MARMARA ÜNİVERSİTESİ YAYINEVİ

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INTERNATIONAL CONFERENCE on TRENDS and PERSPECTIVES in LINEAR STATISTICAL INFERENCE

AUGUST 22-25, ISTANBUL

ABSTRACT BOOK

MARMARA ÜNİVERSİTESİ

MARMARA UNIVERSITY

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Preface

The International Conference on Trends and Perspectives in Linear Statistical Inference (LinStat2016) hosted by Marmara University Department of Statistics, is held 22-25 August, 2016, in Istanbul, Turkey, at Congress and Culture Center of Istanbul University. This is the follow-up of the 2014 edition held in Linkoping, Sweden.

The purpose of the conference is to bring together researchers sharing an interest in a variety of topics related to linear statistical inference and offer them a possibility to discuss current developments in these subjects. The meeting covers a wide range of topics in both theoretical and applied statistics. The topics of interest include, but are not limited to:

- Bayesian Statistics
- Biostatistics
- Computational Statistics
- Categorical Data Analysis
- Design of Experiments
- High-Dimensional Statistical Analysis
- Matrix Theory and Linear Models
- Mixed Linear Models
- Model Selection and Dimension Reduction
- Multilevel models
- Multivariate Analysis
- Numerical Methods and Linear Models
- Optimal Design
- Statistical Inference
- Survey Methodology including Small Area Estimation

Connected to the above mentioned topics are very distinguished speakers which are listed in Invited Speakers. The conference consists of invited speakers sessions, contributed speakers sessions, young scientist speaker session and a poster session. Sessions on special topics (listed in Special Sessions) will also be organized.

A very important aim of the conference is to provide opportunities for professional development, networking, mentoring and collaboration for the young researchers. The work of young scientists is highly appreciated. The Scientific Committee will award the best presentation and best poster. The awarded will be Invited Speakers at the next edition of LinStat.

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Previous Conferences in the LinStat series

- Wisła, Poland (1977, 1978, 1980)
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- Tomar, Portugal - LINSTAT'2010
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Acknowledgments:

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We would like to thank our sponsors

- Istanbul University (Venue Partner)
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- Gezici Research
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Thanks to all the attendees for their valuable contributions!

Best wishes

Müjgan Tez and Birsen Eygi Erdogan

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Abstract - Invited Speakers

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Exact Linear Inference for Component and System Lifetime Characteristics based on System Lifetime Data

Narayanaswamy Balakrishnan
McMaster University, Ontario, Canada

Abstract

In this talk, I will first introduce the notion of signatures for coherent systems and then use it to develop exact linear inference for different lifetime parameters of interest for both component and system lifetime distributions having observed a data from system lifetimes. I will extend these results to the case of censored data. I will also discuss some generalizations of these results to the case when coherent systems share some of the components. Finally, I will illustrate all these results with simulation results as well as illustrative examples.

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A New Class of Distributions for Lifetime Data

Serkan Eryilmaz
Atilim University, Ankara, Turkey

Abstract

In this work, a new class of lifetime distributions that is obtained by compounding arbitrary continuous lifetime distribution and discrete phase-type distribution is introduced. In particular, the class consists of distributions which appear as distributions of random variables in the form of $\min(X_1, ..., X_N)$, where $X_1, X_2, ...$ is a sequence of positive valued independent and identically distributed random variables, independent of the discrete phase-type random variable N. The bivariate extension of the class is also presented.

Keywords: Maximum likelihood estimation, Mixed distribution, Phase-type distributions, Random minima

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Block-Circulant Matrices in Multivariate Data Analysis: Visualization and Modelling

Michael Greenacre
Universitat Pompeu Fabra, Barcelona, Catalonia, Spain

Abstract

In this talk I consider *block-circulant matrices*, in some cases *nested*, for example:

$$\begin{bmatrix} \mathbf{A} & \mathbf{B} \\ \mathbf{B} & \mathbf{A} \end{bmatrix} \qquad \begin{bmatrix} \mathbf{A} & \mathbf{B} & \mathbf{C} \\ \mathbf{B} & \mathbf{C} & \mathbf{A} \\ \mathbf{C} & \mathbf{A} & \mathbf{B} \end{bmatrix} \qquad \begin{bmatrix} \mathbf{A} & \mathbf{B} & \mathbf{C} & \mathbf{D} \\ \mathbf{B} & \mathbf{A} & \mathbf{D} & \mathbf{C} \\ \mathbf{C} & \mathbf{D} & \mathbf{A} & \mathbf{B} \\ \mathbf{D} & \mathbf{C} & \mathbf{B} & \mathbf{A} \end{bmatrix}$$

Various special cases are found depending on the circulant pattern and whether the matrices are square or rectangular. Properties and applications of the simple two-matrix case, when $\mathbf{A}$ is a square asymmetric matrix and $\mathbf{B}$ is its transpose was considered by [1] and an extension to two square asymmetric matrices by [2]. The general case of rectangular matrices is considered in [3] and extensions to nested block circulants in [4]. Many algebraic results are given by [5].

Block-circulant matrices allow visualization of averages and contrasts in matched matrices, i.e. matrices that have identical row and column entities. Examples are matrices for test and control data respectively, or matrices of multivariate responses by males and females, or four matrices defined by the combinations of two binary design variables.

In this talk I discuss the general properties of block circulant matrices, especially with regard to the singular value decomposition, and point out their usefulness in multivariate analysis, both for modelling and data visualization.

Keywords: Block circulant matrix, Decomposition of matrix variance, Interactions, Matched matrices, Singular value decomposition, Visualization

References

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Residual Empirical Processes

Hira L. Koul
Michigan State University, USA

Abstract

Residual empirical process play a central role in developing inference for regression, autoregressive and other additive models. In the past three decades numerous useful results about these process have been obtained under independence set up and under long memory dependence set up. This talk will review some of these results and their usefulness in advancing the inference in nonparametric inference in ARCH models.

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Recent Optimal Design Strategies in Applied Regression Modelling

Timothy E. O'Brien
Loyola University Chicago, USA

Abstract

Researchers often find that nonlinear regression models are more applicable for modelling various biological, physical and chemical processes than are linear ones since they tend to fit the data well and since these models (and model parameters) are more scientifically meaningful. These researchers are thus often in a position of requiring optimal or near-optimal designs for a given nonlinear model. A common shortcoming of most optimal designs for nonlinear models used in practical settings, however, is that these designs typically focus only on (first-order) parameter variance or predicted variance, and thus ignore the inherent nonlinear of the assumed model function. Another shortcoming of optimal designs is that they often have only support points, where p is the number of model parameters.

Measures of marginal curvature, first introduced in Clarke (1987) and further developed in Haines et al (2004), provide a useful means of assessing this nonlinearity. Other relevant developments are the second-order volume design criterion introduced in Hamilton and Watts (1985) and extended in O'Brien (2010), and the second-order MSE criterion developed and illustrated in Clarke and Haines (1995).

This talk examines various robust design criteria and those based on second-order (curvature) considerations. These techniques, coded in the GAUSS and SAS/IML software packages, are illustrated with several examples including one from a preclinical dose-response setting encountered in a recent consulting session.

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On Prediction in Multivariate Mixed Linear Models with Structured Covariance Matrices

Tatjana von Rosen
Stockholm University, Stockholm, Sweden

Abstract

The mixed linear models have become a powerful and widely used tool for the analysis of data having complicated structures and exhibiting various dependence patterns, e.g. repeated measures or longitudinal data containing multiple sources of variation. Prediction problems in univariate mixed linear models have got considerable attention due to numerous applications in small area estimation, school effectiveness studies and animal breeding, among others. Despite complexity of real-life phenomena, the multivariate mixed linear models have received little attention. This work concerns prediction of linear combinations involving both xed and random effects in balanced multivariate mixed liner models which can handle both the multivariate response and spatial or/and temporal dependence. More specifically, the equality of linear predictors under two multivariate mixed effects models with different covariance matrices is of interest. In practice, it can be difficult to decide about an appropriate covariance structure of random effect, so using equivalent linear models can resolve that problem and possibly reduce computations. The task is rather complicated if one aim is to get explicit results, hence we shall focus on a certain class of covariance matrices whose structure is preserved under matrix inversion.

Keywords: Balanced data, Block covariance matrix, Fixed effect, Random effect

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Marrying Survey Sampling and Scalable Inference

Matias Quiroz
Linköping University and Sveriges Riksbank, Sweden

Abstract

It is a well known fact that Markov Chain Monte Carlo (MCMC) algorithms are time consuming for data sets with many observations. Speeding up MCMC by data subsampling has recently received considerable attention in the literature. This talk will review key features for a successful implementation of subsampling MCMC [1, 2, 3]. We illustrate the superiority of our developed framework compared to other subsampling MCMC approaches.

