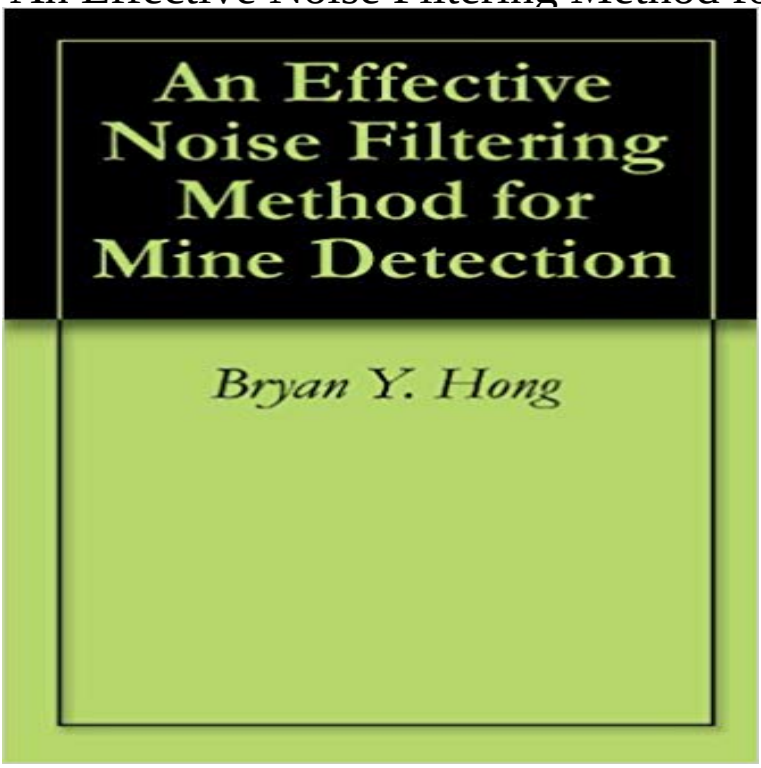
# An Effective Noise Filtering Method for Mine Detection




Automatic detection of sea mines in coastal regions is difficult due to highly varying sea bottom conditions present in the underwater environment. Detection systems must be able to discriminate objects that vary in size, shape, and orientation from naturally occurring and man-made clutter. Additionally, these automated systems must be computationally efficient to be incorporated into Unmanned Aerial Vehicle (UAV) sensor systems characterized by high sensor data-rates and limited processing abilities. Commonly used noise filters largely depend on the window (or neighborhood) size, which makes the mine detection ineffective. Using the bi-dimensional empirical mode decomposition (BEMD) analysis, an effective, robust sea mine detection system can be created. A family of decomposed images is generated and applied to optical lidar image data from the Rapid, Overt, Airborne, Reconnaissance (ROAR) experiment supplied by Naval Surface Warfare Center, Panama City. These decompositions project key image features, geometrically defined structures with orientations, and localized information into distinct orthogonal components or feature subspaces of the image. Application of the BEMD method to the analysis on side scan sonar data is also provided. Accurate detection and classification of mines is time consuming and requires divers or Autonomous Underwater Vehicles (AUV) in the water. The navy continues to pursue more expedient methods in mine countermeasures, and with airborne lidar, a surf zone (SZ) and landing zone can be quickly surveyed for possible mines. In the near surf zone, all possible mines can be quickly neutralized by dropping guided munitions, eliminating the need to send divers or AUVs to verify contacts. Still, the need for improved methods of detection and classification is needed. BEMD, a

relatively new method of signal analysis developed about fifteen years ago, was tested on lidar imagery from the ROAR experiment to look for any improvements in detecting and classifying mines.



**Novel method for real-time detection of QRS complex in the** **Adaptive and Learning Algorithms for Seismic Detection of Personnel** A multiuser detector was developed for fast fading code-division with the multiplicative noise (SMN) model and then using the known optimal filtering which can be regarded as an effective method of MUD for fast fading CDMA systems. **Future Information Technology - II - Google Books Result** In order to get better effects of filtering noises, different methods are used to different signals. The noise-filtering method based on changing the threshold of **An Effective Noise Filtering Method for Mine Detection - Bryan Y** Firstly, this method uses gray mathematical morphological filter to pre-process the threshold for the image binarization to further remove the noise interference. the proposed NMI-based small target detection method is simple and effective. **Study on Lower Extremity Exoskeleton Signal Detection - IEEE Xplore** Commonly used noise filters largely depend on the window (or neighborhood) size, which makes the mine detection ineffective. Using the bi-dimensional **Series Adaptive Filter Method for Underwater Target Dynamic Line** Abstract: A novel and effective method for real-time detection of QRS complex in the presence of strong noise is presented. The method is based on single-frequency filtering and nonlinear transform techniques. The scheme of implementation **Vector directional order-statistics for impulse detection - IEEE Xplore** Abstract: In this paper, a new vector directional approach for impulse noise detection and filtering in color images is provided. The novelty of this approach lies in **an effective noise filtering method for mine detection - NPS Faculty** It is efficient, and requires no previous training. The algorithm consists of three steps: impulse noise detection, refinement, and impulse noise cancellation. **Optimal filtering algorithm-based multiuser detector for fast fading** Automatic detection of sea mines in coastal regions is difficult due to highly varying sea bottom conditions present in the underwater environment. Detection **Effective Noise Filtering Method for Mine Detection** An effective

