

In the Name of God

**The 11th Iranian
Statistical Conference**

ABSTRACTS

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PREFACE

This volume contains the abstracts of contributed articles at the 11th Iranian Statistical Conference (ISC11). The Iranian Statistical Conference is a three day event held every two years with cooperation of the Iranian Statistical Association. The ISC11 organized jointly by the Iran University of Science & Technology and Iran Statistics Society, is taking place from 28 to 30 August at Iran University of Science & Technology.

The scientific committee of the conference selected 170 articles for oral presentations, 178 articles for posters, and 10 articles for workshops, out of 415 submitted articles. Moreover, a number of famous national and international statistical figures have been invited to present their latest works in the conference. Among them, 28 could attend the conference and present their top-notch lectures.

We would like to thank our colleagues and all who helped us for this publication. We gratefully acknowledge the careful efforts of A. Saghafi, H. Rabiei, E. Ghazarian, M. Aalaei and A. Feizabadi Farahani to made the publication of the proceeding possible.

R. Farnoosh

August 2012

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Oral Presentations

Modeling overdispersed discrete time series

A-10-199

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Abstract. The classic first-order nonnegative integer valued autoregressive (INAR(1)) process is usually assumed to have Poisson marginal distribution and, consequently, the corresponding innovations are Poisson random variables. This model is naturally suitable for equidispersed time series wherein the mean and variance are the same. In this paper, we consider modeling overdispersed discrete time series. At first, we propose a simple check for the distribution of innovations in INAR(1). Then, we fit INAR(1) model with each Poisson, geometric and zero inflated Poisson innovations to two real overdispersed time series to illustrate the superiority of INAR(1) model with geometric and zero inflated Poisson innovations. We use conditional maximum likelihood approach for the estimation of the parameters and the predicted values of the time series.

Keywords. Zero inflated Poisson distribution, Discrete time series, Conditional maximum likelihood estimation, Binomial thinning operator

The DFD Method for Analyzing Data in Unreplicated Factorial Designs

A-10-407

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Abstract. Unreplicated factorial designs are commonly used in industrials and laboratories. Because of traits of these designs, the analysis of such designs is a pretty challenging problem. There are a number of methods proposed for analyzing data in unreplicated factorial designs, most of which are nonparametric. Although, there are some advantages with these proposed methods, however, non of them is doing well in terms of power in testing the factorial effect, in overall.

In this paper, we propose a parametric method, say double F distribution (DFD), which is able to control the error at IER or EER level. This method, like step-up and step-down methods is based on sparsity principle in factorial designs. By DFD method, we first define a test statistic and obtain the exact distribution of the test statistic. Then, we employ the method in analyzing the data and finally it is compared with some current methods through a simulation study.

Keywords. Bayes Estimator, Error variance, Factorial Effects, Likelihood Ratio Test, Non-central Fisher Distribution, Simulation Study

A new method for estimating parameters of a profile hidden Markov model based on phylogenetic tree

A-10-570

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Abstract. Hidden Markov Models (HMM) are popular statistical tool for modelling a wide range of time series data. These Models are practical tools which have been successfully implemented in many fields of bioinformatics. They are applied to protein sequence alignment, protein family annotation and gene-finding. A Profile Hidden Markov Model (PHMM) is a standard form of an HMM representing a class of Left-to-Right model used for modelling protein and DNA sequence families based on multiple alignment. It is possible to train the PHMM directly from unaligned sequences. The Baum-Welch algorithm and the Bayesian Monte Carlo Markov Chain (BMCMC) method are well known approaches for estimating parameters of HMMs. In this paper, we first implement two methods for estimating parameters of small artificial PHMM with 6 Match states and mid entropy. Secondly, in order to improve the prediction accuracy of the estimation of the parameters of the PHMM, we classify the training data based on their phylogenetic tree. We finally apply an heuristic algorithm for estimating parameters of the PHMM. It is expected that the use of our methodology improves the precision of parameter estimation considerably. All the program is available at <http://www.bioinf.cs.ipm.ir/software/CSPHTREE/>.

Keywords. Hidden Markov Models, Profile Hidden Markov Models, The Baum-Welch algorithm, Bayesian Monte Carlo Markov Chain method, Entropy, Phylogenetic tree

Reconstruction of the past observations: A review study

B-10-36

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Abstract. There are some situations in life testing, reliability experiments, industrial stress testing, industrial quality control experiments and other similar situations measurements may be made sequentially and the observations are ordered. In such situations, where experiments often are not monitored continuously or at the beginning of the experiment some data points may be censored due to negligence. So, one question that arises here is: what were the missing failure times? In this regards, we might be interested in getting inference more about the history of the experiments. Recently, a little works have been done on the reconstruction problem based on order statistics and record values, e.g, Klimczak and Rychlik (2005), Balakrishnan *et al.* (2009), Razmkhah *et al.* (2010, 2012), Asgharzadeh *et al.* (2011) and Khatib *et al.* (2012a, b). In this talk, first we introduce several lifetime models based on ordered data. Then in each case, we suppose that the experimenter lost some observations and show that how one can reconstruct the past failure times based on available observations. Various reconstructors are demonstrated and compared.

Keywords. Life testing, Reliability, Ordered data

Clustering and discrimination of multivariate stationary processes: Comparison time domain and spectral domain

A-10-628

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Abstract. Clustering and discrimination are very important aspects in multivariate statistical analysis. The classical methods of clustering and discrimination can also be employed for classification of multivariate stationary process with using some specific distance functions. We mention here the common methods of clustering and discrimination in both time domain and spectral domain and through a case study we compare these methods together.

Keywords. Cluster Analysis, Discrimination, Principal Component, Auto-correlation function, Spectral density

Hill Cipher Algorithm

A-10-928

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Abstract. Hill ciphers are an application of linear algebra to cryptology, the science that coding and decoding the text messages. The cryptographic involves the use of nonsingular $n \times n$ matrices with integer elements that said *key matrices* and their inverses. Key matrices must have some properties. In this paper we want to introduce a method of generating these invertible matrices in simple way.

Keywords. Hill Cipher, Cryptography, Key matrix

Archimedean copula and its application

B-10-10

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Abstract. In many statistical models, assumption of independence among data or components in multivariate data is not valid and even wrong in some cases, which results in incorrect inference of observation. In this paper, we shall attempt appeared in several papers to use Archimedean copulas for modeling dependency in practical situations. Residual and past lifetime of an $(n - k + 1)$ -out-of- n system with non-identical and dependent components is investigated using some extension of usual stochastic ordering in multivariate case. We also consider multivariate aging notions for a vector \mathbf{X} of lifetimes based on stochastic comparisons between \mathbf{X} and \mathbf{X}_t , where \mathbf{X}_t is the multivariate residual lifetime after time $t > 0$, under the assumption that the dependence structure in \mathbf{X} is described by an Archimedean survival copula. We also obtain the density and distribution functions of progressively Type-II censored order statistics (PCOS)-II arising from dependent variables distributed according to an Archimedean copula and an example of a special case of PCOS-II from dependent variables is provided for illustration.

Keywords. Archimedean copula, Order statistics, $(n - k + 1)$ -out-of- n

Some Results for Discrete Strong Unimodality of Order Statistics with Applications

A-10-261

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Abstract. It is known that order statistics (OSs) appear in many areas of statistical theory and applications including quality control, robustness, outlier detection, and reliability analysis. Unimodality of OSs for both discrete and continuous cases and their strong unimodality only for continuous case have been investigated by some authors. In this article, we shall first establish the strong unimodality of OSs in discrete case by means of the notion of total positivity. Then, we shall apply this result to give an application in IFR property. Finally, by using these results, we shall show that the IFR and DFR classes are not closed under the formation of coherent systems in the discrete life distribution case.

Keywords. Strong unimodality, Order statistics, Total positivity, Failure rate function, Parallel system, Geometric distribution

Unbiased Confidence Intervals for Families of Distributions Involving Two Truncation Parameters

A-10-307-2

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Abstract. In this paper we construct unbiased confidence intervals for families of distributions involving two truncation parameters. The method used is that of the pivotal quantity. Several examples are given to show the performance of the proven theorems.

Keywords. Unbiased confidence intervals, Shortest confidence intervals, Pivotal quantities, Pivotal quantity method, Truncation parameters

A Kullback-Leibler information type test of fit

B-10-26

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Abstract. The paper introduces a general goodness of fit test based on an estimate of Kullback-Leibler information. The proposed test is consistent and the limit distribution of the test statistic is given. The results are used to introduce goodness of fit tests for the normal, the exponential and Weibull distributions. A simulation study is performed to compare the power of the proposed test with existing procedures. Real examples are presented and analyzed.

Keywords. Information theory, Kullback-Leibler information, Goodness of fit tests, Normal, Exponential, Weibull

Abstracts 11

Exponentiality Tests Based on Entropy

A-10-447-3

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Abstract. The paper studies tests of exponentiality based on entropy estimators. Critical values for various sample sizes determined by means of Monte Carlo simulations. We compare the power of tests for various alternatives and sample sizes.

Keywords. Entropy, Tests of exponentiality, Monte Carlo methods, Test power

Constructing new classes of bivariate distributions

B-10-11

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Abstract. In this paper, we introduce two class of bivariate distributions having proportional (reversed) hazard rates models as their marginals. Also, two families of bivariate distributions constructed by a stochastic mixture of the order statistics of a sample of size two are given as competitors for FGM family. Dependence structure and corresponding copula functions of these families of bivariate distributions are studied.

Keywords. FGM family, copula function, proportional hazard rate, proportional reversed hazard rate, association measure

Multi-Objective Economic-Statistical Design of EWMA Control Chart

A-10-709

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Abstract. EWMA Control charts are widely used for monitoring the quality of a process, especially in detecting small shifts. Their high implementation cost that may increase the cost of the production results in developing economic-statistical design of control charts with the lowest possible cost and more desired statistical properties. Lorenzen and Vance cost function is applied to design EWMA control charts considering both economic and statistical criteria. For this purpose, cost function is often optimized subjected to statistical properties. In most cases, cost function depends on statistical properties, so minimizing the cost function as a single objective is not efficient to design control charts. In this paper cost function and statistical properties including in-control and out-of-control average run length, are considered as objectives. We proposed multi-objective approach in which both economic and statistical criteria are optimized. A numerical example illustrates the efficiency of proposed approach comparing to single objective method.

Keywords. EWMA control chart, economic-statistical design, multi-objective, Lorenzen and Vance

Robust Shrinkage Estimation Under Schwartz Space

A-10-171

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Abstract. In this paper, we are basically discussing on a class of Stein-type shrinkage estimators of the vector parameter in a location model, with errors belonging to a sub-class of elliptically contoured distributions. We derive conditions under Schwartz space in which the underlying class of shrinkage estimators outperforms the sample mean. It is nicely presented that the dominant properties of the class of estimators are robust truly respect to departures from normality.

Keywords. Elliptically contoured distribution, Jeffreys' prior, Minimax, Robustness, Shrinkage estimator, Schwartz space

Distribution-free prediction of progressively type-II censored order statistics based on k -records from two independent sequences

A-10-586

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Abstract. In this paper, we study the problem of nonparametric predicting future progressively type-II censored order statistics based on observed upper and lower k -records. Also, outer prediction intervals are obtained for progressively type-II censored order statistics intervals from an independent sample based on observed upper k -records. We show that the coverage probabilities of these intervals are exact and do not dependent on the underlying distribution. Furthermore, we present numerical results for obtained intervals.

Keywords. Progressively type-II censored order statistics, k -records, Prediction interval

Generalized Weibull-Geometric Distribution

A-10-120

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Abstract. In this paper, we shall attempt to generalize the Weibull-geometric distribution of Barreto-Souza et al. (2011) using *resilience parameter family*. The new four-parameter lifetime distribution also generalizes the generalized exponential geometric distribution of Silva et al. (2010), exponentiated Weibull, and several other lifetime distributions as special cases. A useful characteristic of the new distribution is that its failure rate function can have different shapes. We first study certain basic distributional properties of the new distribution. The model parameters are estimated by the maximum likelihood method. Finally, the model is applied to a real data set and its advantage over some rival models is illustrated.

Keywords. Beta Weibull distribution, Failure rate, Logconcavity, Logconvexity, Maximum likelihood estimation, Resilience parameter family, Weibull-geometric distribution

Some preservation theorems for systems with minimal repairs

A-10-467

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Abstract. Consider a one-component repairable system that the number of its repair is a positive random variable. It is shown that several reliability properties preserve under minimal repair policy. A necessary and sufficient condition for the lifetime of system with one component to be $IFR(DFR)$ whenever the original component follows an $IFR(DFR)$ distribution is obtained.

Keywords. Minimal repair, Record values, Stochastic ordering

On the Properties of Cost Functions in Financial Market

A-10-180

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Abstract. In this paper the properties of cost functions in financial market is investigated and the relation between the market structure and the functional form of the cost function is discussed. Cost function is necessarily the maximum of expectations with respect to a given family of probabilities. Based on this, some necessary criteria for a given arbitrary function to be a cost function are obtained.

Keywords. Cost function, Market structure, Complete & incomplete market, Risk neutral probability, No-arbitrage principle

On limiting properties of central order statistics

B-10-39

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Abstract. Various asymptotic properties of central order statistics are known in the literature in the case when observations form a sequence of independent and identically distributed random variables. First, I will present an overview of some of these properties. Then I will give extensions of these properties to properties of central order statistics arising from strongly stationary sequences of observations. In particular, I will show that central order statistics from strictly stationary and ergodic sequences are strongly consistent estimators of population quantiles provided that the quantiles are unique. I will also describe three types of asymptotic behavior of central order statistics in the case when the corresponding population quantile is not unique. Finally, I will discuss a special case of strongly stationary sequences, namely linear processes, and show how my results can be applied to linear processes with absolutely continuous innovations and with discrete innovations.

Keywords. Central order statistics, Stationary processes, Linear processes, Quantiles, Almost sure convergence

Best Linear Unbiased Estimator of the location parameter of heavy tail distributions based on a ranked set sample

A-10-569

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Abstract. The problem of estimation of the location parameter of stable distributions by using a Ranked Set Sample (RSS) is considered. We derive the Best Linear Unbiased Estimator (BLUE) and its variance, based on RSS. We compare numerically, variance of this estimator with Mean Square Error (MSE) of a few classical estimators.