Keywords: Bayesian inference, Metropolis-Hastings, Estimated likelihood, Data subsampling

References

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Abstract - Contributed Speakers

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A Comparison Between Parametric Mixture Cure Models in Survival Analysis of Cirrhosis Patients

Saeede Khosravi Bizhaem[1] **Jamileh Abolghasemi**[1] Mohsen Nasiri Toosi[2] and Elnaz Saeedi[1]
[1]Iran University of Medical Sciences, Tehran, Iran
[2]Tehran University Medical of Science, Tehran, Iran

Abstract

Liver cirrhosis is one of the most common causes of death in digestive disease with more than one million deaths annually in the world. Liver transplantation is the only treatment of liver cirrhosis. Due to shortage of available donor livers, prioritize medically patients who are in waiting list for transplantation is necessary. The present study aimed to investigate the risk factors affecting short- and long-term survival of patients who are in waiting list for liver transplant.

Data of 305 patients who were on waiting list for liver transplantation in Imam Khomeini Hospital (Tehran, Iran) during May 2008 to May 2009 were analyzed in this survival study. The patients were followed up for 7 years. Due to high rate of censoring, parametric mixture cure models were used. Analysis performed using Stata (version14) and R (version 3.2.1) software and significance level was set at p-values< 0.05.

Mean age of patients was 47.7($\pm$14.32) years. A total of (26.9%) 82 patients died due to complications of liver cirrhosis and the major cause of liver disease was viral hepatitis (34.8%). The survival rate at one, three and five years were estimated 85%, 67% and 60%, respectively. The analysis showed that the logistic mixture cure model with the minimum value of AIC was more efficient than other models and serums bilirubin, and albumin were significant on the long-term survival of patients.

Since more than 34.8% cause of liver cirrhosis was viral hepatitis and about 22.6% was cryptogenic, so prevention and control of hepatitis and fatty liver disease can be effective in reducing the risk of cirrhosis. Cure models can be used in appropriate circumstances to analyze the survival of cirrhotic patients. According to the results, logistic mixture cure model was chosen as the best model to predict survival of cirrhotic patents.

Keywords: Akaike's criterion, Liver cirrhosis, Long-term survival, Mixture cure model

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Assessing the Influential Observations for Linear Regression Model with Second-Order Autoregressive Errors

Tuğba Söküt Açar[1] and M. Revan Özkale[2]
[1]Çanakkale Onsekiz Mart University, Çanakkale, Turkey
[2]Çukurova University, Adana, Turkey

Abstract

Usually, all observations do not have equal influence on a fitted model. Observation that extremely influences on the fitted regression equation as compared to other observations is called influential observation. Numerous influence measures for the linear regression model with homoscedastic errors and correlated regressors have been largely investigated in statistical literature over the ordinary least-squares (OLS) and ordinary ridge regression (ORR) estimators. If the data set includes the correlated errors (autocorrelation), OLS is not best linear unbiased estimator (BLUE). In this context, the generalized least-squares estimator which is the BLUE under the model with correlated error and autocorrelated ridge regression estimator which deals with multicollinearity are used.

In this study, influence measures namely DFFITS (proposed by [1]), Cook's D (proposed by [2]), Andrews-Pregibon (proposed by [3]), Covariance Ratio (proposed by [4]) are considered over the generalized least-squares estimator and autocorrelated ridge regression estimator. A numerical example, where the correlation structure between the errors is modelled by second-order autoregressive process, is used to determine the influential observations and the adequacy and validity of the model are tested when the influence observations are omitted.

Keywords: Autocorrelation, Confidence ellipsoids, Influence measures, Multicollinearity

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Ridge Type-Modified Maximum Likelihood Estimators in Linear Regression Model

Sukru Acitas[1] and Birdal Senoglu[2]
[1]Anadolu University, Eskisehir, Turkey
[2]Ankara University, Ankara, Turkey

Abstract

It is well known that the multicollinearity among exploratory variables and the nonnormality of the error terms adversely influence the performance of the traditional regression estimator obtained by least squares (LS) methodology and the test based on LS in linear regression model. Silvapulle [4] proposed ridge-type M-estimator when the distribution of the error terms has longer tails than the normal distribution and multicollinearity among exploratory variables to alleviate these problems. Acitas and Senoglu [1] have recently proposed a robust methodology proceeding along the same lines as in Hoerl and Kennard [2] when the error distribution is long-tailed symmetric (LTS). Different than [1], here we propose a new ridge-type modified maximum likelihood (MML) estimator by using the methodology suggested by Silvapulle [4], see also [3] in the context of MML. A Monte Carlo simulation study is carried out to compare the performances of the ridge-type MML, ridge-type M and the traditional ridge estimators. It is seen that ridge-typeMML estimator outperforms the mentioned rival estimators.

Keywords: Mean square error, Modified maximum likelihood, Multicollinearity, Ridge regression

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Jackknife-type Ridge Estimator in Semiparametric Regression Models

Esra Akdeniz
Marmara University, Istanbul, Turkey

Abstract

In this paper we introduced a ridge estimator for the vector of parameters β in a semiparametric regression model (SPRM). To reduce the bias, the standard jackknife and weighted jackknife techniques are proposed in SPRM. Jackknife-type ridge estimator is defined. Performances of the proposed estimator is examined with respect to the mean squared error (MSE) criterion. Through simulation the jackknife estimators are compared in terms of mean squared error criterion when the sample size is small to moderate. The proposed estimator is also applied on a real data set.

Keywords: Almost unbiased ridge estimator, Jackknifed estimator, Multicollinearity, Ridge regression estimator, Semiparametric regression, Smoother matrix

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MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

Generalized Difference-based Weighted Mixed Almost Unbiased Ridge Estimator in Partially Linear Models

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Abstract

In this paper, a generalized difference-based estimator is introduced for the vector parameter β in partially linear model when the errors are correlated. A generalized difference-based almost unbiased Ridge estimator is defined for the vector parameter β. Under the linear stochastic constraint $r = R\beta + \varepsilon$, we introduce a new generalized difference-based weighted mixed almost unbiased Ridge estimator. The efficiency properties of the difference-based weighted mixed regression method is analyzed. The efficiency properties of the new estimator is illustrated by a simulation study. Finally, the performance of the new estimator is evaluated for a real data set.

Keywords: Difference-based estimator, Generalized Ridge estimator, Generalized difference-based weighted mixed almost unbiased Ridge estimator, Partially linear model, Weighted mixed estimator

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MARMARA ÜNİVERSİTESİ

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The Generalized Inverse Weibull Distribution: Properties and Different Estimation Methods

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Abstract

The inverse Weibull (IW) distribution has received considerable attention in recent years. It provides flexibility for describing the failure times and degradation of complex mechanical components; see [3]. Also, it has common usage in reliability, engineering and survival analysis.

In this study, we give some existing properties and recent developments of the generalized IW distribution (GIW) proposed by [1]. GIW distribution is much more flexible than the IW distribution for modeling various different data sets, see [2]. Here, we consider the estimation of the parameters of GIW distribution. In this sense, we use the maximum likelihood (ML), the least squares (LS), the weighted least squares (WLS) and the percentile estimators (PE). The performances of the estimators are compared via an extensive Monte-Carlo simulation study. The robustness properties of the estimators are also investigated. Finally, a real data set is provided to show the implementation of the proposed estimators.

Keywords: Generalized Inverse Weibull distribution, Least squares, Maximum likelihood, Percentile estimators, Robustness, Weighted least squares

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MARMARA ÜNİVERSİTESİ

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Ensemble Clustering Selection with Additional Bound Constraints

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Abstract

Clustering which is one of the unsupervised learning methods in machine learning considers grouping objects according to their similarities within the group. The aim of clustering is to group objects which have common features within the group but have dissimilarities with other groups. Clustering algorithms involves finding a common structure without using any labels similarly like other unsupervised methods. Recent studies show that the decision of the ensemble clusters gives more accurate results than any single clustering solution. Besides that, the accuracy and diversity of the ensemble are one of the important factors which affect the overall success of the algorithm [3]. There is a tradeoff between accuracy and diversity, in other words, you sacrifice one while you increase the performance of the other [4]. On the other hand, the optimum number of clustering solutions is one of the parameters that affect the final result. Recently finding the best subset of the ensemble clustering solutions by eliminating the redundant solutions has become one of the most challenging problems in the literature [1, 2, 4]. The proposed study here aims to find a best model which optimizes the accuracy and diversity trade-off with selecting the best subset of cluster ensemble. The proposed model optimizes accuracy and diversity simultaneously by selecting the subset of clustering solutions from the ensemble with approximated $\|L\|_0$ norm regularization and additional bound constraints on cardinality of subset.

