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Acoustic signal processing methods for detecting intrusions and threats in the battlespace

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The processing of acoustic sensor data enables the detection, classification, localization and tracking of intrusions and threats in the battlespace. Initially, passive acoustic signal processing methods that are used in unattended ground sensor networks and onboard uninhabited aerial vehicles are reviewed. These methods process radiated noise (acoustic signature) data generated by sources of military interest and extract tactical information on air and ground vehicles as well as direct (rifle) and indirect (artillery/mortar) fire weapons. Examples of applying various passive acoustic signal processing methods to real sensor data collected during field experiments are presented. The tactical parameter estimates derived from these acoustic methods are then compared with ground truth data. Next, the application of active sonar signal processing to the automatic detection and tracking of a fast inshore watercraft in a cluttered harbor environment is demonstrated using real data. The air bubbles associated with wakes from high-speed surface craft are highly reflective of incident high frequency sonar signal transmissions. Finally, various high frequency active sonar methods that use both real and synthetic apertures to image sea mines are reviewed and demonstrated.