

Inverse Gaussian Autoregressive Models

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ABSTRACT

A first-order autoregressive process with inverse gaussian marginals is introduced. The innovation distributions are obtained under certain special cases. The unknown parameters are estimated using different methods and these estimators are shown to be consistent and asymptotically normal. The behavior of the estimators for small samples is studied through simulation experiments.

On Sums of Triangular Numbers

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ABSTRACT

In this note we show how, W.N.Baily's $2(2)$ summation formula can be employed to obtain formulas for $t_2(n)$, $t_3(n)$, $t_4(n)$, $t_2^*(n)$ and $t_3^*(n)$ where $t_k(n)$ is the number of representations of n (≥ 1) as a sum of k triangular numbers and $t_s^*(n)$ is the number of representations of n in the form $[x(x+1)]/2 + s[y(y+1)]/2$ where x and y are nonnegative integers. Our formulas for $t_3(n)$, $t_2^*(n)$ and $t_3^*(n)$ seem to be new.

A Connection Between Burge's Restricted Partition Pairs And Frobenius Partitions

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ABSTRACT

By giving combinatorial arguments we obtain generating functions for three restricted Frobenius partition functions. A connection between these restricted Frobenius partition functions and Burge's restricted partition pairs (J. Combin. Theory Ser A, 63, (1993), 210-222) is shown. This connection and Burge's Theorem 1 give us three new analytic identities. A comparison of these analytic identities with three known identities from Slater's compendium (Proc. London Math. Soc. (2) 54 (1952), 147-167) leads us to Rogers-Ramanujan type identities for Burge's restricted partition pairs.

Progressive Censoring and Warranty Design

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ABSTRACT

The design of effective warranties is of concern to producers in any manufacturing industry, particularly in today's ever-changing high technology markets. In order to determine a cost-effective yet attractive warranty period, one must have an accurate description of a product's failure time distribution (where "failure" is not necessarily complete break down, depending upon the terms of the warranty). If n items are placed on life test, a practitioner will rarely wait for all n items to fail before making inference about the life time distribution of interest, rather he or she will censor the sample at some point in time before all of the items fail. In this talk, we will consider using "Progressive Censoring schemes" as a versatile extension to conventional censoring practices. In light of the number of ways to employ progressive censoring schemes, we will discuss selection of optimal censoring schemes and provide an example related to warranty design based on the extreme value distribution.

A Genetic Algorithm for the Traveling Salesman Problem with Some Restrictions

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ABSTRACT

The travelling salesman problem with some restrictions (TSP-R) is defined on complete symmetric digraph $G = (V, E)$. A cost matrix which may not satisfy the triangle inequality is defined on the edge set E . The TSP-R consists of determining a least-cost Hamiltonian tour on G of n vertices starting at any given vertex, say v_1 visiting each vertex in his tour exactly once and returning to the vertex v_1 such that any particular vertex say v_i must be visited before visiting another particular vertex, say v_k . In this paper a genetic algorithm is developed for obtaining heuristically optimal solution for the TSP-R. Also, this paper develops a data guided lexi-search approach, which gives us an exact solution, and another heuristic approach called sequential random sampling approach. The efficiency of the genetic algorithm to the TSP-R as against data guided lexi-search approach and sequential random sampling approach has been examined.

Casa VIRTUALE (VIRTUALE Home)

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'CASA VIRTUALE' (Virtual Home) is a multimedial prototype produced in collaboration with Prof. Giorgio ALBERTINI director of the 'CHILD, ADULT DEVELOPMENT CENTER' at SAN RAFFAELE HOSPITAL in ROME. The product, designed in a multidisciplinary contest (psychologists, pedagogists, logopedists, etc..), has been thought for children with medium or little mental retardation and/or experiencing learning difficulties at the primary school. Exercises, included in the program as games, are bound to consolidate some cognitive capacities as oculo-manual coordination, memory, attention, time and space concepts. Also included are metaphonological and reading and writing exercises. Besides of contents, anyway accurately designed, the emotional impact on the child has been privileged. Proposed activities are inserted in a familiar contest very close to the real life style. In the ambient of 'CASA VIRTUALE' the child has an active part in proceeding of 'virtual exploration' and builds his own navigation route. Very peculiar flexibility has been inserted, allowing the adult operator to select level and characteristics of any single exercise compared to the abilities of any child. He can decide whether to play a game and check the results of any activity proposed to the child. This section of the program is hidden to the child so that he is not aware of been controlled by the adult.

Graphoidal Covering Number of Graphs With $K_1 = 1$ and on Graphs With $\chi = (a$

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ABSTRACT

A graphoidal cover of a graph G is a collection (of (not necessarily open) paths in G such that every vertex of G is an internal vertex of at most one path in \mathcal{C} and every edge of G is in exactly one path in \mathcal{C} . If further no member of \mathcal{C} is a cycle, then \mathcal{C} is called an acyclic graphoidal cover of G . The minimum cardinality of a graphoidal cover is called a graphoidal covering number of G and is denoted by $\chi(G)$ and the minimum cardinality of an acyclic graphoidal cover is called an acyclic graphoidal covering number and is denoted by $\chi_a(G)$. In this paper we characterize the class of graphs G with $k_1 = 1$ for which $\chi(G) = q - p$ where p and q denote the order and size of G respectively. We also obtain a characterization of graphs with $\chi(G) = (a$. We also determine the value of $\chi_a(G)$ for any graph G .

Equality of Edge Domination Parameters in Graphs

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ABSTRACT

Let $G = (V, E)$ be a graph. A subset D of E is called an edge dominating set of G if every edge not in D is adjacent to at least one edge in D . An edge dominating set D is called a connected edge dominating set if the edge induced subgraph $\langle D \rangle$ is connected. It is called a total edge dominating set if $\langle D \rangle$ has no isolated edges. It is called an independent edge dominating set if no two edges in D are adjacent. The minimum cardinality of an edge dominating set in G is called the edge domination number of G and is denoted by $\gamma(G)$. Similarly we define the connected edge domination number (γ_c), the total edge domination number (γ_t) and the independent edge domination number (γ_i). In this paper we investigate graphs in which some of the edge domination parameters are equal.