Keywords: Ensemble learning, Clustering, Ensemble selection, Pruning

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MARMARA ÜNİVERSİTESİ

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Sufficient m-out-of-n (m/n) Bootstrap

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Abstract

Traditional resampling methods for estimating sampling distributions sometimes fail, and alternative approaches are then needed. For example, if the classical central limit theorem does not hold and the naive bootstrap fails, the m/n bootstrap, based on smaller-sized resamples, may be used as an alternative. An alternative to the naive bootstrap, the sufficient bootstrap, which uses only the distinct observations in a bootstrap sample, is another recently proposed bootstrap approach that has been suggested to reduce the computational burden associated with bootstrapping. It works as long as naive bootstrap does. However, if the naive bootstrap fails, so will the sufficient bootstrap. In this paper, we propose combining the sufficient bootstrap with the m/n bootstrap in order to both regain consistent estimation of sampling distributions as well as to reduce the computational burden of the bootstrap. We obtain necessary and sufficient conditions for asymptotic normality of the proposed method, and propose new values for the resample size m. We compare the proposed method with the naive bootstrap, the suffcient bootstrap, and the m/n bootstrap by simulation.

Keywords: Asymptotic normality, Finite population, Naive bootstrap, m/n bootstrap, Simulation, Sufficient bootstrap

MARMARA ÜNİVERSİTESİ

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Estimation of the Weibull Renewal Function Under Progressively Censored Data

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Abstract

In many applications of probability such as reliability theory, inventory theory and warranty analysis, one of the widely used stochastic models is renewal process. In the applications of this process its mean value function, so-called renewal function, is required. For instance, let's consider a unit that must be renewed immediately after failure. For such a situation, the number of failures that will occur up to a specified time, can be predicted by means of the renewal function. So, estimation of the renewal function is of importance.

Let $(X_n)_{n=1,2,...}$ be a sequence of independent and identically distributed positive random variables representing the successive failure times with distribution function F. The number of renewals up to time t based on the random variable sequence $(X_n)_{n=1,2,...}$ is

$$N(t) = \max\{n : S_n \leq t\}, \ t \geq 0,$$

where $S_0 = 0$, $S_n = X_1 + X_2 + ... + X_n$, $n = 1, 2, ...$ The renewal function is the mean value function of the renewal process $\{N(t), t \geq 0\}$ and defined as $M(t) = E(N(t)), \ t \geq 0$.

In order to estimate the renewal function $M(t)$, we must observe the failure times throughout the process. However, it is equivalent to observe the failure times simultaneously since they are all independent and identically distributed. Also, one can use censoring approach to accelerate the observation process.

In this study, we will consider the estimation problem of renewal function in the case of that the failure times are distributed as Weibull and are observed under progressive censoring. The maximum likelihood estimation of parameters of the Weibull distribution under progressive censoring is studied by Ng et al. [1]. We present a plug-in estimator for the renewal function $M(t)$ based on the maximum likelihood estimators of parameters of Weibull. Further, consistency and asymptotic unbiasedness of this estimator are investigated.

Keywords: Estimation, Progressive censoring, Renewal function, Weibull distribution

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MARMARA ÜNİVERSİTESİ

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Measures of Departure from Marginal Homogeneity Model in Square Contingency Tables

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Abstract

Square contingency tables arise in dependent samples where the row and column variables of cross-classification tables have the same categories. Marginal Homogeneity Model (MH) in square contingency tables represents the equality of marginal cell probabilities. The measures calculated over the observed frequencies gives the degree of departure from MH. The estimated measure lies between $(0, 1)$. Zero represents the marginal homogeneity model holds and one represents the degree of departure from marginal homogeneity is maximum. In this paper, the departure measures along with their standard errors are calculated on three real data sets each has four categories. The measures are calculated successively for all categories to reveal that which category cause the departure from the MH model.

Keywords: Square contingency table, Marginal homogeneity model, Departure measure, Matched pairs

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MARMARA ÜNİVERSİTESİ

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Statistical Inference for the Location Model When the Distribution of the Error Terms is Jones and Faddy's Skew t: Type II Censored Samples

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Abstract

In this study, we estimate the parameters of the location model for the Type II censored samples under the assumption of Jones and Faddy's Skew t (JFST) error distribution, see Jones and Faddy [3] in the context of JFST, Acitas et al. [1] for the complete samples and Arslan [2]. In the estimation procedure, we use the well known maximum likelihood (ML) methodology. Likelihood equations can not be solved explicitly because of the nonlinear terms. We therefore resort to widely used iterative method known as Newton-Raphson (NR) to solve the likelihood equations numerically. We also use modified maximum likelihood (MML) methodology which is a noniterative alternative of ML methodology, see Tiku [4]. The MML estimators are the functions of the sample observations and also asymptotically equivalent to the ML estimators. We then propose a test statistics based on ML and MML estimators for testing the location parameter. In computing the ML estimators via NR, we use least squares (LS) and the MML estimates of the model parameters as initial values. An extensive Monte Carlo simulation study shows that the ML estimators and the test statistics based on them are more preferable than the corresponding estimators and the test statistic based on MML estimator as expected. However, the results obtained from the MML methodology are very close to the corresponding results obtained from the ML methodology. As a conclusion, we propose to use ML methodology when our concern is efficiency. When we focus on both high efficiency and computing time, MML methodology can be preferred.

Keywords: Location Model, Type II Censoring, Jones and Faddy's Skew t

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MARMARA ÜNİVERSİTESİ YAYINEVİ

On Biased Estimators in the Negative Binomial Regression Model

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Abstract

Count data models are generally used to model the data when the dependent variable is in the form of counts. Therefore, Poisson regression or negative binomial regression being members of count regression models are used in the field of health, social, economic and physical sciences such that the non-negative and integer-valued aspect of the outcome plays an important role in the analysis.

The purpose of this study is to generalize Liu-type estimator (LT) [1] to the negative binomial regression and discuss some properties of the new estimator. Moreover, LT is compared to negative binomial ridge estimator [2] and negative binomial Liu estimator [3] by conducting a Monte Carlo simulation study and a real data example.

According to the results of the simulation and real data example, LT has the best performance among others and it is recommended to the researchers.

Keywords: Liu-type estimator, Multicollinearity, Negative binomial regression

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MARMARA ÜNİVERSİTESİ

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Appraisal of the Performance of Recursive Partitioning, Conditional Inference Tree, and Evolutionary Learning Tree: A Comparative Study

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Abstract

Tree-based classifiers are among the data mining techniques used to explore and model complex data which has strongly non-linear associations and different variable types. The rpart package [3] essentially implements the algorithms described in Breiman's book [4] and is the de-facto standard in open-source recursive partitioning software. Ctree [2], found at core of the party package (Hothorn, Hornik, and Zeileis, 2006), is an implementation of conditional inference trees which embeds tree-structured regression models into a well-defined theory of conditional inference procedures, and evtree [1] is an evolutionary method for learning globally optimal classification and regression trees. This paper discusses the following; (a) the way these classifiers deal with data comprising missing values in the response variable and/or the explanatory variables, (b) their accuracy and/or misclassification rates, (c) and how complex they are. Using car accident data, classification was carried out using the three models aiming to determine accident result (injured, not injured) based on different factors. In all the three models, any observation with values for the dependent variable and at least one independent variable was found to participate in the modeling. In cases of missing values in the response variable, rpart and evtree deal with it by tossing the incomplete observation out, however ctree returns error message. rpart outmaneuvers evtree and ctree in terms of accuracy, kappa, specificity, and positive predicted values but it is found to be more complex than the others. evtree performed better in evaluation function, which shows that it is least complex model and in terms of accuracy it is close to rpart. The only value that ctree outperformed the others was the sensitivity.

Keywords: Global optimal, Local optimal, Tree algorithms

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MARMARA ÜNİVERSİTESİ YAYINEVİ

Estimation of the Quantiles of Two-parameter Gumbel Distribution

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Abstract

The Gumbel distribution, known as the extreme value type I distribution, proposed by [2], is widely used to model the extreme events in many areas, such as extreme floods, snowfalls, wind speeds, temperatures, etc.

Estimation of quantiles of distribution is very important tool in real life problems. As an example due to [3] "*Estimates of the upper quantiles of the distribution of a risk factor or an exposure index are commonly used to assess the risk to human health as a result of exposure to chemicals and microbes in the environment, or to determine if concentration levels of contaminants exceed specified limits*".

In this study, we obtain different estimators of the quantiles of two-parameter Gumbel distribution by using the methodologies known as the maximum likelihood (ML), modified maximum likelihood (MML) (see [4]) and probability weighted moment (PWM) (see [1]). We compare the performances of the estimators with respect to bias and mean square error (MSE) criteria via Monte Carlo simulation study. Their robustness is also examined in the presence of outliers.

