Good article review about biometrika: time series by howell tong

Education

Biometrika has fro the last 100 years published over 400 years concerning the subject of Time Series. Time series is a significant feature in Biometrika under the editorship of Professor E. S. Pearson.

These papers grew enormously at a rate of 10% up to the present time. The first Time series paper was written by Gosset " student" and Anderson (1914). Correlation was a new and a crucial concept in Time series. Consider two time series, (Xt) and (Yt) as expressed below

Xt = mt +et and Yt = Mt + Et

Where et and Et are sequences of uncorrelated random variables, mt and Mt are polynomial mean functions in t of p and q respectively and q Corr(ΔpXt, ΔpYt) = corr (et, Et), the parameter Δp is the pth order differencing. The difference of the time series, correlation difference is obtained. However, this was not in favor with time series because the inequality does not hold in case of lag correlation.

Comment:

For me I think Biometrika has tremendously improved over time due to technological advancement in history. Since Biometrika is a mathematical institution, through its collection of mathematical ideas, these ideas have contributed significantly in the world of technology.

Autocorrelation Analysis

Estimation

For a weakly stationary time series (Xt) the autocorrelation is given as pt = corr (Xt, Xt-t) a natural extension of correlation. Bertlette (1946) laid interference of correlation outside Biometrika. Contributors from Biometrika like White (1961), for special cases considered approximating the bias term for sample autocorrelation functions. The main idea was to come up with expression for general classes of model. The saddle point approximation by Daniels (1956) led into statistics to derive a distribution for a sample autocorrelation. Later, the study was restricted to a circular time series with a finite index set.

Comment: I think for a correlation is obtained by comparing two time series. Again extension on this time series is quite effective when it comes to obtaining the correlation coefficient of the time series. Biometrika has become a beneficial platform where evolution of time series has been taking place.

Spectral Analysis

Consider the following expression where F (w) is a spectral distribution function or a spectral matrix for multivariate time series. The Fourier pairs and F (w) is a spectrum unequal vital pillar for time series analysis. This was a crucial idea for Bertlette and Tukey since it laid a foundation of smoothing the priodogram. The smoothing function is called the Bartlett window. After Bertlette frequency domain approach was the title of the papers produced afterwards by the Biometrika. Bertlette made some remarks on nonnormality, cross-spectral analysis of the off-diagonal elements of the spectral matrix and bispectral test for nonlinearity.

Comment:

The above expression can represent a probability distribution function if -π is replaced with 0 and π is replaced by 1. From there again ω is replaced with x such that 2

Leads and lags

The complex valued of the cross spectral distribution function is the Fourier transform of the cross-correlations between two component time series of a weakly bivariate time series. In polar coordinates, it contains information about lead lag relation between input or output time series. Building on Akaike and Yamanouchi (1963), Thomson and Hannan (1971, 1973) gave crucial results on spectral approach of lead lag relation and the concomitant estimation of the spectrum of coherency. Foutz and Zhang (1989) researched about two signals that are linked to a common third signal with a different lag. Tuan (1987) considered variable lags also referred to as jittered sampling or time errors which arose from brain potential data.

Autoregressive spectra

Akaike (1969) estimated the spectrum using an autoregressive model of the form

$Xt + \alpha 1 + Xt\text{-}1 +. . . + \alpha kXt\text{-}p = nt(1)$

Where the parameter nt is a sequence of identically and independently distributed random with its mean = 0 and a finite variance. Pagano and Newton (1984) and Van Wyk and Swanepoel (1986) addressed the issue of setting the simultaneous confidence bands fro the spectra. Sheffe’s projection, inverse correlation function and autoregressive spectrum were employed by the former. Resampling from the already fitted residuals was employed by the latter. Tjostheim and Lysne (1987) showed that Yule-Walker estimate of autoregressive parameters led to the loss of spectral peaks addressing the issue of spectral peak estimation. Akaike’s information criterion leads to a consistent estimator of peak frequency according to Newton and Ensor (1988).

Autoregressive models

Observe that equation (1) above is an autoregressive model of order p denoted by AR (p) model. As early as 1927, George Udny Yule had already invented class for the autoregressive model. On the other hand this was not the case fro the Biometrika had its first paper in 1944 by Kendall. Kendall (1944) had an in depth study of the AR (2) models majoring in quasi-periodicity and illustrating its significance in some sheep population and wheat prices between 1871 and 1934. Kendall was the first to note superimposed error which was caused by persistent errors in measurements in time series. This later prompted to Walker among other scholars to show how a provided estimator from auto-correlation of higher lags for the autoregressive coefficients. However, this method applied to short series with superimposed errors. When the model was not deemed stationary, Reeves (1972) and Fuller & Pantula considered the distribution of parameters. For an AR (1) maximum likelihood estimator of the slope parameter can assume an asymptotic distribution a linear combination of X2 random variables.

Autoregressive Moving Average Models

Univariate case

Univariate case are of the form AR (p) models in § 3. 4 and n is replaced by an MA (q) model normally denoted by (p, q). The likelihood of a Gaussian ARMA model is as given in the elements of L as functions of ARMA parameters which are alpha and beta parameters. Some of the methods for estimation of parameters of MA models as the primary object. Later on others extended to cover ARMA models like Walker (1961).

Durbin (1960) outside Biometrika periphery reinvented Levinson (1949) recursive algorithm called Levinson-Durbin algorithm which is a special kind of Gram-Orthogonalisation. This algorithm involves projection on a succession on a past Banach spaces.

Conclusion

It is crucial to observe that empirical likelihood approach in the frequency domain produces M-estimators and confidence regions for the ARMA parameters. The strength of maximum possibility estimators with respect to h-step prediction is obtained by comparing the predictions on the basis of reusing parameter estimates deduced for a single-step prediction with those based on re-estimation of parameters for each h.