

ANALYSIS OF CREATING BENCHMARK IMAGES METHODS TO TEST THE ACCURACY OF PHOTOGRAMMETRIC SOFTWARE

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Digital photogrammetry is based on the use of specialized photogrammetric software (or digital photogrammetric systems) to solve problems related to the aerospace imagery processing. A wide range of programs and high price motivate consumers to choose the right software that responds to requirements of processing accuracy, amount of work, time of execution, etc. The main goal of this study is to analyze the existing methods of benchmark images creating to test photogrammetric programs. The article carries out the analysis of existing techniques of creating benchmark images, classification, selection of benchmark images types suitable for testing of photogrammetric software, and substantiates the necessity for checking of aerial survey results quality in specialized software.

Keywords: benchmark image, photogrammetric software, accuracy of result, photogrammetry, accuracy, image, processing, unmanned aerial vehicle

REFERENCES

1. Brach, M., Cheung-Wai Chan, J., & Szymański, P. (2019). Accuracy assessment of different photogrammetric software for processing data from low-cost UAV platforms in forest conditions. Retrieved from <https://doi.org/10.3832/ifor2986-012>.
2. Khlebnikova, T. A., & Opritova, O. A. (2017). Experimental studies of contemporary software for modeling geospatial. *Vestnik SGUGiT [Vestnik SSUGT]*, 22(1), 119–131 [in Russian].
3. Kalantarov, E. I. (1986). *Fotogrammetricheskoe instrumentovedenie [Photogrammetric instrumentation]*. Moscow: Nedra Publ., 126 p. [in Russian].
4. Lobanov, A. N. Dubinovskij, V. B. Sarancev, A. I., & et al. (1989). *Analiticheskie modeli mestnosti i snimkov (maketnye snimki) [Analytical terrain and imagery models (layout images)]* (2nd ed.). Moscow: Nedra Publ., 140 p. [in Russian].
5. Voronkov, N. N., Plotnikov, V. S., Kalantarov, E. I., & et al. (1991). *Geodeziya. Geodezicheskie i fotogrammetricheskie pribory [Geodesy. Geodetic and photogrammetric instruments]*. Moscow: Nedra Publ., 429 p. [in Russian].
6. *Kompleks programm dlya tekhnologicheskoy obrabotki fotogrammetricheskikh izmerenij na 32-razryadnyh personalnyh kompyuterah (FOTOKOM-32, versiya 1.0)* [Complex of programs for technological processing of photogrammetric measurements on 32-bit personal computers (FOTOKOM-32, version 1.0)]. (1999). Novosibirsk, 175 p. [in Russian].
7. Korkin, V. S. (1998). Simulation of realistic digital stereo images for testing the SDS photogrammetric complex. In *Tezisy dokladov mezhdunarodnoy nauchno-tehnicheskoy konferentsii "Sovremennye problemy geodezii i optiki», posvyashchennoy 65-letiyu SGGA-NIIGAiK"* [Proceedings of the International Scientific and Technical Conference "Modern Problems of Geodesy and Optics" dedicated to the 65th anniversary of the SGGA-NIIGAiK] (150 p.) [in Russian].
8. Krasnopovcev, B. V. (1981). Analysis of the design and study of the instrumental accuracy of the STs-1 stereograph. *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 2, 92–98 [in Russian].
9. Lyubivaya, L. S. (1983). Results of analytical phototriangulation using the self-calibration method of images. In *Sbornik nauchnykh trudov NIIPG: Vyp. 7. Fotogrammetriya v topografo-geodezicheskem proizvodstve i inzhenerno-geodezicheskoy praktike [Proceedings of NIIPG: Issue 7. Photogrammetry in Topographic and Geodetic Production and Engineering and Geodetic Practice]* (pp. 33–42). Moscow: CNIIGAiK Publ. [in Russian].