Keywords: Efficiency, Gumbel distribution, Modified maximum likelihood, Monte-Carlo simulation, Probability weighted moment

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MARMARA ÜNİVERSİTESİ

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Bayesian Analysis of Beta-Hidden Markov Model

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Abstract

Hidden Markov model (HMM) is a powerful and flexible framework to explain the behavior of partially observable and randomly changing systems. A standard HMM is a discrete-time bivariate stochastic process $(X, Y) = (X_t, Y_t)_{t>0}$. $X = (X_t)_{t>0}$ is a finite-state homogeneous Markov Chain which is not directly observable, but can only be indirectly observable through Y. $Y = (Y_t)_{t>0}$ is a process which produces the sequence of observations and depends on Markov Chain X. At each point of time t, the conditional distribution of Y_t given X_t is a parametric family of distribution and X is considered as a parameter process.

In this study, we examine HMM under the family of beta distributions. In classical approach, the shape parameters of beta distribution can not be estimated analytically. In order to overcome the problem of analytical insolubility, we aim to estimate the shape parameters under Bayesian approach. Thus, we adapt Bayesian approach to beta-HMM. The dependency structure of HMM allows the full conditional distributions to be obtained for all model parameters. Due to this property, we implement Gibbs sampling for generating samples from the joint posterior distribution. Employing the conjugate prior distributions for model parameters, the full conditional posterior distributions are obtained easily in closed form. For the shape parameters of beta distributions, we adopt a joint conjugate prior distribution proposed by Bayyari [2] in 1985. In order to generate samples for the shape parameters, Metropolis-Hastings algorithm is carried out within Gibbs sampling as well. We also address the model selection problem for Bayesian beta-HMM. Finally, we perform the Bayesian analysis of beta-HMM to the unemployment rates of the United States of America for the period of 2000:01 and 2015:12. We obtain the posterior predictive distributions for the next time period of 2016:01 and 2016:04.

Keywords: Beta-Hidden Markov Model, Gibbs Sampling, Metropolis-Hastings Algorithm.

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MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

Generalized Bimodal Gamma Distribution on R

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Abstract

This paper is an extension of the gamma distribution to the real line via adding two shape parameters which control the peak shape of bimodality. The special values of shape parameters of the distribution can be regarded as a combination of half Laplace and half normal distributions on the real line. Each part of distribution on the real line can have leptokurtic and platikurtic properties for the different values of the shape parameters. The distribution has also two parameters controlling the height of peakedness, so the capacity of bimodality can be enhanced when it is compared with the bimodal distributions proposed by [1] and [2] in a class for the extension of gamma distribution to the real line. The resulting distribution can model the different shape of the peakedness in data. Adding a skewness parameter is also considered to model the asymmetry in data. The location and scale variant form of this distribution are proposed. Some properties, such as *rth* moment, cumulative distribution and entropy functions for the new distribution are obtained. The maximum likelihood estimates of parameters of the proposed distribution are derived. Real data examples are given.

Keywords: Bimodality, Distributions, Gamma distribution

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MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

Parameter Estimation of Interaction Effect in Generalized Measurement Error Models

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Abstract

Regression analysis is a statistical methodology for studying the relationship between two or more quantitative variables so that one variable can be explained from the other variables. The response variable Y is a dependent variable whose variation can be explained by an explanatory variable or independent variable X which must be observable in traditional regression analysis. Sometimes the explanatory variable X cannot be observed, either because it is too expensive, unavailable, or mismeasured. In this situation, a substitute variable W is observed instead of X, that is $W = X + U$, where U is measurement error and W is said to be a surrogate for X. The substitution of W for X creates problems in the analysis of the data, generally referred to as measurement error problems. The statistical models used to analyze such data are called *measurement error models*. In the case a substitute variable W is observed instead of the true variable X, so that it is not possible to carry out a direct statistical analysis of the dependence of Y on X.

The main purpose of this research are to develop and study estimators for generalized linear measurement error models when the mean function contains error-free predictors as well as predictors measured with error and interactions between error-free and error-prone predictors. Attention is restricted to generalized linear models in canonical form with independent additive Gaussian measurement error in the error-prone predictors. The purpose is to obtain sufficient and consistent estimators of the parameters on the observed data instead of the true data. Some methods are suggested to correct this attenuation to get statistical inference for the parameters of interest. One of these methods is the conditional-score which is defined to eliminated of the effect of measurement error for parameter estimations.

Keywords: Conditional score function, Generalized linear models, Measurement error models, Error-free and error-prone predictors, Error in variables, M-estimator.

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MARMARA ÜNİVERSİTESİ YAYINEVİ

Bootstrap Type-1 Fuzzy Functions Approach for Forecasting

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Abstract

In this study we proposed an alternative approach in the prediction of Istanbul Stock and Bond Exchange (ISE) time series. Many approaches have been developed and applied for forecasting stock exchange data in the literature. In the last years, most of these approaches are fuzzy system modeling approaches. Fuzzy functions approach were proposed by [2] because traditional fuzzy system modeling approaches are generally based on fuzzy rule base. Fuzzy functions approaches no need to use rule base. Fuzzy functions approaches should employ randomness, and their values change randomly from sample to sample. Taking into consideration this change, researchers need to obtain estimators, but this process for nonlinear models is not easy task to carry out. Thus, bootstrap methods can be used in order to overcome this problem. In this paper we proposed a new approach that uses fuzzy c-means techniques for clustering, type-1 fuzzy functions approach for fuzzy system modeling, and stationary bootstrap method, was firstly proposed by [1], for probabilistic inference. The advantages of the proposed method are "obtaining the confidence intervals and forecast distribution", "combining many different forecast results", and "no need to use rule base". For experimental study, we used ISE 100 indices as data sets which include first five months of 5 years from 2009 to 2013, respectively. For comparison of the results obtained from the proposed method, some other methods that are well-known in the literature are used. In fuzzy functions approaches, confidence intervals for forecasts cannot be obtained. By means of the proposed method, researchers can obtain confidence intervals, forecast distribution, forecasts can be obtained from distribution of forecasts as a measure of central tendency, and combine many different forecast results.

Keywords: Bootstrap methods, Forecasts, Stock and bond exchange, Type-1 fuzzy functions approach

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MARMARA ÜNİVERSİTESİ

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Finite Mixtures of Multivariate Skew Laplace Distributions

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Abstract

Finite mixture models which are known as a flexible and powerful tool are used for modeling heterogeneous data sets. In general, due to its easier tractability and wide applicability, the distribution of mixture model components is assumed to be normal. In practice, the data sets may have asymmetric and/or heavy-tailed empirical distribution. In the multivariate settings, the multivariate skew normal (MSN) ([2] and [4]) distribution has been proposed as an alternative to the multivariate normal (MN) distribution to deal with skewness in the data. The multivariate skew Laplace (MSL) distribution studied by [1] can be considered as a heavy-tailed alternative distribution to the MSN distribution. Since the mixtures of MN distributions are not capable of modeling skewness, finite mixtures of MSN distributions have been proposed by [5] to model such data sets. In this study, finite mixtures of MSL distributions are considered as an alternative to the mixtures of MSN distributions to handle both skewness and heavy-tailedness in the data. The maximum likelihood (ML) estimators for the parameters of interest are obtained by using the Expectation-Maximization (EM) algorithm ([3]). A simulation study and a real data example are given to illustrate the performances of the proposed estimators.

Keywords: Multivariate mixture model, Multivariate skew Laplace distribution, ML estimation, EM algorithm

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MARMARA ÜNİVERSİTESİ YAYINEVİ

Median-Pi Artificial Neural Network for Forecasting

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Abstract

Data sets with outliers can be predicted with robust learning methods or robust artificial neural networks. In robust artificial neural networks, the architectures are robust by using robust statistics as aggregation functions. Median neural network [1] and trimmed mean neural network [3] are two robust artificial neural networks. In these robust artificial neural networks, median and trimmed mean statistics were used as aggregation functions. In this study, median-pi artificial neural network is proposed as a new neural network. In median-pi artificial neural network, median and multiplicative functions are used as aggregation functions. Because of using median, the proposed network can produce good results for data with outliers. The median-pi artificial neural network is trained by using particle swarm optimization. The performance of the neural network can be researched by using data sets from International Time Series Forecast Competition (CIF2016). The twenty time series are injected by five or ten times of maximum value of observations as an outlier. Median neural network, trimmed mean neural network, pi-sigma neural network [2] and the proposed networks are applied to time series with outliers, and the obtained results are compared. According to application results, median-pi artificial neural network can produce better forecast results from the other networks.

