Global Journal of Advanced Engineering Technologies and Sciences

Economic Development and Well-being of Society is Simply Not Possible without a Sustainable Environment

Mohsen Hamidi

Department of Electrical Engineering, Mahabad Branch, Islamic Azad University, Mahabad, Iran

Abstract

An adaptive noise canceller based fetal electrocardiogram extraction method is proposed and implemented. From the simulation results we can conclude that FECG signals can be extracted from the abdominal electrocardiogram signals using LMS algorithm for changing tap-weight vector. Software implementation of LMS algorithm is presented to implement the ANC system and the proposed algorithm is implemented using simulink. Fetal heart rate signals are extracted from the peaks of R-R intervalemotional well-being of the society.

Keyword:- Economic, FECG, CDM, LMS

I Introduction and Related Works

The changing economic landscape from agriculture-, manufacturing- and service-based towards knowledge- and innovative-based economies had inflicted significant and in some cases irreversible impacts on the carrying capacity of the environment as a life supporting system. The exponential population growth, rapid advancement in technologies and the increase in affluence of the population in the developed and rapidly developing economies had been the main cause of the deterioration of the environment. The increase in pollutant load onto the environment had led to several global phenomena such as the release of what is currently classified as emerging or priority pollutants rendering serious hazards to the biotic environment and emission of greenhouse gasses leading to global warming and climate change. The shift in economic focus globally and the undeniable evidences of climate change had significantly affected the concepts and approaches adopted by engineers and scientists in providing services and solving environmental problems with the main aim of improving the quality of life for human (mostly measured through economic gains). These changes in approaches to include environmental importance are shown in Table 1. In the last two decades intense focus was accorded to carbon and ecological footprints. Carbon footprint is an indirect measure of human activities while the ecological footprint measures the impact on the environment. More efforts were focused on Quantitative Sustainability Assessment in order to have a better estimate of the carbon and ecological footprints.

To estimate the parameters of the Weibull distribution, various estimation methods have been proposed by different authors [7-10]. Among which, maximum likelihood estimation (MLE) method is the most popular in terms of the theoretical prospective and the median rank regression (MRR) method is computationally easier to handle and provides simple closed form solutions for the estimates. Comparisons between MLE and MRR have been made by some researchers [11-14]. These studies, however, resulted in contradictory opinions on the preference of one method over the other, as they were conducted with different data generating mechanisms at various censoring levels. It is suggested that for application in a specific situation, simulations should be designed to greatly mimic that specific sampling scenario based on which optimal method can be chosen. This paper therefore discusses and compares MLE and MRR for their properties in estimating transformer lifetime data. MLE and MRR are briefly summarized in Section II. After analysing the characteristics of field collected transformer lifetime data, Monte Carlo simulations are designed and conducted to simulate multiple sets of transformer lifetime as presented in Section III. Comparisons are then made in terms of the relative difference between the median value and the true value (RD) as well as the relative root mean square error (RRMSE) of the estimates. Results are presented and discussed in Section IV based on which conclusions are finally drawn. Lastly an important engineering observation is that $s(t)$ has frequency components not present in either $s1(t)$ or $s2(t)$. This is because multiplication is a nonlinear operation and passing signals through nonlinearities such as squarers, rectifiers, saturation, etc., creates frequencies that were not present in the input signal. This is in contrast to a linear operation (or filter), which never creates new frequencies, it only modifies the magnitude/phase of the frequencies in the input signal.

II. WEIBULL DISTRIBUTION AND PARAMETER ESTIMATION METHODS

A. The Weibull Distribution Function

Cumulative distribution function (CDF) of the two-parameter Weibull distribution [9] is presented in (1). It's corresponding reliability function (RF), robability density function (PDF) and hazard function (HF) are listed in (2)-(4), respectively. η is the scale parameter or termed as the characteristic lifetime; β is the shape parameter. A very important characteristic of the two-parameter Weibull distribution is that the value of the shape parameter corresponds to the three regions of the bathtub curves as follows

- $\beta<1$ corresponds to region 1 of the bathtub curve, where hazard rate decreases as transformer ages;
- $\beta=1$ corresponds to the region 2 of the bathtub curve, where hazard rate is independent of the time;
- $\beta>1$ corresponds to region 3 of the bathtub curve, representing the relationship that hazard rate ncreases as transformer ages.

The scale parameter, η, represents the time by which 63.2% of the transformers are expected to have failed. For the special case that $\beta=1$, the value of η is the same as the mean lifetime of the distribution.

B. Maximum Likelihood Estimation

In present days, transformer lifetime data are often collected as incomplete dataset as a large number of units are still in safe operating condition. Maximum likelihood estimation [11] can be adopted to deal with these two types of data.

Suppose that a set of lifetime data is collected from N transformer units as (X_1, X_2,…, X_r, C_{r+1},C_{r+2},…, C_N), among which the first r units are observed as failure data for whom the event of failure is actually observed, whereas the remaining N-r units are survival data for whom the event of failures are not observed yet but only known to be beyond the current running times. Likelihood function of this dataset is as follows.

