An Effective Method to Measure Evoked Potential

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Abstract: *In the clinic, the traditional method to obtain Evoked Potential (EP) is the calculated average value of repeated measurements. This is inefficient and inaccurate. An adaptive signal enhancement filter embedded with Least Mean Square (LMS) or Recursive Least Square (RLS) algorithm is an effective tool. It significantly decreases the number of repeat measurements needed to obtain satisfactory results.*

INTRODUCTION

EP plays an important role in neuroscience [1]. External stimulation is transfer to the cortex membrane through nerve channels. This biomedical signal is random in amplitude and duration. Thus, an effective way to measure [2-4] is imminent.

METHOD

Figure 1 is the proposed filter. The reference input x is the average value calculated from a few sample. The output from the adaptive filter is compared to d, the measured EP. The difference is used to regulate the filter parameters. LMS and RMS are used to process the EP respectively. The EP, contaminated with EEG is tested for signal to noise ratio (SNR) of –4dB and –20dB.

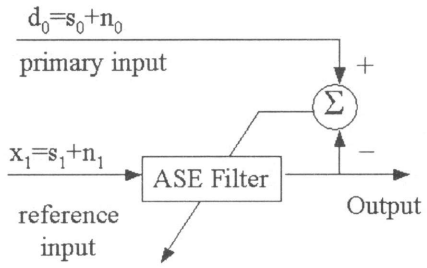

Figure 1: Model of adaptive signal enhancement filter.

RESULT

In Table 1 (SNR = –4dB), the reference input using LMS and RLS is the computed average of initial data collected (5 data for LMS, 25 for RLS). This reference is compared to a newly measured EP. The results showed that the mean square error (MSE) is close to that obtained by average to experimental data.

Table1: Mean square error after processing, when SNR is –4dB.

	LMS	RLS	AVG
MSE(%)	5.52	5.57	5.59

In Table 2 (SNR = –20dB), the above procedure is repeated to obtain the reference input (250 for LMS, 750 for RLS). The reference is compared to 100 newly measured EP. The MSE is close to that obtained by averaging 1000 experimental data collected by traditional method.

Table2: Mean square error after processing, when SNR is –20dB.

	LMS	RLS	AVG
MSE(%)	6.50	6.58	6.29

CONCLUSION

When SNR is set to –4dB, comparing to traditional average method, the number of experiments needed is decreased by 91.4% for LMS and 62.9% for RLS. When SNR is set to –20dB, the number of experiments needed is decreased by 65% for LMS while that for RLS is 15%. This shows that with the use of adaptive signal enhancement (ASE) filter, the number of experiments needed is substantially reduced. The LMS outperforms the LMS.

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