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Performance of Modified Variable Step Size NLMS Algorithm

Gunjan Kohar[1], Er. Vikas Mittal[2]

[1] M.Tech Student of MMEC, Mullana
M.M. University, Mullana-Ambala-Haryana, India
[1]gunjankohar@gmail.com,

[2] Asst. Prof. in ECE department MMEC, Mullana
M.M. University, Mullana-Ambala-Haryana, India
[2]vikasmittal2k7@rediffmail.com

Abstract: *In this paper, author wants to remove the echo from the signal. Numerous Variable step- size normalized least mean square algorithm have been derived to solve the problem of fast convergence rate or low excess mean-square error in the past two decades. The normalized least mean square is the most popular due to its simplicity. The stability of the basic NLMS is controlled by a fixed step size. This parameter also governs the rate of convergence, speed of tracking ability and the amount of steady-state excess mean-square error. The main aim of this paper is to reduce the low excess MSE associated with the conventional NLMS, a number of variable step-size NLMS (VSS-NLMS) algorithms have been presented in the past two decades. In this we compare the result with previous one.*

Keywords: *NLMS, VSS, Mean square error.*

1. INTRODUCTION

The echo cancellation application is one of the most challenging system identification problems. Even though many interesting adaptive algorithms are theoretically applicable for AEC [1], in applications with limited precision and processing power, the normalized least mean- square (NLMS) algorithm [2] and some versions of it are usually applied. The performance of this algorithm, in terms of convergence rate, mis-adjustment, and stability, is governed by the step-size parameter. Within the stability conditions, the choice of this parameter reflects a tradeoff between fast convergence rate and good tracking ability on the one hand and low mis-adjustment on the other hand. To meet these conflicting requirements, the step size needs to be controlled.

2. LITERATURE SURVEY

Junghsi et.al. [3] Presented a variable step-size normalized LMS filter is to solve the dilemma of fast convergence rate and low excess MSE. In the past two decades, many VSS-NLMS algorithms have been presented and have claimed that they have good convergence and tracking properties. This paper summarizes several promising algorithms and gives a performance comparison via extensive simulation. Simulation results demonstrate that Benesty's NPVSS and our GSER have the best performance in both time-invariant and time-varying systems.

Hsu-Chang et. al.[4] presented numerous variable step-size normalized least mean square (VSS-NLMS) algorithms have been derived to solve the dilemma of fast convergence rate or low excess mean-square error in the past two decades. This paper proposes a new, easy to implement, nonparametric VSS-NLMS algorithm that employs the mean-square error and the estimated system noise power to control the step-size update. Theoretical analysis of its steady-state behavior shows that, when the input is zero-mean Gaussian distributed, the mis-adjustment depends only on a parameter controlling the update of step size. Simulation experiments show that the proposed algorithm performs very well. Furthermore, the theoretical steady-state behavior is in very good agreement with the experimental results.

Cassio et. al. [5] presented a new methodology for evaluation and design of variable step size adaptive algorithms. The new methodology is based on a learning plane, which combines the evolutions of both the step size and the mean square error. It includes both transient and steady-state behaviors and can be used to compare performances of different

Algorithms against an optimum trajectory in the learning plane. The new technique can also be used for algorithm optimization in system identification applications.
Zhao et. al. [6] in this, the modified LMS and NLMS algorithms with variable step-size are presented. It is shown that the variable step size is computed using a ratio of the sums of weighted energy of the output error with two exponential factors α and β, thus the fast error convergence of the modified LMS and NLMS algorithms can then be achieved. Also, by properly choosing the values of α and β, the mis-adjustment can be further improved. A few simulation results are presented in support of the good performance of the proposed algorithms by comparing with other LMS-type algorithms.

3. MODIFIED ALGORITHM

***3.1 Variable Step Size LMS Algorithm**:* Based on the error-squared power, Kwong and Johnston proposed a simpler Variable Step Size least mean square algorithm (VSS LMS) [7]. The error power reflects the convergence state of the adaptive filter, where a converging system has a higher error power while the converged system has a smaller error power. Therefore, scalar step size increases or decreases as the squared error increases or decreases, thereby allowing the adaptive filter to track changes in the system and produces a smaller steady state error. The variable step size algorithms (except for the gradient adaptive step size) are based on some heuristic rules on the step size adjustment which are translated into numerical formulae. An overall weakness of the variable step size algorithms are that they require the user to select additional step size recursion constants and an initial step size to control the adaptive behavior of the step size sequence. More importantly, anticipation of the maximum and minimum limits are needed to avoid instability as well as to maximize performance. Nevertheless, the body of work in this field has enabled adaptive performance to be achieved that is comparable to the RLS algorithm. However, the performances gained are always followed by an increase in complexity and additional parameters to manage. The gear shifting approach and the VSS algorithm are the most simple and effective algorithms for fast convergence. Alternatively, to increase the convergence speed, the normalized LMS algorithm is the natural choice, as it is independent of the parameter selection.

