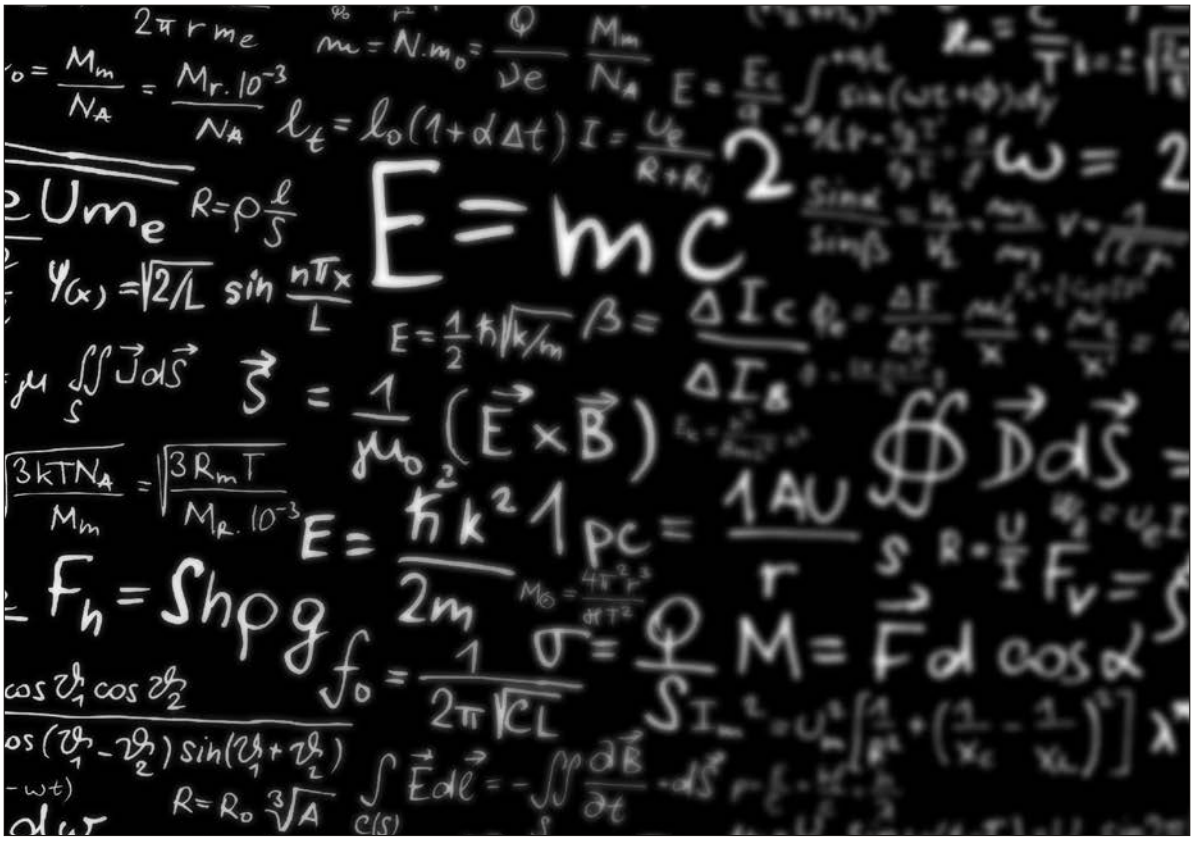

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On the Selection of Models in Nonlinear Regression

S.A. El-Shehawy

This study discusses the selection of parametric models of the moisture retention characteristic MRC as nonlinear regression models from a mathematical and statistical viewpoint. Simulation studies and some measures of nonlinearity are given. A comparison is introduced between the used famous models of the moisture retention characteristic (van Genuchten and King) which are presented early and their variants. Following the considered simulation study and the used measures of nonlinearity in nonlinear regression the author find that although a variant of van Genuchten model with four parameters is an optimal model but it has a strong nonlinear parameter. Moreover, a possible appropriate reparametrization with respect to this nonlinear parameter is proposed. *(Asian Journal of Mathematics and Statistics 1 (1): 1-13, 2008;* ***doi:*** *10.3923/ajms.2008.1.13)*

Understanding Estimators of Linear Regression Model with AR(1) Error Which are Correlated with Exponential Regressor

