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Machine learning and shoreline monitoring using optical satellite images: case study of the Mostaganem shoreline, Algeria

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Abstract : Coastal monitoring is an essential feature for the sustainable management of naturally vulnerable areas; however, data acquisition is a tedious task. We aim to identify an efficient method of automatic shoreline monitoring based on high water level detection using very high-resolution Pleiades images and taking as the pilot zone the Mostaganem coastline (Algeria). Through a comparative study between classification methods based on pixel- and object-based image analyses (PBIA and OBIA, respectively), algorithmic development and optimizing was conducted on two machine learning (ML) classifiers: random forest (RF), and support vector machine (SVM), and two segmentation algorithms: multiresolution (MRS) and meanshift (MSS). These classification methods yielded six different shorelines that were validated using an *in-situ* GPS survey shoreline acquired on the same day as the Pleiades image. The results showed that the OBIA generated a shoreline with a 5% to 25% better accuracy than that of PBIA using the same ML algorithm. Within the OBIA approach, MRS generated a shoreline with 20% higher accuracy compared to MSS, suggesting the importance of segmentation possessing. The RF based on MRS was the method that produced the shoreline at the best accuracy, where 55.5% of the extracted shoreline was within 1 pixel of the *in situ* shoreline. This method was successfully shown to be a good alternative for shoreline monitoring of sandy microtidal coasts, offering to coastal managers a reliable tool to complete the data and efficiently manage the coastal erosion.

Keywords: Shoreline monitoring; Remote sensing; GPS survey; Machine learning; Pleiades image; Erosion.

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