The title (العنوان):

Rocky shoreline extraction using a deep learning model and object-based image analysis

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Abstract: In the context of the increasing anthropogenic influence on the coastal areas that are subject to high climate variability, the main challenge is to understand its current dynamics and to predict its future evolution. Therefore, monitoring of the shoreline kinematics is a key factor for the coastal erosion assessment and an essential feature for the sustainable management of these naturally vulnerable areas. This work focuses on the detection and extraction of the shoreline, basing on a specific remote sensing methodology using Very High Resolution (VHR) optical images. Indeed, an integrated approach based on a Deep Learning model, which is the Convolutional Neural Network (CNN) and Object Based Image Analysis (OBIA) has been developed. This study aims to evaluate the methodological contribution of this integrated approach for the (semi)-automatic extraction of the rocky shoreline, for which the botanical indicator has been chosen. Therefore the upper limit of black marine lichen has been detected and extracted as the target shoreline. It is the first indication of a (semi)-automatic detection of such a complex type of shoreline. The classification results derived from the combined CNN model and OBIA methods had achieved a high overall accuracy of 0.94. The extracted shoreline have been compared to a shoreline of reference derived from a traditional method that is a manual digitizing. The distances between the two shorelines has been calculated in order to assess the accuracy of the extraction method. This comparison revealed that 76 % of the extracted shoreline lies within 1m, and 35% lies within 0.5 m of reference one. Therefore, the CNN model integrated to OBIA was successfully shown to be a good method for shoreline extraction and could offer an immediate insight regarding rocky shoreline position, providing an alternative to its monitoring.

Key words: Convolutional neural network (CNN) ; Object-Based Image Analysis (OBIA) ; Shoreline detection ; Marine Lichen