J.O. Olaomi and A. Ifederu

Assumptions in the classical normal linear regression model include that of lack of autocorrelation of the error terms and the zero covariance between the explanatory variable and the error terms. This study is channeled towards the estimation of the parameters of the linear regression models when the above two assumptions are violated. The study used the Monte-Carlo method to investigate the performance of five estimators: Ordinary Least Squares (OLS), Cochrane Orcutt (CORC), Hildreth Lu (HILU), Maximum Likelihood (ML) and Maximum Likelihood Grid (MLGRID) in estimating the parameters of a single linear regression model in which` the exponential explanatory variable is also correlated with the autoregressive error terms. The simulation results, under the finite sampling properties of bias, Variance and Root Mean Squared Error (RMSE), show that all estimators are adversely affected as autocorrelation coefficient (ρ) is close to unity. In this regard, the estimators rank as follows in descending order of performance: OLS, MLGRID, ML, CORC and HILU. The estimators conform to the asymptotic properties of estimates considered. This is seen at all levels of autocorrelation and at all significant levels. The estimators rank in decreasing order in conformity with the observed asymptotic behaviour as follows: OLS, ML, MLGRID, HILU and CORC. The results suggest that OLS should be preferred when autocorrelation level is relatively mild ($\rho = 0.4$) and the exponential regressor

is significantly correlated at 5% with the autocorrelated error terms. *(Asian Journal of Mathematics and Statistics 1 (1): 14-23, 2008;* ***doi:*** *10.3923/ajms.2008.14.23)*

Accommodation of Outliers in Time Series Data: An Alternative Method

Shittu O. Ismail

Considerable attention has been devoted to identification and detection of outliers in discrete univariate samples in time and frequency domains, with less attention paid on what to do with detected outliers. Available techniques for treatment of detected outliers were found to be subjective and deficient. An algorithm is proposed for accommodation of aberrant observations in the frequency domain. A new filtering method of accommodating outliers is also suggested and the performance of various accommodation techniques was determined in respect of the fixed and dynamic models. Five real and analyzed data of sizes (T = 48, 70, 100, 146 and 150) were used in the study. Reductions of between 3.3 and 4.5% in the standard error for both fixed and dynamic models were observed respectively after suspected outliers were accommodated by the filtering method. There was improvement in the precision of the estimates of parameters at ($p<0.05$) level of significance for both real and simulated data. This work has established that the filtering method of accommodation of outliers is a better and more efficient technique than all existing methods especially when the data are large. *(Asian Journal of Mathematics and Statistics 1 (1): 24-33, 2008;* ***doi:*** *10.3923/ajms.2008.24.33)*

Single Ordinal Correspondence Analysis with External Information

Amenta Pietro, Simonetti Biagio and Beh Eric

Several non-iterative procedures for performing correspondence analysis with external information have been proposed in literature. The interpretation of the multidimensional representation of the row and column categories may be greatly simplified if additional information about the row and column structure are incorporated. In this paper, a new combined approach to impose external information (as linear constraints) in analyzing a contingency table which can be of an ordinal nature, is showed. Linear constraints are imposed using the polynomial approach to correspondence analysis. The classical approach to correspondence

analysis decomposes the Pearson chi-squared statistic into singular values by partitioning the matrix of Pearson contingencies using singular value decomposition. The polynomial approach to correspondence analysis decomposes the same statistic by partitioning the matrix of Pearson contingencies using orthogonal polynomials rather than singular value decomposition. An alternative approach to partitioning the Pearson chi-squared statistic for a two-way contingency table is essentially to combine the approach of orthogonal polynomials for the ordered columns and singular vectors for the unordered rows. With this mixed approach, the researcher can determine any statistically significant sources of variation (location, dispersion and higher order components) of the ordered columns along the a particular axis using the simple correspondence analysis. Main aim of the present study is to introduce external information to this approach. In our proposal external information, such as taking into account that categories are not equally spaced is then included directly on suitable matrices which reflect the most important components. This approach allows for one to overcome the problem of having to impose linear constraints at the variables based on subjective decisions. *(Asian Journal of Mathematics and Statistics 1 (1): 34-42, 2008;* ***doi:*** *10.3923/ajms.2008.34.42)*