Pseudo-Complete Color Critical Graphs

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ABSTRACT

A pseudo-complete coloring of a graph G is an assignment of colors to the vertices of G such that for any two distinct colors, there exist adjacent vertices having those colors. The maximum number of colors used in a pseudo-complete coloring of G is called the pseudo-achromatic number of G and is denoted by $s(G)$. A graph G is called k -edge critical if $s(G) = k$ and $s(G - e) < k$ for every edge e of G . A graph G is called k -vertex critical if $s(G) = k$ and $s(G - v) < k$ for every vertex v of G . In this paper we study the degrees, diameter and traversability concepts of these critical graphs.

Fuzzy Techniques in Pattern Recognition

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ABSTRACT

Fuzzy sets were introduced in 1965 by Lotfi Zadeh as a new way to represent vagueness in everyday life. The recently propounded theory of fuzzy sets has attracted the attention of researchers in various disciplines since this theory is apparently a generalization of classical set theory. Since 1965, a great deal of work has been done on the development of this theory and on its applications. Computational Pattern Recognition has played a central role in the development of Fuzzy models because Fuzzy interpretations of data structures are a very natural and intuitively plausible way to formulate and solve various problems. In this paper, we attempt to discuss some of the Fuzzy methodologies that have suggested for Pattern Recognition.

Asymptotic Theory for Random Permutations with Applications to Genetics

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ABSTRACT

In the last few decades, mathematical population geneticists have been exploring the mechanisms that maintain diversity in a population. Some geneticists believe that much of genetic diversity occurs mainly due to mutation and random fluctuations that are inherent in the reproductive process. Ewens (1972) established an approximation to the sampling distribution of a sample of genes from a population that was evolved over several generations, by a family of measures on the set of partitions of an integer. The derivation ignores the selective effects and assumes that there is no meaningful way of labelling the alleles. In this case the allelic partition contains all the information available in a sample of genes. Ewens formula can be used to test if the popular assumptions are consistent with data, and to estimate the parameters. The statistics that are useful in this connection will generally be expressed as functions of the sums of transforms of allelic partition. Such statistics can be viewed as functions of a process on the permutation group of integers. A functional limit theorem for such a partial sum process will be presented using ideas and concepts from Probabilistic Number Theory. Ewens sampling formula also arises in Bayesian statistics via mixtures of Dirichlet processes.

Semi-Parametric Approach to Bayesian Estimation of Reliability Under Ranked Sampling with Dirichlet Processes:

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ABSTRACT

Modern nonparametric schools of thought are moving towards Bayesian Models using Dirichlet Processes. The standard hierarchical models are being used to incorporate the nonparametric ideas. In this work some of the simulation results are used to estimate the approximate priors, posteriors, and predictive distributions.

Application of EM Algorithm in a Multistate Proportional Hazards Model

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ABSTRACT

In longitudinal studies we observe the repeated observation of outcome and prognostic factors over time. The study of a subject over time may show changes from one outcome state to another and the histories of a group of individuals may include the partially censored data. The transition from one state to another can be categorized into three distinct types: Transition, Reverse transition, and Repeated transition. In this paper a method is exploited for estimating parameters of the model for reverse and repeated transition developed by Kay (1982) and further extended by Islam (1997.) For estimating parameters, the algorithm expectation-Maximization (EM) was utilized. We apply the model to longitudinal data on Diabetes mellitus (DM) collected at diabetes hospital in Bangladesh.

Optimality of Partial Geometric Designs

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ABSTRACT

In the present paper, we prove optimality properties of the partial geometric designs defined in Bose, R.C.; Shrikhande, S.S. and Singhi, N.M. (1973) [Edge Regular Multigraphs and Partial Geometric Designs, Proc. Intern. Colloq. Combin. Theory, Rome]. First we prove that whenever the nullity of the concurrence matrix of a partial geometric design d^* is small enough, d^* is better (with respect to all convex decreasing optimality criteria) than all unequally replicated designs (binary or not) with the same parameters b, k, v as d^* . Combining this result with existing optimality results we obtain the following results. A linked block design with parameters $b = q^2, v = q^2 + q, k = q^2 - 1$ is optimal with respect to all the criteria mentioned above in the unrestricted class of all connected designs with the same b, k, v . Many of the regular partial geometric designs (i.e., partial geometric designs which are also regular graph designs) are type I optimal among all the connected binary designs (with the given parameters). This class included many singular and semi-regular group divisible designs and complements of partial geometries. Many more regular partial geometric designs are A-optimal amongst all connected binary designs. This class includes the complements of many partial geometries and the linked block designs which are the dual of the complement of a BIBD satisfying $v \equiv (k+4) \pmod{2}$.

Order Statistics from Non-identically Distributed Random Variables and Applications to Robustness

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ABSTRACT

In this talk, I will introduce the distributions of order statistics arising from n independent and non-identically distributed random variables in terms of permanents of some matrices. Making use of these convenient expressions, I will establish some basic properties of order statistics in this general context. Next, I will turn my attention to some special cases including exponential, logistic and Pareto, and show how the calculation of single and product moments of order statistics can be done efficiently in a recursive process. These results, incidentally, generalize the corresponding well-known results for the i.i.d. case. I will then make use of these results in order to discuss the robustness properties of various linear estimators of the parameters of the distributions (mentioned earlier) when multiple outliers are present in the sample. Some numerical calculations and examples will be presented at the end.

Three Isomorphic Vector Spaces and Their Application to Statistics

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ABSTRACT

Three vector spaces are defined and they are shown to be isomorphic. The isomorphisms lead to very interesting applications to (i) identities among binomial coefficients with their group of automorphisms, (ii) distributions arising from sampling with and without replacement, (iii) order statistics for arbitrary random variables, (iv) generalized binomial distributions. Generalizations of the above results for multinomial case are indicated. It is hoped that the techniques presented will find extensive applications in future.

Assessing Therapeutic Equivalence (TE) in Clinical Trials Using the Beta Binomial Distribution

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ABSTRACT

Non rejection of the null hypothesis when comparing two response rates in a clinical trial does not necessarily imply that the two treatments are equivalent with respect to their therapeutic effectiveness. Recently researchers have invested much time and effort in describing situations in which TE may be achieved. These have involved direct hypothesis testing procedures and confidence interval techniques. The latter involves determining if such an interval lies within predefined equivalent regions. The authors (Al Bartolucci, Karan Singh) have published previously on this subject when the parameters of interest were from growth curve or survival distributions. In this research endeavor the focus is on the binomial parameters characterizing the response from clinical trials. The prior involves the natural conjugate beta family of distributions. The primary parameter of interest is the difference of the two binomial parameters. Limiting values of the hyperparameters of the conjugate family are used to demonstrate the robustness of the outcomes. Several equivalence regions are utilized to test whether or not equivalence has been achieved and under what conditions the attainment of equivalence may not be established. The procedure has wide application as well in the quality control setting.

