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Title: **Agisoft PhotoScan is a topical solution for creating a three-dimensional object model with images taken from digital cameras.**

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Agisoft PhotoScan is a topical solution for creating a three-dimensional object model with images taken from digital cameras.

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Abstract: In the article reviewed the Agisoft PhotoScan program prospect and modern technologies realization are considered for creation of three-dimensional high quality models on the basis of digital photos. For a reconstruction 3D Agisoft PhotoScan object models allows to use the photos taken off by any digital photocameras from any foreshortening.

Keywords: 3D model, set of concentrated points (x,y,z coordinates are clear), digital camera, textured model, digital location model, orthophotoplan, elevation map, Agisoft PhotoScan.

Introduction

The use of unmanned aerial vehicles (UAVs) can significantly reduce the cost of aerial photography. UAVs are typically equipped with household cameras, without hydro-stabilization equipment, and the optical axes often experience significant vertical deviations. Based on the above, in terms of traditional photogrammetry, it would not be possible to process such cartographic data, for *Agisoft PhotoScan* modern photogrammetric software, these shortcomings do not pose significant problems. In addition, digital methods development of photogrammetric processing, even led to the programs and software systems emergence capable for processing such “low-quality” aerial photography data in a highly automated mode, with minimal operator involvement.

Based on digital photography and state-of-the-art technology, *Agisoft PhotoScan* provides high-quality three-dimensional space modeling. *Agisoft PhotoScan* software allows you to process a three-dimensional location model from any angle, using unmanned aerial vehicles, photos taken from a digital camera. The program is fully automated in creating a three-dimensional place model.

As a result of the technological topographic mapping chain using the following components, modern digital maps are created:

1. Unmanned aerial vehicles
2. *Agisoft PhotoScan* software

3. GAT programs for vectorizing orthophotoplanes and creating topographic maps

The working principle of *Agisoft PhotoScan*.

Using the standard *Agisoft PhotoScan* software, three-dimensional modeling of the main issue allows you to depict the available space, surrounding objects and their location in a textured view. The purpose of this work is a of the technology solution of three-dimensional construction models. The work process in the project consists of four stages:

1. **Determining the internal and external orientation parameters of the camera.** In this process, *PhotoScan* finds common points in the photo and uses these points to determine all camera parameters: location, orientation, internal geometry (focal length, distortion parameters, and so on). This phase product consists of a set of points of a three-dimensional spatial model, camera position, and orientation data. In *PhotoScan*, a set of points is not involved in the next step process, it can only be used in image modeling and visual quality assessment. Camera status and orientation information is used in post-processing.

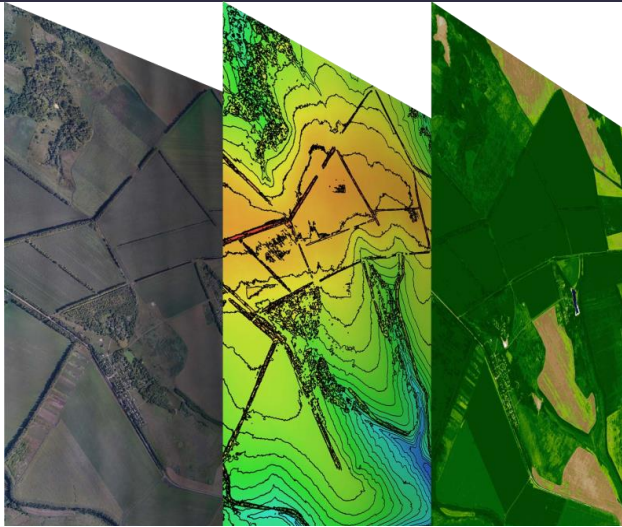


Fig 1. The high-resolution digital ground models obtained by Agisoft PhotoScan guarantee accurate measurement of area and volume.

2. **Create a set of condensed points.** Based on the camera status detected in the first step and the images taken, PhotoScan builds a condensed set of points in the second step. The next step is to edit and classify the model before exporting it.
3. **Construction of a polygonal model of an object.** Based on the set of condensed points, the object shape is described, and PhotoScan builds a polygonal object model in the third step. PhotoScan offers two basic algorithms for building a polygonal object model: Height card - for flat surfaces and Optional - for all surface types.
4. **PhotoScan** can use several methods to build a textured model.



Fig 2 Create a set of condensed points

Starting information for PhotoScan: Before creating a dimensional model, it is necessary to select and download images that are compatible with PhotoScan. PhotoScan can process photos taken on all digital camera

types. But better results can be achieved if certain rules are followed.

Tools and equipments:

- Select the one that has the highest resolution of the camera (5 MPix and higher).
- Do not use a wide-angle lens and a "fish eye" lens. We recommend using a lens with a focal length of 50 mm to get a quality result. In the absence of such a lens, 20 to 80 mm lenses can also solve the problem. If there is an object captured in the "fish eye" type lens, it must be calibrated in the settings section of PhotoScan before processing the images.
- It is necessary to use a lens that changes the focal length. When using a lens with a fixed focal length, it is necessary to select the focal length (maximum or minimum) that has the last value to obtain a stable result.

Performance scheme: Processing photos in PhotoScan involves the following steps:

- upload photos to PhotoScan;
- view uploaded photos and delete unnecessary frames;
- image alignment;
- build a set of condensed points;
- construct a polygonal model of the model;
- object texture;
- construction of the "tail" model of the object;
- build a digital model of the place;
- creating an orthophotoplan;
- export the results.

Carrying out measurements on the model: PhotoScan software has a set of measuring tools in the settings menu, which allows you to measure and calculate the distance between points, determine the surface area and size of a three-dimensional model.

Conclusion:

In the article, we can see that the aerial photography using unmanned aerial vehicles made it possible to determine the altitude. It is also easier to work with the calculated height, objects location and its coordinate dimensions in three-dimensional modeling and using a 3D model, we can see the ground in detail when viewed from any angle and any point. This



opens up new possibilities for modeling to be more accurate.

Literature:

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