ISSN 1726-3328

JPSS

Journal of Probability and Statistical Science

A Comprehensive Journal of Probability and Statistics

for Theorists, Methodologists, Practitioners, Teachers, and Others

Volume 1 Number 1

February 2003

JPSS *Journal of Probability and Statistical Science* **ISSN 1726-3328**

Preliminary Aims and Scope : *JPSS*, published semiannually, in February and August, is a multipurpose, comprehensive journal of probability and statistics that publishes papers of interest to a broad audience of theorists, methodologists, practitioners, teachers, and other users of probability and statistics. Research papers involving probability and/or statistics, either theoretical or applied in nature, are all welcomed for publication consideration. Additionally, papers involving innovative techniques or methods in teaching probability and/or statistics will also be considered. It is the goal of *JPSS* to publish a wide range of works involving probability and/or statistics (theoretical and/or applied in nature) and provide widespread availability of such to a broad audience of people interested in probability/statistics.

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Journal of Probability and Statistical Science

Preface

The *Journal of Probability and Statistical Science* (*JPSS*) is a modified version of the *Journal of Propagations in Probability and Statistics* (*JPPS*, ISSN 1607-7083), which was a multipurpose and comprehensive journal of probability and statistics. The scope of *JPSS* is intended to be quite broad, including all the major areas of probability and statistics. Papers submitted for publication consideration will be peer reviewed. Initially, we will publish semiannually, one issue each in February and August. Hopefully, as time accrues, we will be able to publish quarterly. Finally, I would like to take this opportunity to express my deep thanks to all the supporters of the former journal *JPPS* and hope that you will be able to support this new journal *JPSS* as well.

Kuang-Chao Chang
Founding Editor of *JPSS* and *JPPS*

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Journal of Probability and Statistical Science

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Editor's Invited Papers

General Research Papers

Journal of Probability and Statistical Science
1(1), 1-14, Feb. 2003

On Post-Hoc Assessments of "Disease Cluster Alarm Rates"

Paul S. Levy
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University of Illinois at Chicago

ABSTRACT We consider a method of evaluating whether a suspected *disease cluster alarm rate* (i.e., an observed group specific disease incidence rate that comes to the attention of a health official because of its large size) is greater than that expected on the basis of appropriate prevailing or historical rates. This method differs from methods used in the past based on adjustment of the signal detection level including one proposed recently based on what we refer to as *universe enlargement.* The method proposed here takes into consideration the concept of *"visibility"*, i.e., the fact that cluster alarm rates are not representative of the underlying distribution of the group specific incidence rates about which an inference is to be made, since rates not perceived to be high would be unlikely to become cluster alarm rates. Using various visibility models, we incorporate this concept into the computations of observed versus expected number of events used in assessing whether or not a particular cluster alarm rate is significantly higher than what would be expected on the basis of endemic rates. We show tables that display the effects of visibility on the statistics commonly used to assess cluster alarm rates, and compare our method with methods based on universe enlargement and other adjustments of the signal detection level.

Keywords：Mixtures; Visibility; Universe enlargement; Epidemics.

Received May 2002, revised July 2002, in final form October 2002.

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Journal of Probability and Statistical Science
1(1), 15-27, Feb. 2003

Using the Transform Approximation Method to Analyze Queues with Heavy-Tailed Service

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George Mason University

Martin J. Fischer
Denise M. B. Masi
Mitretek Systems

ABSTRACT Many modern queueing problems involve probability distributions which are heavy-tailed. This means their distribution functions decay more slowly than any exponen- tial function. Analyzing queues with these distributions is difficult since they may not have closed-form, analytic Laplace transforms. This paper investigates a recently proposed method for numerically approximating Laplace transforms, called the Transform Approxima- tion Method (TAM). While TAM can be used to approximate the Laplace transform of a heavy-tailed distribution, one must still invert a Laplace transform to recover the desired probability distribution. This paper investigates using TAM with two numerical methods for inverting Laplace transforms. In particular, we compare the well-known Fourier-series method with a recursion method specifically adapted for TAM. We give several benchmark problems and algorithms to compare the methods. In general, the Fourier method is better at finding $P(W_q \le t)$ for a single t. For the inverse problem, neither method clearly dominates.

Keywords：Heavy-tailed distributions; Approximating Laplace transforms; Numerical methods.

□Received May 2002, revised September 2002, in final form October 2002.