Keywords. Best linear unbiased estimator, Location parameter, Ranked set sampling, Stable distributions

Utility of Dependence: Reduction of Uncertainty and Departure from Independence*

B-10-30

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Abstract. Dependence between variables with a multivariate normal distribution can easily be assessed through the correlation measures. But in general, dependence is more complicated than that could be measured by the traditional indices such as the correlation coefficients, its nonparametric counterparts, and the fraction of variance reduction. The mutual information, denoted here as M , measures departure of a joint distribution from the independent model. We also view M as an expected utility of variables for prediction. This view integrates ideas from the general dependence literature and the Bayesian information. After an overview of its theoretical foundations, we show that M provides a robust dependence index which extends the interpretations of the normal squared correlation to all distributions that are absolutely continuous relative to the product of their marginals. We illustrate the success of this index as a “common metric” for comparing the strength of dependence within and between families of distributions in contrast with the failures of the popular traditional indices. For the location-scale family of distributions, an additive decomposition of M gives the normal distribution as the unique minimal dependence model in the family. An implication for practice is that the popular association indices underestimate the dependence of elliptical distributions, severely for models such as t distributions with low degrees of freedom. Finally, we draw attention to a caveat: M is not applicable to continuous variables when their joint distribution is singular.

Keywords. Entropy, location-scale family, Marshall-Olkin, Mutual information, Predictability, Student’s t , Utility

* This document is an abridged version of a manuscript entitled “Information about Dependence in the Absence and Presence of a Probable Cause”, which is currently under review at a journal, prepared for presentation at the 11th Iranian Statistics Conference. Please do not quote without permission of the authors.

Importance of Components for a System*

A-10-929

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Abstract. The importance of a component for a system is defined in terms of the dependence between the operational state or life length of the system and the corresponding variable for the component. The information measures of dependence order the importance of the components. Our results, though motivated and presented in terms of the reliability of physical systems, are applicable to economic units with system structures and more generally to dependence in binary structures, convolution of continuous variables, and order statistics. The mutual information (M) is used for the states of the series, parallel, and k-out-of n systems and for the life length of the stand-by system. For series, parallel, and k-out-of n systems, the bivariate distributions of the systems and a components life lengths is singular and the mutual information is not applicable. For these systems, we derive the bivariate distributions and use an extension of the mutual information index recently proposed for singular distributions.

Keywords. Bayesian predictive distribution, Convolution, Dependence, Duration analysis, Mutual information, Order statistics, Proportional hazard, Singular distributions, Stochastic order

* An expanded version of this paper is under review at *Econometric Reviews*, Special Issue on Bayesian Inference and Information: In Memory of Arnold Zellner. Please do not quote with permission of the authors.

Bayesian Semi-parametric Meta-Regression for Count Data

B-10-12

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Abstract. The Bayesian semi-parametric analysis is widely used as a new methodology in clinical trials and meta-analysis. In this paper, we study the behavior of meta-regression analysis in a Bayesian semi-parametric model. This article introduces a method for computing the posterior distribution using the meta-regression. A Bayesian semi-parametric model with covariates is used to study the specific effects of the treatment and covariates. For estimating the posterior distributions under the model, we employ the Gibbs sampling. Finally, the proposed model is illustrated with a real example.

Keywords. Bayesian Model Selection, Bayesian Semi-parametric Model, Dirichlet Process, Meta-Regression, Multinomial Distribution

Multivariate Stable Distributions and Generating Densities

A-10-237

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Abstract. The probability density function of multivariate stable distributions are only partially accessible. So, Because their probability distribution function does not have an explicit solution, the application of them has been limited. In this paper, we present an analytic method – generating densities – to resolve this problem. Finally, some examples and special cases are discussed.

Keywords. Stable distribution, Fractional calculus, Generating densities, Spectral measure

M-Estimators for Distributions with Moderate Growth

A-10-203

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Abstract. We consider one class of Distributions with Moderate Growth arising in biomolecular systems. The asymptotic properties of M-Estimators as obtained by the "Generalized Method of Moments" (GMM) are proposed for such distributions.

Keywords. Distributions with Moderate Growth, M-Estimators as obtained by the GMM

Adaptive Monte Carlo method for linear systems with applications to mathematical finance

A-10-923

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Abstract. In this paper, an adaptive Monte Carlo method is discussed for linear systems which has simple structure, low cost and desirable speed and accuracy. To confirm the accuracy and efficiency of the present method, it is used to solve large linear systems. Furthermore, the method is implemented to price options successfully.

Keywords. Adaptive Monte Carlo method, large linear systems, option pricing

Two Iterative Algorithms for Solving Linear Equation Systems with Sequential and Parallel Approach

A-10-922

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Abstract. In this paper, two iterative methods are presented to solve linear system of equations from sequential and parallel computations point of view. The major goal of this paper is pointing out the advantages of the parallelization of these methods for solving linear systems over distributed environments with Message Passing Interface. For this purpose, the simulation study is carried out for Monte Carlo and Jacobi methods. Results show, parallel algorithms can converge to the true answer faster than sequential algorithms with increasing matrix size.

Keywords. Sequential algorithm, Parallel algorithm, Jacobi Method, Monte Carlo Method

Characterization results based on entropies of concomitants of order statistics and record values

A-10-814

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Abstract. In this paper, the concomitants of order statistics and record values of Farlie-Gumbel-Morgenstern (FGM) family of bivariate distributions are considered. We extend the results of Fashandi and Ahmadi (2012) and obtain some new characterization results for symmetric distributions. The results may be used for testing symmetry of the population from which the data are coming.

Keywords. Concomitant, Entropy, FGM family, Power distribution, Symmetric distributions

Optimal Halton sequences based on linear and inversive Scrambling

A-10-77

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Abstract. In this paper, we present two new quasi random numbers generators. We first study the Halton sequence, then we construct a new efficient algorithm for linear and inversive scrambling Halton sequences.

Keywords. Halton sequence, two-dimensional projections, Linear scrambling, Inverse scrambling

Reducing the Number of Iterations of the Greatest Eigen Fuzzy Set in Stationary Distribution of Fuzzy Markov Chains

A-10-455

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Abstract. A general definition of fuzzy Markov chains over a finite state space is introduced. It has been pointed out that unlike for the classical Markov chains recurrency does not imply ergodicity in the case of the fuzzy Markov chains. However, if a fuzzy Markov chain is ergodic then the rows of its limiting transition matrix are equal to the greatest eigen fuzzy set of the fuzzy relation associated with the chain. We make use of some quasi-random sequences for generating elements of fuzzy transition matrix.

Keywords. Fuzzy Markov Chains, Eigen Fuzzy Set, Ergodicity, Stationary Distribution, Quasi-Random Sequences

Asymptotic Expansions for the Ergodic Moments of Semi-Markovian Random Walk with a Generalized Delaying Barrier

A-10-112

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Abstract. In this study, semi-Markovian random walk process $(X(t))$ with a generalized delaying barrier is considered and the ergodic theorem for this process is proved under some weak conditions. Then, the exact expressions and asymptotic expansions for the first four ergodic moments of the process $X(t)$ are obtained.

Keywords. Semi-Markovian random walk, Delaying barrier, Ergodic distribution, Ergodic moments, Asymptotic expansion, Ladder height

Regression O-Martingale Models

A-10-925

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Abstract. The questions relating to a Strong Consistency, Asymptotic Normality, asymptotic behaviour of the paths (the Iterated Logarithm Law) for the Least-Squares (LS) estimator of the vector-valued unknown parameter in a multidimensional Linear Regression Model with Option-measurable (O)-Martingale noise are studied. With respect to the filtration $\mathbf{F} = (\mathcal{F}_t)_{t \geq 0}$, given on a complete probability space $(\Omega, \mathcal{F}, \mathbf{P})$ doesn't made any assumptions. Besides, the paths of all considered processes are supposed belonging to the space of functions without second kind of discontinuity (i.e. they have both one-sided finite limits at the each point $t > 0$).

Keywords. Regression models, O-Martingales, LS-estimators

Consistency of Subsampling Estimator for Wavelet Cyclic Autocorrelation of Periodically Correlated Processes

A-10-546

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Abstract. In this article, we consider periodically correlated process and define cyclic autocorrelation based on wavelet coefficients of periodic wavelet transform of autocovariance function. Also, we prove consistency of subsampling procedure for estimator of wavelet coefficients of autocovariance function, that call it wavelet cyclic autocorrelation, and compute confidence interval for wavelet cyclic autocorrelation.

Keywords. Periodically correlated process, Periodic wavelet, α -mixing sequence, Subsampling

Prediction of biological properties of some benzophenone and indanone derivatives as acetylcholinesterase inhibitors by parametric and fuzzy nonparametric regression methods

A-10-660

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Abstract. The biological activity of some acetylcholinesterase inhibitors were predicted by parametric and non parametric methods. The molecular descriptors or independent variables were obtained from Hyperchem and Dragon software's . The dependent variable is biological activity named logIC₅₀ . In parametric multiple linear regression (PMLR) the coefficient of determination R^2 is 0.6 and in fuzzy nonparametric regression (NPFR) $CV = 1 - R^2$ is 7.1e-4 .

Keywords. Benzophenone, Indanone, Acetylcholinesterase, Linear regression, Fuzzy nonparametric regression

First-Order Spatial Integer-Valued Autoregressive SINAR(1,1) Model and Some of its Properties

A-10-162

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Abstract. Binomial thinning operator has a major role in modeling one-dimensional integer-valued autoregressive time series models. The purpose of this paper is to extend the use of such operator to define a new stationary first-order spatial non-negative integer-valued autoregressive SINAR(1,1) model. We study some properties of this model like the mean, variance and autocorrelation function. Yule-Walker estimator of the model parameters is also obtained and the strong consistency of the autocovariance function, autocorrelation functions and Yule-Walker estimators are established. Some numerical results of the model are presented and moreover this model is applied to a real data set.

Keywords. SINAR(1,1) model, Binomial thinning operator, Spatial integer-valued autoregressive, Modelling

Dynamic Shape Analysis in medicine

A-10-101

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Abstract. The field of Dynamic Shape Analysis, especially the potential to support the process of decision-making in medicine was almost unnoticed by the users. The temporal shaping in medicine has to consider the medical relevance for certain time points in the measurement. For each object of a discrete time point t to the next time point $t+1$ a function can be determined: $g(o_i^t) = o_{i^{t+1}}$. In our first linear approach every of the k landmarks l is weighted.

$$l_j^{i^{t+1}} = W_j^{i^t} l_j^{i^t}, W_j^{i^t} \in R^{m \times m} \quad (1)$$

For the entries in the diagonal of the matrix, we take $w_{j,r}^{i^t} = 0$, if $l_{j,r}^{i^t} = 0$:

$$w_{j,r}^{i^t} = \frac{l_{j,r}^{i^{t+1}}}{l_{j,r}^{i^t}}, \forall r = 1, \dots, m \quad (2)$$

Instead of a "mean shape" for a longer time period or the distance to the "mean shape", the differences in the process of the shaping are used. The "mean shape" is calculated for every time point. Hence we have one process of shaping of the mean, one for every shape in our sample and the possibility to calculate a distance between both processes. The advantage of our approach, we will show in cardiology and oncology.

Keywords. Dynamic Shape Analysis, Mean Shape, Permutation test, Cardiology, Oncology

New Challenges in the Statistical Shape Analysis

B-10-14

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Abstract. The statistical shape analysis is dealing with the geometrical data (information) in which the orientation, location and scale of the objects are not of any interest. These typical data are known as non-linear statistics (or also manifold valued statistics). In the traditional view to the statistical shape analysis, the landmarks, usually setting on the outline of the objects, are key for further analysis. Recent advances in technology has ability to capture as many information as possible, such as closed-curves and contour paths from the various types of object including free-object, dynamic objects and so on. However, these force the statistical shape analysis to encounter with new challenges. In this paper, through some real life examples, some of the such problems and also possible approaches to treat them will be discussed.

Keywords. Statistical shape analysis, Principal component analysis, Non-linear statistics, Non-Euclidean space

Goodness-of-Fit Test Based on Kullback-Leibler Information for Progressively Type-II Censored Data

A-10-544

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Abstract. We express the joint entropy of progressively Type-II censored order statistics in terms of an incomplete integral of the hazard function, and use it to develop a simple estimate of the joint entropy of progressively Type-II censored data, considered earlier by Balakrishnan et al., *IEEE Trans. Reliability*, vol. 56, pp. 349356. We then construct a goodness-of-fit test statistic based on the Kullback- Leibler information for Pareto, log-normal, and Weibull distributions by using maximum likelihood estimates and approximate maximum likelihood estimates of the model parameters. Finally, we use Monte Carlo simulations to evaluate the power of the proposed test for several alternatives under different sample sizes and progressive censoring schemes.

Keywords. Approximate maximum likelihood estimate, entropy, Goodness-of-fit test, Hazard function, Kullback-Leibler information, log-normal distribution, maximum likelihood estimate, Monte Carlo simulation, Pareto distribution, progressively type-II censored data

A note on likelihood ordering on general order statistics

A-10-921

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Abstract. In this talk we present some new stochastic ordering results among general order statistics. These new results generalize some of the recent results in Balakrishnan, Belzunce, Hami and Khaledi (2010) univariate and multivariate likelihood ratio ordering of general order statistics and associated conditional variables, *Probability in the engineering and informational science* (2010),24, 441-455

Keywords. Order statistics, Record values, Generalized order statistics, m -generalized order statistics, Progressively Type-II censored order statistics, Conditional variables, Stochastic comparison, Likelihood ratio ordering

Randomly Weighted Average with Beta Random Proportion

A-10-325

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Abstract. A weighted average of two independent continuous random variables X_1 and X_2 with random proportions obtained by Beta distribution is introduced. A formula between the Stieltjes transforms of the distribution functions of the weighted average and X_1 and X_2 is established. We review Van Assche's results and related issues for this weighted average and we also find characterizations for Beta, Cauchy, arcsin, semicircle and power semicircle distributions.

Keywords. Arcsin, Cauchy, Random proportion, Stieltjes transform, Schwartz theory, Weighted average

A Novel Extension of Randomly Weighted Average

A-10-298

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Abstract. The concept of a randomly weighted averages introduced recently with random proportions that are jointly uniformly distributed over the unit simplex. In this article we study some generalization this concept and results. Our study on conditional distribution of randomly weighted averages also leads us to a new rich class of extension triangular distribution. We also find characterization for Cauchy, arcsin, semicircle and power semicircle distribution.

Keywords. Arcsin distribution, Stieltjes transform, Schwartz theory on distributional derivatives, uniform Distribution, Cauchy distribution

A Random Variable Distributed Between Two Random Variables

A-10-487

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² Department of Statistics, K.N. Toosi University, Tehran, Iran.

Abstract. Let X and Y be independent random variables and let Z be a random variable (which is uniform or not uniformly distributed) over $[X, Y]$. We study the distribution of the random variable Z and show that the arcsin distribution and cauchy distribution can be characterized in a particular way by means of this construction.