Quasivertex – Total Graphs With Crossing Numbers

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ABSTRACT

The quasivertex – total graph $Q(G)$ of a graph G as the graph whose point set is the union of the set of points and the set of lines of G in which two points are adjacent if and only if they correspond to two nonadjacent points of G or to two adjacent lines of G or to two adjacent points of G or to a point and a line incident to it in G . In this paper we establish a necessary and sufficient condition for quasivertex – total graph to have crossing number 1. We also prove that the Quasivertex – total graph $Q(G)$ of a connected graph never has crossing number 2. In addition we deduce a necessary and sufficient condition for quasivertex – total graph to have crossing number 1 in terms of forbidden subgraphs. Further we investigate some hamiltonian properties of quasivertex – total graphs.

On Concomitant of Order Statistics in Some Specific Bivariate Distributions

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ABSTRACT

We find the distribution of the concomitant of the r -th order statistic of one of the components for some specific bivariate distributions e.g., bivariate exponential distribution of Marshall's and Olkin, Morgenstern type bivariate bivariate exponential distribution and Gumbel's bivariate type bivariate exponential distribution and Gumbel's bivariate exponential distribution. Properties that concomitants get from the corresponding order statistics are used to derive a number of results. Recurrence relations between moments of concomitants are also obtained. Finally, we consider the joint distribution of two concomitants and obtain their product moments.

General Inference for Stochastic Processes

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ABSTRACT

It is well-known that for an infinite sequence of random variables $\{X_n\}$, the almost sure (a.s.) limit of likelihood ratios (l.r.) of (X_1, X_2, \dots, X_n) is the l.r. of the sequence. Likelihood ratios of many (separable) stochastic processes are obtained by this method. But this method is applicable, if the limit is finite; conditions ensuring this case ($P_q \perp P_0$) are widely discussed in the literature, (where, the underlying probability measures are P_q and P_0 (say)). The measures will be mutually singular (perpendicular), denoted $(P_q \perp P_0)$, if the limit is zero or infinite, almost certainly on $\mathbb{R}^{\mathbb{N}}$. This method fails, if the limit is zero or infinite on a set with probability strictly between 0 and 1. This set, called the set of singularity of P_q and P_0 , will have probability unity if $(P_q \perp P_0)$. Otherwise, there will be non-trivial Lebesgue decomposition of P_q into absolutely continuous part and singular part (w.r.t. P_0). The case of singular measures has been discussed by Grenander (Abstract Inference, (Wiley), 1981). This last important possibility has been ignored by workers on Inference for Stochastic Processes. In this paper, we highlight this non-ergodic case, pointing out its implications. We shall also give simple illustrative examples.

**Estimation of Scale Parameter k of Distribution E_k in Queue $M/E_k/1$
Using Data on Service Completions**

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ABSTRACT

There are many occasions when it may not be possible to observe service times fully to collect data for estimating parameters of the service time distribution. The method proposed here envisages using primarily the number of service completions. We consider service completion epochs as renewal points (eliminating idle periods if necessary). The maximum likelihood estimate of the mean of the service distribution is readily obtained as S/n where n is the number of renewals observed during the observation period $(0, S)$. To estimate the scale parameter k , two sampling plans are proposed: (i) Assuming that the observation period begins at time zero, record the number of renewals in $(0, t)$. Also assume that a total of s observations are collected; (ii) Assuming that the first observation period begins at time zero, record the number of renewals in $(0, t)$. In addition also record the time until the next renewal following time t , which will signal the start of a new observation period. Again we assume that a total of s observation periods are used. Maximum likelihood estimates are obtained based on likelihood functions resulting from these sampling plans.

Since k is an integer, the usual method of maximizing the log likelihood using differentiation is not appropriate. In this context, a convenient method is the one given by Dahiya (1981, *The American Statistician* 35, 34-37), in which the MLE is obtained as the greatest integer contained in V such that $L(V, X) = L(V-1, X)$ where $L(k, X)$ is the likelihood function continuous in k , and X represents sample observations (See G.K. Miller (1998) for improvements in this procedure.). Because k is an integer, we cannot use Fisher's information measure to obtain the accuracy of the estimator. A logical criteria for comparing the estimator with the one obtained by observing the actual service times, is to compare the probability that each correctly estimates k . The paper includes simulated results of the embedded renewal process of the queue $M/E_k/1$. The results show that the second sampling plan frequently leads to exact estimation of k .

Grouping Genetic Algorithm and its Parallelization

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ABSTRACT

This paper considers the problem of partitioning N objects into M disjoint, non-empty clusters. Existing algorithms that optimally solve this problem employ branch-and-bound or dynamic programming techniques. Some heuristic methods, such as the K-MEANS, C-MEANS and basic ISODATA, are also available to find an approximate solution. Our genetic algorithm based solution has a considerably reduced execution time than the branch-and-bound and dynamic programming techniques and produce near-optimal result for the clustering problem. In order to further reduce the execution time, we introduce a parallel implementation using dynamic load balancing technique.

We consider two encoding methods for our genetic algorithm. The first method, called permutation encoding, uses a permutation of objects. Then a dynamic programming algorithm is used to determine the optimal clusters. This helped us use a variation of some of the crossover operators already developed for the traditional Travelling Salesman problem. The other method, called group-based encoding, uses a group number for each object. Two crossover operators, edge-based and group-based, are used for this encoding. We implement the parallel genetic algorithm using a master-slave model. In our implementation, the master process stores the population and distributes its individuals to slave processes whenever the latter needs work. For the first encoding method master process distributes different individuals among different processes for fitness evaluation. In the other encoding, master process distributes pairs of individuals to the slave processes for crossover operation as well as fitness evaluation.

