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Automatic Posidonia Oceanica monitoring by means of Autonomous Underwater Vehicles to study the effects of anthropogenic impacts on marine ecosystems.

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In recent years the ecosystems and habitats of the oceans and seas have been subjected to ever-increasing pressures and impacts that can affect their maintenance and sustainability.
As far as the Mediterranean Sea is concerned, it is characterised by the presence of Posidonia Oceanica (P.O.) seagrass along almost all the coastal areas. Ecosystems dominated by the presence of P.O. contain a large biodiversity, play a role in preventing erosion of the seabed, produce oxygen and store large quantities of CO_2. However, the P.O. is extremely sensitive to changes in the state of the environment in which it lives. The coastal impacts that can influence the presence of the P.O. are various and have different nature: some are induced by large-scale climate changes (temperature variation, alteration of marine currents) while others are anthropogenic (dispersion of pollutants from urban and industrial wastewater, placement of submarine cables and pipelines and use of invasive fishing tools).
Given their importance, the P.O. meadows are protected by the European Directive "Habitat Directive 92/43/EU" and are included in the list of priority habitats in the "Marine Strategy Directive Framework" which aims to achieve the Good Environmental Status (GES) by 2020. Within this regulatory framework, actions to continuously monitoring P.O. play a key role in the study of marine environmental quality in order to make a proper assessment whether GES was reached or maintained.
In particular P.O. could be used as a biotic factor to highlight the effects of anthropogenic impacts on the ecosystems and, more generally, for the overall assessment of the quality of the littoral marine environment.
Research presented in this paper focuses on the automatic identification of the presence of P.O. on the seabed based on acoustic and optical data acquired by an Autonomous Underwater Vehicle (AUV) and machine learning methodologies for their processing.
AUV technology allows the acquisition of acoustic and optical data characterised by great precision and resolution while machine learning methods enable to detect the presence of P.O. with a high degree of reliability. Some results obtained with data acquired in the coastal area of Biograd na Moru, characterised by the presence of large P.O. meadows, will be shown.
The aim of the work is to use the automatic P.O. detection method to develop a contour tracking procedure in order to integrate it with the automatic guidance module of the vehicle. In this way the robotic system will be able to track the P.O. meadow boundary in different time instants, allowing a fast and automatic assessment of the P.O. grow/decrease rate over the time and thus studying the effects that anthropogenic impacts have on coastal ecosystems.