Keywords. Arcsin, Cauchy, Stieltjes Transform, Schwartz theory

Hidden Markov Mixture Autoregressive Models: Stability and Moments for Order p

A-10-807

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Abstract. In this paper, we introduce a new approach to model nonlinear time series, namely Hidden Markov Mixture Autoregressive ,HM-MAR(K, p), model. We also investigate limiting behavior of unconditional first moment of a process, and derive an appropriate upper bound for the limiting value of the variance. Further we show convergence and stability of the second moment.

Keywords. Hidden Markov Model, Mixture Autoregressive Model, Stability

Closure of random samples

B-10-40

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Abstract. This paper shows that the closure of a random sample for a k -dimensional random vector is almost surely the deterministic set of all heavy points of the distribution, where a heavy point is defined to be a point for which all its neighborhoods have positive probability.

Keywords. Distribution function, Random sample, closure, almost surely

Application of Kriging and Co-kriging in Predicting Electrical Conductivity (EC) of Chahar Mahal va Bakhtiari provinces Groundwater

A-10-62

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Abstract. Most of statistical approaches always assume that observations on a phenomenon are taken under identical conditions and each observation is taken independently of the others. As a matter of fact, the nearer data in the space is more realistic if it is considered as correlated and can be modeled with spatial statistics. There are different methods which can be used in order to have a prediction of values of the variable under study where there is no information about that variable in the specified location. Different types of Kriging and Co-Kriging can be considered as some exapmle. An expression of an applied example about Groundwater quality in the province of Chahar Mahal Va Bakhtiari which will predict electrical conductivity of water (EC) by using Kriging and Co-kriging was offered. TDS has been applied as an auxiliary variable and the result was compared. It was concluded that the result of Co-Kriging are more exact than the other method.

Keywords. Spatial statistics, Spatial correlation, Variogram, Kriging, Co-kriging

Optimal Design in a Simple Linear Regression with Skew-Normal Distribution for Error Term

A-10-38

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Abstract. The locally D-optimal design was derived for simple linear regression with the error term of Skew-Normal distribution. In this paper, to obtain a D-optimal design, the locally D-optimal criterion was considered, because of depending the information matrix on unknown parameters.

Keywords. Information Matrix, Skew-Normal Distribution, D-Optimal Criterion, A-Optimal criterion, Locally D-Optimal Design

Prediction via L-statistics in multivariate elliptical distributions

B-10-15

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Abstract. In this paper, by considering a $(k + n)$ -dimensional random vector $(\mathbf{X}^T, \mathbf{Y}^T)^T$, $\mathbf{X} \in \mathfrak{R}^k$, $\mathbf{Y} \in \mathfrak{R}^n$ having a multivariate elliptical distribution, we derive the exact joint distribution of \mathbf{X} and linear combinations of order statistics from \mathbf{Y} , as a mixture of multivariate unified skew-elliptical distributions. This mixture representation enables us to predict \mathbf{X} based on a linear combination of order statistics from \mathbf{Y} , when $k = 1$ and the kernel distributions are normal and t .

Keywords. Elliptical distribution, Multivariate unified skew-elliptical distribution, Order statistics, Mixture distribution, Linear combination, Prediction

Copulas Applications in Estimating Value-at-Risk (VaR): Iranian Crude Oil Prices

B-10-32

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Abstract. Crude oil being the primary source of energy has been unquestioningly the main driving engine of every country in this world whether it is the oil producer and/or oil consumer. Crude oil, one of the key strategic products in the global market, may influence the economy of the exporting and importing countries. Iran is one of the major crude oil exporting partners of the Organization of the Petroleum Exporting Countries (OPEC). Analysis of the risk measures associated with the Iranian oil price data is of strategic importance to the Iranian government and policy makers in particular for the short- and long- term planning for setting up the oil production targets. Oil-price risk-management focuses mainly on when and how an organization can best prevent the costly exposure to the price risk. Value-at-Risk (VaR) is the commonly accepted instrument of risk-measure and is evaluated by analysing the negative tail of the probability distributions of the returns/profit and loss. Among several approaches for calculating VaR, the most common approaches are variance-covariance approach, historical simulation, Monte-Carlo simulation. Recently, copula functions have emerged as a powerful tool to model and simulate multivariate probability distributions. Copula applications have been noted predominantly in the areas of finance, actuary, economics and health and clinical studies. In addition, copulas are useful devices to deal with the non-normality and non-linearity issues which are frequently observed in cases of financial time series data. In this paper we shall apply copulas namely; Frank copula, Clayton copula and Gumbel copula to analyse the time series crude oil price data of Iran in respect of OPEC prices. Data considered is the monthly crude oil prices of Iran and OPEC from January 1997 to December 2008. We shall discuss the results with respect to the risk associated with Iranian crude oil prices.

Keywords. Value-at-Risk (VaR), OPEC crude oil prices, Quantile distributions, Copula Functions, Monte Carlo simulations

Application of Bayesian Method in Parameters Estimation of Logistic Regression Model with Missing at Random (MAR) Covariate

A-10-41

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Abstract. The old customary method to deal with missing data is discarding those cases with missing data and to run analysis on what remains (complete case method). This technique have major problems such as the amount of information lost in the process and bias results. This study checked the MAR mechanism in datasets and compared three approaches (SCMCMC, MI, CC) in the Logistic Regression model with missing covariate by using simulation data and real data.

Keywords. Logistic regression, Missing at Random, Bayesian method, MCMC

On the Inactivity Times of the Failed Components in a Coherent System

A-10-644

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Abstract. In this note, we first consider a $(n - k + 1)$ -out-of- n system and second a coherent system with the property that, upon its failure, some of its components have been failed in the system. For these systems, we study the inactivity time of the failed components. Signature based mixture representation of the joint and marginal distribution functions of the such components in coherent systems are obtained and some aging properties and stochastic orders of them are studied.

Keywords. Order statistics, Stochastic order, Inactivity time, Mixture of distributions, Signature, Reversed hazard rate, Mean inactivity time.

Path Sets with Known Size and Its Application to the Signature of a Coherent System

A-10-503

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Abstract. The concept of signature of a coherent system was introduced by Samaniego (1985). It is a very useful tool for studying of reliability analysis of coherent systems. In this paper using the number of path sets with known size in a coherent system, signature of the system is obtained. As an example the signature of a consecutive- k -out-of- n :F system is discussed in details.

Keywords. Coherent System, Path Sets, Order Statistics, Signature, Consecutive- k -out-of- n :F system

On Bayesian consistency of the posterior distribution without the Kullback-Leibler condition

A-10-912

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Abstract. In this work, we study consistency in nonparametric Bayesian estimation of a nonincreasing density on \mathcal{R}^+ . Since such a density can be written as a mixture of uniform densities, it is natural to consider Bayesian procedures that are based on nonparametric mixture models. we consider in particular as priors the Dirichlet mixture process and finite mixtures with unknown number of components. We show that for finite mixture priors, the Kullback-Leibler property is not satisfied, and we propose an alternative condition that still ensures consistency of the posterior distributions and which is satisfied in those models. As an application of the main theorem we define the nonincreasing densities on $[0, 1]$ and we proof the posterior distribution is consistent.

Keywords. Nonparametric Bayesian inference, Consistency, entropy, Kullback-Leibler, k -monotone density, Kernel mixture

Discrete Log-Odds rate function and a new measure of skewness

A-10-278

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Abstract. In this paper, we introduce the discrete version of log-odds rate function and study some of its monotone ageing properties. We show that log-odds rate can characterize the distribution uniquely and also we characterize the constant Log-Odds rate for discrete logistic (in terms of t) and discrete log logistic (in terms of $\ln t$). Furthermore, we define a new measure of skewness based on log-odds function.

Keywords. Log-Odds function (LO), Log-Odds Rate (LOR), Hazard rate, Second hazard rate, Second reversed hazard rate, Skewness

Copula Based Multivariate Statistical Models Using WinBUGS

B-10-31

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Abstract. Multivariate probability models, where normal distributions fail to provide an adequate approximation, can be constructed by employing the copula functions. Copula functions have emerged in mathematical finance, statistics, extreme value theory and risk management as an alternative approach for modeling multivariate dependence. The International Actuarial Association recommends using copulas for modeling dependence in insurance portfolios. Copulas are now standard tools in credit risk management. Any multivariate distribution can be expressed as a copula function evaluated at each of the marginal distributions. WinBUGS is a window based program with its ability to fit complex statistical models using Bayesian inference approach and MCMC algorithms. In this paper, we discuss implementation of the WinBUGS programs in fitting the copula models using Iran's light oil prices and export data.

Keywords. Multivariate models, Dependence measures, Copulas, Simulation, WinBUGS

Second order approximations in sequential point estimation of the probability of zero in Poisson distribution

A-10-446

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Abstract. In analysis count data, the Poisson model becomes overtly restrictive because of over-dispersed or under-dispersed in such data. When count data are under-dispersed, specific models such as generalized linear models (GLM) proposed. Some estimation problems with unknown parameter cannot attain the minimum risk where the sample size is fixed. To resolving this captivity, working with a sequential sampling procedure can to be useful. In this paper, we consider sequential point estimation of the probability of zero in Poisson distribution. Second order approximations to the expected sample size and the risk of the sequential procedure are derived as the cost per observations tends to zero. Finally, simulation study is given.

Keywords. Poisson distribution, Regret, Second-order approximations, Sequential estimation

Bayesian improvements of a MRE estimator under general convex loss functions

A-10-416

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Abstract. We study the frequentist risk performance of Bayesian estimators of a bounded location parameter, and focus on conditions placed on the shape of the prior density guaranteeing dominance over the minimum risk equivariant (MRE) estimator. For a large class of even and logconcave densities, even convex loss functions, we demonstrate in a unified manner that symmetric priors which are bowled shaped and logconcave lead to Bayesian dominating estimators. The results generalize similar results obtained by Marchand and Strawderman for the fully uniform prior, as well as those obtained by Kubokawa for squared error loss. Finally, we present a detailed example and several remarks.

Keywords. Bayes estimator, Bounded mean, Dominance, location family, logconcavity, Minimum risk equivariant, restricted parameter space

On the Stochastic and Reliability Properties of Skew Distributions

A-10-10

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Abstract. In recent years, a large number of research works are appeared in the literature dealing with the properties and applications of the skew distributions. Skew distributions are shown to be flexible models for describing different kind of data. In the present study, we consider some skew distributions such as skew-normal, skew- t and power-normal, and obtain some of their reliability properties. Among other results, we explore the stress-strength models based on the skew distributions. Also, the aging and stochastic properties of skew distributions under different scenarios are investigated.

Keywords. Hazard rate, Log concavity, Mean residual life time, Scale mixture

Labour Force Flows: Measurement and Analysis

B-10-16

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Abstract. Labour force flow data provide information on the movements of the working age population between labour force categories: employed, unemployed, and inactive. The various sources of labour force flow data are examined and the measurement issues involved are briefly described. The use of transition matrices and probability generating functions for analyzing labour force flow data is shown and numerical applications are given for the measurement of employment and unemployment inflows and outflows, job gains and job losses, probabilities of employment and unemployment, duration of employment and unemployment spells and school-to-work transitions of young people.

Keywords. Labour force flows, Rotation samples, Transition matrices, Probabilities of employment and unemployment, Spells of employment and unemployment, Probability generating functions

Distributions related to a Markov chain and Application in Finance

B-10-17

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Abstract. In this talk I discuss the discrete distributions, related to two-state homogeneous Markov chain and interrupted Markov chain. The geometric distribution related to Markov chain, as well as some properties, recursions and characterizations are given. Negative binomial and binomial distributions are then defined in the two cases - Markov chain and interrupted Markov chain. As a limiting distributions, two compound Poisson distributions are derived. Some properties and the corresponding stochastic processes will be discussed. The application of the defined distributions is related to the Markov binomial model of financial market. The European call option pricing formula according to this model is a generalization of the classical Cox-Ross-Rubinstain formula (1979).

Keywords. Markov chain, financial market, call option pricing formula

Visualization of Randomness through Hist2D

A-10-506

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Abstract. In this note, a visualization of randomness through two dimensional histogram is proposed. This new application of histogram simplify rejecting randomness assumption of non-random data or digits. A few well known examples are reviewed.

Keywords. Randomness test, two dimensional histogram, Cauchy random variables, simulation, pseudo random number

Abstracts 61

Comparison among some estimators of Pareto distribution based on records in the Pitman measure of closeness

A-10-564

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Abstract. In this paper, by assuming the record sample, we study the comparison of maximum likelihood and unbiased estimators of the parameters of Pareto distribution based on Pitman' measure of closeness. Next, we check the Pitman monotonicity of MLE of shape parameter and present the numerical result.

Keywords. Records, Pitman measure of closeness, Pareto distribution, Pitman monotonicity, Maximum likelihood estimator, Unbiased estimator

Attribute Acceptance Sampling Plans With Maxima Nominated Samples

A-10-673

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Abstract. This paper demonstrates the use of Maxima Nomination Sampling (MNS) technique in design and evaluation of single AQL, LTPD, and EQL acceptance sampling plans for attributes. We exploit the effect of the sample size and the acceptance number on the performance of our proposed MNS plans using Operating Characteristic (OC) curve. Among other results, we show that MNS acceptance sampling plans with smaller sample size and bigger acceptance number perform better than commonly used acceptance sampling plans for attributes based on Simple Random Sampling (SRS) technique. Indeed, MNS acceptance sampling plans result in OC curves which, compared to their SRS counterparts, are much closer to the ideal OC curve. A computer program is designed which can be used to specify the optimum MNS acceptance sampling plan and to show, visually, how the shape of the OC curve changes when their parameters vary. Theoretical results and numerical evaluations are given.

Keywords. Acceptance sampling, Attributes, Maxima nominated sampling, OC curve, Proportion estimation, Ranked set sampling

Innovative Method for Estimating Scale Parameter of Semi-Selfsimilar Processes

A-10-798

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Abstract. The characteristic feature of semi-selfsimilar process is the invariance of its finite dimensional distributions by certain dilation for specific scaling factor. Estimating the scale parameter λ and the Hurst index of such processes is one of the fundamental problem in the literature. We present some iterative method for estimation of the scale and Hurst parameters which is addressed for semi-selfsimilar processes with stationary increments. This method is based on some flexible sampling scheme and evaluating sample variance of increments in each scale intervals. For such iterative method we find the initial estimation for the scale parameter by evaluating cumulative sum of moving sample variances and also by evaluating sample variance of preceding and succeeding moving sample variance of increments. As an example we introduce simple fractional Brownian motion (sfBm) which is semi-selfsimilar with stationary increments. We present some simulations and numerical evaluation to illustrate the results and to estimate the scale for sfBm as a semi-selfsimilar process.