Detecting Non-linearity Using Squares of Time Series Data

C.O. Omekara

The aim of this study is to discuss the properties of squares of a pure diagonal bilinear (PDBL) time series model and how these properties can be used to distinguish between a linear (ARMA) model and a non-linear (bilinear) model. We showed that for the Pure diagonal bilinear process, the square of the series have the same covariance structure as an ARMA process. Simulated data was used to illustrate the results obtained in this study. *(Asian Journal of Mathematics and Statistics 1 (1): 43-49, 2008;* ***doi:*** *10.3923/ajms.2008.43.49)*

Bilinear Autoregressive Vector Models and Their Application to Estimation of Revenue Series

A.E. Usoro and C.O. Omekara

This study was motivated by the need to establish multivariate time series models for pure autoregressive vector series which assume both linear and nonlinear components. General Bilinear Autoregressive Vector (BARV) models were established. The three vector series namely, a response vector (X_{1t}) and predictor

vectors (X_{2t}) and (X_{3t}) used for the modelling called for trivariate time series models as a special case of multivariate time series models and estimates obtained from the models. The finding in this study is the isolation of multivariate bilinear models for a pure autoregressive process based on the distribution of autocorrelation and partial autocorrelation functions of the series from mixed models. This has been achieved as the models were used for the estimation of the vector series. These prove reality of the BARV models established. *(Asian Journal of Mathematics and Statistics 1 (1): 50-56, 2008; **doi:** 10.3923/ajms.2008.50.56)*

Strong Law of Large Numbers for Nonlinear Semi-Markov Reward Processes

K. Khorshidian

We obtain a Strong Law of Large Numbers (SLLN) for the reward process {Z(t), $t \geq 0$}, the cumulative reward gained by operating a Semi-Markov system during the time interval [0, t]. The important and striking point in this study is leaving the usual assumption that rewards for each state are of constant rates. In most of applications this frequently used assumption is not realistic, therefore we deal with reward functions of general forms. The SLLN obtained is in the sense that $\text{Lim}_{t\to\infty} Z(t)/t = \alpha$, a.s. for some real value α. Mild conditions for this SLLN are existence of sojourn times means and integrability of reward functions with respect to sojourn time distributions. As it has been shown, the parameter α coincides with the shift parameter in asymptotic representation of $E[Z(t)], t\to\infty$. *(Asian Journal of Mathematics and Statistics 1 (1): 57-62, 2008; **doi:** 10.3923/ajms.2008.57.62)*

Pseudo-Additive (Mixed) Fourier Series Model of Time Series

Emmanuel John Ekpenyong

This study improves on the Additive Fourier Series and traditional model of discrete periodic time series. It seeks to formulate a mixed (multiplicative-additive) Fourier Series model which decomposes a time series into multiplicative trend, seasonal components and additive error component together with additive trend. It is discovered that for time series with strongly marked and obviously fluctuating seasonal effects a multiplicative-additive (mixed) Fourier series model is suitable. The relevance of the new model is shown by analyzing the rainfall data of Uyo metropolis with the use of the model. The resulting model gives $Y_t = 210.1$ (1-

0.984 cos ωt) which fits well to the original data and can be used in forecasting future values of the rainfall data. *(Asian Journal of Mathematics and Statistics 1 (1): 63-68, 2008;* ***doi****: 10.3923/ajms.2008.63.68)*

A Stochastic Analysis of the Effect of Sudden Increase in the Income of Individuals on the Economy

O. OSU Bright and C. Okoroafor Alfred

In this study, we investigate the effect of sudden increase in the income of individuals on the economy. Such situation arises in countries where upward adjustment of salaries increases the income of individuals by a certain percentage. We show that accumulated wealth of individuals through capital investment follows the power law distribution. We quantify the effect of low and high propensity, respectively, of an individual to invest on the economy using an empirical illustration. *(Asian Journal of Mathematics and Statistics 1 (2): 69-79, 2008;* ***doi****: 10.3923/ajms.2008.69.79)*

