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Improve Divers Tracking and Classification in Sonar Images Using Robust Diver Wake Detection Algorithm

Authors : Mohammad Tarek Al Muallim, Ozhan Duzenli, Ceyhun Ilguy

Abstract : Harbor protection systems are so important. The need for automatic protection systems has increased over the last years. Diver detection active sonar has great significance. It used to detect underwater threats such as divers and autonomous underwater vehicle. To automatically detect such threats the sonar image is processed by algorithms. These algorithms used to detect, track and classify of underwater objects. In this work, divers tracking and classification algorithm is improved be proposing a robust wake detection method. To detect objects the sonar images is normalized then segmented based on fixed threshold. Next, the centroids of the segments are found and clustered based on distance metric. Then to track the objects linear Kalman filter is applied. To reduce effect of noise and creation of false tracks, the Kalman tracker is fine tuned. The tuning is done based on our active sonar specifications. After the tracks are initialed and updated they are subjected to a filtering stage to eliminate the noisy and unstable tracks. Also to eliminate object with a speed out of the diver speed range such as buoys and fast boats. Afterwards the result tracks are subjected to a classification stage to deiced the type of the object been tracked. Here the classification stage is to deice wither if the tracked object is an open circuit diver or a close circuit diver. At the classification stage, a small area around the object is extracted and a novel wake detection method is applied. The morphological features of the object with his wake is extracted. We used support vector machine to find the best classifier. The sonar training images and the test images are collected by ARMELSAN Defense Technologies Company using the portable diver detection sonar ARAS-2023. After applying the algorithm to the test sonar data, we get fine and stable tracks of the divers. The total classification accuracy achieved with the diver type is 97%.

Keywords : harbor protection, diver detection, active sonar, wake detection, diver classification
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