Keywords: Forecasts, Outliers, Particle swarm optimization, Robust artificial neural networks

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MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

Ensemble Learning by Two Step-Margin based Model Selection: Case Study on Turkish Commercial Banks Bankruptcy Data

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Abstract

Ensemble Learning has been effective and successfully applied in classification and clustering problems. Over the years, many classification/clustering algorithms are proposed but it has been shown that decision made by a community of classiffiers/models gives better results than a single model. In this study, we developed a new ensemble learning algorithm for the classification problem. The library of classifiers in the ensemble are generated by different margin based models [5] and different kernel functions in which Support Vector Machine (SVM) is chosen as a base classifier. The decision phase is constructed by two steps: In the first step, the consensus function is defined by three different norms which are based on maximum margin principle. In the second step, the results of these norm based decisions are aggregated by well known voting method. We tested our algorithm on bankruptcy data [3] of Turkish commercial banks.

Keywords: Ensemble Learning, Model Selection, Voting, Support Vector Machines (SVM), Bankruptcy Data.

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MARMARA ÜNİVERSİTESİ YAYINEVİ

Exact Similar Kolmogorov-Smirnov Goodness-of-Fit Test for Discrete Distributions

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Abstract

The Kolmogorov-Smirnov goodness of fit test was known a conservator when the nonparametric assumption is discrete distribution. In this paper, we introduce procedures based on the Monte Carlo tests method to show Kolmogorov-Smirnov test is exact even in discrete distributions case. In a simulation experiment, we show that the technique suggested provides perfect control of test size in all cases for discrete distributions.

Keywords: Monte Carlo test, Goodness-of-fit test, Kolmogorov-Smirnov Test, Discrete distributions

MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

Bayesian Estimation of Scale Parameter for the Frećhet Distribution with Known Shape Based on Type-II Censored Data

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Abstract

In this study, we consider the maximum likelihood estimator and Bayesian estimators of scale parameter of Frećhet distribution with known shape parameter under Type-II censored samples [1, 5, 6]. Bayesian estimators are obtained by using squared error loss [5], LINEX loss [1] and general entropy loss [1, 3] functions under Jeffreys' prior [4]. We also compare the performance of maximum likelihood and Bayesian estimators in terms of bias and mean square error for various sample sizes with different percent of censoring through an extensive simulation study [2].

Keywords: Frećhet distribution, Bayesian estimator, Squared error loss, LINEX loss, General entropy loss, Jeffreys' prior.

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MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

A New Robust Training Algorithm for Multiplicative Neuron Model Artificial Neural Network and Bootstrap Inferences for Weights and Forecasts

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Abstract

Selected analysis method has a great effect on accuracy and forecasting performance. Different types of artificial neural networks as alternatives to the traditional time series methods are used in the literature for the time series forecasting problem. Multiplicative neuron model artificial neural network is not including architecture selection problem. This feature provides considerably simple usage, and forecasting performance is positively affected. Training algorithm that affecting forecasting performance of multiplicative neuron model artificial neural network is an important factor. Presence of outliers in the time series, performance of all methods are negatively affects. The multiplicative neuron model artificial neural network is utilized aggregation function different from other artificial neuron models. It is expected to affect more than other artificial neuron model by outliers because of using multiplicative aggregation function.

In this study, a robust training algorithm that ability to work without outliers' detection is proposed for multiplicative neuron model artificial neural network. Thus, it will be eliminated by the negative effects of outliers and improved forecasting performance of multiplicative neuron model artificial neural network. Least trimmed squares method based guaranteed convergence particle swarm optimization method is used as fitness function for training of the network in the proposed method. Hypothesis testing and confidence intervals for parameters are estimated by using moving block bootstrap method. The multiplicative neuron model artificial neural network neurons are shown that it is possible to do statistical analysis through bootstrap methods.

Keywords: Forecasting, Multiplicative neuron model, Robust training algorithm, Moving block bootstrap

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MARMARA ÜNİVERSİTESİ YAYINEVİ

Growth Curve Model with Bilinear Random Coefficients

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Abstract

A growth curve model (GCM) is often used to fit dependent data, and we need to estimate a covariance matrix of the response variables. When the number of dependent observation points is large, the estimate of the covariance matrix may be unstable or impossible to carry out due to the large number of unknown parameters. In this talk, we avoid this problem by carrying out a dimension reduction of the parameter space. Concretely, we assume the regression coefficients to be bilinear random variables, which can naturally lead to a GCM with a Kronecker product covariance structure considered in Srivastava et al. [1]. Under our assumptions, we can estimate the unknown parameters of this model without using any iterative algorithm.

Keywords: Growth curve model, High-dimensional data analysis, Random coefficients

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MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

Robust Estimation for Cox Regression Model based on Sufficient Jackknife-After-Bootstrap Method

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Abstract

In survival analysis the identification of individuals who died far too early or lived far too long according to their prognostic factors is an important issue. There are many studies focused on developing diagnostic tools to identify these extreme individuals, so called outliers for Cox model. Most of these studies based on residual analysis. In fact, directly using residual analysis can give unreliable results because of the masking and swamping effects. This is due to the fact that the lack of robustness of the cox model. In this study a robust Cox regression model with outliers is proposed. The model is fitted by using Sufficient Jackknife-After-Bootstrap Method. Performance of the proposed model is compared with the other models through the simulation studies.

Keywords: Cox model, Outliers, Robustness, Sufficient jackknife-after-bootstrap method

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MARMARA ÜNİVERSİTESİ

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A Note on m-consecutive-k-out-of-n:F Systems

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Abstract

In this talk, more generalized version of m-consecutive-k-out-of-n:F system is introduced in circular case, that is named as circular m-consecutive-k,l-out-of-n:F system. This system consists of n circularly ordered components such that the system fails if and only if there are at least m l-overlapping runs of k consecutive failed components. The parameter l is a leverage in this system which provides that the reliability of this system is bounded by overlapping $(0 < l < k; k > 1)$ and non-overlapping $(l = 0)$ cases. The main aim of this paper is finding $r_i(n)$ which denotes the number of path sets of circular m-consecutive-k, l-out-of-n:F system including i working components. A combinatorial formula, which calculates the exact reliability of this system, is given. Signature based analysis are illustrated and numerics are provided.

Keywords: System Signature, Reliability, Combinatorial method, Survival function

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MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

The Effect of Computer Assisted Instruction on Eight Grade Students' Permutation-Combination-Probability Achievement and Attitudes Towards Computer Assisted Learning

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Abstract

The purpose of this study was to examine the effects of computer assisted instruction on eight grade students' permutation-combination and probability achievement and attitudes towards computer assisted learning. A computer assisted instructional material including a sequence of animation activities to illustrate probabilistic concepts, was developed with R software. The subjects of this study were ($N = 74$) eighth grade students from four distinct schools in two different regions of Turkey in the spring semester of academic year 2015-2016. Two groups (experimental and control) of state elementary school students from "Dereyanı" elementary school in Mardin and "Sehit Ogretmen Fasih Sogut" elementary school in Mardin were used in this study. In the experimental group, computer-assisted instruction based on animation prepared in R software was used as a supplementary teaching tool. The control group was instructed through traditional teaching method. Since both experimental and control groups consisted of schools located in villages of Mardin, it was difficult to determine the effectiveness of computer assisted instructional material. Despite the possible deviations that may occur, two private schools; "Mardin Bahcesehir College" and " Ankara Ihsan Doğramacı Foundation Bilkent College" were included in the study to examine the cultural impact. Computer-assisted instruction was given to both of these private elementary schools to identify potential cultural impact. Objective Comprehension Tests and Computer Assisted Learning Attitude Scale were administrated as post-tests to both the experimental groups and the control group to assess the effects of R animations on achievement and attitudes towards computer assisted instruction. Linear models were utilized to test the hypotheses at the level of significance $p = .05$. For the analysis of data, the SPSS 20 was used.

Keywords: Computer assisted instruction, Linear models, Permutation-combination and probability education, R software

MARMARA ÜNİVERSİTESİ

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Modelling Multiple Correlated Data in a Longitudinal Family Based Framework by Using Latent Class Approach

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Abstract

In genetic epidemiology the relationship between trait and individual's genetic information is commonly investigated by using linear models [1]. In recent years longitudinal family based designs have had success in identifying genetic factors that cause the disease. Standard modelling techniques are not applicable in complex designs such as longitudinal measurements which are useful tools to understand the behaviour of the trait. In addition to this, family-based designs provide evidence about the heredity of the disease among the pedigrees. In the presence of multiple correlated data, regarding the dependency between the observations may cause assumption violations. Hence the clustered structure of the data should be taken into consideration in modelling process. In a longitudinal family-based design, there are two different source of correlations, one is serial and the other is familial, both cause heterogeneity in the phenotype distribution [2].