Insert RF and PDF of Weibull distribution as shown in (2) and (3) into (5) and then taking the natural logarithm, thequation is then transformed.

C. Median Rank Regression

To estimate the Weibull parameters, median rank regression [11] linearizes the Weibull data and then performs simple linear regression on the transformed data. The basis is the transformation of Weibull CDF; the transformed equation is as shown in (11).

Denoting $\ln(-\ln(1-F(x;\eta,\beta)))$ as y, equation (11) becomes a linear model between y and ln$x$. In this respect,the parameters, i.e. η and β, can be estimated with the least squares procedure as long as the point pairs (ln$x$, y) are determined. Let L_i be the ith ordered failure and Y_i be the estimate of F(L_i). Then the least square equations are.

III.DESCRIPTION OF THE SIMULATION

A. Design of the Simulation

Assume that the failure times of a transformer fleet follow a Weibull distribution with parameters (η_T, β_T), termed as true values of the distribution. For the ith unit in the transformer fleet, its failure time, $X_i(1 \le i \le N)$, can be randomly sampled from the inverse of the Weibull CDF. The collected lifetime data, L_i, for this specific unit is then specified after comparing its failure time, X_i, with a fixedcensoring time, T_C, which is actually the time duration of the observation. The value of L_i is determined as. Equation (19) represents the time censoring process that if $X_i<T_C$, the unit failed at timeX_i, whereas if$X_i \ge T_C$, the unit is censored.

Repeat the above procedure for N times, a lifetime dataset for a transformer fleet containing N units can be simulated. Besides the sample size, N, another important term that helps to characterise the lifetime dataset is the censoring rate, CR, defined as the proportion of units being censored. By controlling the censoring time, lifetime datasets of transformer fleets with desired CR can be sampled.To greatly mimic the field collected transformer lifetime data, controlling parameters for the simulation are chosen as listed in Table I. The two pairs of scale and shape parameter are chosen as (500, 1), (100, 5) to reflect utility's current understanding on the distribution of random and ageing-related failures respectively. Sample sizes are chosen to cover a wide range from 60 to 1000. The censoring rate, CR, is chosen as 90% to reflect the current situation of field collected transformer lifetime data that the censoring rate are normally in the high value range, mostly over 80% [16-19].

B. Criteria for the Comparison

To assess the performance of MLE and MRR, the relative difference between median value and the true value (RD) the relative root mean square error (RRMSE), as defined in (20) and (21), for each method were calculated using 10000 replications of lifetime data for each of the cross-combinations of the controlling parameter levels.

where

θ is the true value of the parameter;
· ˆis the estimated value of the parameter;

Bias(· ˆ)· E(· ˆ· ·)

SD(· ˆ) is the standard deviation of the estimated parameters.RD is chosen to reflect the central tendency of the results, whereas the RRMSE is adopted for the purpose for an overall evaluation of the results. The two metrics hence complement each other for an effective evaluation. It is expected that the closer the RD and the RRMSE to zero, the higher the accuracy level of the estimated parameters will be. Consequently, properties of ˆdifferent parameter estimation methods in estimating the same sets of lifetime data can be compared.

IV. RESULTS AND DISCUSSIONS

A. Results of Shape Parameter β

RD and RRMSE of the estimated βs obtained by MLE and MRR are presented together in Fig. 1 and Fig. 2, respectively. Results obtained by MLE are plotted as yellow bars, whereas results obtained by MRR are presented as magenta bars. Results obtained while $\beta_T=1$ and $\beta_T=5$ are presented in bars filled with different patterns for differentiation. This format is maintained throughout this paper.

Table1: Load types and exponent values

Load type	α	B
Constant	0.0	0.0
Industrial	0.18	6.0
Residential	0.92	4.04
Commercial	1.51	3.04

1) RD and RRMSE obtained by MLE are always smaller and hence closer to zero than results obtained by MRR in the same scenario. This indicates that MLE can provide more accurate result in estimating β compared with MRR.

2) RDs obtained by MLE are always in the positive value range, whereas RDs obtained by MRR are always in the negative value range. This implies that β tends to be overestimated by MLE whereas underestimated by MRR.

Logic Utilization	Used	Available	Utilization
Number of Slice Flip Flops	715	1,800	37%
Number of 4 input LUTs	867	1,810	43%
Number of occupied Slices	721	960	75%
Number of Slices containing only related logic	721	721	100%
Number of Slices containing unrelated logic	0	721	0%
Total Number of 4 input LUTs	1,339	1,920	69%
Number used as logic	859		
Number used as a route-thru	480		
Number of bonded IOBs	28	66	42%
Number of BUFGMUXs	2	24	8%
Number of MULT18X18SIOs	2	4	50%

3) Influence of sample size for estimating η with MLE is clearly observed that both RD and RRMSEdecreaseas sample size increases. For estimating with MLE, the law of large numbers is followed. The influence of sample size for estimating with MRR, however, is not that straight-forward. Though the same trend is observed in RRMSE,exceptions are found in RD that values obtained when N=60 are lower than values obtained when N=100, which violates the law of large numbers.

