# AUTOMATED IDENTIFICATION AND DETERMINATION OF THE BREED COMPOSITION OF WOOD BY MATERIALS OF DIGITAL MULTISPECTRAL AERIAL SURVEY OF FORESTS

***Stanislav A. Arbuzov***
Siberian State University of Geosystems and Technologies, 10, Plakhotnogo St., Novosibirsk, 630108, Russia, Ph. D., Associate Professor, Department of Photogrammetry and Remote Sensing, phone: (383)361-08-66, e-mail: s.a.arbuzov@sgugit.ru

***Elena P. Khlebnikova***
Siberian State University of Geosystems and Technologies, 10, Plakhotnogo St., Novosibirsk, 630108, Russia, Ph. D., Associate Professor, Department of Photogrammetry and Remote Sensing, phone: (383)361-08-66, e-mail: e.p.hlebnikova@sgugit.ru

***Vyacheslav N. Nikitin***
Siberian State University of Geosystems and Technologies, 10, Plakhotnogo St., Novosibirsk, 630108, Russia, Ph. D., Associate Professor, Department of Photogrammetry and Remote Sensing, phone: (913)712-37-50, e-mail: vslav.nikitin@gmail.com.

Presently, the current task is to automate the determination of the characteristics of forest areas according to remote sensing data. At the same time there is a large number of automated decryption algorithms that are actively used and provide an acceptable result in photointerpretation of medium and low spatial resolution multi-zone images. In processing of high and ultra-high resolution data, both new possibilities for determination of tax characteristics and certain difficulties related to efficiency reduction of algorithms using luminance characteristics arise. The aim of the study is to check the efficiency of the trees automated identification method and to determine their breed affiliation from the images ADS40 of the digital aerial camera. Proposed technique is based on a complex use of methods for controlled classification and identification of objects in the image by areal images. The result of the work done has shown, in the opinion of the authors, a significant efficiency of using the considered methodology on test data and the prospects for its further development.

**Keywords:** automated decryption, remote sensing data, forest taxation, pattern recognition, area reference, ADS40

## REFERENCES

1. Gordienko, A. S., Altyntsev, M. A., & Arbuzov, S. A. (2011). Development of a method for multi-stage decoding of satellite images. *Izvestiya Vuzov. Geodeziya i aerofotos"yemka [Izvestiya Vuzov. Geodesy and Aerophotography]*, 2, 29–32 [in Russian].

2. Oduori, S. M., Vargas, R. R., Osman, A., & Rembold, F. (2009). Detection of tree cutting in the rangelands of North Eastern Somalia using remote sensing. Technical Project Report L-15. FAO-SWALIM, Nairobi, Kenya. Retrieved from http://www.faoswalim.org (accessed data 15.05.2019).

3. Khamedov, V. A., & Mazurov, B. T. (2015). Evaluation of the accuracy of determining the area of forest arms using images from the Russian spacecraft Resurs-P № 1. *Vestnik SGUGiT [Vestnik SSUGT]*, (4)32, 42–50 [in Russian].

4. Chakravarty, S., Ghosh, S., Suresh, C., Dey, A., & Shukla G. (2012). Deforestation: Causes, Effects and Control Strategies. *Global Perspectives on Sustainable Forest Managemen*. Dr. Clement A. Okia (Ed.). doi: 10.5772/33342.

5. Lin Yang Xiaqing Wu, Emil Praun, & Xiaoxu Ma. (n. d.). Tree detection from aerial imagery. Retrieved from http://www.cis.uab.edu/kddm/seminar_home/ Lin_Sept25_tree-camera-ready.pdf.

6. Khlebnikova, E. P., & Simonov, D. P. (2014). Use of statistical analysis methods for decoding multizone satellite images. In *Sbornik materialov Interekspo Geo-Sibir'-2014: Mezhdunarodnoy nauchnoy konferentsii: T. 1. Distantsionnyye metody zondirovaniya zemli i fotogrammetriya, monitoring okruzhayushchey sredy, geoekologiya [Proceedings of Interexpo GEO-Siberia 2014: Internetional Scientific Conference:*

*Vol. 1. Earth Remote Sensing and Photogrammetry, Environmental Monitoring and Geoenvironmental Ecology]* (pp. 19–23). Novosibirsk: SSGA Publ. [in Russian].

7. Altyntsev, M. A., & Shlahova, M. M. (2019). Investigation of the statistical properties of the spectral characteristics of vegetation. Nonparametric Approach. *Vestnik SGUGiT [Vestnik SSUGT]*, *24*(4), 58–65 [in Russian].

8. Nwannebuike Nixon, Nduji. (2017). *Super Resolution Mapping Of Trees From Satellite Images At Different Scales*. Enschede, The Netherlands. doi: 10.13140/RG.2.2.12004.37766.

