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Development of machine learning techniques for automatic modulation classification and performance analysis under AWGN and fading channels

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Abstract

Automatic modulation classification (AMC) is essential in modern wireless communication for optimizing spectrum usage and adaptive signal processing. This study explores the use of various machine learning (ML) methods for AMC, focusing on their performance in additive white Gaussian noise (AWGN) and fading channels. This study evaluates of ML classifiers such as support vector machines (SVM), K-nearest neighbors (KNN), decision trees (DT), and ensemble methods with a dataset spanning signalto-noise ratios (SNRs) from -30 dB to +30 dB. Higher-order statistical features including moments and cumulants are used to train the classifiers for AMC. Performance is measured in terms of classification accuracy and computational efficiency across different SNR levels. The findings show that linear SVM, fine KNN, and fine trees consistently achieved high classification accuracy, even at low SNRs. From the analysis, it is observed that linear SVM and fine KNN achieve over 96% accuracy at 0 dB SNR. These classifiers demonstrate significant robustness, maintaining performance in challenging noise conditions. The research highlights the promise of ML techniques in improving AMC, providing a detailed comparison of classifiers and their strengths.

Keywords

AMC; AWGN; DT; Ensemble classifiers; Fading channels; KNN; SVM

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