The Sequential Feature of the Autoregressive Model

Christos P. Kitsos

Department of Mathematics, Technological Educational Institute of Athens, Egaleo, Athens, Greece
Email: xkitsos@teiath.gr

Abstract: The iterative schemes play a dominant role on evaluating parameters in Statistics. The target of this paper is to consider the first order Autoregressive Model, so important in Econometrics, as a “sequential approach” and construct the appropriate confidence intervals. A simulation study for different sample sizes provide evidence that the method performs rather well when the sample size is small. The normality is also investigated, in cases with small sample size.
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1 Introduction

The sequential procedures, especially when the optimal experimental design is adopted, arise the question if Fisher’s information matrix is valid, as the observations are not independent, Ford et. al. (1985). Moreover when the sequential design approach is adopted, two lines of though are considered: a fully sequential design, or an equal batch sequential approach, Kitsos (1989). The fully sequential design has been defined as that one, were the number of observations, at each stage, coincide with the number of the parameters involved. Therefore for the Autoregressive model one observation is devoted at each stage.

From an Econometric point of view, see Pindyck and Rubinfeld (1988) among others, it is rather difficult to consider an experimentation adopting the model, but for the Statistical Signal Process point of view, it can be certainly accepted, as of practical use.

Therefore, in this paper, we face the Autoregressive model for both lines of though, as we believe both are complementary.

Linear filter Input/Output (I/O) relations are well developed, adopting for the discrete time system, convolution representation of a linear system. Let X_t, $t \geq 1$ be a random discrete time random process with mean $\mu_t = EX_t$, and covariance

$$\mathrm{Cov}(t,t') = E\{(X_t - \mu_t)(X_{t'} - \mu_{t'})\} .$$

Let h_k be the Kronecker δ-response of a discrete time linear filter. For the output process Y_t (described by the convolution integral) we consider

$$Y_t = \sum X_{t-k}\delta_k \, , \tag{1}$$

in the sense that, for an event ω, from the underlying probability space Ω, holds

$$Y_t(\omega) = \sum X_{t-k}(\omega)\delta_k \, , \tag{1a}$$

with probability one.