UNDERWATER ACOUSTIC TARGET CLASSIFICATION SYSTEM USING SVM

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ABSTRACT

Underwater target classification is often a demanding task. Underwater acoustic target classification systems can identify the acoustic target pertaining to their characteristic acoustic signature captured by hydrophones. The performance of any classification system depends on the classification algorithm being used and the feature extraction method used to identify the acoustic signature, of which the Support Vector Machine (SVM) method features better generalization ability when dealing with high-dimensional data. SVM's are nonparametric models that rely on Structural Risk Minimization (SRM) principle in which model complexity is chosen according to data complexity. This paper presents a study on SVM based underwater acoustic target classification. Classification of 4 classes of acoustic targets using the nonlinear multiclass SVM algorithm is discussed. The acoustic features are extracted using Mel Frequency Cepstral Coefficients (MFCC), which has been extensively used in target recognition from acoustic signals. After preprocessing the acoustic data, the MFCC coefficients are extracted frame-by-frame and the feature vector at each frame is clustered using the k-means algorithm to form the acoustic signature. The acoustic signatures are labelled and fed to the SVM algorithm for classification. Performance of the proposed classifier is evaluated using the cross-validation technique. The proposed SVM classifier shows good generalization ability with an error rate of only 9% when evaluated with 10-fold cross-validation.

KEYWORDS: Feature Extraction, *k*- Means Clustering, Mel Frequency Cepstral Coefficients, Support Vector Machines