Keywords. Hurst estimation, Discrete self-similarity, Fractional Brownian motion, Semi-selfsimilar processes, Scale parameter

Design Effect of Inverse Sampling Design

A-10-266

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Abstract. In this paper, we investigate the design effect of inverse sampling design with respect to simple random sampling. We firstly show that the strategy of inverse sampling design with Murthy's estimator is less efficient than simple inverse sampling with ordinary sample mean estimator, specially for the rare populations. However, when the size of population sub-groups are known, we show that it may be achieve more efficient estimators with inverse sampling design for rare populations with near to zero values in rare group.

Keywords. Horvitz-Thompson Estimator, Inverse Sampling, Murthy's Estimator, Post-stratification

Bayesian estimation of random-intercept models using skew-laplace distribution

A-10-390

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Abstract. Random-intercept models frequently used to analyze the correlated data. In fitting these models, the conventional assumption is that the error terms and the random intercepts are normally distributed. In many empirical applications, this assumption may be violated and thus the main concern of most recent studies is the use of alternative distributions. In this paper, we propose a new class of random-intercept models using the skew-Laplace distribution. We then show by conducting simulation studies that the proposed model is flexible such that it can capture heavy tails, peakedness and skewness of the data generating process simultaneously. Since the statistical inference based on the marginal likelihood is complicated we present a Bayesian analysis by using the Markov chain Monte Carlo simulation. Finally, the application of proposed model is illustrated in the analysis of a real data set concerning the tax liability study.

Keywords. Markov chain Monte Carlo, Gibbs sampler, Random effect, Full posterior conditional distributions

Asymptotic properties of quasi-likelihood and maximum likelihood estimators in the second order Markov chains

A-10-463

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Abstract. The likelihood inference in the theory of many spatial models with high dimensional dependencies is too difficult. To overcome the problem, this paper studies the efficiency of the quasi likelihood estimators with it's full maximum likelihood estimators for second order Markov chain models, besides the limiting normality results on the asymptotic properties of the associated estimates. The numerical comparisons with other estimators are carried out.

Keywords. Maximum likelihood, Quasi likelihood, Second order Markov chain, Efficiency

Power Mean in view of Information Measures

A-10-776

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Abstract. Mean values have an important role in mathematics and statistics. Some of the power mean applications in view of statistical inference are discussed here. Also, finding link between entropy versions and generalized mean are derived via aspects of mean entropies. Information measures such as Csiszar divergence and mean divergence measure and their link with each other and various measures are stated. These divergence measures are obtained based on weighted distributions and special cases such as variant ordered data in univariate and bivariate cases also.

Keywords Power mean, Divergence measure, weighted distribution, Entropy, Order statistics, Record data

Some Properties Of an Scale Mixture of Extended Skew Normal Distributions

A-10-267

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Abstract. In this paper, we derive several essential statistical properties of an scale mixture of extended skew normal distributions introduced by Arnold, and Beaver, [B.C, Arnold, and R.J,Beaver, Skewed Multivariate Models Related to Hidden Truncation, Test, 11(2002), 7-54]. As such are stochastic representation, moments and distribution of quadratic forms.

Keywords. Multivariate skew-Normal distributions, scale mixture of Multivariate skew-Normal distribution, scale mixture of Multivariate Normal distribution, normal truncated distribution, Stochastic representation

Estimation Following Selection under LINEX Loss Function

A-10-420

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Abstract. Let $X_{i1}, X_{i2}, \dots, X_{in}$, $i = 1, 2$, be a pair of independent random samples from two exponential populations with unknown location parameters θ_i and common known scale parameter σ . Let X_i denote the minimum of the i -th sample, $X_{(1)} = \min(X_1, X_2)$ and $X_{(2)} = \max(X_1, X_2)$. Suppose the population corresponding to the largest $X_{(2)}$ (or the smallest $X_{(1)}$) is selected. In this paper, we consider the estimation of the location parameters θ_M (and θ_J) of the selected exponential population under LINEX loss function. We characterize admissible estimators of θ_M (or θ_J) within the class of linear estimators of the form $X_{(2)} + c$ (or $X_{(1)} + c$). we give sufficient conditions for minimaxity of estimators of θ_M and θ_J .

Keywords. Admissible estimators, Estimation after selection, Invariant estimators, Two parameter exponential distribution, LINEX loss function

Multivariate Stratification by a New Metric of Clustering

A-10-810

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Abstract. It is shown that the use of volume-based clustering to determine stratum boundaries in multivariate sampling, improves estimation of the vector mean. Moreover the proposed method reduces the generalized and total variances. Example with real data is analyzed.

Keywords. Multivariate stratification, Cluster analysis, Principal component, Minimum volume ellipsoid

Application of Fuzzy Logistic Regression in Modeling Food Patterns

A-10-668

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Abstract. In the logistic regression analysis, sometimes, the observations of the binary response variable are imprecise and due to lack of suitable instruments or well defined criteria we are not able to define the state of binary response variable precisely. Because of the vague nature of the response variable in this situation, a probability distribution can't be considered for it. So, the probabilistic assumptions of the logistic model is not fulfilled. In some other situations, the relationship between variables is not precise enough to be modeled by ordinary logistic regression. In these situations, the fuzzy logistic regression would be a suitable alternative choice. In this paper, we investigate fuzzy logistic regression and, using a real data set, we explain its application by a numerical example in a dietary pattern study.

Keywords. Fuzzy data, Fuzzy logistic regression, Possibilistic odds, binary response, food pattern

Finding the optimized lower bound for the variance of unbiased estimators in some well-known families of distributions

A-10-277

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Abstract. One of the most fundamental things in estimation theory about accuracy of an unbiased estimator is computing or approximating its variance. Most of the time, the variance has complicated form or cannot be computed. In this paper, we consider two well-known lower bounds for the variance of unbiased estimators, which are Bhattacharyya (1946, 1947) and Kshirsagar (2000) bounds for some versatile families of distributions in statistics and especially in reliability such as, generalized gamma (GG), inverse Gaussian, Burr type XII and Burr type III distributions. In these distributions, the general forms of Bhattacharyya and Kshirsagar matrices are obtained. In addition, we evaluate different Bhattacharyya and Kshirsagar bounds for the variance of any unbiased estimator of some parameter functions and conclude that in each case, which bound has higher convergence and is better to use.

Keywords. Bhattacharyya bound, Cramer-Rao bound, generalized gamma distribution, Hammersley-Chapman-Robins bound, inverse Gaussian distribution, Kshirsagar bound

A Computational Approach Test in Two Power Law Distributions

A-10-5

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Abstract. In this article, we apply a computational approach test (CAT) based on maximum likelihood estimator, introduced by Pal et al. (2007), in power law distribution. The CAT does not require the knowledge of any sampling distribution, depends heavily on numerical computations and Monte-Carlo simulation. We apply the CAT for testing the equality of scale parameters in two power law populations. Simulation studies show that the actual size and power of this method is satisfactory. At end, an example with simulation data is given.

Keywords. Power distribution, Hypothesis test, Actual size, Computational approach test

Discrete Generalized Exponential Distribution

A-10-419

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Abstract. In this paper, we shall attempt to introduce a discrete analogue of the generalized exponential distribution of Gupta and Kundu (1999). This new discrete generalized exponential ($DGE(\alpha, p)$) distribution can be viewed as another generalization of the geometric distribution. We shall first study some basic distributional and moment properties of this family of new distributions. Then, we will reveal their structural properties and investigate estimation of their parameters. Finally, we will examine the model with a real data set.

Keywords. Discretizing, Geometric distribution, Hazard rate function, Estimation

On Optimal Design for A Poisson regression Model with Random Slope

B-10-18

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Abstract. In spite of a wide application of mixed effects models, most of the current research on optimal experimental designs concentrates on fixed effects models. In this paper we discuss optimal designs for a Poisson regression model with random slope. The convex design theory is developed for this model to obtain locally D-optimal designs. It has been found that the D-optimal designs depends on the model parameters extensively.

Keywords. Generalized Linear Mixed Model, Optimal Design, Poisson Regression, Quasi-Likelihood, Random Coefficients

Inference for the double generalized exponential distribution under progressive Type II censoring

A-10-18

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Abstract. Skewed distributions play important role in recent studies to enable us to get closer agreement at extremes. Double generalized exponential (DGE) is considered here to extent the scope of this distribution in some asymmetrical studies. The maximum-likelihood (ML) method is used to derive the point estimators of the parameters based on progressive Type II censoring. A wide range of sample sizes and progressive-censoring schemes are considered in a Monte Carlo simulation study to see the performance of estimates of parameters of DGE distribution. The coverage probabilities of the pivotal quantities based on asymptotic normality are shown to be unsatisfactory, especially when the effective sample size is small. To improve the coverage probabilities, we suggest the use of unconditional simulated percentage points for the construction of confidence intervals.

Keywords. Double generalized exponential distribution, Progressive type II censoring, Maximum-likelihood estimator, Monte carlo simulation, Pivotal quantity

Goodness-of-fit Tests for Progressively Type-II Censored Data

A-10-483

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Abstract. In this paper, we will review some new goodness-of-fit test methodologies under progressively Type-II censored data. The new tests are based on empirical distribution function, order statistics and sample spacings. We will describe these goodness-of-fit test methods and discuss some novel approaches in this problem.

Keywords. Anderson-Darling statistic, Cramér-von Mises statistic, Goodness-of-fit testing, Kolmogorov-Smirnov statistic, Monte Carlo simulation, Order statistics, Progressive Type-II censoring, Spacings, Uniform distribution

Useful Period for Some Generalized Gamma Type Distributions with Bathtub Shaped Failure Rate Function

A-10-364

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Abstract. The useful period of lifetime distributions with bathtub-shaped failure rate functions has attracted authors and researchers in reliability, actuary, and survival analysis. The flat region of failure rate function should be long to have a useful unit with corresponding distribution function. In this paper we investigate the difference between the change points of failure rate and mean residual life functions of some generalized gamma type distributions due to the capability of these distributions in modeling various bathtub-shaped failure rate functions.

Keywords. Useful period, Failure rate function, Mean residual life function, Change point, Bathtub curve, Generalized gamma

Modelling Mazandaran's Forest Fires using the Shot-Noise Cox Process

A-10-594

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Abstract. The spatial pattern of human caused forest fires and their relationship to some geographical and geological variables are analyzed with shot noise Cox process models. Such models are flexible and tractable for spatial statistical analysis. We show some of techniques for the analysis of spatial point patterns that have become available due to developments in point process modeling software. The data set consist of the complete records of human caused fires which occurred in Mazandaran (a north province of Iran) during late 2005 to early 2011.

Keywords. Human caused forest fires, Cox process, inhomogeneous K-function, intensity function, minimum contrast estimation, shot noise process

Shannon Information for Expected Net Gain of Sampling

B-10-19

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Abstract. The expected net gain of sampling, ENGS, is the difference between the expected value of sample information, EVSI, and the cost of sampling. In this work we use the concept of the Shannon information to define the ENGS. Maximizing the ENGS, the optimal size of a clinical trial will be obtained. The parameter of interest is the difference between two success probabilities of two binomial distributions. A Bayesian framework will be considered. A Dirichlet prior distribution is assumed. To reduce the computational complexity concerned with sample size determination we use the Monte Carlo Markov Chain, MCMC, method.

Keywords. Shannon Information, Expected Net Gain of Sampling, Clinical Trial, Bayesian Approach, The Monte Carlo Method

Application of multivariate default process based on bayesian copula

A-10-460

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Abstract. One of the main problems in credit risk management is the correlated default. Default dependencies among issuers in a large portfolio play an important role in the quantification of a portfolio's credit. This Paper develops a methodology to assess alternative specifications of the joint distribution of default risk. The study is based on a data set more than of 200 active corporations in Tehran stock exchange. We undertake an empirical examination of the joint stochastic process of default risk over the period 1999-2011. After using the clustering method for sorting the data in six rating classes, thereby we try to study dependency structure of default processes. The model is based on a jump diffusion process for the risk factors, i.e. for the company assets. We also include correlations between the default of companies. We study a simplified version of our model analytically. Furthermore, we perform numerical simulations for the full model. We discuss in details the links between default correlation based on jumps process moreover how these phenomenon depend on the available information.

This paper is to introduce a new methodology for credit risk management, based on Bayesian copulae. One of the main problems related to credit risk management is understanding the complex dependence structure of the associated variables and Moreover lack of data. This suggests the use of Bayesian models, computed via simulation methods and, in particular, Markov Chain Monte Carlo. This methodology combines the use of copulae and Bayesian models. This allows us to split the joint multivariate probability distribution of a random vector into individual components characterized by univariate marginals. Thus, copula functions embody all the information about the correlation between variables and provide a useful technique for modeling the dependency of a high number of marginals. Finally, we try to compare conclusion of Bayesian copulae with classic copulae.

Keywords. Bayesian copula, Credit risk, Jump diffusion process, Rating class

Locally Modified D-Optimal Design for Logistic Models

A-10-316

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Abstract. Most of the criteria have been developed to obtain the optimal designs are based on the variance of the model parameter estimates. However, in case of existence, for non-linear models, a closed form of the variance is not available or it is intractable. To overcome this problem, researchers follow an asymptotic approach by using the Fisher information to approximate the variance. The resulted asymptotic optimal design maybe invalid for small to moderate sample size. In this paper we introduce a modified D-optimality criterion by replacing the Cramer-Rao bound with Bhattacharyya bound in construction of the information matrix. We present the modified information matrix for a two parameters logistic model and obtain the locally modified D-optimal designs for different value of sample sizes. The results show that the optimal designs have been obtained from our modified approach perform more efficiently in term of variance parameter estimates.

Keywords. Bhattacharyya matrix, Logistic models, Information matrix, Modified D-optimal criterion, Locally Optimal Design

On Identification Of Measurement Error In Autoregressive Time Series Model

A-10-635

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Abstract. In this study, the measurement error in $AR(p)$ time series model is investigated. By using Lagrange Multiplier (LM) test, the critical region for identifying the measurement error is asymptotically characterized in both classical models and non-classical ones. An explicit relation to evaluate the power of this test is also presented. Through a simulation study for $AR(1)$ we study the behavior of the power with respect to any changes of each parameters in the model.

Keywords: Measurement error, Non-classical model, Autoregressive process

Generalization of the copula for fuzzy random variables

A-10-869

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Abstract. In this paper we define the fuzzy copulas by new defining of fuzzy joint distribution function and their fuzzy margins. More over, we extend the Frechet-Hoeffding bounds inequality to fuzzy copula.

