









compared to the common object-based classification method, method in this study has obvious advantages in classification accuracy.

However, the process of determining the segmentation scale requires multiple tests which leads to low efficiency. Thus, further research should be emphasize on how to determine the segmentation scale adaptively according to different terrain factors combinations and whether this approach is suitable for micro-landform extraction and classification.

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#### REFERENCES

- Benz, U.C., Hofmann, P., Willhauck, G., Lingenfelder, I., and Heynen, M., 2004: Multi-resolution, object-oriented fuzzy analysis of remote sensing data for GIS-ready information. *ISPRS Journal of Photogrammetry and Remote Sensing*, 58, 239-258.
- Blaschke, T., 2010: Object based image analysis for remote sensing. *ISPRS Journal of Photogrammetry and Remote Sensing*, 65, 2-16.
- Breiman, L., 2001: Random forests. *Machine learning*, 45, 5-32.
- Drăguț, L., and Blaschke, T., 2006: Automated classification of landform elements using object-based image analysis. *Geomorphology*, 81, 330-344.
- Drăguț, L., and Eisank, C., 2012: Automated object-based classification of topography from SRTM data. *Geomorphology*, 141, 21-33.
- Gao, X., 2004: The Subjective and Objective Classification of Geomorphologic Forms. *Journal of Mountain Science*, 22, 261-266.
- Gerçek, D., Toprak, V., and Strobl, J., 2011: Object-based classification of landforms based on their local geometry and geomorphometric context. *International Journal of Geographical Information Science*, 25, 1011-1023.
- Laliberte, A.S., Browning, D., and Rango, A., 2012: A comparison of three feature selection methods for object-based classification of sub-decimeter resolution UltraCam-L imagery. *International Journal of Applied Earth Observation and Geoinformation*, 15, 70-78.
- Lei, Z., 2012: Random Forest and its Application in Remote Sensing. Shanghai Jiao Tong University.
- Li, B., Pan, B., Cheng, W., Han, J., Qi, D., and Zhu, C., 2013: Research on Geomorphological Regionalization of China. *Acta Geographica Sinica*, 68, 291-306.
- Liu, A., and Tang, G., 2012: DEM Based Auto-classification of Chinese Landform. *Geo-information Science*, 8, 8-14, 15.
- Liu, K., Tang, G.A., Tao, Y., and Jiang, S., 2013: GLCM Based Quantitative Analysis of Terrain Texture from DEMs. *Journal of Geo-information science*, 14, 751-760.
- Liu, L., and Kuang, G.Y., 2009: Overview of image textural feature extraction methods. *Journal of Image and Graphics*, 14, 622-635.
- Manakos, I., Schneider, T., and Ammer, U., 2000: A comparison between the ISODATA and the eCognition classification methods on basis of field data. *IAPRS*, 33, 133-139.
- Myint, S.W., Gober, P., Brazel, A., Grossman-Clarke, S., and Weng, Q., 2011: Per-pixel vs. object-based classification of urban land cover extraction using high spatial resolution imagery. *Remote sensing of environment*, 115, 1145-1161.
- Robb, C., Willis, I., Arnold, N., and Guðmundsson, S., 2015: A semi-automated method for mapping glacial geomorphology tested at Breiðamerkurjökull, Iceland. *Remote sensing of environment*, 163, 80-90.
- Shen, Y., Su, S., and Yin, Z., 1982: Retrospect and Prospect of the Research Work on the Classification, Regionalization and Mapping of the Geomorphology of China. *Scientia Geographica Sinica*, 2, 97-105.
- Shruthi, R.B., Kerle, N., Jetten, V., Abdellah, L., and Machmach, I., 2015: Quantifying temporal changes in gully erosion areas with object oriented analysis. *Catena*, 128, 262-277.
- Song, J., 2006: Research on Automated Relief Form Types Classification of China Based on DEM. Northwest University.
- Song, L., 2012: Research on classifier ensemble based on decision tree. Xidian University.
- Tang, G., 2014: Progress of DEM and Digital Terrain Analysis in China. *Acta Geographica Sinica*, 69, 1305-1325.
- Van Niekerk, A., 2010: A comparison of land unit delineation techniques for land evaluation in the Western Cape, South Africa. *Land Use Policy*, 27, 937-945.
- Wang, Y.Q., Li, Y., and Liu, A.L., 2012: Object-oriented Method based Research on Classification of Relief Form in China. *Remote Sensing Information*, 1, 13-18.
- Whiteside, T., and Ahmad, W., 2005: A comparison of object-oriented and pixel-based classification methods for mapping land cover in northern Australia. *Proceedings of SSC2005 Spatial intelligence, innovation and praxis: The national biennial Conference of the Spatial Sciences Institute*. 1225-1231.
- Zhou, F., and Liu, X., 2008: Research on the Automated Classification of Micro Landform Based on Grid DEM. *Journal of WUT (Information & Management Engineering)*, 30, 172-175.