□John F. Shortle is Assistant Professor and Donald Gross is Research Professor, Department of Systems Engineering and Operations Research, George Mason University, Fairfax, Virginia 22030, USA; emails: jshortle@gmu.edu and dgross1@gmu.edu. Professor Shortle was a recipient of the INFORMS Daniel H. Wagner Prize for excellence in Operations Research Practice. Professor Gross is the co-author of the well-known book, *Fundamentals of Queueing Theory*, and is past president of INFORMS. He was Director, Operations Research and Production Systems at the National Science Foundation, 1988- 1990; 1996. He has received the INFORMS Kimball Medal for Service to the Operations Research Profession. Martin J. Fischer is Senior Fellow and Denise M. B. Masi is Principal Engineer, Mitretek's Center for Telecommunications and Advanced Technology, 3150 Fairfax Park Drive South, Falls Church, Virginia 22042, USA; emails: mfischer @mitretek.org and dmasi@mitretek.org.

Journal of Probability and Statistical Science
1(1), 29-40, Feb. 2003

On the Exact Distribution of Hotelling's T^2 When Sampling from a Normal Mixture Model

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Arjun K. Gupta
Bowling Green State University

ABSTRACT In this paper, the exact distribution of Hotelling's T^2 when sampling from a mixture of two normal populations is derived by a direct integration of a multiple integral. The derivation is based on a generalization of Sverdrup's Lemma by Kabe [3]. This doubly non-central distribution can be used to study the robustness of the test based on the T^2 – statistic when the sample is from a normal mixture model.

Keywords：Doubly non-central; Hotelling's T^2; Wishart distribution; Normal mixture model.

Received June 2002, revised September 2002, in final form November 2002.

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Journal of Probability and Statistical Science
1(1), 41-64, Feb. 2003

Some Asymptotic Results in a Quadratic Classification Problem for Stationary Gaussian Time Series

Gerald E. Rubin
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ABSTRACT For the classification problem based on T observations $\boldsymbol{X} = (X(0), X(1), \ldots, X(T-1))'$ from a discrete-parameter, zero-mean, stationary Gaussian time series into two mutually exclusive and exhaustive categories corresponding to different covariance matrices (or, equivalently, different spectral density functions), we have considered various quadratic discriminants, including the most powerful test statistic. In this paper we have shown that these various quadratic discriminants are close in the sense of mean-square and almost-sure convergences of normed forms of these discriminants. We have also derived expressions for the asymptotic means, variances, and cumulants for normed forms of these discriminants.

Keywords : Classification problem; Stationary Gaussian time series; Quadratic discriminant; Covariance matrix; Spectral density function; Finite Fourier transform; Eigenvalue; cumulant; Spectral matrix; Mean-square convergence; Almost-sure convergence; Toeplitz matrix; Lipschitz condition of order α_2 .

☐ Received July 2002, revised October 2002, in final form November 2002.
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Journal of Probability and Statistical Science
1(1), 69-92, Feb. 2003

Using a Genetic Algorithm to Generate Small Exact Response Surface Designs

John J. Borkowski

Montana State University

ABSTRACT A genetic algorithm (GA) is an evolutionary search strategy based on simplified rules of biological population genetics and theories of evolution. A GA maintains a population of candidate solutions for a problem, and then selects those candidates most fit to solve the problem. After the selection process, the most fit candidate solutions are combined and/or altered by reproduction operators to produce new solutions for the next generation. The process continues, with each generation evolving more fit solutions until an acceptable solution is evolved. In this research, a GA is developed to generate near-optimal *D*, *A*, *G*, and *IV* exact *N*-point response surface designs in the hypercube. The optimal exact designs can be found by applying a local search algorithm to these near-optimal designs. A catalog of designs is given for 1, 2, and 3 design factors. Efficiencies are calculated for classical response surface designs relative to exact optimal designs of the same design size.

Keywords：Genetic algorithms; Response surface designs; Design optimality.

□Received June 2002, revised September 2002, in final form October 2002.

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Journal of Probability and Statistical Science
1(1), 89-100, Feb. 2003

Comparisons of Tests for AR(1) Parameter in Regression Models with Autocorrelated Errors

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Chih-Ling Tsai
University of California at Davis

ABSTRACT We consider several methods for testing the autocorrelation parameter in linear regression models with first-order autoregressive (AR(1)) errors. We derive modified profile likelihood ratio and modified score tests by using the modified profile likelihood of Cox and Reid (1987), and we show via Monte Carlo simulations that these two tests are powerful and reliable compared to an asymptotic test (Mittelhammer *et al*. 2000), the likelihood ratio test, and the most popular test, the Durbin-Watson test. In addition, they are more easily computed than the comparable likelihood ratio test with Bartlett's adjustment. We also generalize these tests to nonlinear regression models with AR(1) errors. Finally we use an example to illustrate the behavior of the aforementioned comparison tests.