Seasonal Analysis of Transformations of the Multiplicative Time Series Model

Iheanyi S. Iwueze, Anthony C. Akpanta and Hycinth C. Iwu

Transformations of the purely multiplicative time series model will either remain the purely multiplicative model or the additive time series model. These transformations are required to meet the variant assumptions on either the multiplicative or the additive models with respect to the seasonal component. When these assumptions are met, a transformation is regarded as being successful with respect to the seasonal component. This study deals with the methods required in the determination of intervals for the seasonal indices for successful transformations. Intervals derived are found to lie in the neighbourhood of 1.0. Numerical examples are used to illustrate the results obtained. *(Asian Journal of Mathematics and Statistics 1 (2): 80-89, 2008;* ***doi****: 10.3923/ajms.2008.80.89)*

The Exact Packing Dimension of a Set of Zero Heat Capacity

Alfred Chukwuemeka Okoroafor

We consider the packing measure properties of subsets of R^{n+1} of zero heat capacity relative to the heat equation:

$$\sum_{j=1}^{n} \frac{\partial^2 u}{\partial x_j^2} = \frac{\partial u}{\partial t}$$

The exact packing dimension is determined for subset of R^n, $n \geq 3$ for which u(x, t) is unbounded for $(x, t) \in R^{n+1}$. *(Asian Journal of Mathematics and Statistics 1 (2): 90-99, 2008;* ***doi:*** *10.3923/ajms.2008.90.99)*

On Simulation and Approximation in the Circular Regression Model

Ibrahim Mohamed, Abdul Ghapor Hussin and Ahmad Hazwan Abdul Wahab

In this study, simulation activities are suggested as a tool in understanding the properties of estimators of the coefficients of linear regression model when the variables are circular. This activities are suitable for undergraduate students who have learned simple linear regression theory and would like to extend the idea of regression to the case when the sets of measurements are directions, as well as the using of various approximations in parameter estimations. *(Asian Journal of Mathematics and Statistics 1 (2): 100-108, 2008;* ***doi:*** *10.3923/ajms.2008.100.108)*

Selection of a NLR-Model by Re-Sampling Technique

S.A. El-Shehawy

The aim of this study is to discuss a method for the selection of parametric models of the moisture retention characteristic MRC for natural soils. The author presents computational tools in S-Plus for the adequate selection of these parametric models as non-linear regression models (NLR-models) and this method of selection based on cross-validation and bootstrap (re-sampling technique). Early, these current computational tools were developed in some works about the selection of the nonlinear regression models. The current results will be compared with the obtained results which are based on the simulation studies and some calculations of measures of nonlinearity in NLR models. Finally, the results indicate to the best selected model which is identical with the selected model by the simulation study and the calculation of the measures of nonlinearity. *(Asian Journal of Mathematics and Statistics 1 (2): 109-117, 2008;* ***doi:*** *10.3923/ajms.2008.109.117)*

Asymptotic Properties of Parameters for Linear Circular Functional Relationship Model

A.G. Hussin

This study discusses the asymptotic properties of parameters for unreplicated linear circular functional relationship model. The model is formulated assuming both variables are circular, subject to errors and there is a linear relationship between them. The Maximum Likelihood Estimation (MLE) have been used to estimate the slope parameters (β), intercept (α) and error concentration parameters for both variables which are κ and ν, respectively. The Fisher information matrix have been derived and based on this we estimated the asymptotic covariance matrix of $\hat{\kappa},\hat{\nu},\hat{\alpha}$ and $\hat{\beta}$. *(Asian Journal of Mathematics and Statistics 1 (2): 118-125, 2008; **doi:** 10.3923/ajms.2008.118.125)*

The Solution by Stochastic Iteration of an Evolution Equation in Hilbert Space

A.C. Okoroafor and B.O. Osu

Explicit steepest decent type stochastic method is constructed for approximating the solution of an evolution equation governed by a maximal monotone operator in Hilbert space. The approximating scheme is shown to converge strongly to the global equilibrium of the equation. *(Asian Journal of Mathematics and Statistics 1 (2): 126-131, 2008; **doi:** 10.3923/ajms.2008.126.131)*

A Comparison of Weibull and Gamma Distribution in Application of Sleep Apnea

Nur Zakiah Mohd Saat, Abdul Aziz Jemain and Syed Hassan Ahmad Al-Mashoor

In this study we consider the ratio of the maximized likelihood and Vuong test in choosing between the two distributions. Values of the probability of correct selection are obtained by Monte Carlo simulation. This method provides some basis for decision even when the sample size is small. The sleep apnea data has been analyzed. *(Asian Journal of Mathematics and Statistics 1 (3): 132-138, 2008; **doi:** 10.3923/ajms.2008.132.138)*

