

ACOUSTICS2008/1016

Advanced ATR Techniques based on High-Resolution SAS Sensors

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Automatic Target Recognition (ATR) is a key element of expeditionary Mine Countermeasures (MCM) and port protection operations. Most existing approaches to ATR are currently based on high resolution sonar sensors, which provide enough information to obtain satisfactory detection and classification performance for the large World War 2 mine types (e.g. 2m long cylinder). False alarm rates, however, are still unacceptably high for modern mines, which constrains the way operations are undertaken and often requires either confirmation or re-evaluation by a human operator. The introduction of new AUV-mounted Synthetic Aperture Sonars (SAS) increases the resolution, quality and range of acquired sonar images, which broadens the set of machine vision and computer image analysis techniques that can be used for underwater ATR operations. In this paper we study the impact that the increased quality and resolution have on performance gains and false alarm reduction. A number of classification algorithms are selected to represent the pool of existing approaches to target detection and classification, and their performances are estimated using both simulated and real image data in order to quantify the benefits associated to the new SAS technology. Evolution and near-future plans are discussed, introducing emerging bio-sonar sensors, anomaly detectors and autonomous AUV systems.