Keywords. Copula, fuzzy random variables, fuzzy joint distributions

Weighted distributions family

A-10-227

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Abstract. In applied statistics the set of possible outcomes of an investigation will be set of numbers which the set of value of a random variable. Associated with a random variable X is a probability density function, pdf, which can be used to find the probability that the random variable X is in the set A . When the pdf of X is exactly known, we have a probability model, otherwise we have a statistical model. Frequently in conducting investigations the investigators knows or willing to assume that the pdf form which he takes observation is of a certain functional form with unknown parameter . In this case we have a parametric statistical model. In fact parametric statistical model indexes probability model by parameter. In this paper four methods to index in probability models by parameters are studied.

Keywords. probability model, parametric statistical model, Parametric transformation method

Comparison between Spatial Statistics Model and Bidirectional Hidden Markov Model for Assignment of Protein Sequences

A-10-274

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Abstract. Profile hidden Markov model (PHMM) is widely used in assigning protein sequences to protein families. In PHMM, the homologous sequences are assigned to the protein families using the information of the left side of a residue. In this paper, the information of both left and right sides of a residue in a profile are considered. For this purpose bidirectional profile hidden Markov model (BPHMM) is used. Also, we employ a new method based on spatial statistics on a rectangular lattice for considering the whole information of a site, i.e., left, right, top and bottom sides of residues. We then compare the performance of BPHMM and spatial method by applying them on the real ten top protein profiles from Pfam database. Results show that using the spatial model for sequence assignment increases the number of correctly assigned protein sequences to profiles compared to BPHMM.

Keywords. Bidirectional profile hidden Markov Model, Spatial Statistics, Rectangular Lattice

Stochastic Differential Equation (SDE) and Markov Chain with Applications

A-10-423

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Abstract. The study of stochastic differential equations (SDEs) plays a important role in an range of application areas. In this paper, we will show how to compute probability and expected values of discrete stochastic Markov chain models. However, we will investigate the accuracy of the central limit theorem for Markov chain as random telegraphic noise.

Keywords. Stochastic Differential Equations (SDEs), Stochastic Markov Chain Models, Random Telegraphic Noise

Characterization of Discrete Time Scale Invariant Markov Processes

B-10-20

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Abstract. Scale invariant processes have recently drawn attention of many researchers. We study a discrete scale invariant (DSI) process $\{X(t), t \in \mathbf{R}^+\}$ with scale $l > 1$ and consider to have some fix number of observations in every scale, say T , and to get our samples at discrete points α^k , $k \in \mathbf{Z}$, where α is obtained by the equality $l = \alpha^T$. So we provide a basic class discrete scale invariant Markov (DSIM) sequence $X(\cdot)$ with parameter space $\{\alpha^k, k \in \mathbf{Z}\}$. We show that the covariance structure of DSIM sequence is characterized by the values of $\{R_j^H(1), R_j^H(0), j = 0, 1, \dots, T-1\}$, where $R_j^H(k)$ is the covariance function of j th and $(j+k)$ th observation of the process. In correspondence to the DSIM sequence with scale α^T , we introduce T -dimensional self-similar Markov process. By introducing some multi-dimensional self-similar process corresponding to the DSIM sequence, we present spectral density matrix of such processes. Some examples of such processes like simple Brownian motion and scale invariant autoregressive, AR(1) model are presented and these properties are investigated. By simulating DSIM process we provide visualization of their behavior and investigate results of the paper. Finally we present new method to estimate Hurst parameters of DSI and self-similar process and apply it to the simulated data.

Keywords. Discrete scale invariance, Wide sense Markov, Multi-dimensional self-similar processes

An application of the multivariate skew-normal distribution for Dirichlet processes in mixed-effects modeling

A-10-457

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Abstract. In this paper, we consider a semi-parametric Bayesian model for analyzing of panel data. This is done by introducing a skew Dirichlet process (SDP) as a generalization of the usual Dirichlet process (DP). The SDP is specified by introducing a multivariate skew-normal distribution as a base for the DP instead of the normal distribution. The proposed approach which is applied for the random-effects, can efficiently deal with modeling issues in a wide range of non-normally distributed random-effects. We adopt Gibbs sampling techniques to achieve the parameter estimates. A real data set is analyzed and tested by several hypothetical models to illustrate the usefulness of the proposed approach.

Keywords. Dirichlet process mixture, Gibbs sampling, Multivariate skew-normal distribution, Panel data, Random effects

Difference-based estimation in semiparametric models: Subspace hypothesis

A-10-296

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Abstract. This article is concerned with the problem of multicollinearity in the linear part of a partial linear model. It is also suspected that some additional linear constraints may hold on the whole parameter space. Then, a restricted difference-based ridge estimator is defined for the vector-parameter in a partial linear model. Necessary and sufficient conditions for the superiority of the new estimator over the restricted least-squares estimator for selecting the ridge parameter k are derived. Furthermore, a nonparametric estimation after estimation of linear part is added for detecting the efficiency of the difference-based approach.

Keywords. Differencing estimator, Least squares, Linear restrictions, Multicollinearity, Partial linear model, Ridge estimator

Linear Discriminant Functions for Stationary Time Series with Maximize Discriminant Distances

A-10-443

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Abstract. Linear functions for classifying an observation as coming from one of two stationary time series which maximize the Chernoff distance, the Hellinger distance or the Kullback-Leibler distance are studied here. We obtain optimal linear discriminant function and show that the resulting linear procedure belongs to the Anderson-Bahadur admissible class. We compare linear discriminant functions for MA(1) and AR(1) by using simulated data. The asymptotic form of the discriminant function is also studied.

Keywords. Linear discriminant function, discriminant distances, Admissible class

On improvement in estimating population mean in cluster sampling

A-10-829

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Abstract. Gupta and Shabbir have suggested an alternative form of ratio-type estimator for estimating the population mean. In this paper, we introduced new estimators by mixing two, stratified and cluster sampling method. Then we improved these estimators by using auxiliary variables and introducing new estimators. For sampling in infinity populations with a high geographic dispersion, the population will be divided into some smaller sub-population which leads to dispersion reduction to some extent. This will effect the value of the estimator variance. Additionally dividing the population will result in saving cost and time and eases calculations.

Keywords. Stratified Sampling, Cluster Sampling, Auxiliary Variables, Estimator

Second-order Least Squares Estimation in Linear Dynamic Panel Data Model

B-10-38

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Abstract. We propose the second-order least squares estimator for the autoregressive panel data model. This method requires only the specification of the first two conditional moments of the unobserved effects given the process initial observation, and does not require any other distributional assumptions. The data generating process can be either stationary or nonstationary. The proposed estimator is consistent and asymptotically normal for large N and finite T under fairly general regularity conditions. Moreover, we show that our estimator reaches an optimal semiparametric efficiency bound. Monte Carlo simulation studies show that the proposed estimator performs satisfactorily in finite sample situations compared to the usual first-differenced GMM and the random effects pseudo ML estimators.

Keywords. Dynamic models, Panel data, Autoregressive processes, Error components, Unobserved heterogeneity, Random effects, Least squares method, Method of moments, Semiparametric efficiency

A comparison of two sampling schemes for generating record-breaking data from exponential distribution

A-10-615

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Abstract. In this paper, we introduce a new sampling scheme in record-breaking data set up, as record rank set sampling. We compare the proposed sampling with the well-know sampling scheme in record values subjects as inverse sampling while the underlying distribution is one parameter exponential distribution. Various point estimators are obtained in each sampling schemes and compared with respect to mean squared error (MSE) and Pitman measure of closeness (PMC) criteria. It is shown that for the most cases the new sampling provided more efficient estimators.

Keywords. Record values, MSE, PMC, BLUE, UMVUE, MLE, BLIE

A Finite Mixture Kullback-Leibler Model Selection Criterion

B-10-25

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Abstract. The purpose of statistical modeling is to construct a model that approximates the true structure as accurately as possible through the use of available data. A good model will generally yield good results; however, one cannot expect to obtain good results when using an inappropriate model. Herein lies the importance of model evaluation criteria for assessing the goodness of a subjective model. This paper considers a finite mixture of the known Kullback-Leibler criterion to the model selection problem. The aim of this criterion is to select an admissible set of models based on a measure of closeness. We demonstrate that a very general class of statistical criterion, which we call that finite mixture Kullback-Leibler criterion, provides a way of rival theory model selection.

Keywords. Kullback-Leibler risk, Model selection criteria, Non-Nested models, Vuong's test

A new four-parameter lifetime distribution and its applications

A-10-496

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Abstract. In this paper, we introduce a new four-parameter generalization of the exponentiated Weibull (EW) distribution, called the exponentiated Weibull-logarithmic (EWL) distribution, which obtained by compounding EW and logarithmic distributions. The new distribution arises on a latent complementary risks scenario, in which the lifetime associated with a particular risk is not observable; rather, we observe only the maximum lifetime value among all risks. The distribution exhibits decreasing, increasing, uni-modal and bathtub-shaped hazard rate functions, depending on its parameters and contains several lifetime sub-models such as: generalized exponential-logarithmic (GEL), complementary Weibull-logarithmic (CWL), complementary exponential-logarithmic (CEL), Rayleigh-logarithmic (RL) and exponentiated Rayleigh-logarithmic (ERL) distributions. We study various properties of the new distribution and provide numerical examples to show the flexibility and potentiality of the model.

Keywords. EM-algorithm, Exponentiated Weibull distribution, Maximum likelihood estimation, Logarithmic distribution, Probability weighted moments, Residual life function

Residual Lifetime of Live Components in Consecutive k -out-of- n Systems

A-10-604

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Abstract. The consecutive k -out-of- n systems are important types of coherent structures and have many applications in various areas. There are consecutive k -out-of- n systems with the property that some of the components of the system remain unfailed in the system at any time t . In the paper, we study the stochastic and properties of residual lifetime of the live components of the system under the condition that the system is working at time t .

Keywords. Order statistics, Usual stochastic order, Signature, Reliability

Contextual Kinetics - Bayesian Modelling of Dynamic Images

B-10-37

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Abstract. Perfusion imaging aims to investigate the kinetics in human tissue in vivo. This is of interest in particular in oncology, cardiology and neurology. Using a contrast agent, a series of images is obtained, which show the distribution of contrast agent in the tissue over time. Similar data structures can be seen in other imaging modalities, e.g., in FRAP microscopy.

Such scans are typically analyzed using kinetic models composed of a input function and a response function. In order to assess the tissue perfusion, one has to perform deconvolution or optimize the highly non-linear convolved model. The latter approach is typically prone to convergence problems, whereas deconvolution often is affected by numerical instability.

We present a Bayesian approach to model perfusion images. Prior knowledge about the context of the local kinetic models allows for a more robust estimation of these parameters and the computation of interval estimators. Here, context can refer to either spatial information, potentially including edges in the tissue. Patient or study specific information can be used, to develop a comprehensive model for the analysis of complete drug studies with perfusion imaging.

Keywords. Bayesian inference, Medical Imaging, Adaptive smoothing, Generalized Regression

On the generalized pivotal quantity for the quantiles of two-parameter exponential distribution

A-10-103

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Abstract. The interval estimation of the p th quantile of the two-parameter exponential distribution on the basis of the progressively Type-II censored samples is investigated. Toward this end, the concept of the generalized confidence intervals is used and the lower and upper generalized confidence limits are obtained. The results of the paper are applied to a real data set. Finally, some concluding remarks are presented.

Keywords. Generalized pivotal quantity, Incomplete gamma function, Order statistics, Progressively Type-II censored data, Survival analysis

Numerical tau method for solving dynamic systems in fuzzy normed spaces with Schauder Bases

A-10-422

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Abstract. In this work, we present a numerical tau method in fuzzy normed space. We formulate a general problem in a fuzzy normed spaces making use of a Schauder basis and the Tau method to approximate the load function and the solution of the differential problem. Finally, we offer several numerical example.

Keywords. Differential equations, Approximation, Dynamic system, Schauder basis, Tau method, Fuzzy norm space

Estimation of $P(Y < X)$ for generalized Linear Failure Rate distribution

A-10-488

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Abstract. In this paper, we deal with the estimation of $R = P(Y < X)$ when both X and Y are two independent random variables with the Generalized linear failure rate distributions with different parameters. We present the maximum likelihood estimator of R and its asymptotic distribution are studied. The confidence interval based on the parametric bootstrap methods is also proposed when the sample size is small. When the common scale parameter is assumed to be known, maximum estimator of R is given. We calculate the estimations mentioned above for a toy example.

Keywords. Generalized Linear Failure Rate distribution, Maximum likelihood estimator, Bootstrap confidence intervals, Asymptotic distributions

Copulas and calculation of Value-at-Risk

B-10-35

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Abstract. In this paper the computation of the Value-at-Risk (VaR) from the perspective of the dependence structure between the risk factors, is described. Apart from historical simulation, most VaR methods assume a multivariate normal distribution of the risk factors. Therefore the dependence structure will be the correlation between factors. However this assumption is usually failed. So by demonstrating the process of deriving the VaR of a portfolio using copulas it is shown that the normality assumption is not necessary. In this method first, the copula itself, is estimated and selected, then its parameter is estimated and finally the VaR is computed. Back testing of the results is performed to show to show the validity and relative quality of the results.

Keywords. Copula, Dependence structure, Portfolio, Risk factors, Value-at-Risk

Application of the scale-mixture of multivariate normal distributions in multilevel models using Markov chain Monte Carlo simulation

A-10-360

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Abstract. This paper extends fitting multilevel models using scale mixtures of multivariate normal (SMMN) distributions in a Bayesian perspective. This class of models covers the analysis of several heavy-tailed correlated data using flexible distributions, such as the multivariate t, multivariate Laplace and multivariate slash, for the error terms and the random effects. The corresponding multilevel models are shown to follow hierarchical representations that enable researchers to implement the Markov chain Monte Carlo (MCMC) methods and to make simple simulating samples from the joint underlying posterior distributions. Finally, in order to highlight the theoretical concepts of these models, we conduct a simulation study.

Keywords. Bayesian inference, Gibbs sampler, Hierarchical representation, Multilevel models, Scale mixtures

A new class of lifetime distributions with decreasing, increasing, unimodal and bathtub-shaped failure rate

A-10-481

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Abstract. In this paper we introduce the exponentiated Weibull-power series (EWPS) class of distributions which is obtained by compounding exponentiated Weibull and power series distributions, where the compounding procedure follows same way that was previously carried out by Cancho et al. (2011) and Louzada-Neto et al. (2011) in introducing the two-parameter Poisson-exponential (PE) and complementary exponential-geometric (CEG) lifetime distributions, respectively. This distribution contains several lifetime models such as: exponentiated weibull-geometric (EWG), exponentiated weibull-binomial (EWB), exponentiated weibull-Poisson (EWP) and exponentiated weibull-logarithmic (EWL) distributions as a special case.