We evaluate all these methods on three test problems using C language with MPI libraries. The experiments are conducted in the Tuskegee University's Distributed System Lab (DSL) consisting of 27 Sun SPARC stations. Preliminary experimental results show that the proposed strategies represent a compromise, in terms of the complexity and accuracy, between the best heuristic algorithm known to us and the traditional branch-and-bound or dynamic programming techniques for clustering. Asymptotic Theory for Random Permutations with Applications to Genetics

Some Properties of Certain Infinitely Divisible Discrete Distributions

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ABSTRACT

Elementary infinitely divisible distributions, which are formulated on the basis of simple models, seem to be inadequate to describe the situations which may occur in a number of phenomena. In the last few years a number of various infinitely divisible distributions have been derived. In this paper three forms of infinitely divisible discrete distributions have been studied. The recurrence relations for their probabilities and factorial moments are investigated. Further, the recurrence relations for partial derivatives of the probabilities with respect to its parameters are also investigated which may facilitate the calculation of the asymptotic covariance matrix of ML estimators. As the method of ML will be very cumbersome, some other ad hoc methods have been also used to estimate the parameters. A few sets of reported data have been considered for the fitting of the distributions, and the fits are compared with that obtained with other distributions.

Poisson – Lindley and Some of Its Mixture Distributions

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ABSTRACT

The discrete Poisson Lindley distribution is a one-parameter mixture distribution obtained from Poisson distribution by mixing with one due to Lindley. In this paper an attempt has been made to review some of the problem of estimation for the fitting of the Poisson – Lindley distribution to some well-known data. Two generalized distributions namely Poisson – Poisson - Lindley and Poisson – Lindley - Poisson are also investigated. The recurrence relations with out any derivatives have been obtained for the computation of higher order probabilities and factorial moments of the above newly derived distributions. The parameters of the distributions have been estimated in terms of first two moments, and also in terms of mean and ratio of first two frequencies. A few sets of reported data to which different types of ‘derived’ distributions are fitted with varied amount of success, have been considered for the fitting of the above distributions.

Use of Genetic Algorithm for the Solution of a Combinatorial Replacement Problem

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ABSTRACT

In a k-series system with n-k standbys, items are to be replaced when the systems fail where the life of each item is assumed to be known. The problem is to find the first k elements to be selected in the system to start with and the sequence in which replacements are to be made such that the system life is the maximum. It is pointed out that this problem is essentially a 'bottle-neck' problem and it is equivalent to partitioning n numbers into k subsets (parts) such that the minimum of the k part-sums is maximized. Effective bounds can be computed for the optimum solution value and this can be achieved using the efficient Genetic Algorithm procedure. In this paper, a set of problems has been solved using the lexi search and genetic algorithms approach which give heuristically optimal solution. The efficiency of the proposed genetic algorithm approach has been examined and compared with Lexi-search approach.

Delay Methods and Digital Channels

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ABSTRACT

In this paper we shall show how a digital channel can be modeled as an iterated function system (and that consequently interesting fractal structures can be obtained even when the channel is linear). We shall then go on to show how the time delay methods developed in dynamical systems theory for analyzing experimental data, can be modified and applied to this kind of model. Finally we shall suggest ways in which these ideas - developed specifically to cope with nonlinear systems - suggest an approach to a general theory of nonlinear signal processing.

On Self-similarity of Directional Data of Turbulent Flow

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If direction of flow of a turbulent fluid is measured continuously we get a time series of directional data. These data are random in nature and may be analyzed statistically. In the present paper an attempt has been made to analyze the data from the stand-point of multifractal dimensions. In an earlier work Chanda and Das (Jr. Tech. Physics, 1998, 39, 23-29) have shown that fractal and correlation dimensions of wind direction may be gainfully utilized to interpret the intensity of randomness of the velocity field and the degree of intermittency of the field as well. Here we have utilized various atmospheric directional data and calculated the multifractal dimensions including the correlation dimension. The results show some interesting observations/inference to unfold many characteristics of conventional turbulent flow field. The study also describes in detail the way of interpreting multifractal dimensions of random fields.

Stochastic Models for Rainfall - Inference and Simulation

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ABSTRACT

In recent years the growing public awareness of environmental issues, together with advances in technology enabling widespread data collection, has triggered increasing interest in environmental problems amongst the statistical community. A particular consequence of this has been growing collaboration with workers in other disciplines in trying to solve applied, and often highly complex, problems. Rainfall is an example of a complex phenomenon that has been, and continues to be, extensively studied as a result of this growing interdisciplinary activity. The dynamics of the rainfall process over a wide range of spatial and temporal scales are complicated, and present serious challenges to the mathematical modeler; however, the applied problems which motivate the study of rainfall are very real and require practical, realistic solutions. Often the aim is to develop a tool for simulating rainfall patterns, usually with a view to providing input to some other application (for example in water resource management or insurance risk assessment). Here we give an overview of some recent and ongoing developments in rainfall modeling for practical application, and give three examples of the types of problems that may be encountered: (i) Detection and quantification of 'climate change' through available rainfall records, (ii) Improving the spatial resolution of meteorological model output, and (iii) development of stochastic models for continuous space-time simulation of rainfall patterns. Emphasis is placed upon the need for feasible simulation algorithms, and upon the problems of statistical inference and model checking which arise in connection with stochastic models for large complex data sets.

Generalized Confidence Intervals for the Largest Value of Functions of Parameters Under Normality

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ABSTRACT

This paper deals with the generalized confidence intervals for the maximum value of functions of parameters under consideration in the presence of nuisance parameters. Consider k Normal populations, we propose generalized confidence intervals for respectively the largest mean, the largest quantile and the largest signal-to-noise ratio. For the case of the largest mean, it can be shown that the proposed generalized confidence interval is better than that given by Chen and Dudewicz (1973a) when the variances are assumed to be equal and known, and it can also be shown that the proposed generalized confidence interval is better than that given by Chen and Dudewicz (1973b) when the variances are assumed to be unknown but equal. A new measure of efficiency is proposed and some Monte Carlo comparisons are made between the proposed confidence intervals and the known results. We have also shown that the generalized confidence interval is equivalent to a Bayesian confidence interval using improper priors under several situations.

Optimal Combination of Expert Opinions in Complex Designs

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ABSTRACT

We propose to investigate the problem of optimal allocation of resources while engaging several experts for qualitative assessment. Interesting combinatorial and algebraic inequalities will be discussed.

Sequential Allocation of Resources in Combining Expert Opinions

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ABSTRACT

We propose to discuss some sequential sampling schemes for optimal allocation of resources while engaging several experts for purposes of qualitative assessment. Interesting Stopping Rules will be presented

Robustness of the Sequential Procedures for a Family of Life Testing Models

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ABSTRACT

A family of probability density functions is considered, which covers many life-testing models as specific cases. Sequential probability ratio tests are developed for testing the hypotheses regarding the parameters of the probabilistic models. In respect of the operating characteristic and the average sample number functions, robustness of the proposed sequential procedures are studied when the parameters have undergone a change.

