Remote Sens. **2015**, *7*, 2171-2192; doi:10.3390/rs70202171

OPEN ACCESS

remote sensing

ISSN 2072-4292

www.mdpi.com/journal/remotesensing

Article

Unsupervised Global Urban Area Mapping via Automatic Labeling from ASTER and PALSAR Satellite Images

Yulin Duan [1], Xiaowei Shao [2,*], Yun Shi [3], Hiroyuki Miyazaki [2], Koki Iwao [4] and Ryosuke Shibasaki [1]

[1] Center for Spatial Information Science, University of Tokyo, Kashiwa 277-8568, Japan

[2] Earth Observation Data Integration and Fusion Research Initiative, University of Tokyo, Tokyo 153-8505, Japan

[3] Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, Beijing 100081, China

[4] Geological Survey of Japan, National Institute of Advanced Industrial Science and Technology, Tokyo 100-8921, Japan

* Author to whom correspondence should be addressed; E-Mail: shaoxw@iis.u-tokyo.ac.jp; Tel.: +81-4-7136-4307; Fax: +81-4-7136-4292.

Academic Editors: Qihao Weng and Prasad S. Thenkabail

Received: 9 September 2014 / Accepted: 2 February 2015 / Published: 16 February 2015

Abstract: In this study, a novel unsupervised method for global urban area mapping is proposed. Different from traditional clustering-based unsupervised methods, in our approach a labeler is designed, which is able to automatically select training samples from satellite images by propagating common urban/non-urban knowledge through the unlabeled data. Two kinds of satellite images, captured by the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) and the Phased Array L-band Synthetic Aperture Radar (PALSAR), are exploited here. In this method, spectral features are first extracted from the original dataset, followed by coarse prediction of urban/non-urban areas via weak classifiers. By developing an improved belief-propagation based clustering algorithm, a confidence map is obtained and training data are selected via weighted sampling. Finally, the urban area map is obtained by employing the Support Vector Machine (SVM) classifier. The proposed method can generate urban area maps at a resolution of 15 m, while the same settings are used for all test cases. Experimental results involving 75 scenes from different climate zones show that our proposed method achieves an overall accuracy of 84.4% and a kappa coefficient of 0.628, which is competitive relative to the supervised SVM method.