In this study, we propose a latent class mixed model (LCMM) for testing the association between phenotype and genotype which accounts both serial and the familial correlations by using a latent class structure for the heterogeneous longitudinal phenotype distribution. The model results are compared to standard mixed (LM) model which also accounts for both types of correlations. Additionally, another common tool for longitudinal measurements, Generalized Estimating Equations (GEE) is adapted for multiple correlated structure of the data. A real genome data is used for the implementation of the propose model and the comparisons. According to results, the proposed approach provides a better model comparing to standard approaches.

Keywords: Genetic association, Mixed models, Latent class models, Multiple correlation

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MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

Censored Regression with Measurement Error in Covariates

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Abstract

In this paper we propose a new method to find non-parametric estimators of the regression coefficient vector in the censored linear model where the covariates are subject to measurement error. The method assume that instrumental variables are available for the study. We prove the large sample properties of the estimators by representing them as a martingale plus higher order remainder term. The performance of the estimators are evaluated through simulation study.

Keywords: Censored regression, Instrumental variable, Measurement error, Martingale

MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

Reliability Properties of Systems with Marshall-Olkin Bivariate Weibull Distribution

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Abstract

The study of systems with dependent components is a very important topic in reliability. The life lengths of some possibly dependent components in a system can be modelled by a bivariate distribution. The lifetimes of two components in a system can be represented by a positive random vector (X_1, X_2). Then, the series system is represented by $X_{(1)} = \min(X_1, X_2)$ and the parallel system by $X_{(2)} = \max(X_1, X_2)$. When we only have information for the life length of the system, it is interesting to study distributional and inference properties of the life length of the system.

In recent years, the study of systems with dependent components has been considered by different authors. When the random vector (X_1, X_2) follows the bivariate distribution with exponential conditionals, the exchangeable bivariate Gumbel exponential, symmetric bivariate Pareto and exchangeable bivariate log-logistic distributions, the reliability properties of series and parallel systems were studied by Navarro et al. [2, 3, 4] and Eryılmaz [1], respectively.

In this study, we consider the reliability properties of systems when the joint distribution of the components is a Marshall-Olkin bivariate Weibull (MOBW) distribution. The joint moment of MOBW distribution is derived in a closed form. For this model, the distributions and moments of the series and parallel systems are obtained. The reliability measures such as the hazard rate, mean residual life and regression mean residual life functions are obtained for these systems. Moreover, some ordering and classification properties are investigated for the series and parallel systems.

Keywords: Marshall-Olkin bivariate Weibull distribution, Parallel system, Series system, Orderings

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MARMARA ÜNİVERSİTESİ YAYINEVİ

A New Fuzzy Time Series Algorithm based on Recurrent Pi-Sigma Artificial Neural Network

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Abstract

The method of particle swarm optimization (PSO) was proposed by Kennedy and Eberhart [3] for the first time. This method can easily be adapted to solve many problems, as it doesn't require to take the derivative of the objective function. As a result, many modifications of PSO have been proposed to the literature till now. One of them is the modified particle swarm optimization (MPSO) algorithm for training of the multiplicative seasonal artificial neural network model [2].

Akdeniz and Egrioglu [1] proposed the recurrent pi-sigma Artificial Neural Network (RPS-ANN) for the first time in the literature. RPS-ANN is a feedback version of the pi-sigma artificial neural network which was proposed by Shin and Ghosh [4].

In this study, a new fuzzy time series algorithm has been proposed based on RPS-ANN [1] in determining the fuzzy relation. MPSO method of Aladag [2] has also been used in training of RPS-ANN. The application results have showed that the proposed method is better than some other methods in forecasting performance.

Keywords: Fuzzy time series, Pi-Sigma network, Recurrent Pi-Sigma, Particle swarm optimization

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MARMARA ÜNİVERSİTESİ YAYINEVİ

Linear Mixed Model Selection under Ridge Regression Based on the Conceptual Predictive Statistic

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Abstract

Model selection plays an important role in statistical literature. The goal of model selection is to search among the candidate family to find a model that is "closest" to the true model. The notion of closeness is quantified by a measure that reflects the disparity between each fitted candidate model and the true model. Such a measure is called a discrepancy. A model selection criterion is a statistic that estimates the discrepancy between the candidate model and the true model.

One of the most popular discrepancies is the Gauss discrepancy which is an applied measure of proximity between the fitted candidate model and the true model. Mallow's conceptual predictive (C_p, [1]) statistic is a classical model selection criterion based on the Gauss discrepancy.

In linear mixed models, Wenren et al. [2] proposed marginal C_p (MC_p) statistic which is a model selection criterion derived on the basis of the expected marginal Gauss discrepancy. They also proposed an improvement of MC_p (IMC_p) and proved that it is an asymptotically unbiased estimator of the expected marginal Gauss discrepancy. Additionally, Wenren and Shang [3] proposed conditional C_p (CC_p) which was derived under the conditional mean of response variable.

The objective of this paper is to redefine MC_p, IMC_p and CC_p statistics under ridge regression for linear mixed model selection. Motivated by this, we propose marginal ridge C_p (MRC_p) and an improvement of MRC_p ($IMRC_p$) statistics based on the expected marginal Gauss discrepancy. Then, the conditional ridge C_p (CRC_p) statistic based on the expected conditional Gauss discrepancy is defined. Finally, a Monte Carlo simulation study is given to examine the performance of the proposed criteria.

Keywords: Conditional ridge C_p, Linear mixed model, Marginal ridge C_p, Ridge regression

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MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

Optimal Neighbor Designs under Mixed Models

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Abstract

The concept of neighbour designs was introduced and defined by Rees [1] who gave also some methods of their construction. Henceforth many methods of construction of neighbor designs as well as of their generalizations are available in the literature. Recently, some results on the optimality of specified neighbor designs under various fixed linear models were published; cf. Filipiak and Markiewicz [2]. The aim of the talk is to give an overview of study on the problem of optimality of neighbor designs under mixed linear models. It will include some new results as well as recently published by Filipiak and Markiewicz [3]. The study of optimality of designs under mixed model is partially based on the method of Filipiak and Markiewicz [4].

Keywords: Circular balanced design, Mixed model, Neighbor designs, Universal optimality

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MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

Empirical Likelihood Inference for the Sen Index

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Abstract

In this paper we discuss the Jackknife empirical likelihood based inference for the Sen index. The large sample properties of the empirical likelihood ratio statistic are studied. We obtain hybrid bootstrap and empirical likelihood confidence interval for Sen index using the proposed Jackknife empirical likelihood inference. Finite sample performance of the empirical likelihood based confidence band are illustrated through simulation study.

Keywords: Empirical likelihood, Jackknife empirical likelihood, Sen index

MARMARA ÜNİVERSİTESİ

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Finite Sample α-Similar Linear Procedures for Inference on AR(2) Processes; Approach Based on Full Information

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Abstract

In this paper, we develop finite-sample α-similar linear procedures for inference (tests and confidence region) on autoregressive process of order 2. We test hypothesis which fixes the complete vector of autoregressive parameters by a Fisher-type statistic (with null distribution free of nuisance parameters and easy to simulate by MC techniques) against an augmented alternative. In order to test multiple unit root hypotheses of order 2, we use parameterization of Dickey(1976), Fuller(1976), Hasza-Fuller(1979), Beveridge-Nelson(1981) and Diebold-Nerlove(1990). Proposed methods are applied to time series of US velocity.

Keywords: AR(2) process, Confidence region, Finite-sample similar linear procedures, MC techniques, Multiple unit root, Time series

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The Success Factors of In Vitro Fertilization

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Abstract

In this study, the affects of variables including the women's ages, AMH (Anti-Mullerian Hormone) [1], AFC (Antral Follicule Count) [2], Embryos grade 2,Total Fertilized Number of Embryos on the success of IVF (In Vitro Fertilization) was examined.

Logistic regression analysis was used to construct the model, since our dependent variable was categorized into two groups: pregnant or non-pregnant.

In logistic regression Probability or Odds of the response taking a particular value was modeled based on combination of values taken by the predictors. Omnibus Tests of Model Coefficients (p-value=0.048) and Hosmer and Lemeshow tests (p-value=0.485) was considered for decision of statistical meaningfulness of the model. As a result, our model was found statistically significant.

The results of age factor in the success of IVF was examined by grouping women in the study into two age groups, the age 35 and below and above 35. According to Chi-Square test it was seen a significant difference exists between age groups and in the success of IVF (p-value=0.0).

