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BER Performance Enhancement for Wireless Communication Systems Using the AdaBoost Technique

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ABSTRACT

Boosting is a machine learning approach built upon the idea of producing a highly precise prediction rule by combining many relatively weak and imprecise rules.
The Adaptive Boosting (AdaBoost) algorithm was the first practical boosting algorithm. It remains one of the most broadly used and studied, with applications in many fields.

In this thesis, the AdaBoost algorithm is utilized to enhance the bit error rate (BER) of different modulation techniques. By feeding the noisy received signal into the AdaBoost algorithm, it is able to recover the transmitted data from the noisy signal. Consequently, it reconstructs the constellation diagram of the modulation technique. This is done by removing the noise that affects the signal space of the data.

As a result, AdaBoost shows an enhancement in the BER of coherently detected binary phase shift keying (BPSK), quadrature phase shift keying (QPSK), 8 quadrature amplitude modulation (8QAM) and 16 quadrature amplitude modulation (16QAM).

The AdaBoost is next used to enhance the BER of the noncoherent detection of the used modulation techniques. The enhancement appears in the form of better results of the noncoherent simulated BER in comparison to that of the theoretical noncoherent BER.

The AdaBoost is simulated for several techniques in additive white Gaussian noise (AWGN), Rayleigh fading channel and Rician fading channel so, as to verify the enhancement effect of the AdaBoost algorithm.

Next the AdaBoost algorithm is added to the channel estimation techniques such as the Least Squares (LS), Least Mean Squares (LMS) and Recursive Least Squares (RLS) and is used to enhance the BER performance of the different estimation techniques in a Rayleigh fading environment as well.

Ones are also interested in and concerned with applying the AdaBoost technique to the 5G mobile technology such as the orthogonal frequency division multiplexing (OFDM) and the multiple input multiple output OFDM (MIMO-OFDM). So, as to evaluate the BER performance of the simulated system in a Rayleigh fading environment and further verify the enhancing effect of our main line of work in this thesis to the latest wireless communication systems in comparison with that done by others in previous research.