Keywords. EM algorithm, Exponentiated Weibull distribution, Maximum likelihood estimation, Power series distributions

A Survey on B-random Variables

B-10-21

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Abstract. Until recently, the theory of random variables with values in Hilbert spaces, H -R.V. in abbreviation, was not well developed. The position has now changed with developments on operatorial statistics. Besides, these random variables play a crucial role when we are going to analyze data providing information about curves, surfaces or anything else varying over a continuum, which is known as functional data analysis.

In this talk we are going to introduce and develop the theory of H -R.V. We also provide some examples to illustrate the concept of these random variables. As a special case, autoregressive Hilbertian processes of order 1, $ARH(1)$, are studied. Some of their properties are established and the existence and uniqueness of $ARH(1)$ processes are discussed in brief. Finally, some recent results on this topic are presented.

Keywords. Hilbert Space, Random Element, Functional data, Hilbertian Autoregressive Process

Small Area Estimation Based on Data Cloning Approach

A-10-607

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Abstract. The frequentist analysis of complex models such as GAMM is computationally difficult. On the other hand, the advent of the Markov chain Monte Carlo algorithm has made the Bayesian analysis of complex models computationally convenient. Recent introduction of the method of data cloning has made frequentist analysis of mixed models also equally computationally convenient. We propose the recently introduced approach of data cloning to conduct frequentist analysis of small area estimation to overcome the problems which statisticians face in the context of small area estimation. Another important feature of the proposed approach is to predict small area parameters by providing prediction intervals. We illustrate the performance of the proposed approach through several simulation studies.

Keywords. Data Cloning, GAMM, Small Area Estimation, Hierarchical Model, MSPE, Prediction interval

ICA for heavy-tail α -stable sources

A-10-663

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Abstract. Most of the classical solutions of independent component analysis are failed to use when we face with heavy tail observations with infinite second moment. α -stable class of distributions is a famous class of heavy-tail distributions which dealing with them is difficult because of their special properties. An efficient method proposed in this paper to solve the ICA problem for the case of α -stable sources, is based on the estimation of discrete spectral measure of an α -stable random vector. We also study a special case of sub-Gaussian class, where ICA does not exist. Some discussions and simulations are also provided.

Keywords. Independent component analysis, α -stable class of distributions, Sub-Gaussian class of distributions, Discrete spectral measure

Functional Principal Component Analysis: A Generalization of Multivariate Principal Component Analysis

A-10-808

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Abstract. A principal component analysis (*PCA*) is trying to find a sequence of orthogonal components through a few linear combinations of original variables. The main goal of *PCA* is data reduction. The term “functional data” refers to data where each observation is a curve, a surface, or a hypersurface, as opposed to a point or a finite-dimensional vector. Functional data are intrinsically infinite dimensional and measurements on the same curve display high correlation, making assumptions of classical multivariate models invalid. In functional principal components (*FPCA*) we are trying to summarize the infinite dimensional random trajectories through a finite number of functional principal component scores. In this paper, we decide to explain some of the proprieties of *PCA* and *FPCA*. The Hilbert space and the proprieties of eigenvalues and eigenvectors (*EEP*) will be stated, too. Finally, we work on a real data as an example of *FPCA*.

Keywords. Hilbert Space, Functional Data, Functional Principal Component Analysis, Multivariate Principal Component Analysis, Eigenvalues, Eigenvectors, Spectrum of a Bounded Linear Operator

Divided differences and Their Applications in Statistics

B-10-22

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Abstract. Divided differences are powerful tools in various fields of mathematics, such as approximation theory, numerical analysis and spline theory. Interestingly, Divided differences also appear to be appropriate and useful in statistics, as in distribution theory for randomly weighted averages. This is observed by a number of statisticians. In this paper we will provide a review on divided differences and provide insights to their appearances in statistics.

Keywords. Divided difference, Approximation theory, Distribution theory, Randomly weighted averages

S-Distributions: A Class of Continuous Heavy Tail Distributions To Model Erratic Data

B-10-28

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Abstract. Erratic data has recently become very frequent due to political, economical sharp turbulence and natural disasters. Classical distributions in statistics in general fail to model erratic data. We introduce new heavy tail Cauchy type distributions on $[0, \infty)$, called here S-distributions, that appear to be very power full tools and easily applicable in modeling erratic data. We apply S-distributions to variety sets of real data including, AMEX, FOREX, NASDAQ stocks price. Theoretical contributions include introducing new one-sided kernels that has link to the generalized Linnik distributions, new integral formulas including an extension for the Kotz-Ostrovskii (1996) mixture representation. The existence of S-distributions appears to be a very challenging problem in mathematical statistics. We provide a constructive solution.

Keywords. Cauchy distribution, Linnik Distribution, S-distribution, Conjugate property

On comparison of the well-known estimators for the stable index in the α -stable distributions and distributions attracted in their domain

A-10-576-3

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Abstract. The most important of tail estimators for the stable index of a heavy tailed distributions is the Hill's estimator which is often applied to stable distributions with index $\alpha < 2$, and distributions in their domain of attraction. However, for stable distributions with index close to 2, the behavior is not satisfactory. Under the same assumption on the distributions, Press (1972) and Zolotarev (1986) constructed different estimators for stable index based on characteristic function of stable random variables, separately. De Haan and Pereira (1999) developed a further estimator based on the order statistics and described some of the disadvantages of Hill's estimator. Fan (2004) establish a new estimator with U-statistics structure for the tail index of heavy-tailed distributions. In this paper, we study these five estimators, and then compare all of them in the sense of the mean square error criteria. The simulation study conducted to evaluate the performances of these estimators in the sense that, whether the distribution of the parent population is α -stable, Press's estimator performs better than Zolotarev's estimator, Zolotarev's estimator performs better than Fan's estimator, Fan's estimator performs better than Hill's estimator and finally, Hill's estimator performs better than De Haan and Pereira estimator. On the other hand, whether the parent distribution is attracted to some α -stable law, we will show that the Press's estimator will be most accurate in contrast with Hill's estimator. Also, we construct a minimum-distance estimator for the stable index when the parent distributions are in a special class of heavy-tailed distributions, strictly stable distributions. This estimator can be explained as a V-statistic and so it possesses "double" good properties.

Keywords. Stable distributions, Domain of attraction, stable index, V-statistic

Shrinkage Estimation in Growth Curve Models

A-10-106

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Abstract. In this paper we consider a class of shrinkage estimators for the matrix parameter of a growth curve model. We propose unbiased as well as restricted estimators to construct the form of the shrinkage estimator. Its weighted quadratic risk is also derived and its performance is compared for some specific members such as Stein-type and its positive part estimators.

Keywords. Growth curve model, Matrix variate normal distribution, Non-central chi-square, Shrinkage estimator

An Efficient Bayesian Optimal Design for Logistic Model

B-10-27

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Abstract. Consider the Bayesian optimal designs with many support points such that arise the problem of having small number of observations at each design point. Under such a scenario the asymptotic property of using Fisher information matrix for covariance matrix of ML estimators might be doubtful. We used Bhattacharyya matrix as an approximation for covariance matrix to proposed a modified Bayesian D-optimal criterion in construction a more efficient optimal design for logistic model. It is shown that the resulted optimal designs are more efficient than the previous one, obtained under the same conditions.

Keywords. Bhattacharyya matrix, Logistic model, Design support points, D-optimal criterion, Bayesian Optimal Design

Convergence of Euler-Maruyama method for stochastic differential equations driven by alpha-stable Levy motion

A-10-531

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Abstract. In this article we review diffusion driven by semimartingale and then consider the Stochastic Differential Equations driven by alpha-stable Levy motion, as a special case of semimartingale. We also prove that the Euler method approximation of such Stochastic Differential Equations converges in probability to the exact solution by helping semimartingale theory. Some examples and their numerical solutions are provided.

Keywords. Semimartingale, Stochastic differential equation, Euler-Maruyama method, alpha-stable

Some notes on FIGARCH and its properties

A-10-482

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Abstract. This paper reviews the theory and applications related to fractionally integrated generalized autoregressive conditional heteroscedastic (FIGARCH) model, mainly for describing the observed persistence in the volatility of a time series. The long memory nature of FIGARCH allows it to be a better candidate than other conditional heteroscedastic models for modeling volatility in exchange rates, option prices, stock market returns and inflation rates. We discuss some of the important properties of FIGARCH in this review.

Keywords. ARCH, GARCH, FIGARCH, Long memory models, Volatility models

Characteristic function of Asymmetric exponential power distributions

A-10-290-2

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Abstract. The asymmetric exponential power distributions (AEPDs) have received, theoretically and practically, much attention in the econometric literature. Here, for the first time, we derive explicit closed form expressions for the characteristic function of AEPDs. The expressions involve the complex parameter Wright generalized hypergeometric function. Also, some properties of this family are discussed.

Keywords. Asymmetric exponential power distributions, Characteristic function, Complex parameter Wright generalized hypergeometric function

Inferences on the lifetime performance index of products with Pareto distribution under progressive first-failure censored data

A-10-805

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Abstract. One of the most important topics in the manufacturing industries is the evaluating the lifetime performance of products. In this paper, based on lifetime performance index C_L proposed by Montgomery (1985), we tackle to assess the performance of a process in the condition of known lower specification limit L . Also, it is assumed that the lifetime of products follows a common Pareto distribution with known scale parameter. On the basis of the progressive first-failure censored data, the maximum likelihood (ML) estimate of C_L , the uniformly most powerful (UMP) test for testing $H_0 : C_L \leq c$ versus $H_1 : C_L > c$ and then the uniformly most accurate (UMA) lower bound for C_L are obtained. In addition, based on Bayesian approach the Bayes estimates of C_L under linear-exponential (LINEX) and squared error (SE) loss functions are derived. Finally, these Bayes estimates are utilized to develop a lower credible bound for C_L and a Bayesian rejection region for testing H_0 against H_1 .

Keywords. Bayesian inference, Likelihood inference, Pareto distribution, Progressive first-failure censoring, Lifetime performance index, Uniformly most accurate lower bound, Uniformly most powerful test

Response Variable Selection in Regression

A-10-772

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Abstract. Selection a variable as response variable, based on observations, is a forgotten step in regression analysis. In this article we consider two dependent random variables that are related through a linear regression model. we propose a novel method for distinguishing between explanatory variable and response variable.

Keywords. Direction of Causality, Direction of Dependency, Response Variable Selection, Linear regression

Probabilistic Principal Component Analysis With Anisotropic Gaussian Distribution of Latent Variables

A-10-221

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Abstract. Principal component analysis (PCA) is a well established technique for data analysis and processing. Recently, it has been shown that the principal axes of a set of observed data vectors might be determined through maximum likelihood estimation of parameter in a specific form of latent variable model closely related to factor analysis. It is assumed that the latent variables have a unit isotropic Gaussian distribution. In view of this, in this study, we consider more general case, in which the latent variables are independent with different variances, and investigate properties of the associated likelihood function.

Keywords. Principal component analysis, Latent variable, Maximum likelihood, Anisotropic distribution

Relationship between Entropy and Sampling

A-10-924

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Abstract. Recent developments in survey sampling allow one to quickly draw sample with unequal probability and fixed sample size. In this paper, with regard to this issue, we present a review of entropy and sampling designs with an emphasis on Poisson sampling. We compare the property of the entropy of some sampling designs.

Keywords. Sampling design, Poisson sampling, Bernoulli sampling, Inclusion probability, Entropy

A method for obtaining the OWA weights by a measure of entropy

A-10-234

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Abstract. In this paper, a new model based on a measure of entropy for obtaining the ordered weighted averaging (OWA) operators is introduced. In the model it is assumed that, according to the available information, the OWA weights satisfy inequality constraints. The model is solved according to some given constraints with specific level of orness comparing the results with other methods. The results demonstrate the efficiency of our model in generating the OWA operator.

Keywords. OWA operator, Operator weights, Maximum entropy

A Bayesian approach for modeling ceramic's fracture Strength

A-10-836

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Abstract. In modeling fracture strengths, a researcher may have rough predictions about the characteristics of his trial. Besides, some prior knowledge could also be available from historical data. In this paper, this prior knowledge is used via Bayes rule to build more reliable estimations of parameters of the Weibull distribution which is widely employed in reliability and lifetime studies. This approach is really helpful especially when dealing with small sample sizes. After applying different priors, the sampling-importance-resampling technique, which is a special Markov Chain Monte Carlo method, is used to study the posterior properties. Some numerical simulations are given to compare the statistical properties of estimations by the Bayes and the common maximum likelihood and linear regression methods.

Keywords. Weibull distribution, Fracture strength, Monte Carlo Method, Bayesian estimation, Sampling-Importance-Resampling

Longitudinal Quantile Regression and its Application in Medical Research

A-10-733

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Abstract. Quantile regression is an evolving body of statistical methods for estimating and drawing inferences about conditional quantile functions. However inference for these models is challenging, particularly for clustered data. This paper investigates a class of penalized quantile regression estimators for longitudinal data. The penalized least squares interpretation of the classical random effects estimator suggests a possible way forward for quantile regression models with a large number of "fixed effects". The introduction of a large number of individual fixed effects can significantly inflate the variability of estimates of other covariate effects. Regularization, or shrinkage of these individual effects toward a common value can help to modify this inflation effect. A general approach to estimating quantile regression models for longitudinal data is represented employing ℓ_1 regularization methods. Sparse linear algebra and interior point methods for solving large linear programs are essential computational tools. An application of the proposed method was illustrated for analyzing a longitudinal data of growth development in early treated children with congenital hypothyroidism.

Keywords. Quantile regression, Longitudinal data, Penalty method, Growth

A glance at the Law of Iterated Logarithm: Barndorff-Nielsen and Kiefers form

A-10-13

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Abstract. Consider an independent and an identical random sample of X_1, X_2, \dots, X_n distributed uniformly over $(0,1)$, the r^{th} upper order statistics of sample is denoted by $M_{r,n}$. The law of iterated logarithm (l.i.l.) for maximum (minimum) is discussed by Barndorff-Nielsen ($\overline{\lim} \frac{n(1-M_{r,n})}{\ln \ln n} = \frac{1}{0}$ a.s.), where these results are extended to $M_{r,n}$. On the other hand the Kiefers form of l.i.l. is investigated ($\overline{\lim} \frac{\ln(1-M_{r,n}) + \ln n}{\ln \ln n} = \frac{0}{-\frac{1}{r}}$ a.s.), which its results are valid for $M_{r,n}$, extreme and intermediate order statistics. Sharp bounds for extreme order statistics are discussed by these strong laws and using these bounds, one can produce the set of almost sure limit points of extreme order statistics and joint of consecutive order statistics. The results are extended to a larger class of distributions by introducing few examples in regularly and exponential varying fast right tail distributions using transformation.

