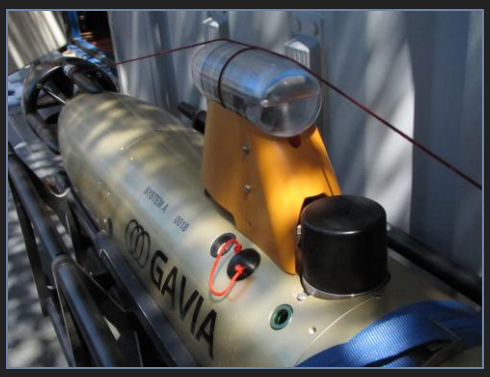
Automatic Target Recognition

Automatic target recognition for MCM operations

Mine warfare operations rely upon gathering a situational awareness of the battle space in which they operate by utilizing multiple sensors and platforms to gather information. This information is integrated into a single operating picture to allow tactical decisions to be made. High-resolution side-scan sonar provides much of the information to determine the picture of the seafloor. Computer-Aided-Detection/Computer-Aided-Classification (CAD/CAC) can perform automatic target recognition to enable rapid operator assisted processing of this information. It is critical to meet the ever-increasing demands of the MCM community for performance under the wide variety of required operating scenarios.

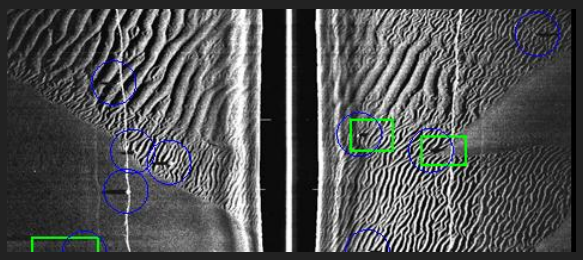


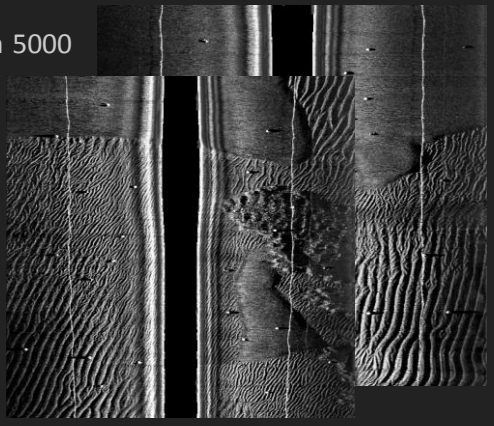
Automatic Target Recognition systems are generally comprised of a Computer Aided Detection (CAD) and a Computer Aided Classification (CAC) component. The aim of these models is to highlight possible targets within the sensor data to the operator.The CAD component is designed to detect all mine-like objects (MILOC's) from the sidescan sonar data. The CAC component then provides further analysis, and is tasked with providing a measure of how 'mine-like' each of the MILOC's produced by the CAD module are. Based on this information, the user may decide whether the MILOC is a mine or a false alarm.

Integrated performance

SeeByte CAD/CAC is integrated into SeeTrack and allows the user to browse, QA, modify and add/subtract to the output produced by the CAD/CAC. The CAD/CAC can also be provided as a real-time embedded module running on a small form factor PC (PC-104).

SeeByte CAD/CAC has been used operationally on Klein 5000 series, Marine Sonic, Edgetech 4400 SAS, and Edgetech 4200.





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Sonar and environmental factors

Two important factors in the performance of CAD/CAC models are the sonar type and the seafloor which the AUV is surveying. While the resolution remains high enough to resolve an object from the background, the CAD module is often able to provide a high probability of detection regardless of the particularities of these factors. However, as the conditions move away from the ideal, this high probability of detection may only be achievable if the false positive rate is also increased.

The SeeByte CAD/CAC module is a model-based approach and so uses any available navigation and sonar information when producing its output. Changes to parameters such as the sonar resolution, AUV height and sonar slant range are all considered by the CAD/CAC system when producing its output, enabling the same CAD/CAC system to be used on different sonars and under different sonar conditions.

Detections at different ranges on various sonars

In-situ training

The most recently developed SeeByte CAD/CAC also uses fast, supervised classification techniques, which provide a step-up improvement in processing speeds and results. This model can be trained using augmented data (real sidescan data, simulated targets) produced by the Performance Analysis Training Tool (PATT). PATT is capable of inserting realistic mine-like objects into real side-scan imagery, enabling in-situ environmentally dependent re-training of the CAD/CAC model. The ensures the CAD/CAC model is capable of adapting to changing environments.

Further Details

SeeTrack CAD/CAC requires SeeTrack Military. The Performance Analysis Training Tool (PATT) module provides training and evaluation of both CAD/CAC models and operators. Further technical details for any of these products are available on request.

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