Time Series Regression Model for Forecasting Malaysian Electricity Load Demand

Z. Ismail, F. Jamaluddin and F. Jamaludin

The demand of electricity forms the basis for power system planning, power security and supply reliability. Forecasting electricity demand with linear methods has always been challenging tasks, as the load time series exhibit several superimposed levels of seasonality. In Malaysia, the demand for electricity has reached over 15,000 MW for the past few years and the demand is increasing. This power demand is significantly affected by many non linear factors such as temperature, holiday, special events and other seasonality. This study investigates the impact of weather variables, holidays and other type of variables on daily and monthly electricity demand in Malaysia. A multiple regression model is developed to forecast electricity demand on weather variables, holiday types, daily and monthly seasonality. Due to the nature of the time series data, a time series regression model with autoregressive errors is developed to forecast daily peak electricity demand. The empirical study shows that the Mean Absolute Percentage Error (MAPE) for model with holiday variables is approximately 1.71% in fitting the daily load model. This study also demonstrates the forecast for one month ahead using time series regression model with load reduction weights yield better accuracy. Thus it proved the suitability of the adopted time series regression method for the forecasting short-term electricity load demand. *(Asian Journal of Mathematics and Statistics 1 (3): 139-149, 2008;* ***doi:*** *10.3923/ajms.2008.139.149)*

On the Performance and Estimation of Spectral and Bispectral Analysis of Time Series Data

J.F. Ojo

In this study, discrete spectral and bi-spectral analysis of time series data were considered to determine which of them perform better. The parameters of the spectral and bi-spectral models were estimated using Modified Newton Raphson Iterative method. Since the order of a model cannot be increased indiscriminately because of the closeness of some parameters to zero; discrete spectral and bi-spectral analysis model of orders one to five were fitted to the real series. Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were used to determine the best order of the model. To determine the best model, the residual variance attached to the spectral and bi-spectral models was used. Order

one and order four gave the best order in spectral and bi-spectral models, respectively. Residual variances of spectral and bi-spectral models compared favourably with each other. The residual variance of bi-spectral model was smaller than the residual variance of spectral model and this made us to conclude that bi-spectral analysis of time series data performed better than spectral analysis of time series data. *(Asian Journal of Mathematics and Statistics 1 (3): 150-158, 2008; **doi:** 10.3923/ajms.2008.150.158)*

Recurrence Relations for Single and Product Moments of k-th Record Values from Linear-Exponential Distribution and a Characterization

J. Saran and S.K. Singh

In this study we give some recurrence relations satisfied by single and product moments of k-th upper record values from the linear-exponential distribution. Using a recurrence relation for single moments we obtain a characterization of linear-exponential distribution. *(Asian Journal of Mathematics and Statistics 1 (3): 159-164, 2008; **doi:** 10.3923/ajms.2008.159.164)*

Efficient Approximation for the von Mises Concentration Parameter

A.G. Hussin and I.B. Mohamed

This study discusses some of the approximation which can be used to obtain the maximum likelihood estimate of the concentration parameter of the von Mises distribution. This study shows that the efficient approximation may also be obtained by solving the equation for the ratio of the modified Bessel function of first kind of order one and first kind of order zero. The closed-form solution for parameter concentration is also given. We have found out that the new proposed method performs well especially for large κ. *(Asian Journal of Mathematics and Statistics 1 (3): 165-169, 2008; **doi:** 10.3923/ajms.2008.165.169)*

On the Kernel Estimation of the Conditional Mode

Raid Salha and Hazem El Shekh Ahmed

The estimator of the conditional mode obtained by maximizing the Nadaraya Watson (NW) kernel estimator of the conditional density function has

disadvantages of producing rather large bias and boundary effects. The aim of this study is to overcome these disadvantages by proposing a modified estimator of the conditional mode obtained by maximizing the Reweighed Nadaraya Watson (RNW) kernel estimator of the conditional density function. The asymptotic normality and consistency of the proposed estimator are established and its efficiency is examined by two applications for both simulation and real life data. *(Asian Journal of Mathematics and Statistics 2 (1): 1-8, 2009;* ***doi:*** *10.3923/ajms.2009.1.8)*