Sequential Estimation Procedures for the Weibull Failure Model

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ABSTRACT

The paper deals with estimation problems related to the Weibull distribution. For the parameter involved with the model, sequential procedure is developed in order to construct a confidence interval of 'preassigned width and coverage probability'. The proposed sequential procedure is proved to be 'asymptotically efficient and consistent'. Secondly, under squared-error loss function and linear cost of sampling, the problem of point estimation is considered. Sequential procedure is proposed and the associated second order asymptotics are derived. An 'improved' estimator is also proposed and its dominance over the conventional estimator is established. Finally, the problem of constructing confidence interval of 'fixed-ratio-width and coverage probability' for the reliability function is considered. The failure of the fixed sample size procedure is proved and a sequential procedure is recommended. The proposed sequential procedure is proved to be 'asymptotically efficient and consistent.'

Robustness of the Sequential Procedures for a Family of Life Testing Models

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ABSTRACT

A family of probability density functions is considered, which covers many life-testing models as specific cases. Sequential probability ratio tests are developed for testing the hypotheses regarding the parameters of the probabilistic models. In respect of the operating characteristic and the average sample number functions, robustness of the proposed sequential procedures are studied when the parameters have undergone a change.

Blocking of Fractional Factorial Designs

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ABSTRACT

Blocking is an effective method for improving the efficiency of an experiment by reducing the experimental error due to differences among the experimental units. The construction of blocked fractional factorial designs is discussed in many textbooks on experimental design. One has to choose k independent interactions (called treatment defining effects) to define a $(1/2^k)$ -fraction of a design with n two-level factors. To divide the $2^{(n-k)}$ treatment combinations into 2^p blocks, p more independent interactions (called block defining effects) are required. Once the k treatment defining effects and the p block defining effects have been chosen, the design can be constructed easily. But the issue of how to choose these $k+p$ independent interactions and to measure the "goodness" of the resulting design has not been properly addressed. Minimum aberration (Fries and Hunter, 1980, *Technometrics*) is a popular criterion for constructing good unblocked fractional factorial designs. It will be shown that several recent attempts (e.g., Sitter, Chen and Feder, 1997, *Technometrics*) to extend Fries and Hunter's criterion to blocked designs are not entirely satisfactory. A major difficulty is due to the different roles played by the treatment and block defining effects. An alternative criterion will be proposed and shown to lead to designs with desirable properties.

Comparing the ADF test with the KPSS test: An Application to the India Data

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ABSTRACT

Recently, a series of papers have shed light on the weakness of the unit root testing procedure (Sargan-Bhargava test, Dickey-Fuller test, Phillips-Perron test). In particular, it has been shown that, for samples of the sizes usually available in practice, these tests suffer from large size distortions and low power. Kwiatkowski, et al. And others have thus proposed testing the null hypothesis of stationarity against the alternative of a unit root.

Given that the evidence at present available shows that this new procedure also suffers from low power and size distortions, it has been suggested that they should be used in combination with the standard unit root test, rather than as a true alternative to them.

Using a set of annual macroeconomic time series characterizing the Indian economy, this paper compares the results of the augmented Dickey-Fuller test (henceforth ADF test), the most common test for unit root, with that of Kwiatkowski et al. (KPSS test) where one tests the null hypothesis of stationarity against the alternative of a unit root. Research has shown that the power of both the ADF and KPSS test is highly sensitive to the way one parametrizes each test. Therefore, evidence will be provided on the stationarity of our test of time series under different parameter specifications of the various testing procedures.

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The Comparison of the Two Sample Welch Test and the Trimmed Test When the Population Variances are Unequal

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ABSTRACT

In the two-sample location problem, to test the null hypothesis that the populations have equal means against the alternative that the means are not equal, one would use the Student's 't' test if the underlying distributions are normal with equal population variances. In this paper, we try to make a comparative study of the Welch t and the trimmed t tests for unequal population variances considering both normal and non-normal populations. We also try to study the power of both tests to find out the most suitable one out of these two statistics, at least for some experimental situations.

The Convergence of Serial Hopfield Network Model

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ABSTRACT

The main contribution is on the convergence of serial Hopfield network model. We prove without using an energy function, the convergence of Hopfield network model, i.e., that a state is stable in a serial mode of operation of the network if and only if it correspond to a minimal cut of the corresponding undirected graph.

A Revisit to Life-Data Analysis

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ABSTRACT

Analysis of life – data generated by biological and engineering system is one of the well known problem in Statistics Parametric models viz, Weibull , gamma , log-normal ,non – parametric estimators of survival / hazard functions based on censored observations, or using aging classes and proportional hazard models are widely familiar techniques to handle data sets. Industrial experiment planned to improve the reliability is a situation wherein censored data is generated under casual relationships. Such experiments are highly fractionated resolution three designs. A common practice is to compute signal to noise ratio and use exploratory graphical procedures to decide the optimal level of the factors. In this paper, we use methods based on quasi-likelihoods to analyse such censored data. Recent versions of softwares like S-Plus have a module on quasi-likelihood hence users may be in a position to use it without knowing the details of mathematical logistics behind statistical thinking.

Continuous Monotonic Decomposition of Trees

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ABSTRACT

Let $G = (V,E)$ be a connected graph. A decomposition $H = (H_1, \dots, H_n)$ of G is a continuous monotonic decomposition of G if $|E(H_i)| = i$ for all $i = 1, \dots, n$. In this paper, we investigate trees which admit a continuous monotonic decomposition in which each H_i is a path / star.

A Fuzzy Model for Conflict Resolution In Numerical Recognition

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ABSTRACT

Character recognition has been extensively studied for many years and a number of techniques have been proposed. However, character recognition is still a difficult task in which human beings perform much better than any computer system. Two characteristics of human recognition are robustness and accuracy. These are the goals one tries to reach when designing a recognition system. In order to achieve the robustness and accuracy we suggest employing fuzzy sets. Fuzzy sets deal with uncertainty as humans do. It would be equally possible and perhaps desirable for us to directly build these insights about categorization in to an artificial system. Fuzzy systems take this approach. The proposed algorithm has two stages. In the first stage we will use a novel method of extracting features from the digitized image containing numerals and the features are converted in to pattern matrix. The second stage comprises of a fuzzy classification algorithm which gives the degree of confidence measure in recognizing a numeral with respect to the training or ideal numeral.