Keywords : Asymptotic test; Autocorrelation; Durbin-Watson test; Likelihood ratio test; Profile log-likelihood function; Score test.

Received June 2002, revised September 2002, in final form November 2002.

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Journal of Probability and Statistical Science
1(1), 101-116, Feb. 2003

Parametric Bayesian Analysis of Interval-Censored and Doubly-Censored Survival Data

M. Luz Calle
University of Vic

ABSTRACT Survival analysis is used in different fields to analyze the elapsed time between two events. What distinguishes survival analysis from other areas in statistics is that data are usually censored. Interval censoring arises when the occurrence of the final event of interest cannot be exactly observed and the failure time is only known to lie in an interval. A more complex censoring scheme is found when both initial and final times are interval-censored. This situation is referred to as double censoring. In this paper we provide a formal description of a parametric Bayesian method for the analysis of interval-censored and doubly-censored data and clear guidelines for its practical use. The proposed methodology is illustrated with data from a cohort of hemophilia patients who were infected with HIV in the early 1980's.

Keywords：Bayesian analysis; Double censoring; Interval censoring; Gibbs sampler; Markov chain Monte Carlo methods; Survival analysis.

□Received May 2002, revised August 2002, in final form October 2002.

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Journal of Probability and Statistical Science
1(1), 117-128, Feb. 2003

Bayesian Analysis of Repeated Surveys in Small Areas

Yih Su
Cheng Shiu Institute of Technology

Jing-Shiang Hwang
Academia Sinica

ABSTRACT Estimation of characteristics in small areas is becoming more and more important because of a growing demand for reliable small area statistics. Direct survey estimates for small areas are likely to yield unacceptably large standard errors due to unduly small sample sizes in the areas. Model-based approaches of combining multiple time series of the characteristics are often applied to solve the problem. In this paper, the authors propose an alternative approach by first estimating the spatial vector of the characteristic proportions of each small area to the whole, instead of their original characteristics. The characteristic estimate of each small area is then obtained from the product of the estimated proportion and the characteristic estimate of the whole. The estimation procedures are conducted in a Bayesian framework with the choices of priors from the previous data. We show that the Bayes estimates achieve the expected goal of variance reduction and simpler computation compared to commonly used mixed-effects model estimates in simulation studies. The proposed method is applied to obtain Bayes estimates of unemployment in 23 counties/cities in Taiwan for demonstration.

Keywords：Bayesian inference; Small area estimation; Repeated sample survey.

□Received May 2002, revised August 2002, in final form November 2002.

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□This research is supported by grants from the National Science Council of the Republic of China.

Journal of Probability and Statistical Science
1(1), 123-128, Feb. 2003

One Simple Test of Symmetry

Yonghong Gao
University of Missouri-Kansas City

ABSTRACT A simple test based on mean and median is proposed for testing symmetry. We discuss the asymptotic distribution of the test statistic and compare the performance of the proposed test with the classical skewness test under different distributions. Numerical examples are also given.

Keywords：Asymptotic distribution; Bootstrap; Empirical power; Test of symmetry.

Received May 2002, revised August 2002, in final form October 2002.

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Journal of Probability and Statistical Science
1(1), 135-140, Feb. 2003

A Note on Change Point Analysis in a Failure Rate

Jie Chen
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ABSTRACT The problem of estimating the change point (τ) in a failure rate is studied. Several estimates of such a change point have been proposed in the literature. In this note, a new estimate is proposed in light of an information criterion. A simulation study of the new estimate of τ is given in comparison with the estimates that already exist in the literature.

Keywords：Change point; Failure rate; Information criterion; Model selection.

Received June 2002, revised September 2002, in final form October 2002.

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Journal of Probability and Statistical Science

A Comprehensive Journal of Probability and Statistics
for Theorists, Methodologists, Practitioners, Teachers, and Others

Published by: Susan Rivers' Cultural Institute, Hsinchu, Taiwan, Republic of China
(Partially sponsored by: International Chinese Association of Quantitative Management, Taiwan, ROC)

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Appendix

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