An Analytic Proof of Bugeaud-Mignotte Theorem

Jamel Ghanouchi

The Bugeaud-Mignotte theorem concerns the Diophantine equation $\frac{X^n-1}{X-1}=Y^q$, when X = 10. It includes the fact that any integer greater than 2 and with all digits equal to 1 in base ten cannot be a pure power. It means that does not exist Y an integer strictly greater than 1 and q an integer strictly greater than 1 for which Y^q is a number with all digits equal to 1 in base ten. *(Asian Journal of Mathematics and Statistics 2 (1): 9-14, 2009;* ***doi:*** *10.3923/ajms.2009.9.14)*

An Approximate Likelihood Ratio Method for Testing Equality of Two Dependent Proportions

Tadewos Koroto

This study considers an approximate likelihood ratio test for equality of two dependent proportions. A bivariate probability distribution of a specified form is assumed and the likelihood ratio statistic is approximated from this distribution. The distribution accounts for the correlation of the underlying two binomial random variables. The application of the procedure on data resulting from treatment of TB patients shows that the proposed test can be used as an alternative test for data involving non-response. *(Asian Journal of Mathematics and Statistics 2 (1): 15-19, 2009;* ***doi:*** *10.3923/ajms.2009.15.19)*

Conditional Dependence of Trivariate Generalized Pareto Distributions

Diakarya Barro

In this study we consider the dependence of the family of multivariate generalized Pareto distributions under given conditions on lower dimensional margins. A new

function which describes this conditional dependence is built via Pickands dependence function. This function provides a new characterization of the basic subfamilies of trivariate generalized Pareto distributions. *(Asian Journal of Mathematics and Statistics 2 (2): 20-32, 2009; **doi:** 10.3923/ajms.2009.20.32)*

On the Comparative Performance of Pure Vector Autoregressive-Moving Average and Vector Bilinear Autoregressive-Moving Average Time Series Models

I.A. Iwok and E.H. Etuk

This study was motivated by the need to establish a vector form of autoregressive moving average (VARMA) models comprising linear and non linear components that could compete with the pure vector linear VARMA models. General bilinear vector autoregressive moving average (BIVARMA) was established as an extension of the univariate bilinear model. Three revenue series identified as autoregressive (AR) and Moving Average (MA) processes on the basis of the distribution of autocorrelation and partial autocorrelation functions were used to illustrate the performances of the two competing vector forms in terms of estimates and residual variances. Graphical comparisons were also made. The results showed that BIVARMA models established perform best and provide better estimates than the VARMA models. *(Asian Journal of Mathematics and Statistics 2 (2): 33-40, 2009; **doi:** 10.3923/ajms.2009.33.40)*

Modelling the Dependence of Parametric Bivariate Extreme Value Copulas

S. Dossou-Gbété, B. Somé and D. Barro

In this study, we consider the situation where contraints are made on the domains of two random variables whose joint copula is an extreme value model. We introduce a new measure which characterize these conditional dependence. We proved that every bivariate extreme value copulas is totally characterized by a conditional dependence function. Every two-dimensional distribution is also shown to be max-infinite divisible under a restriction on the new measure. The average and median values of the measure have been computed for the main bivariate families of parametric extreme value copulas. *(Asian Journal of Mathematics and Statistics 2 (3): 41-54, 2009; **doi:** 10.3923/ajms.2009.41.54)*

Formulation of the Mixed-Integer Goal Programming Model for Flour Producing Companies

M.E. Nja and G.A. Udofia

Based on production times of three products, a procedure for obtaining an optimal mixed integer goal programming model for flour producing companies is developed. With this model, the magnitudes of goal deviations for each of the goals formulated are determined. Three derived models are obtained from the first by changing priority factors for non-basic activities, interchanging goals and changing goal levels, for this purpose. Fresh optimality should be discouraged if the goals are properly prioritized. This model is cost-effective and can be adapted for use, by flour producing firms and indeed manufacturing industries in general. *(Asian Journal of Mathematics and Statistics 2 (3): 55-64, 2009;* ***doi:*** *10.3923/ajms.2009.55.64)*