



Automatic Extraction of Shoreline from satellite images: a new approach*

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Providing critical information for policy and decision makers on a local as well on national and supra-national events, the monitoring of coastal environments, and particularly the investigation of shoreline trends, has an enormous potential to improve the understanding of the coastal environment and of beaches' state of erosion or accretion. Nowadays, remote sensing and satellite imagery, coupled with periodic surveys of emerged beaches, provide a systematic view of the Earth, useful to monitor short and long-term changes of coastal zones. Particularly, Sentinel missions provide global information at high spatial resolution (up to 10m) and high temporal resolution allowing monitoring changes at scales of days and weeks.

In the context of the EU H2020 funded ECOPOTENTIAL Project, a new automatic method to retrieve the shoreline position has been developed. Sentinel -1 freely downloadable data have been employed. Sentinel-1, the first mission developed by European Space Agency (ESA), carries a C-band Synthetic Aperture Radar (SAR) which allows overcoming limiting factor for passive sensors as missing of sunlight and clouds covering. The method has been based on image processing techniques to detect land-water edges. Edge detection techniques, one of the common methods to detect the shoreline from active sensors data, is a process of finding boundaries which separate two different regions. First, a median filtering approach is adopted in order to reduce the speckle effects due to the constructive/destructive interferences of backscattered electromagnetic waves which, appearing as a salt-pepper noise in the image, preclude the recognition of the water/land boundary by intensity values. Then, by means of the Otsu's threshold method, a binary image is obtained and morphological operations (opening, closing, fill holes) are carried out to remove peaks and noises on the image. At last, the Canny's edge filter is applied in order to automatically get the shoreline.

This method has been tested on a total of 11 satellite images over 2017 along Torre Canne beaches, located in the Apulia region (south of Italy) and facing the Adriatic Sea. In order to obtain accuracy and precision metrics, the resultant delineated shorelines are validated against those derived from video-monitoring systems extracted and in-situ monitoring; a mean distance of 1 to 3.51 pixels is found.

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