Hybridization of SLIC and extra tree for object based image analysis in extracting shoreline from medium resolution satellite images

ABSTRACT

Observation satellites orbiting the Earth provide important surveillance information that helps in identifying various types of land cover. As such, the resolution of satellite images is critical to ensure high accuracy in classifying land cover types. Clearly, high-resolution images are desirable, but such images are prohibitively expensive. Hence, the use of medium-resolution satellite images seems more economical and practical. Several techniques have been developed to monitor the conditions of land covers across the world, such as aerial photography, ground survey, and remote sensing. Among the three techniques, remote sensing is the best, given its ability to monitor vast geographical areas more accurately and much faster compared to those of the other two techniques. In recent decades, many countries have been relying on remote sensing to monitor the conditions of coastal areas by extracting shorelines from satellite images. To date, several pixel-based methods have been proposed for the extraction of shorelines, but most of these methods are fraught with problems. Thus, the object-based approach is proposed using a combination of segmentation algorithms, namely Felzenswalb, Quickshift, and SLIC, together with 15 machine learning classifiers, to classify segmented images of Langkawi Island. The performance of the segmentation algorithms and machine learning classifiers were assessed in terms of segmentation time and overall accuracy in four experimental settings comprising of three different parameters. The research findings showed that the proposed hybridization of SLIC segmentation and Extra Tree classifier was the most efficient and accurate technique compared to other combinations of techniques in extracting the shoreline of the study area. Specifically, SLIC was faster than Felzenswalb and Quickshift by as much as 37 times and 500 times, respectively. Together with Extra Tree classifier, SLIC managed to achieve 100% overall accuracy in the object-based classification in three out of four settings compared to the rest of the techniques tested in the study.

Keyword: Object based image analysis; SLIC segmentation; Extra tree classifier; Machine learning; Shoreline extraction