Keywords. Order Statistics, Law of iterated logarithm

New Tests for Equality of Two Continuous Distribution

A-10-587

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Abstract. In this paper we first introduce a two sample test statistic for testing equality of two continuous distributions and next use a recently proposed nonparametric estimator for the continuous distribution function (cdf) of a completely unknown continuous distribution for developing a permutation test based on the above test statistic, and show, by simulation, that the proposed procedures compares favorably, in terms of power, with the existing tests.

Keywords. Continuous cdf estimator, Permutation test, Anderson-Darlingtest, Cramer-Von Misestest, Watson test, Kolmogrov-Smirnov test

Maximum Likelihood Estimations For Weibull Progressive Type-II Censored Step-Stress accelerated life-testing

A-10-514-2

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Abstract. In this paper, we explore the MLE for the k-step Weibull step-stress accelerated life-testing model under progressive type-II censoring. A Monte Carlo simulation study is carried out to find the bias and MSE for estimators.

Keywords. Accelerated life test, Step-stress, Weibull distribution, Progressive Type-II censoring, Maximum likelihood estimators, Bias, Mean square error(MSE)

Approximate MLE for the generalized exponential distribution under progressive type-I interval censoring

A-10-510

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Abstract. For the generalized exponential distribution (GE) the maximum likelihood method does not provide an explicit estimator for parameters under progressive type-I interval censoring. This paper provides two methods of deriving explicit estimators by approximating the likelihood estimation. These estimate methods are applied to the real data set based on patients with plasma cell myeloma in order to demonstrate the applications.

Keywords. Approximate maximum likelihood estimate, Bias, Generalized exponential distribution, Monte Carlo simulation, Profile likelihood, Progressive Type-I interval censoring

Functional form for the Zero-Inflated generalized Poisson regression model

A-10-268

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Abstract. The generalized Poisson (GP) is an increasingly popular approach for modeling overdispersed as well as underdispersed count data. Several parameterizations have been performed for the GP, such as GP-1, GP-2 and the GP-P model which recently has been proposed. This paper develops a functional form of the ZIGP regression model that parametrically nests the ZIP and the two well known ZIGP regression models (ZIGP-1 and ZIGP-2). The proposed model has the advantage of allowing a statistical test of the ZIGP-1 and the ZIGP-2 against a more general alternative. The ZIP and the ZIGP regression models are fitted, compared and tested on insurance count data.

Keywords. overdispersion, zero-inflation, Poisson, generalized Poisson, zero-inflated Poisson, zero-inflated generalized Poisson

Case deletion model and related diagnostic for linear mixed measurement error models

A-10-72

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Abstract. In this paper, we present case deletion model for linear mixed measurement error models using the corrected likelihood of Nakamura (1990). Furthermore, generalized Cook's distance is constructed as a tool for influence diagnostics. It is found that it can be written in terms of studentized residuals of model, error contrast matrix and the inverse of the response variable covariance matrix. Our influence diagnostic is illustrated through a real data set.

Keywords. Case deletion, Corrected score method, Influential points, Linear mixed measurement error models

On further developments of nonparametric Bayesian inference

B-10-34

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Abstract. We describe a simple yet efficient procedure for approximating the Lévy measure of a Gamma($\alpha, 1$) random variable. We use this approximation to derive a finite sum-representation that converges almost surely to Ferguson's representation of the Dirichlet process. This approximation is written based on arrivals of a homogeneous Poisson process. We compare the efficiency of our approximation to several other well-known approximations of the Dirichlet process and demonstrate a substantial improvement. Similar techniques will be considered for Poisson-Dirichlet process and normalized inverse Gaussian process. If $P_{H,a}$ is the normalized inverse Gaussian process in \mathcal{R} with a base probability measure H and a concentration parameter $a > 0$ then, we show that $\sqrt{a}(P_{H,a}((-\infty, t]) - H((-\infty, t]))$ converges to a certain Brownian bridge as $a \rightarrow \infty$. We also derive a certain Glivenko-Cantelli theorem for the Dirichlet process. Using the functional delta method, the weak convergence of the quantile process is also obtained. A large concentration parameter occurs when a statistician puts too much emphasize on his/her prior guess. This scenario also happens when the sample size is large and the posterior is used to make inference.

Keywords. Dirichlet process, Poisson-Dirichlet process, Glivenko-Cantelli theorem, Bayesian inference

Poster Sections

Estimation of $P(X < Y)$ for Six Parameter Generalized Burr-type XII

A-10-793

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Abstract. In this paper, we will discuss about the MLE of $P(X < Y)$ when X and Y are independent random variables from a six parameter generalized Burr-type XII distribution. By using transformation method, we will transform a six parameter generalized Burr-type XII into exponential distribution to find the MLE for $P(X < Y)$. The results of using transformation method for finding the MLE are presented by simulation.

Keywords. Stress-strength model, Transformation method, Six parameter generalized Burr-type XII distribution, Exponential distribution

Inference for the weighted exponential distribution based on progressively censored data

A-10-664

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Abstract. In this paper, we consider the statistical inference of the unknown parameters of the weighted exponential distribution in presence of progressive censoring. We obtain maximum likelihood estimators of the unknown parameters using EM algorithm. We also compute the expected Fisher information matrix using the missing value principle.

Keywords. Asymptotic distribution, EM algorithm, Fisher information matrix, Maximum likelihood estimators

Fractional Probability Measure And its Properties

A-10-859

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Abstract. Based on recent studies by Guy Jumarie (2007) which defines probability density of fractional order and fractional moments by using fractional calculus (fractional derivatives and fractional integration), this study expands the concept of probability density of fractional order by defining the fractional probability measure, which leads to a fractional probability theory parallel to the classical one. According to the probability principles in classical probability theory and the definition of probability density of fractional order by Guy Jumarie, at first, the fractional probability principles are discussed. Then the fractional probability space $(\Omega, \mathcal{F}, P_\alpha)$ is introduced. Consequently, the fractional probability measure $P_\alpha : \mathcal{F} \rightarrow [0, 1], 0 < \alpha < 1$ is explained. Moreover, validity of the classical "probability measure continuity" theorem ($P(\lim_{n \rightarrow \infty} X_n(\omega)) = \lim_{n \rightarrow \infty} P(X_n(\omega))$) for the fractional probability measure P_α is verified, which results in "Fatou Lemma" and some theorems in convergence concept

Keywords. Probability density of fractional order α , Fractional probability measure, Fractional probability space, Fractional probability principle, Probability measure continuity, Fractional moments

Kendal Tau Correlation Coefficient with Tied Data

A-10-382

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Abstract. In non-parametric statistics Kendall tau correlation coefficient, determined level of Coordination and non Coordination of two random variables. In the face of tied data, has been suggested that they remove. In this article we estimate Kendall tau correlation coefficient with existent tied data. In estimate of coefficients, if we delete tied data and number of them be large, actually we have ignored part of our random sample and remove some information. That may be a sign of a special relationship between two variables, also eliminates tied data increased absolute value of correlation coefficient and this increasing is unrealistic. We want to calculate the Kendall tau correlation coefficient, use of the tied data and we don't delete them. Finally we obtain estimation for Kendall tau correlation coefficient and compar means and variances of them.

Keywords. Kendall tau, Coordination, Tied data

Distortion copula, Construction and Orderings

A-10-489

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Abstract. given a distortion function $g : [0, 1] \rightarrow [0, 1]$, we will introduce a generalized method for constructing by transformation. properties such as log-concavity, associativity and sharper bounds for copula will be studied under distortion. Finally, preservation of some bivariate stochastic orders will be checked under distortion.

Keywords. Distortion function, Copula, Construction of copula, Associativity, Log-concavity, Stochastic orders

Normality and Exponentiality Tests

A-10-447-1

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Abstract. This article studies four different tests of normality and four different tests of exponentiality. The tests in question for normality are Vasicek, Shapiro-Wilk, Kolmogorov-Smirnov, and Anderson-Darling. Tests in question for exponentiality are Kolmogorov-Smirnov, Anderson-Darling, Finkelstein and Schafer, and Ebrahimi et al. test. Each test is described and power comparisons are made by using Monte Carlo computations. The results are discussed and interpreted separately.

Keywords. Test of normality, Test of exponentiality, Monte Carlo simulation, Power of test

Evaluating Symmetry by Skewness Measures

A-10-579

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Abstract. Skewness indicates a lack of symmetry in a distribution. Knowing the symmetry of the underlying data is important for parametric analysis, fitting distributions or doing transformations to the data. The coefficient of skewness is the commonly used measure to identify a lack of symmetry in the underlying data. In this paper, we consider twelve different measures of skewness proposed in the literature. Also, we introduce some criteria to detect asymmetry for mentioned skewness measures. Finally, as we are interested in finding the best skewness measures in symmetry study, we evaluate ability of considered skewness measures by computing type I error rate and power of considered measures via simulation.

Keywords. Symmetry, Skewness, Simulation, Power, Type I error

Analysis of Simple Step-Stress Accelerated Life Test with Geometric Distribution

A-10-348

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Abstract. In this article, we apply a computational approach test (CAT) based on maximum likelihood estimator, introduced by Pal et al. (2007), in power law distribution. The CAT does not require the knowledge of any sampling distribution, depends heavily on numerical computations and Monte-Carlo simulation. We apply the CAT for testing the equality of scale parameters in two power law populations. Simulation studies show that the actual size and power of this method is satisfactory. At end, an example with simulation data is given. Discrete distributions are extremely needed in reliability when the life time measurements are taken in discrete time. On the other hand, accelerated life testing (ALT) is widely conducted to obtain failure-time data in a much shorter time and to make inference about reliability at normal conditions. In this paper, we consider a simple step-stress ALT model with Type-I censored sample from geometric distribution. Assuming a cumulative exposure model with lifetimes being geometric distributed, the maximum likelihood estimators (MLEs) of the parameters are obtained. Then, the associated distributions functions of the MLEs are derived. and then the confidence interval for the parameters are constructed. Finally, an example is presented to illustrate the proposed procedure in this paper.

Keywords. Cumulative exposure model, Maximum likelihood estimation, Order statistics, Distribution function, Step-stress model, Geometric distribution

Estimation for the Logistic Distribution under Progressive Type II Hybrid Censoring

A-10-451

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Abstract. Progressive Type-II censoring scheme is a mixture of Type-II progressive and hybrid censoring schemes. This article presents the analysis of the Type-II progressively hybrid censored data when the lifetime distributions of the items follow the logistic distribution. Maximum likelihood estimators and approximate maximum likelihood estimators are developed for estimating the unknown location and scale parameters. One real data set has been analyzed for illustrative purposes.

Keywords: Maximum likelihood estimators, Approximate maximum likelihood estimators, Progressively Type-II hybrid censoring, Logistic distribution

The CUSUM test for detecting structural changes in strong mixing processes

A-10-817

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Abstract. Strong mixing property holds for a broad class of linear and nonlinear time series models such as ARMA and GARCH models. In this article we study correlation structure of strong mixing sequences, and some asymptotic properties are presented. We also present a new method for detecting change point in correlation structure of strong mixing sequences, and present a nonparametric CUSUM test statistic for this. Asymptotic consistency of this test statistics is shown. This method is applied to simulated data of some linear and nonlinear models and power of the test is evaluated.

Keywords. Structural changes, Strong mixing, Functional central limit theorem, CUSUM test, Brownian bridge

A Study On Weibull Extension Model for Estimating

A-10-307-3

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Abstract. The uniform minimum variance unbiased (UMVU) and maximum likelihood (ML) estimators of the probability density function (PDF) and cumulative distribution function (CDF) are derived for the weibull extension model. This model has shown to be useful in reliability and lifetime data modelling, especially when the hazard rate function has a bathtub-shape. Simulation studies are also carried out to show that MLE is better than UMVUE.

Keywords. Weibull extension model, Maximum likelihood estimator, Uniform minimum variance unbiased estimator, probability density function, cumulative distribution function

Inference for Stress-strength in the proportional hazard models based on Type-II censored samples

A-10-344

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Abstract. In this paper, we consider the problem of estimating the stress-strength parameter $R = P(X < Y)$, when the available data has the form of Type-II censored. Also, suppose that X-sample and Y -sample are independent and generated from the proportional hazard rate models. Uniformly minimum variance unbiased estimator (UMVUE), maximum likelihood estimator (MLE) and exact confidence interval for the parameter of interest are derived.

Keywords. Stress-strength parameter, Type-II censored samples, Lehmann and Scheffe Theorem

A compound form of Lindley distribution

A-10-379

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Abstract. In this paper we introduce a new lifetime distribution by compounding a weighted form of the exponential distribution and Geometric distribution, named weighted exponential-Geometric distribution. Several properties are derived, such as density, survivor function, failure rate, moment generating function, moments and Renyi entropy. The maximum likelihood estimation procedure is discussed and an algorithm EM (Dempster et al., 1977; McLachlan and Krishnan, 1997) is provided for estimating the parameters. The paper is motivated by the application to real data set and we hope that this model be able to attract wider applicability in survival and reliability.

Keywords. weighted distribution, hazard function, maximum likelihood estimates, EM algorithm

Extremes of Radial Asymmetry

A-10-426

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Abstract. In this paper we shall construct a measure of radial asymmetry, investigate one form of maximal asymmetry with respect to this measure and study the dependence structure of maximally radially asymmetric random variables which are marginally symmetric.

Keywords. Bivariate distribution, copula, radial symmetry

The Influence of Common Effects on Hierarchical Credibility Models with Dependence induced by Common Effects

A-10-920

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Abstract. In the usual credibility model, observations are made of a risk or group of risks selected from a population, and claims are assumed to be independent among different risks. However, there are some problems in practical applications and this assumption may be violated in some situations. Some credibility models allow for one or two possible sources of dependence, namely, across time for the same individual risk and between risks. In this paper, we argue for the notion of modeling claim dependence on a three-level common effects model that allows for three possible sources of dependence, namely, across portfolios, across individuals and simultaneously across time within individuals. We also obtain the corresponding credibility premiums hierarchically using the projection method. Then we derive the general hierarchical structure or multi-level credibility premiums for the models with h -level of common effects.