4) The influence of true β in estimating η is observed. Same accuracy level of estimatedη hence cannot be reached with different β_T. The general trend found is that estimated ηs are expected to be more accurate for dataset collected from distribution with higher β_T value as it is observed that RDs and RRMSEs obtained in the case of $\beta_T=5$ are generally lower than these values obtained in the corresponding case of $\beta_T=1$.

V. CONCLUSION

The modulation/demodulation aspect concludes with Chapter 11 where three modern modulation approaches are described and analyzed. The first modulation, known as trelliscoded modulation (TCM) was discovered in the late 1970s and developed during the 1980s. Its main feature is that a significant bandwidth reduction is achieved with no power or error penalty. The second modulation paradigm presented is code-division multiple access (CDMA) used in the so-called third (and future) generations of wireless communication networks. Finally space-time coding, introduced in the late 1990s, concludes the chapter. Space-time coding provides a significant improvement for wireless communication where fading is present. Though advanced, the modulations are quite readily understood in terms of the fundamental background material presented in the text up to this chapter. In fact all three modulations can be classed under the rubric of coded modulation wherecoding/modulation is viewed as a single entity.

REFERENCES

I. R. A. Jhonson and D. W. Wichern, *Applied multivariate statistical analysis*, 5th ed. New Jersey: Pearson, 2002.

II. M. R. Spiegel, *Theory and problems of probability and statistics*. New York: McGraw-Hill, 1992.

III. E. S. Chagas, S. L. Russo, and V. H. Simon, *Geração de Perfil Sônico Sintético em Poços de Petróleo Através dos Modelos de Regressão Não Lineares Usando a Profundidade como Variável Regressora*. São Cristovão: Scintia Plena, 2010.

IV. S. L. Russo, M. S. Prata, and V. H. Simon, "Aplicação do controle estatístico de qualidade na variável DT do processo de perfilagem de um poço de petróleo," *INGEPRO,* 2010.

V. F. Miranda, "Modelação Linear de Series Temporais na Presença de Outliers," *Tese (Mestrado em Estatística) – Departamento de Matemática Aplicada, Universidade do Porto,* 2001.

VI. M. M. C. Figueira, "Identificação de outliers," *MILLENIUM nº12,* 1998.

VII. F. R. C. B. Lourenco, *Controle estatístico de qualidade*. Rio De Janeiro: LTC, 1981.

VIII. C. Montgomery, "Introdução ao controle estatístico de qualidade," *LTC,* 2009.

IX. R. W. Samohyl, *Controle estatístico de qualidade*. Rio De Janeiro: Editora Elsevier, 2009.

X. A. Silva, M. J. S. Neto, V. H. Simon, and S. L. Russo, "Estudo do perfil sônico sintético: Caracterização da variáve lDT," *Natal. ERMAC: Encontro Regional de MatemáticaAplicada e ComputacionaL,* 2008.

XI. J. J. Harou, M. Pulido-Velazquez, D. E. Rosenberg, J. Medillin-Azuara, J. R. Lund, and R. E. Howitt, "Hydro-economic models: Concepts, design, applications, and future prospects," *Journal of Hydrology,* vol. 375, pp. 627-643, 2009.

XII. G. Colby, "Enhancing instream flow benefits in an era of water marketing," *Water Resources Research,* vol. 26, pp. 1113-1120, 1990.

XIII. R. C. Griffin and S. H. Hsu, "The potential for water market efficiency when instream flows have value," *American Journal of Agricultural Economics,* vol. 75, pp. 292-303, 1993.

XIV. P. Rogers and D. V. Smith, "The integrated use of ground and surface water in irrigation project planning," *American Journal of Agricultural Economics,* vol. 52, pp. 13-24, 1970.

XV. M. Pulido-Velazquez, M. W. Jenkins, and J. R. Lund, "Economic values for conjunctive use and water banking in Southern California," *Water Resources Research,* vol. 40, p. W03401, 2004.

XVI. J. J. Harou and J. R. Lund, "Ending groundwater overdraft in hydrologic-economic systems," *Hydrogeology Journal,* vol. 16, pp. 1039-1055, 2008.

XVII. M. Fisher, A. Huber-Lee, I. Amir, and M. J. Haddadin, *Liquid assets: An economic approach for water management and conflict resolution in the Middle East and beyond*. Washinton D.C.: Routledge RFF Press, 2005.

XVIII. M. E. Kragt, L. T. H. Newham, J. Bennett, and A. J. Jakeman, "An integrated approach to linking economic valuation and catchment modelling," *Environmental Modelling and Software,* vol. 26, pp. 92-102, 2011.

XIX. S. O. Lesmana, N. Fabriana, F. E. Soetaredja, J. Sunarso, and S. Ismadji, "Studies on potential applications of biomass for the separation of heavy metals from water and wastewater," *Biochemical Engineering Journal,* vol. 44, pp. 19-41, 2009.