A New Quantized Input RLS, QI-RLS, Algorithm

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Abstract. Several modified RLS algorithms are studied in order to improve the rate of convergence, increase the tracking performance and reduce the computational cost of the regular RLS algorithm. . In this paper a new quantized input RLS, QI-RLS algorithm is introduced. The proposed algorithm is a modification of an existing method, namely, CRLS, and uses a new quantization function for clipping the input signal. We showed mathematically the convergence of the QI-RLS filter weights to the optimum Wiener filter weights. Also, we proved that the proposed algorithm has better tracking than the conventional RLS algorithm. We discuss the conditions which one have to consider so that he can get better performance of QI-RLS against the CRLS and standard RLS algorithms. The results of simulations confirm the presented analysis.

Keywords: Adaptive Filter, Recursive Least Square (RLS), Weiner Optimum Weights, Tracking.

1 Introduction

An adaptive filter is a filter which self-adjusts its transfer function according to an optimizing algorithm. Because of the complexity of the optimizing algorithms, most adaptive filters are digital filters that perform digital signal processing and adapt their performance based on the input signal. The Recursive Least Square (RLS) and the Least Mean Square (LMS) are two famous adaptive filtering algorithms [5]. They have attained its popularity due to a broad range of useful applications in such diverse areas as communications, radar, sonar, seismology, navigation and control systems, and biomedical electronics.

The optimization of convergence speed and tracking performance are open problems in adaptive filter theory. Fast convergence of the RLS has given rise to the development of the algorithms based on it [6,9,10,12].

The works reported in [1,2,3,7,8,14] have been done for increasing the real-time performance of the LMS algorithm using the sign of the input data and/or error during updating the filter weights. In the clipped RLS algorithm [11], the input signal is quantized into three levels of -1, 0, +1. They discussed the convergence and the computational complexity of their own CRLS algorithm.