One-Way MANOVA Tests under Nonnormality

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ABSTRACT

This paper is concerned with the distributions of one-way MANOVA test statistics for testing the equality of mean vectors of q multivariate populations with common covariance matrix. We consider three test statistics which correspond to the likelihood ratio criterion, the Lawley-Hotelling trace criterion and the Bartlett-Nanda-Pillai trace criterion, respectively, in the case of normal populations. The null and nonnull distributions of these test statistics are extensively studied under the case of normal populations, but are little studied in the case of nonnormal case. One of the known results is that the null distributions of these test statistics converges to a chi-square distribution when all the sample sizes from the q populations are large. The purpose of present paper is to study some refinements to the chi-squared approximation. First we derive Bartlett's corrections of the test statistics which give improved approximations. Next we derive monotone transformations of the test statistics which gives improved approximations for the first and second moments. Further, we derive asymptotic expansions of the null distributions of these test statistics under a general condition, assuming Cramer condition and the existence of first few moments. The derivation is based on perturbation method, and is to use an asymptotic expansion of the joint distribution of sample mean vector and sample covariance matrix, which is also derived. Numerical accuracies of these approximations are also examined.

Some Issues in Equivalence Testing

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ABSTRACT

Nowadays, equivalence trials are being widely used in the drug development and registration processes. The inherent statistical problem in testing equivalence is fundamentally different from testing the traditional hypotheses where two treatments are tested for inequality. In this talk we will discuss some of the theoretical and practical issues with respect to these equivalence problems.

Clustering In Cardiology

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ABSTRACT

Cardiology pertains to the study of the heart and its ailments. Agglomerative clustering was employed in this paper to perform classification. Acute Myocardial Infarction was the most prominent category of heart disease in the population. The features used in the classification process were Blood Pressure, Pulse Rate and Lipids. The features that are of interval type were prominent in the data set. This study was carried out in Mysore City whereas literature gives an account of Framingham Study in Massachusetts and Rotterdam study in the Netherlands. In classical classification problems, the data set consists of samples that are described by feature vectors of numeric type. In automatic classification methods have been developed allowing clustering large data sets where n objects in rows take values on p variables in columns. Nowadays, data analysts are confronted with new challenges. On one hand they are asked to process data that go beyond the classical framework by considering both objects defined by intention and objects which are complex due to the variable structure, taking advantage of the recent advances in artificial intelligence and machine learning. On the other hand they are asked for self explanatory outputs, i.e., the conclusions of the analysis should be expressed in terms that are easily understood by the outside user.

The existing classical techniques of data analysis were not prepared to address these issues. New formalization was needed, classical methods were to be extended and new criteria were to be conceived. A new perspective in data analysis was necessary. The development of symbolic data analysis arose in this context. Symbolic clustering algorithms were useful in identifying various categories of heart disease.

Mathematics between Consciousness (Mind) and Unconsciousness (Soul)

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ABSTRACT

For PYTHAGORAS and PLATON mathematics was not an 'art pour l'art', just an intellectual game or training of the mind, but the most important instrument for the education of the human beings, especially their souls. In our scientific age we often think scientific is identical with rational, logique..., with mind or consciousness, something, which you can see (an object for our senses) and measure. The unconsciousness or the soul you can't see, you cannot measure, but it is real. The reality of the unconsciousness is not something, which S. FREUD has invented, but is a reality, which PYTHAGORAS and PLATON tried to describe in a mathematical language. Mathematics is not an object for our senses which you can see with your physical eyes or grasp with your hands (senses), but its objects are real; mathematics is science. K. GAISER and H.J. KRAEMER have demonstrated, that PLATON sees the fundamentals of mathematics deepin the unconsciousness, he even identifies math and soul: (ta mathematica = he psyche) The rules of this unconsciousness are important (being conscious or unconscious) for many parts of mathematics, for instance statistics, computers, pattern recognition. The rules of statistics, this being uncertain, casual is characteristic not for the consciousness, for the mind, for the rational logique where everything has to be certain, but for the unconsciousness. In computerscience there are many links to the unconsciousness, the difference between hardware and software corresponds to the difference between body and soul It is very interesting to make conscious some of our ruling patterns in our unconsciousness and their influence upon our ways of recognition.

Solution to Conjecture of D. C. Godwin and R. P. Sullivan in Set Theory

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ABSTRACT

In an elementary way of presenting theory Venn diagrams have been used as a very convenient tool. In this paper we prove a conjecture proposed by Godwin and Sullivan.

Reduced-Bias Kernel Density Estimators

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**James Madison University, Harrisonburg, VA 22807, USA

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ABSTRACT

A new second kernel density estimator is developed which has a smaller asymptotic bias than the standard kernel density estimator. The "optimal" bandwidths with respect to the asymptotic mean squared error (local) or asymptotic integrated mean square error (global) are derived and are quite different from those for the usual kernel density estimator. Computer Simulations are carried out to compare the estimator to another reduced bias estimator and to two fourth-order kernel density estimators. The new estimator has a smaller bias than the existing second order reduced bias estimator and is a competitive substitute for the fourth order kernel density estimators.

Estimating Fractionally Differenced ARIMA Models

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ABSTRACT

Fractionally differenced ARIMA models have been used to model persistence in a variety of time series data. Applications of these models can be found in Economics, Hydrology and Geo-sciences. Maximum likelihood estimation is a commonly used technique to estimate these models, but it requires correct specification of the model. Even when the model is correctly specified, the asymptotic theory does not apply well for moderate length time series data. In this paper we discuss a regression method to estimate fractional models and present results of an extensive simulation study. The simulation results show that the proposed method works very well for large time series, and does not require correct model specification.

Optimal Row-Column Designs for Complete Diallel Crosses

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Northern Illinois University
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ABSTRACT

We consider row-column designs for complete diallel crosses in which two sources of nuisance variability are to be controlled. At present one can use an efficient or an optimal row-column design, e.g. a Latin square design, identifying crosses with the treatments of the row-column design, see Singh and Hinkelmann (1988). A major drawback of this approach is that it results in several replications of the crosses in the experiment. Universally optimal, Kiefer (1975), row-column designs for complete diallel crosses having few replications are provided in this paper. Three series of designs given involve just one replication of each cross. A series of designs having two replications of each cross is also provided.