10. Kalantarov, E. I., & Krasnopevcev, B. V. (1971). Determination of instrumental errors of universal stereophotogrammetric devices. *Izvestiya vuzov. Geodeziya i aerofotos"emka* [Izvestiya Vuzov. Geodesy and Aerophotography], 4, 55–60 [in Russian].
11. Krekov, G. M., Orlov, I. M., Belov, V. V., & et al. (1988). *Imitacionnoe modelirovanie v zadachah opticheskogo distancionnogo zondirovaniya* [Simulation in problems of optical remote sensing]. Novosibirsk: Nauka Publ., 165 p. [in Russian].
12. Tucci, G., Gebbia, A., Conti, A., Fiorini, L., & Lubello, C. (2019). Monitoring and Computation of the Volumes of Stockpiles of Bulk Material by Means of UAV. Retrieved from <https://doi.org/10.3390/rs11121471>.
13. Kurczynski, Z., Bakuła, K., Karabin, M., Kowalczyka, M., Markiewicz, J. S., Ostrowsk, W., Podlasiak, P., & Zawieska, D. (2016). The possibility of using images obtained from the UAS in cadastral works. Retrieved from <https://doi.org/10.5194/isprs-archives-XLI-B1-909-2016>.
14. Gergel', I. A., & Kortunov, V. I. (2015). Analysis of the flight of small unmanned aerial vehicles to perform aerial photography of area objects. *Aviacionno-kosmicheskaya tekhnika i tekhnologiya* [Aerospace Engineering and Technology], 4, 38–42 [in Russian].
15. Templin, T., & Popielarczyk, D. (2020). The Use of Low-Cost Unmanned Aerial Vehicles in the Process of Building Models for Cultural Tourism, 3D Web and Augmented/Mixed Reality Applications. Retrieved from <https://www.mdpi.com/1424-8220/20/19/5457>.
16. Kingsland, K. (2020) Comparative analysis of digital photogrammetry software for cultural heritage. Retrieved from <https://doi.org/10.1016/j.daach.2020.e00157>.
17. Yao, H., Qin, R., & Chen, X. (2019). Unmanned Aerial Vehicle for Remote Sensing Applications – A Review. Retrieved from <https://doi.org/10.3390/rs11121443>.
18. Pepe, M., Fregonese, L., & Scaioni, M. (2018). Planning airborne photogrammetry and remotesensing missions with modern platforms and sensors. Retrieved from <https://doi.org/10.1080/22797254.2018.1444945>
19. Štroner, M., Urban, R., Reindl, T., Seidl, J., & Broucek, J. (2020). Evaluation of the Georeferencing Accuracy of a Photogrammetric Model Using a Quadrocopter with Onboard GNSS RTK. Retrieved from <https://doi.org/10.3390/s20082318>.
20. Ichikawa, K., Ebinuma, T., Konda, M., & Yufu, K. (2019). Low-Cost GNSS-R Altimetry on a UAV for Water-Level Measurements at Arbitrary Times and Locations. Retrieved from <https://doi.org/10.3390/s19050998>.
21. Geodetic, Cartographic Instructions, Norms and Regulations. (2002). GKINP (GNTA)-02-036-02. Instruction for photogrammetric works to create digital topographic maps and plans]. Moscow: CNIIGAiK Publ., 100 p. [in Russian].
22. Rakov, D. N., & Nikitin V. N. (2012). Choosing a digital camera for non-metric unmanned aerial complex. In *Sbornik materialov Interexp GEO-Sibir-2012: Mezhdunarodnoy nauchnoy konferentsii: T. 7. [Proceedings of Interexpo GEO-Siberia-2012: International Scientific Conference: Vol. 7]* (pp. 27–36). Novosibirsk: SSGA Publ. [in Russian].
23. Cramer M., Przyilla H.-J., & Zurhorst A. (n. d.). UAV cameras: overview and geometric calibration benchmark. Retrieved from <https://doi.org/10.5194/isprs-archives-XLII-2-W6-85-2017>.

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