important to recognize that, from the end-user point of view, a so-called UAV-photogrammetry operation is much easier, accessible, cheaper, faster and multitasking, compared to a conventional one. The fact here is that for the so-called conventional photogrammetry, images are obtained by large-format digital metric cameras taken perpendicular to the object, in a well-behaved environment, with well-defined longitudinal and lateral overlays, establishing regular image blocks to be treated in high-performance photogrammetric workstations, developed by photogrammetrists. On the other hand, the so-called UAV-photogrammetry reduces all these constraints by allowing the use of low-cost non-metric digital cameras, oblique images and collected different heights. Furthermore, they can be distributed unevenly in space, as long as they guarantee the necessary overlaps. Finally, data processing, in general, is performed in programs developed by computer vision professionals with little experience in photogrammetry mapping.

As a result of these two technical approaches, analytical data treatment and user interfaces are quite different. Conventional photogrammetry is based on well-known collinearity equations, image matching and aero triangulation by block adjustment. On the other hand, for UAV-photogrammetry, the integration of computer vision and image processing has resulted in a technique called Structure from Motion (SfM), that paired with Multi-View Stereo (MVS) algorithms and scale-invariant feature transform (SIFT) operators automatically solve the geometric problem of camera positioning and orientation in the space with very few user interactions, making the so-called UAV-photogrammetry an easy-to-use tool for collecting geospatial data by non-photogrammetrists. Then, even if at the end, all processing steps are the same for both, which comprises camera calibration, interior orientation (or intrinsic orientation), tie points detection (or key-points detection), ground control point (GCP) measurements or direct GNSS georeferencing paired with inertial system (IMU) installations for exterior orientation (or extrinsic orientation), the UAV-photogrammetry users hardly notice.

In the end, although it seems to users that there are two different photogrammetries, it is worth saying that this assumption is not true. In fact, there are not two photogrammetries, but two different image data collection platforms, making the use of the term UAV-based photogrammetry more appropriate than UAV-photogrammetry. This simple conclusion is very important information for the user, who must understand that, although UAV-based photogrammetry is a much easier tool used to provide geospatial data, it is still based on the same photogrammetric concepts as always. There is no magic. Without a good set of images, reliable camera calibration, precise control points or qualified GNSS and IMU facilities, there will never be reliable photogrammetric geospatial data collection. It has been verified that the lack of knowledge about photogrammetry, or the noncompliance with its basic procedures, has led to incompatible results with the proper use of technology. Users who just press the buttons should be careful in doing so.

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