IN51D-0672 - Exploring Object-Based CNN Architecture for Land Cover Classification of High-Resolution Remote Sensing Data

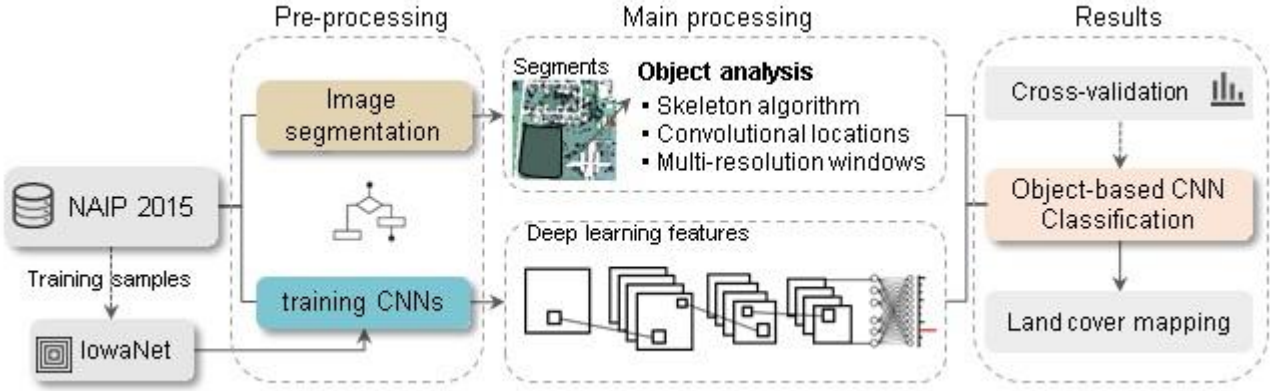
https://agu.confex.com/agu/fm19/meetingapp.cgi/Paper/567177

Friday, 13 December 2019 08:00 - 12:20 Moscone South - Poster Hall

Swirl Topics: Data & Rising Technologies - SWIRL

Abstract

Convolutional Neural Network (CNN) has been increasingly used for land cover mapping of remotely sensed imagery. However, standard CNN classification is computationally redundant and only produces coarse maps using patch-based inputs and a sliding window approach. An alternative to address this problem, object-based CNN (OCNN) uses image objects to improve the classification performance and accuracy. Since previous studies were mainly developed in urban context and small areas, further evaluation of OCNN is needed for broader contexts, especially in a heterogeneous landscape. Moreover, an efficient approach requires a strategy for less computation during object labeling. This study presents a new OCNN framework for large-area land cover classification of aerial 1-m imagery. The experimental area is the state of Iowa, United States. Our approach consists of three steps: i) image segmentation, ii) object analysis with a skeleton-based algorithm, and iii) multi-resolution CNN application. We also developed a large benchmark dataset, called IowaNet, with 1 million labeled images and C = 10 classes. In our approach, multi-resolution CNN models were trained to better capture the contextual information during semantic label of objects. The skeleton-based algorithm provides morphological lines of objects and supports the selection of convolutional locations for CNN predictions. The preliminary results indicate that multi-scale OCNN presents a higher accuracy compared with pixel-wise CNN or fixed-input OCNN approaches. The classification errors are partially explained by segmentation accuracy and the limitation of observation scale for small objects. The object analysis was efficient for large-area mapping, turning CNN model as a practical tool for massive object classification. With the advance of deep learning algorithms, this study supports the claim of OCNN benefits for land cover classification.



Authors

- Vitor Martins Iowa State University
- Amy L Kaleita Iowa State University
- Brian K Gelder Iowa State University
- Hilton L. F. da Silveira EMBRAPA Brazilian Agricultural Research Corportation
- Camila A Abe University of Wisconsin Madison