Keywords: Fertilized oocyde, In Vitro Fertilization, Logistic regression, Odds

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On p/n-Asymptotics Applied to Traces of 1st and 2nd Order Powers of Wishart Matrices with Application to Goodness-of-Fit Testing

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Abstract

Assume that a matrix $X : pxn$ is is matrix normally distributed and that the Kolmogorov condition holds, i.e. $n/p \overset{n,p\to\infty}{\to} c > 0$. Then, the distribution of the vector of the normalized traces of $\frac{1}{n}XX'$ and of $\left(\frac{1}{n}XX'\right)^2$ is proved to be multivariate normal distributed. We propose a test for identity of the covariance matrix using a goodness-of-fit approach. Calculations are based on a recursive formula derived in [3]. The test performs well regarding the power compared to presented alternatives, for both $c < 1$ or $c \geq 1$.

Keywords: Covariance matrix, Goodness-of-fit test, Multivariate normal distribution, Wishart matrix

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MARMARA ÜNİVERSİTESİ

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Some Further Properties of the Linear Sufficiency

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Abstract

In this talk we consider the linear sufficiency of statistic Fy when estimating the estimable parametric function of β under the linear model $A = \{y, X\beta, V\}$. The concept of linear sufficiency was essentially introduced in early 1980s by Baksalary, Kala and Drygas, see [1], [2] and [3]. For a recent review, see [4]. We go through some properties that have not been received much attention in the literature and provide some new results and insight into the meaning of the linear sufficiency. In particular, we consider the best linear unbiased estimation (BLUE) under the transformed model $A_t = \{Fy, FX\beta, FVF'\}$ and study the possibilities to measure the relative linear sufficiency of Fy by comparing the BLUEs under A and A_t. We also consider some new properties of the Euclidean norm of the distance of the BLUEs under A and A_t.

Keywords: Best linear unbiased estimator, Generalized inverse, Linear model, Transformed linear model

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MARMARA ÜNİVERSİTESİ

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Application of Binary Logistic Regression on Coronary Heart Disease Risk Factors in North Cyprus

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Abstract

In this study, binary logistic regression analysis have been employed in order to specify the risk factors that affect coronary heart disease (CHD) in North Cyprus. In general, logistic regression is used in areas such as modelling life probability in medical fields and evaluating diseases risk factors. The data has been obtained from 6380 individuals who received consultation from the Cardiology Department of the State Hospital in Nicosia. Since this study can be intrinsically qualified as exploratory, one of the stepwise methods was considered to be the most appropriate method and therefore, the Forward and Backward Likelihood Ratio stepwise methods were compared with the "Likelihood ratio test" [1]. The classification accuracy of each model has been detected as 95%. Family history (FH), age, smoking, diabetes mellitus (DM), total cholesterol level (TCL) and hypertension (HT) variables have been identified as risk factors that affect CHD. The fitted logit model is $logit(p) = -6.027 + (0.607\text{x}FH) + (0.021\text{x}age) + (2.934\text{x}smoking) + (2.513\text{x}DM) + (1.316\text{x}TCL) + (0.503\text{x}HT) - (0.937\text{x}gender)$, where p is the estimated probability of CHD. When the coefficient estimates of the model variables were analyzed at the end of the study, it was concluded that smoking which is changeable risk factor is a high risk factor as the morbidity rate of smokers is 18.801 times higher when compared with non-smokers.

Keywords: Binomial distribution, Coronary heart disease, Logistic regression, Odds ratio, Stepwise methods

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MARMARA ÜNİVERSİTESİ

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Moving Block Bootstrap based ANFIS Approaches for Forecasting

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Abstract

Fuzzy inference systems have been used to obtained forecasts for time series in the literature. Adaptive network fuzzy inference system (ANFIS) is the well-known fuzzy inference system and it is the most preferred method because of its systematic and objective structure. In ANFIS method, uncertainty is handled by using fuzzy sets but there is no any probabilistic inference. When the sample data is randomly changed, the estimations from ANFIS is randomly changed, too. As a result of this, ANFIS estimations are come from some estimators but it is not easy to obtain formulas for this estimators in a closed forms. Probabilistic inferences are needed in an ANFIS approach because of using randomly selected sample data. In this study, three algorithms are proposed to obtain probabilistic results from ANFIS based on moving block bootstrap (MBB) method. Because of using MBB, forecasts are obtained as a centrality measure of forecast distributions in ANFIS. The proposed algorithms are applied to Istanbul Stock Exchange data sets and the performances of algorithms are compared.

Keywords: ANFIS, Forecasting, Fuzzy sets, Moving block bootstrap

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MARMARA ÜNİVERSİTESİ

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Alternative Approaches for the Use of Uncertain Prior Information to Overcome the Rank-Deficiency of a Linear Model

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Abstract

The rank-deficiency of a linear model indicates some information deficit that may be covered by "prior information" (p.i.) in spite of its uncertainty. There are several ways of introducing such p.i., which may be characterized as hierarchical or simultaneous. Here, three hierarchical methods will be compared with four simultaneous methods; in particular, the question of rescaling the p.i. itself or only its dispersion matrix will be investigated. A small (surveying) leveling network will serve as a numerical example for the comparison.

Keywords: Hierarchical vs. simultaneous methods, Rank-deficiency, Rescaling prior information itself vs. its dispersion matrix, Uncertain prior information.

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Recurrent Type-1 Fuzzy Regression Function for Time Series Forecasting

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Abstract

Recently, fuzzy time series models have been commonly used by researchers for various problems. There are numerous methods suggested for these kinds of concepts. While most of these methods are rule-based methods, there are a few methods which do not require rules. The method we propose in this paper is not a rule based and it is a combination of a few well known methods: Autoregressive model, Moving average model, Type-1 fuzzy function, and Particle swarm optimization. Our purpose is to combine these methods and get better outcomes than the methods proposed before.

The input data set is organized with the following variables. First, lagged values of the time series are used for the autoregressive part. Second, FCM algorithm is used to cluster the inputs. The degree of memberships and centers are stored. Third, for the moving average part, a recurrent learning algorithm is used. So, $AR(p)$, $MA(q)$, and degree of memberships of the objects are restored in the input data set. Since the function we have is not a derivative function, particle swarm optimization algorithm is used to obtain estimations of the coefficients. Istanbul Stock Exchange daily data sets from 2009 to 2013 are used to evaluate the performance of the proposed method. The outcomes show that the proposed method outperforms the other methods for 5 real-world time series data sets.

Keywords: Autoregressive model, Forecasting, Moving average model, Nonlinear time series, Particle swarm optimization, Type-1 fuzzy function

MARMARA ÜNİVERSİTESİ

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Evaluation of Two-Compartment Model Parameter Estimates Through Bootstrap Method

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Abstract

Compartment models are often used to describe transport of material in biological systems. Two-compartment model is common in all multi-compartment models which have applications in many fields including pharmacokinetics, biomedicine, engineering, information science, etc. Generally, the mathematical functions associated with compartment models are intrinsically nonlinear in parameters. In this case, it is hard to obtain an analytical solution for the minimization of sum of squared errors to get estimates of the parameters. In addition to the problem caused by nonlinearity on the estimation of parameters, there is a problem with the distribution of the estimated parameters. Therefore, usage of resampling methods, e.g. bootstrapping, can be applied to nonlinear model to make statistical inference.

In this study, a two-compartment pharmacokinetic model is considered as a nonlinear regression problem. In order to estimate the pharmacokinetic model parameters, called disposition parameters, sum of squared errors is considered a kind of objective function. Genetic Algorithm (GA) is used as an optimization tool for minimization of the objective function. The statistical inference about the disposition parameters are achieved by using bootstrap method. A simulated data set is used for the evaluations and the obtained results are discussed briefly.

Keywords: Compartment model, Genetic algorithm, Bootstrap method

Acknowledgement: This study is supported by The Scientific and Technological Research Council of Turkey (TÜBİTAK-2218).

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MARMARA ÜNİVERSİTESİ YAYINEVİ

Estimation of the Mean Parameters in the Growth Curve Model When the Size of the Dispersion Matrix is Large

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Abstract

When the number of variables compared with the number of observations is large a new approach of estimating the parameters describing the mean structure in the classical Growth Curve model is presented. An explicit estimator is obtained which is unbiased and asymptotically normally distributed. We also consider an extended growth curve model.

Keywords: High-dimensional analysis, Growth Curve model

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Multivariate Semiparametric Regression Estimation with Errors in Variables

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Abstract

Regression models cause measurement error in the independent variables and known as errors in variables models or measurement error models described as:

$$Y = X^T\beta + g(x^*) + \Delta y$$
$$\chi = x^* + \Delta\chi \tag{1}$$

where y is dependent variable, $X = (X_1, \ldots, X_p)$ and x^* are $p \times 1$ vectors of independent variables, β is a vector of unknown parameters, g is an unknown function and Δy is model error has zero mean and σ^2 variance, χ is variable measured with error, and $\Delta\chi$ is the measurement error.

