AUTOMATIC DETECTION OF MAGNETIC UXO ANOMALIES IN NOISY ENVIRONMENTS

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Magnetometry has emerged as one of the most efficient and cost-effective methods for detecting and discriminating unexploded ordnance (UXO) targets. Successful application of the method to large areas depends on the ability to automatically detect targets by picking the anomalies that are caused by UXO-like objects. Efficient and reliable first-order detection of potential anomalies lays the foundation for achieving accurate and cost-effective discrimination in subsequent analysis. Towards this goal, we have developed a new approach to automatic anomaly detection using the concept of structural index (SI) in SERDP Project MM-1414. SI describes the rate of magnetic field decay as a function of distance from the source and directly characterizes the source type. For example, the total-field magnetic anomaly produced by a dipole-like source, such as a UXO, decays with inverse distance cubed and therefore has an SI of 3, whereas the field due to an elongated geologic source would have an SI of 2. Identifying magnetic anomalies with SI close to 3 enables direct detection of potential UXO targets. The recently developed extended Euler deconvolution based on 3D Hilbert transforms provides a reliable means for calculating the SI of compact and isolated anomalies. We have adapted extended Euler to form the basis for our automatic anomaly detection algorithm. To fully develop it for application in geologically noisy environments, we have investigated different methods for pre-processing magnetic data and post-processing of detection results to minimize the influence of geologic effect. In particular, we have examined the use of wavelet and Wiener filtering techniques in extracting residual UXO anomaly. We have also developed an amplitude analysis technique based on approximate source strengths to winnow false alarms statistically. In this presentation, we will present the details of the detection algorithm, discuss the effect of pre-processing, and illustrate the importance of post-processing based on amplitude analysis.