Similarity of Graphs and the Reconstruction Problem

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ABSTRACT

Similarity among graphs has been a central issue in the reconstruction problem. Therefore we introduce the concept of coefficient of similarity of two graphs. This also leads to a novel approach to the reconstruction conjecture. Many important results on reconstruction then follow as simple corollaries. Tables of the coefficient of similarity for six point graphs are also given. It is also shown that the highest coefficient of similarity of two graphs on n points eventually stabilizes.

Hypothesis Testing through the Closed Sequential Decision Procedures

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Department of Statistics
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ABSTRACT

The present paper deals with the problem of testing of hypothesis about stochastic processes through the closed sequential decision procedures. The closed sequential procedures to K-decision problems has been developed by Paulson (1964). He dealt with the problem of testing of hypothesis regarding the mean of the normal distribution either one sided or two sided alternatives and also discussed testing of hypothesis of normal distribution through the closed sequential procedure. The theory has been extended to a general class of distributions by Halakatti (1994). The author has discussed the testing of hypothesis regarding the mean of normal distribution and the procedures have been illustrated through some examples.

On a similar line using the procedures suggested by Paulson (1964) and Halakatti (1994) we have discussed in this paper, the problem of testing of hypothesis regarding the variance of the normal distribution through the closed sequential procedures and obtained an approximate formula for the ASN function for the closed sequential procedures. We have also obtained the closed sequential decision procedure for Koopman-Darmois family of processes and discussed some particular cases viz., Wiener process and Poisson processes.

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Intentionally Biased Bootstrap Methods

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We suggest a class of weighted bootstrap techniques, called biased bootstrap methods. It is motivated by the need to adjust empirical methods, such as the 'uniform' bootstrap, in a surgical way so as to alter some of their features while leaving others unchanged. Depending on the nature of the adjustment, the biased bootstrap can be used to reduce bias, or reduce variance, or render some characteristic equal to a predetermined quantity. Examples of the latter application include an approach to hypothesis testing in nonparametric contexts, where the biased bootstrap enables simulation 'under the null hypothesis', even when the latter is false; techniques for variance stabilisation; methods for rendering estimators robust in either parametric or nonparametric settings; adjustments of Nadaraya-Watson kernel estimators to make them competitive with local linear smoothing; methods for density estimation under constraints; etc.

Constructing Force Closure Grasp under Shape Ambiguity

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ABSTRACT

The inherent errors and sensor inaccuracies do not allow a perfect model of the world. Therefore robotic grasping is always under certain degree of uncertainty. In this paper we explore the possibility of constructing a force closure grasp under such ambiguity in shape. The idea is not to have a perfect model of the shape. For this we do an ambiguous shape modeling using genetic algorithm. Ambiguous shape modeling can be defined as a shape-modeling approach where the model represents not one but a class of geometrics. In this paper we propose a qualitative (inexact) version of chain code called the Hybrid Qualitative Chain Code (HQCC) that is a boundary – based model for ambiguous shape. Using HQCC we generate a class of geometrics which includes the shape of the object to be grasped. An algorithm to construct a force closure grasp valid for the whole class is explored. The grasp so constructed ensures a force closure grasp under shape ambiguity.

On Limiting Distribution of Max and Second Max from a Discrete Distributions

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ABSTRACT

In this paper, the limiting distribution of suitably normalized vector sequence of maxima and second maxima of i.i.d non-negative integer random variables having an exponential decay rate is discussed.

On Relative Information Generating Function with Utilities

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Hisar 125 004, India

ABSTRACT

In the present communication relative information generating function with utilities has been defined and its particular and limiting cases have been studied. Interestingly, the derivatives of these information functions at $t = 0$ give various known measures of information. The relative information generating functions for uniform, geometric and exponential probability distributions have been defined. Some important properties of the proposed information generating functions have also been studied.

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In the present communication relative information generating function with utilities has been defined and its particular and limiting cases have been studied. Interestingly, the derivatives of these information functions at $t = 0$ give various known measures of information. The relative information generating functions for uniform, geometric and exponential probability distributions have been defined. Some important properties of the proposed information generating functions have also been studied.

Dose-Response Model with Dependent Binary Data with Application to Clinical Trials

Balakrishna Hosmane
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ABSTRACT

In many situations the measurements of response variable are made on a fixed number of subjects at different dose or concentration levels or at different time points. The primary objective of this talk is to provide classical procedures such as the repeated measurement model for categorical data or generalized estimating equation methodology along with hierarchical Bayes alternative to the analysis of dependent binary data. The application of the methodology will be presented using adverse event data from a clinical trial.

**A Branching Non-linear Autoregressive Model for the Transmission
of the Fragile X Dynamic Repeat Mutation.**

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ABSTRACT

The fragile X syndrome is a common X linked genetic disorder which arises as the result of progressive CGG trinucleotide repeat expansion in the FMR1 gene and leads to a failure of gene expression. A non-linear time series model for the transmission of CGG repeats is examined. The model is fitted to data on parent-offspring transmissions and the resulting parameter estimates are used to simulate an evolving population.

Analysis of Structural Change in Nonparametric Regression Surface

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ABSTRACT

Several papers have been appeared in the statistical literature to fit regression models with discontinuities or change points. Parametric regression model with change points has been discussed for more than thirty years. In practice, nonparametric regression techniques, which allow for a large class of regression functions to be considered, seem to be more appropriate in a variety of situations than parametric approaches. Recently, nonparametric methods to fit regression models with change points have been discussed by several authors. Almost all the papers discussed in the literature are of one-dimensional (1-D) jump regression function. In this paper, we discuss estimation of two-dimensional (2-D) jump regression function (jump regression surface). In the 2-D case, the jump location is a curve and jump size is a function. We have given a simple procedure to estimate jump location curve and jump size function. For a given design point, the estimators are obtained by fitting kernel weighted least squares regression using the observations in the four quadrants and comparing the difference. The limiting distributions and the asymptotic properties of the estimators are investigated.

Location Subset Selection from Type I Extreme Value Populations

S. Jeyaratnam and S. Panchapakesan
Southern Illinois University
Carbondale, IL 62901, USA

ABSTRACT

We discuss selection procedures under the classical indifference-zone and subset selection formulations for selection from type I extreme value populations in terms of their location parameters. We also discuss a related test for homogeneity.

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Evolving Linear Grammars

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ABSTRACT

Wyard, Lankhorst, Grefenstette, Zhou, as well as others, have published approaches, techniques and results concerning grammar inference using genetic algorithms. Primarily, all of the grammars they have evolved are context free. This paper restricts its attention to linear grammars. This narrower focus simplifies the representation of the grammars as chromosomes. As a consequence, closure under the basic genetic algorithm operators is immediate. Fitness of the chromosomes, as in many other approaches to these problems, will be computed using both positive and negative sets. Experimental results concerning the evolution of linear grammars will be presented.

