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A wrapper-based strategy to jointly combine remote sensing image segmentation and object detection

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Geospatial Object-Based Image Analysis (GEOBIA) has emerged as a new paradigm for remote sensing image classification and interpretation over the last two decades. However, due to the different sensor spatial characteristics, image timing, viewing geometry, etc., the object-based assumption was challenged across a whole scene when dealing with those targets with highly heterogeneous internal characteristics. In this paper we go one step further and address the problem of object detection using a wrapper-based strategy to jointly combine image segmentation and object detection. It offers an insight into full exploitation of the available remotely sensed data. Object detection and image interpretation not only rely on information from raw images, but also depend on knowledge of the target even knowledge from the outside world beyond the image. Regarding this issue, we used high-level object constraint knowledge to refine the image segmentation, going beyond bottom-up models and considering higher order cliques behind the image contexts. As segmentation helps recognition and recognized or delineated objects constrain segmentation, meanwhile, the "correct" segmentation is somehow a compromise between Top-Down & Bottom-Up segmentation. The framework of the proposed approach suggested that the high resolution satellite image was preprocessed, and then the wrapper-based strategy that jointly combined image segmentation and object detection was conducted to represent and interpreted the total scene. In fact, if image objects are badly constructed, objects cannot be accurately identified and recognized. The key idea of this study is to adopt the wrapper-based strategy for remote sensing image analysis, which enables hierarchically representation and recognition of remote sensing images. This kind of representation is determined by the physical properties of the geospatial objects and implemented based on the multi-scale scheme of real world geospatial objects. The method was tested on optical high resolution satellite imagery and obtained promising experimental results, which confirm the effectiveness and robustness of the proposed procedure.