Keywords. Credibility models, Common effects, Claim dependence, Hierarchical structure

One Limit Characteristics of Random Conditional Probability For Sequence of Bernoulli Variables

A-10-400

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Abstract. In this paper we deal with the Strong Limit Theorem on almost everywhere (a.e.) convergence for Harmonic mean from random conditional probability in the sequence of dependent Bernoulli variables. In fact, in proof we use the conditional Moment generation function and the theorem of derivative existent for monotone function with applying the measure in probabilities, we survey the Strong Limit Theorem on the sequence of dependent Bernoulli variables.

Keywords. Conditional probability, Conditional moment generation function, Strong limit theorem, Harmonic mean

Some applications of fuzzy alternating renewal processes based on fuzzy simulation

A-10-476

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Abstract. This paper studies an alternating renewal process when on-off times are fuzzy random variables. A theorem about the long-term un average expected service times of customers and the long-run average coast is proved. Here, we do not use the α_0 -pessimistic value and the α_0 -optimistic value of fuzzy variables. We use the simulation of expected of fuzzy random variables to calculate the long-term average expected service times of customers per unit time. Finally, an application example is provided to illustrate the result.

Keywords. Fuzzy alternating renewal processes, Fuzzy random variables, Fuzzy simulation

Comparison of various progressive Type-II censoring schemes in Bayesian two-sample prediction based on Weibull model

A-10-746

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Abstract. Prediction on the basis of censored data is very important topic in many fields such as medical and engineering sciences. In this paper, based on progressive Type-II right censoring scheme, we will discuss Bayesian two-sample prediction. Weibull model is considered for obtaining prediction bounds for the s -th order statistic in a future random sample drawn from the parent population, independently and with arbitrary progressive censoring schemes. Finally, we carry out a simulation study to assess the computational comparison of coverage probabilities in different progressive Type-II censoring schemes based on Bayesian two-sample prediction. In addition, we present schemes which are not suitable for predicting the s -th order statistic in a future random sample drawn from Weibull model.

Keywords. Bayesian prediction bounds, Progressive Type-II right censoring scheme, Two-sample prediction

On a wavelet-based method of estimating a regression function for certain dependent sequences

A-10-563

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Abstract. This article considers two-dimensional wavelet expansion of joint density function in introducing regression function estimation for certain dependent random variables. First we consider the process is strong mixing and we show that the rate of convergence of wavelet estimators is the same as that of the independent case. Moreover another class of dependent sequences, defined m -dependent is considered and the rate of convergence is checked under certain conditions.

Keywords. Besov space, Multi-resolution analysis, Two-dimensional wavelet, Strong mixing, M -dependent

Bayes Estimations of the Unified Hybrid Censored Weibull Distribution

A-10-596

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Abstract. Unified Hybrid censoring is a mixture of generalized Type-I and Type-II hybrid censoring schemes. This article presents the Bayesian inferences on weibull parameters when the data are unified hybrid censored. We obtain the Bayes estimates of the unknown parameters under the assumption of independent using the Gibbs sampling procedure. Simulations are performed to compare the performances of the different scheme for illustrative purposes. Finally, a real data set has been analyzed for illustrative purposes.

Keywords. Unified hybrid censoring, Generalized Type-I hybrid censoring scheme, Generalized Type-II hybrid censoring scheme, Bayes estimators, Gibbs sampling

The exponential uniform distribution and its applications

A-10-669

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Abstract. This paper introduces a general class of distributions generated from the truncated exponential variable. A special case of this family is the exponential uniform (EU) distribution is discussed. We provide the closed form of the moment generating function (mgf), the characteristic function, the moments and we obtain the exact estimation of parameters using the maximum likelihood method. The applications of this distribution is illustrated by fitting it to two real data sets and comparing the result to perviously used distribution.

Keywords. Exponential uniform distribution, moment generating function, moments, maximum likelihood estimators

Distribution of a variable and order statistics from the other two variables of a trivariate elliptical random vector

A-10-792

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Abstract. In this paper, by considering a trivariate elliptical distribution, we derive the exact joint distribution of one variable (X) and two order statistics from the other two variables (Y_1, Y_2). We show that this joint distribution is a mixture of truncated trivariate elliptical distributions and then we derive the corresponding marginal and conditional distributions.

Keywords. Exchangeable distribution, Linear and nonlinear prediction, Order statistics, Truncated trivariate and univariate elliptical distribution

Modified General test proposed by Neill and Miller in detecting LOF when have semi-replicated data

A-10-804

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Abstract. Fisher (1924) proposed a lack of fit (LOF) test and Miller and Neil (2007) generalized it when there exist replicated data to fit a regression model. Same method, also, like classic (Fisher or generalized form) has been used to detect LOF in semi-replicated data, but these do not use all of data. Here, we propose a general form of Miller and Neil procedure that has power better than two old methods and use all of data to detect LOF.

Keywords. lack of fit, semi-replicated data

A New Generalization of the Weibull Distribution and its Application

A-10-393

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Abstract. In this paper, a new version of the Weibull distribution which is called the new generalized Weibull distribution is introduced. This distribution belongs to a family of distributions which includes the Weibull distribution along with an extra parameter to regulate skewness and kurtosis. We derive the density function and various properties of the new distribution. The properties derived include the r th moment, moment generating and characteristic functions, estimation of parameters using the methods of moment and maximum likelihood. Finally, the flexibility of the new distribution is illustrated in an application to a real data set.

Keywords. Hazard rate function, Moment generating function, Renyi entropy, Weibull distribution

Comparison of MCMC Estimators with Classical Estimators in Time Series

A-10-512

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Abstract. We wish to compare the performance of the average cost of Iran khodro's stock where this average cost is estimated from Monte Carlo simulation and normal equations. According to the models which we obtained through these two methods, we show that the predictions from MCMC method are the same as the predictions gained by normal equations.

Keywords. Time series, MCMC, Classical regression, Average cost

Exchangeable Random Variables

A-10-51

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Abstract. An exchangeable sequence of random variables is a sequence such that future samples behave like earlier samples, meaning formally that any order (of a finite number of samples) is equally likely. This formalizes the notion of "the future being predictable on the basis of past experience". The notion is central to Bruno de Finetti's development of predictive inference and to Bayesian statistics. Sequences of exchangeable random variables play an important role in Bayesian theory.

Keywords. Exchangeable Random Variables, Bayesian Theory, Probability

Shannon Entropy in Order Statistics and their Concomitants from Bivariate Normal Distribution

A-10-784

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Abstract. In this paper, we derive result on the Shannon entropy contained in the order statistics and their concomitants in a sequence of iid random variables from the bivariate normal distribution.

Keywords. Bivariate normal distribution, Concomitants of Order statistics, Shannon entropy

Singular ridge regression under stochastic constraints

A-10-311

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Abstract. This paper is concerned with the parameter estimation in singular linear model with stochastic linear restrictions. In order to tackle the multicollinearity or ill-conditioning design matrices in singular linear model with stochastic linear restrictions, the conditional ridge type estimate is proposed and some properties of the estimator are also studied. Furthermore, the conditional ridge type estimation is compared with the least squares estimator, and separate sufficient conditions are derived for the superiority of the new estimator over the least square estimator in terms of mean squares error. Finally, by simulation study superiority of the proposed estimator is shown over the least square estimator under some conditions.

Keywords. Ridge Regression, Multicollinearity, Simulation study

Efficient Estimation in the Uniform Distribution

A-10-284

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Abstract. In this paper, two estimator are derived for Uniform distribution. The probability density function (PDF) and cumulative distribution function (CDF) of maximum likelihood estimator (MLE) and uniformly minimum unbiased estimator (UMVUE) are obtained for computing the efficiency of these estimators. Finally, a simulation study shows the performance of MLE in CDF and UMVUE in PDF.

Keywords. Maximum likelihood estimator, Uniform distribution, Uniform Minimum Variance Unbiased Estimator

Modelling the Iran financial data using pair-copula

A-10-789

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Abstract. This paper focuses on new methodologies for copulas from Bedford and Daneshkhah (2011) on vines as a way of constructing higher dimensional distributions. The paper provides a fundamental approximation result, demonstrating that we can approximate any density as closely as we like using vines. We use the minimum information techniques from Bedford and Meeuwissen (1997), Bedford and Daneshkhah (2011) in conjunction with the information provided from the constraints (on moments, rank correlation, expert elicitation of observables) to define a copula that represents the joint distribution of two random variables of interests. We eventually apply this method to approximate a joint distribution of three variables from the Iran financial data: the Investment index, the petroleum export and the Gross Domestic Production index.

Keywords: copula, minimum information copula, pair-copula, vine, density approximation

A memetic algorithm for redundancy optimization

A-10-252-2

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Abstract. Reliability improvement problems have much importance in various engineering systems. Real-world engineering systems contain multiple levels. So, redundancy allocation problem (RAP) is an efficient method to improve the reliability. In this paper, multi-level redundancy allocation problem (MLRAP) is considered for the modular and component levels, simultaneously. So that, units are duplicated by cold standby redundant units. A customized memetic algorithm (MA) is applied to solve the modular and component redundancy allocation optimization problem in multi-level reliability configuration series. The optimal multi-level redundancy allocation provides improved reliability and lower lifecycle cost. Also, the proposed cold standby redundancy is compared with active redundancy. Finally, numerical example illustrates how the theoretical results obtained in this paper can be applied.

Keywords. Redundancy allocation, Modular redundancy, Memetic algorithm, Multi-level series system

Nonparametric correlation coefficients for fuzzy random variables

A-10-872

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Abstract. In this paper we investigated the nonparametric correlation between two fuzzy random sample. It is shown that Spearman's rank correlation coefficient can be applied if the members of the supports are ranked according to the specific fuzzy metric. Moreover, by this approach we generalized the correlation coefficient of Kendall for joint fuzzy random samples.

Keywords. Fuzzy Correlation coefficient, Nonparametric, Spearman's correlation coefficient, Kendall's correlation Coefficient

L^∞ -measure of non-exchangeability for some copulas like: NQD, SD, EV, Archimax

A-10-779

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Abstract. In this paper, we define several classes of copulas that calculated upper bounds them by the measure of non-exchangeability μ_∞ .

Keywords. Copula, Exchangeability, Dependence function, Generator

Monitoring Fuzzy Capability Index \tilde{C}_{pk} using the EWMA Control Chart with Imprecise Data

A-10-409

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Abstract. A measurement control system ensures that measuring equipment and measurement processes are fit for their intended use and its importance in achieving product quality objectives. Capability indices can determine whether the manufacturing process is capable in producing products or not. In most real life applications, the observations are imprecise and they are expressed in fuzzy terms, so that the classical capability indices could not be applied. In this paper we develop the method proposed by Vännman and Castagliola as a new way of monitoring capability indices by using the EWMA control chart that is famous because of detecting small shifts in process. In fact, we construct a fuzzy capability index $\tilde{C}_p(1, 0)$ for fuzzy data and rank the triangular fuzzy numbers by using the radius of gyration ranking method. The results were concluded for $\alpha=0.6$.

Keywords. Capability index, $D_{p,q}$ -distance, Fuzzy set, Membership function, EWMA control chart

Renyi entropy in Continuous case is not the limit of discrete case

A-10-273

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Abstract. Shannon entropy is the creation of Shannon (1948) based on the experiences in Bell System Company during and after the second World War. Then, Renyi (1961) generalized it for one parameter families of entropy. This entropy for discrete random variables is non-negative but it can be negative in continuous case. In this paper, we show that Renyi entropy for continuous random variables is not equal to the limit of it for discrete random variables. Also, some notes are derived in view of variate versions of entropy criteria

Keywords. Shannon entropy, Renyi entropy, Continuous random variable, Riemann integrable, Information Theory

Order statistics from a bivariate Birnbaum-Saunders distribution

A-10-799

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Abstract. Birnbaum-Saunders (BS) distribution [Birnbaum and Saunders (1969)] has been used quite effectively to model lifetime data and crack growth data. In this article we consider a family of life distributions, based on the skew-normal distribution, and we denote it by GBS . Then, we show that the distributions of order statistics arising from a bivariate BS distribution are mixtures of GBS distributions.

Keywords. Birnbaum-Saunders distribution, Bivariate Birnbaum-Saunders distribution, Generalized Birnbaum-Saunders distribution, Order statistics, Mixture distributions

Modeling and forecasting Rasht mortality rate based on Lee-Carter model

A-10-467-2

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Abstract. Over the past decades a number of approaches have been applied for forecasting mortality. In 1992, a new method for long-run forecast of the level and age pattern of mortality was published by Lee and Carter. In this article we investigate the feasibility of the Lee-Carter model and two of the main extensions of this model, which are obtained by adding cohort (year of birth) effect, in forecasting mortality rate. We applied these three models on Rasht mortality data (total, men and women) in order to find the best model and then use it to forecast Rasht mortality rate for the next six years.

Keywords. ARIMA process, Cohort, Lee-Carter model, Mortality Reduction Factor

Reliability Analysis using Fuzzy Normal Lifetime Distribution

A-10-318

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Abstract. In this paper, a new approach is developed for analyzing the fuzzy system reliability of series, parallel and k -out-of- m systems using fuzzy lifetime distribution. Formula of a fuzzy reliability function and its α -cut set are presented. The fuzzy reliability of structures is defined on the basis of fuzzy number. Furthermore, the fuzzy reliability functions of k -out-of- m system, series systems and parallel systems and their FMTTF are discussed, respectively. Finally, some simple examples are presented to illustrate how to calculate the fuzzy reliability function and its α -cut set.

Keywords. Fuzzy reliability function, k -out- m system, fuzzy normal distribution

Shape parameter estimation of gamma distribution

A-10-290-3

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Abstract. An estimator for the shape parameter of gamma distribution is introduced. The given estimator is scale invariant and has closed form expression. Unbiasedness and consistency of the given estimator is discussed. Furthermore, the performance of proposed estimator is compared with the maximum likelihood estimator (MLE) and Hwang and Hwang (2002) estimator via simulations.

Keywords. Beta distribution, Gamma distribution, Maximum likelihood estimator, Sample variance

An Application of Multivariate Adaptive Regression Splines in Housing Prices

A-10-511

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Abstract. In this paper we basically consider the problem of model selection based on the residual some of square (RSS) through comparing three sorts of parametric, semiparametric and nonparametric models. The main purpose is to select a better model in the sense of having smaller RSS in a real example, without considering benefits of each given model. It is shown that the multivariate adaptive regression splines proposes smaller RSS in the study of housing attributes prices.

Keywords. Multivariate adaptive regression splines, Semiparametric model, Generalized cross validation, Knot, Residual sum of square

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