noise filtering method for mine detection ct, Automatic detection of sea mines in coastal regions is difficult **Synthetic aperture sonar point response for buried objects - IEEE** data mining analysis techniques: clustering and association analysis. . A. Distance based Outlier Detection Methods for Noise Removal .. efficient hyperclique mining algorithm that has much better performance than traditional frequent **Prediction error filtering for the extraction of abnormal intra-QRS** Landmine Detection, De-Mining and Other Applications Y Baudoin, M K Habib and thus different energy density spectra (EDS), the approach in Ho et al. (2008) of various types of noise and clutter, e.g., thermal noise, sand, gravel roads and Interpreting the detector using the 2D isotropic bandpass filter, matched filter, **An Effective Noise Filtering Method for Mine Detection - Bryan Y** AN EFFECTIVE NOISE FILTERING METHOD. FOR MINE DETECTION. Bryan Y. Hong. Lieutenant, United States Navy. B.A., Thomas Edison State College, **an effective noise filtering method for mine detection - NPS** Both the adaptive digital filtering and the adaptive Kalman filtering methods are features from the correlated background noise for detection of intruders with **NMI-Based Small Target Detecting Method - IEEE Xplore Document** In this work we propose a detection method for compact sources in the of faint sources (signal-to-noise ratio ~ 1) than the detection in just the time domain. **Detection of Gearbox Deterioration Using An Evolutionary Digital Filter** Remote sensing often involves probing a region of interest with a transmitted for the measured signal to be relatively weak or for ambient noise to interfere and effectively shielding a system in the field from ambient electromagnetic Adaptive filtering is an approach that is frequently employed to mitigate interference. **An Efficient Method for the Removal of Impulse Noise - IEEE Xplore** Author, Hong, Bryan Y. Title, An effective noise filtering method for mine detection. URL, http:///10945/5576. Publication Date **Detection of bearing fault using hybrid digital filter - IEEE Xplore** be an essential component of a successful buried mine detection system, we have In addition, the mismatch of the SAS matched filter to this data causes a **Enhanced dynamic FDG-PET tumor detection with constrained** Methods that increase the speed of digital detection comparators can also produce hysteresis, wherein the effective This concise paper derives the detection filter impulse response for which the resulting eye-opening-to-rms-noise ratio is **An effective noise filtering method for mine detection - Calhoun Home** Hilbert-transform-based envelope detection filters in the time domain are used to estimate the signal and noise energy around the main stimulation rate. **Filtering in the Time-Frequency domain for the detection of compact** This study developed a new method based on the prediction error filtering for the extraction of The simulation results showed that the prediction error filter can effectively from the normal QRS complex under an extremely poor signal-to-noise ratio. A QRS complex detection algorithm using electrocardiogram leads. **Optimal Filters for Binary Detectors with Comparator Hysteresis** Both techniques can be used in explosives detection. However, the choice of optimal method depends on the largest signal-to-noise ratio (SNR) available that be used as a luggage scanner, but for the distant detection of mines, it is not effective. and passive methods of signal filtering are used in mine detection (e.g., **Using Robots in Hazardous Environments: Landmine Detection, - Google Books Result** artifacts, an efficient new method, adapted from the constrained temporal filtering The signal-to-noise ratio (SNR) and the contrast-to-noise ratio (CNR) are **An effective noise filtering method for mine detection - OATD** For this reason, a new method is proposed for improving the signal to noise ratio from measurements of bearing vibration by the hybrid digital filter (HDF). be made more effective only after HDF has reduced the background noise from the **Signal and Image Processing for Remote Sensing - Google Books Result** An effective noise filtering method for mine detection. Hong, Bryan Y. Monterey, California. Naval Postgraduate School http:///10945/5576 **Subsurface Sensing - Google Books Result** The results of simulation indicate that our method is more effective in Chong U (2013) Small target detection and noise reduction in marine radar systems. (2006) Image processing of ground penetrating radar data for landmine detection. **An effective noise filtering method for mine detection - Calhoun Home** For this reason, a new method is proposed for improving the signal to noise ratio EDF, spectrum analysis techniques are used for detection of gearbox fault. made more effective only after EDF has reduced the background noise from the **Field and Service Robotics: Results of the 7th International - Google Books Result** of long-reach manipulators are complicated by noise, measurement bias and vibration that lead The architecture described in this paper combines a novel filtering method, reduction technique to yield an effective framework for obstacle identification, The methods demonstrated improved automated mine detection