The interest in study measurement error model for semiparametric specifications is growing with the various publications. The optimal rates of the L_2 convergence for model (1) in the i.i.d. case has been studied by [1]. [2] also studied this model for the case that measurement errors has unknown distribution. In literature, multivariate density estimation of model (1) has not been clarified yet.

In this study we consider the partially linear errors in variable model relating observations (X, X^*, Y) are $R^p \times R^q \times R^l$ valued for $p, q, l \geq 1$.

Keywords: Errors in variables, Multivariate probability density, Partially linear regression model

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MARMARA ÜNİVERSİTESİ

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Modified Particle Swarm Optimization Approach in Portfolio Optimization

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Abstract

Portfolio selection problem is one of the most studied optimization problems in the optimization world. Standard Portfolio optimization is presented in 1959 by Markowitz [1]. Portfolio optimization is a NP-hard problem. Because of that heuristic methods are preferred to solve portfolio selection problem. In this study, modified particle swarm optimization (MPSO) [2] is used to solve portfolio optimization. Aladağ etc. [2] combine the adaptive interia weight and [3] and time varying acceleration coefficient [4] in standard particle swarm optimization method. The new algorithm is named modified particle swarm optimization. This model only differs from the standard particle swarm optimization, are used time varying constituents are using together [2]. In addition, MPSO and standard particle swarm optimization are used to solve two portfolio model which are cardinality constraint mean-variance model and Sharpe ratio model. In the cardinality constraint model two constrains are added to the standard model. One of these constrains is limiting the number of assets. The second constrain is limited the proportion of asset being in the portfolio. On the other hand Sharpe ratio is frequently used measure of return/risk performance. This ratio calculates the return in a unit of risk. So that the investor have to choose larger Sharpe ratio in order to get more return. In application, standard particle swarm optimization and modified particle swarm optimization are compared by using these models which are cardinality constraint mean-variance model and Sharpe model. Finally, As a result of these analysis, it is concluded that MPSO gets more optimal solutions than standard particle swarm optimization.

Keywords: Modified Particle Swarm Model, Particle Swarm Optimization, Portfolio Optimization, Sharpe Ratio Portfolio Model

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Abstract - Posters

MARMARA ÜNİVERSİTESİ

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Application of Competing Risks Models for Evaluation of Effective Factors for Risk/Survival of Cirrhotic Patients

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Abstract

Including multivariate survival data can be pointed competing risks data. There are various methods to analyze such data, includes semi-parametric methods of cause-specific hazard function and cumulative incidence function. The aim of this study is deployment of competing risks model to analyze the determinants of patients with liver cirrhosis.
In this study were used the recorded information of cirrhotic patients in Imam Khomeini Hospital from June 2008 to June 2009 were queued liver transplantation and were followed for at least seven years. In order to determine the effective factors for the time of death and transplantation of cirrhotic patients was used based on the cumulative incidence function regression method and data analysis performed using R statistical software. The error level of 0.05 was considered for all tests.
305 cirrhotic patients include 180 men and 125 women. The age average of patients was 39.8±14.54 years. At the end of the study, 82 patients died and 40 patients were undergoing liver transplantation. 7-year survival for patients died and received liver was respectively 18.3 and 21.2 months.
To investigate the effective factors for the time of death and transplantation of cirrhotic patients, the cumulative incidence function seems desirable. After fitting the multivariate regression model of cumulative incidence function, age, albumin and encephalopathy had a significant effect on the time of patient's death. For this purpose, planning and policy-making in prioritizing patients to receive liver donations can be made on the basis of their age. Also albumin and encephalopathy due to two effective factors can contribute to the Prioritization. In this study, among the various causes of cirrhosis, hepatitis B with 23 percent and cryptogenic with 22.6 percent, were the most important factors.

Keywords: Cause-specific hazard function, Competing risks, Cumulative incidence function, Liver cirrhosis.

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MARMARA ÜNİVERSİTESİ YAYINEVİ

A New Two-parameter Ridge Estimator in the Logistic Regression Model

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Abstract

The binary logistic regression is a commonly used statistical method when the outcome variable is dichotomous or binary. The explanatory variables are correlated in some situations of the logit model. This problem is called multicollinearity. It is known that the variance of the maximum likelihood estimator is inflated in the presence of multicollinearity. As a solution to this problem, the logistic ridge estimator was proposed in [4] and the logistic Liu estimator defined in [3] is another solution to the problem. This estimator is the logistic generalization of the Liu estimator defined in [2] for the linear model.
Therefore, the purpose of this study is to propose a new two parameter logistic ridge estimator which is a generalization of two-parameter ridge estimator defined in [1] and to show that it outperforms the estimators above in the sense of scalar mean squared error criteria via conducting a Monte Carlo experiment. Finally, a real data application is illustrated to show the applicability of the new method. According to the results of the simulation and real application, the new estimator outperforms the other estimators for all of the situations considered.

Keywords: Logistic regression, Multicollinearity, Ridge estimator, MSE, MLE, Monte Carlo simulation

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Evaluation of Performance Effectiveness of Textile Companies by means of Data Envelopment Analysis

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Abstract

Data Envelopment Analysis based on linear programming is used for the measurement of the effectiveness of units which have multiple inputs and outputs and perform the same actions. The most important specialty of this method used by M. J. Farrell in 1957 is its ability to utilize more than one output and input and to measure the activity without any need for production function. Up to the present, the method has been examined in many fields such as banking, health, education and transportation.
Within the scope of the present work, the objective is the measurement of the effectiveness of textile companies by means of Data Envelopment Analysis. Six textile companies have been chosen and their performance effectiveness has been evaluated in this work. In this context, the methods of CCR, BCC and AM have been conducted and the results have been by means of QSB packaged software.

Keywords: Textile Companies, Performance Effectiveness, Data Envelopment Analysis

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Poisson-Pseudo Lindley Distribution(PPsLD) and its Application

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Abstract

In this paper, we give the new distribution named a Poisson Pseudo Lindley Distribution(PPsLD), of which the Pseudo Lindley distribution (PsLD) is a particular case. The properties studied: moments, cumulants, characteristic function, failure rate function, stochastic ordering, distributions of sums, the maximum likelihood method and the method of moments. Also, an application of this distribution is given.

Keywords: Lindley distribution, Poisson distribution, Poisson Lindley distribution, Gamma Lindley distribution, Maximum-likelihood estimation

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MARMARA ÜNİVERSİTESİ

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Investigating the Association Structure Parametrisation within the Joint Modelling of Longitudinal and Survival Data Framework

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Abstract

Joint modelling framework has been recently quite popular to analyse longitudinal and survival data simultaneously. One of the aspects in this framework that needs further investigation is the parametrisation used to specify the association structure between longitudinal and survival processes. In this study, we investigate the aspect with applications to a real data set from an aortic valve replacement study. The parametrisations we consider are: current value, current value plus instantaneous rate of change, interaction of current value with a set of covariates, lagged effect, and cumulative effect. For the particular application, interaction of current value with a set of covariates seems to be the best parametrisation, as suggested by the likelihood ratio.

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Investigate the Factors Influencing on Endometriosis in Women of Reproductive Age Using Logistic Regression

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Abstract

Endometriosis is one of the most common and diseases with a high socioeconomic burden in women. The aim of this study was to investigate the factors influencing on endometriosis by logistic regression.
Data was collected from patient's records in Hazrat Rasoole Akram Hospital in Tehran. The patients who suffered from endometriosis (250) and their disease was diagnosed by laparoscopy, were selected as subjects and (250) patients who suffered from ovarian cysts other than endometriosis that were confirmed by laparoscopy were chosen as control group. Factors affecting the level of 5% of endometriosis through logistic regression using the software SPSS was performed.
The age range of women and their standard deviations were 34.84($\pm$0.62) and 33.75 mean age ($\pm$0.55), respectively. The difference was significant. (p-value=0.02). The variants of age, irregular menses, the duration of menstrual cycle, the duration of bleeding, the number of pregnancies, the number of live births, infertility, speck before menstrual at error level 0.2, were analyzed by multi-variant logistic regression through single-variant logistic regression for independent variables. The factors or variables of age, the number of live births, premenstrual spotting were predicted and the factors influencing suffering from endometriosis through please correct it multi-variant logistic regression.
According to the result of present study, age, the number of live births, premenstrual spotting was predicted as risk factors for endometriosis. As we know increased awareness of women about factors influencing endometriosis may help timely diagnosis and treatment of this important disease.

Keywords: Endometriosis, Reproductive age, Laparoscopy, Logistic regression

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