9. Mustafa, Y. T., Habeeb, H. N., Stein, A., & Sulaiman, F. Y. (2015). Identification and mapping of tree species in urban areas using worldview-2 imagery. *Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *II-2/W2*, 175–181. doi: 10.5194/isprsannals-II-2-W2-175-2015.

10. San-Miguel-Ayanz, J., McInerney, D., Sedano, F., Strobl, P., Kempeneers, P., Pekkarinen, A., & Seebach (Reithmaier), L. (2012). Use of Wall-to-Wall Moderate and High-Resolution Satellite Imagery to Monitor Forest Cover Across Europe. *Global Forest Monitoring from Earth Observation* (pp. 195–210). CRC Press.

11. Khlebnikova, E. P., & Simonov, D. P. (2013). Study of the possibility of using high-resolution digital images to determine the reflective characteristics of vegetation. In *Sbornik materialov Interekspo Geo-Sibir'-2013: Mezhdunarodnoy nauchnoy konferentsii: T. 1. Distantsionnyye metody zondirovaniya zemli i fotogrammetriya, monitoring okruzhayushchey sredy, geoekologiya [Proceedings of Interexpo GEO-Siberia 2013: Internetional Scientific Conference: Vol. 1. Earth Remote Sensing and Photogrammetry, Environmental Monitoring and Geoenvironmental Ecology]* (pp. 64–69). Novosibirsk: SSGA Publ. [in Russian].

12. Daliakopoulos, I. N., Grillakis, E. G., Koutroulis, A. G., & Tsanis, I. K. (2009). Tree Crown Detection on Multispectral VHR Satellite Imagery. *Photogrammetric Engineering and Remote Sensing*, *75*(10), 1201-1211. doi: 10.14358/PERS.75.10.1201.

13. Arbuzov, S. A. (2013). Automated determination of tree coordinates from the materials of aerial and space surveys. In *Sbornik materialov Interekspo Geo-Sibir'-2013: Mezhdunarodnoy nauchnoy konferentsii: T. 1. Distantsionnyye metody zondirovaniya zemli i fotogrammetriya, monitoring okruzhayushchey sredy, geoekologiya [Proceedings of Interexpo GEO-Siberia 2013: Internetional Scientific Conference: Vol. 1. Earth Remote Sensing and Photogrammetry, Environmental Monitoring and Geoenvironmental Ecology]* (pp. 43–47). Novosibirsk: SSGA Publ. [in Russian].

14. Guk, A. P., & Arbuzov, S. A. (2018). Recognition of individual trees from multispectral aerospace images of the forest. In *Sbornik materialov V Mezhdunarodnoy nauchnoy konferentsii Regional'nyye problemy distantsionnogo zondirovaniya Zemli [Proceedings of the V International Scientific Conference: Regional Problems of Remote Sensing of the Earth]* (pp. 43–47). Krasnoyarsk: SFU Publ. [in Russian].

15. Guk, A. P., & Altyntsev, M. A. (2017). Automatic identification of the corresponding points on aerial photographs of forests. *Vestnik SGUGiT [Vestnik SSUGT]*, *22*(4), 68–77 [in Russian].

16. Ok, A. O., & Ozdarici-Ok, A. (2017). Detection of citrus trees from UAV DSMS. *Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *IV-1/W1*; ISPRS Hannover Workshop: HRIGI 17. – CMRT 17. – ISA 17. – EuroCOW 17. Hannover, Germany.

17. DEM Generation based on UAV Photogrammetry Data in Critical Areas Giulia Sammartano and Antonia Spanò GISTAM. (2016). *2nd International Conference on Geographical Information Systems Theory, Applications and Management*. Rome, Italy.

18. Determining stand parameters from UAS-based point clouds. The International Archives of the Photogrammetry (2016). *XXIII ISPRS Congress. Remote Sensing and Spatial Information Sciences, XLI(B1)*. Prague, Czech Republic.

19. Kattenborn, T., Sperlich, M., Bataua, K., & Koch B. (2014). Automatic Single Palm Tree Detection in Plantations using UAV-based Photogrammetric Point Clouds. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *XL-3*, 139–144. doi: 10.5194/isprs-archives-XL-3-139-2014.

20. Yilmaz, V., Serifoglu, C., & Gungor, O. (2016). Determining Stand Parameters From UAS-Based Point Clouds // *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *XLI-B1*, 413–416. doi: 10.5194/isprs-archives-XLI-B1-413-2016.

21. Arbuzov, S. A. (2014). TREE DETECTION. Certificate of registration of the computer program RUS 2015612844 December 30, 2014 [in Russian].

Received 21.01.2020