***3.2 Variable Step Size NLMS Algorithm**:* In general, these algorithms were developed assuming an exact modeling situation, i.e., the length of the adaptive filter is equal to the length of the system that has to be modeled. Due to the fact that the acoustic echo paths are extremely long, the under-modeling situation (i.e., the length of the adaptive filter is shorter than the length of the echo path) is the rule in AEC. The residual echo caused by the part of the system that cannot be modeled can be interpreted as additional noise, and it influences the algorithm's performance. In this, author proposes a VSS-NLMS algorithm derived in the context of under-modeling situation. The algorithm does not need any additional information regarding the acoustic environment, so it is efficient and easy to control in real-world AEC applications. The experimental results indicate the good performance of the proposed algorithm.

4. PERFORMANCE ANALYSIS

In this section, we present simulation results to demonstrate the proposed VSS-NLMS. In this, we take signal and then echo A will introduce in signal. Then signal and Echo A get mix and after processing recover signal we get. After that we get an error between signal and recovery signal. An error is less as compared to previous results. Mean square error is 0.1085.

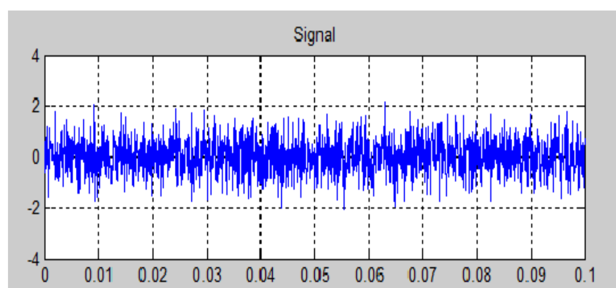

Figure 1: Input Signal

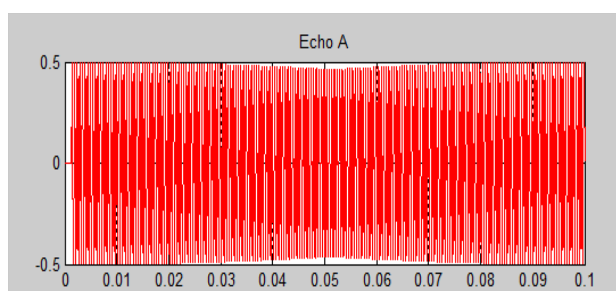

Figure 2: Echo

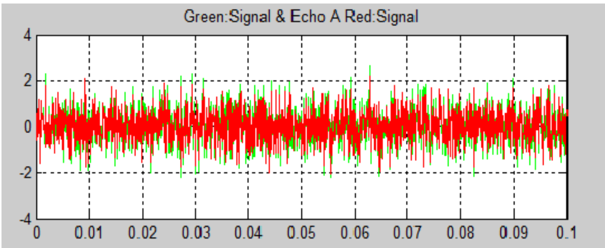

Figure 3: Addition of echo in input signal

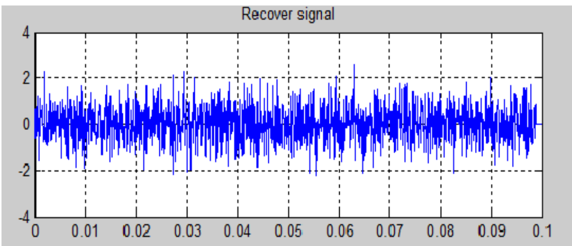

Figure 4: Removal of echo

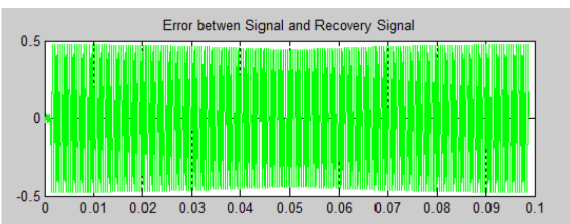

Figure 5: Error

5. CONCLUSION

The new non-parameteric VSS-NLMS algorithm introduced in this paper has been shown to perform with fast convergence rate, good tracking, and low mis-adjustment. In comparison with existing VSSNLMS algorithms, the proposed algorithm has demonstrated consistently superior performance both in convergence and for final error level relative to published algorithms in application on both simulated data and real speech data.

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