Minimum and Maximum L-Fuzzy Topological Spaces

T. P. Johnson
Department of Mathematics
St. Thomas College
PALA, 686 574

ABSTRACT

We characterize all L-fuzzy topological spaces that are minimum or maximum with respect to an L-fuzzy topological property.

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Max-Geometric Infinite Divisibility and Maximal Processes

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ABSTRACT

The concept of max – geometric infinite divisibility is studied and characterized. The Semi – Pareto distribution is shown to be max-geometric infinite divisibility in the context of auto regressive time series modeling is established. The property is employed to construct a first order auto regressive maximal process with semi-pareto marginal stationary distribution. Various properties and applications of the process are studied.

Geometric Exponential Distribution and Its Applications

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V. Seethalakshmy
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ABSTRACT

Geometric Exponential distribution is studied in detail and various properties are established. It is shown that the distribution is geometrically infinitely divisible and can be the marginal distribution of a stationary auto regressive process. Some generalizations are discussed and possible applications are described.

On Graphs Whose Chromatic Number Equals Dimination Parameters

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ABSTRACT

Let $G = (V, E)$ be a connected graph. A set S (V is a dominating set of G if every vertex in $V - S$ is adjacent to some vertex in S . The domination number of G is the minimum cardinality taken over all minimal dominating sets of G and is denoted by $\gamma(G)$. A dominating set S is a total dominating set of G if the induced subgraph $\langle S \rangle$ has no isolates and a connected dominating set of G if $\langle S \rangle$ is connected. The total (connected) domination number of G is the minimum cardinality of a total (connected) dominating set of G and is denoted by $\gamma_t(G)$ ($\gamma_c(G)$). The chromatic number of G is the minimum number of colors assigned to the vertices of G such that no two adjacent vertices have the same color and is denoted by $\chi(G)$. In this paper, we investigate graphs for which $\gamma(G) = \chi(G)$, $\gamma_t(G) = \chi(G)$ and $\gamma_c(G) = \chi(G)$.

Mathematical Models for the Biomechanics of Green Plants

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ABSTRACT

In this paper, biomechanics of green plants for low Reynolds number in the cylindrical stem is considered. The important aspect of the present work is to account for the homogeneous n th order biochemical reaction that characterizes fully developed flow. An analytical solution for the concentration and temperature has been developed. The effect of biochemical reaction on the process of translocation and transpiration are discussed.

A Mathematical Model for Light Absorption by a Heterogeneous Ellipsoidal Tree Canopy

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Orissa, India

ABSTRACT

In this problem, the general law of sunlight penetration has been applied to an ellipsoidal canopy having nonhomogeneous foliage density to study the amount of light interception. The amount of light absorbed per unit time has been calculated. The following assumptions are made while developing the model. Canopy is assumed to be heterogeneous. The distance from the light source to the canopy is considered to be arbitrary. The leaf orientation is assumed to be randomly distributed with respect to inclination and orientation (Oker-Blom & Kellomaki, 1982).

Eigenspace Methods for Estimating Parameters in the Linear Array Model

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ABSTRACT

The linear array model describes an array of sensors recording signals emitted by multiple sources. These models are found in such diverse areas as communications, geophysics, medical diagnosis, and meteorology. The model is highly nonlinear, and traditional estimation methods like least squares and maximum likelihood are numerically quite intractable. We propose some alternative high resolution methods for estimating the parameters using eigendecompositions of the sample covariance matrix. These new algorithms exploit an inherent symmetry in the model leading to a reduction in the number of parameters to be estimated. The computational complexity associated with these algorithms is significantly lower than the more traditional methods. Results of a simulation study will be presented to evaluate the performance of these estimates.

Estimation In Scaled Log Logistic Distribution Using Order Statistics

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ABSTRACT

The log logistic distribution as introduced by Malik (1967) is considered with a scale parameter. The BLUE to the scale parameter is obtained from Type II censored sample. Estimators based on k – optimally selected ordered statistics and those based on selected sample quantiles are also worked out. The reliability function is estimated using suggested methods of estimation for parameters. Comparison of the estimation methods, in large as well as small samples, are also presented. The results are illustrated by an example.

Alphanumeric Character Recognition Using Back-Propagation Neural Network

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T.T.T.I.
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ABSTRACT

There has been significant recent interest in the use of artificial neural network methodology in the solution of pattern recognition problem and also in the application of pattern recognition techniques. This paper elucidates the important issues and describes as an example a project that we have undertaken. The example described here is a pattern recognition system that uses back propagation training algorithm for classifying different types of character pattern. Artificial neural network has been recognized as a powerful tool for pattern classification problem but a number of researchers have also suggested that straight forward- neural network approach to pattern recognition are largely inadequate for various problems. In this paper we present multi-layer perception classifier with back propagation training algorithm,. In order to verify superiority of the proposed classifier, experiments were performed with numerals and four-font alphabet pattern with various modification of standard back propagation algorithm. Effects of variation in learning rate, number of layers, number of neurons in hidden layers, noise in training set, memorization and generalization are highlighted.

Alphanumeric Character Recognition Using Backpropagation Neural Network

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ABSTRACT

There has been significant recent interest in the use of artificial neural network methodology in the solution of pattern recognition problem and also in the application of pattern recognition techniques. This paper elucidates the important issues and describes as an example a project that we have undertaken. The example described here is a pattern recognition system that uses back propagation training algorithm for classifying different types of character pattern. Artificial neural network has been recognized as a powerful tool for pattern classification problem but a number of researchers have also suggested that straight forward neural network approach to pattern recognition are largely inadequate for various problems. In this paper we present multi-layer perception classifier with back propagation training algorithm. In order to verify superiority of the proposed classifier, experiments were performed with numerals and four-font alphabet pattern with various modification of standard back propagation algorithm. Effects of variation in learning rate, number of layers, number of neurons in hidden layers, noise in training set, memorization and generalization are highlighted.

Reliability Stress-Strength Models for Dependent Observations

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ABSTRACT

When studying the effects and side effects of certain medical procedures (treatments), it is often the case that observations are correlated due to subject effect, repeated measurements and observing many characteristics simultaneously. We develop maximum likelihood estimator (MLE) and uniform minimum variance unbiased estimator (UMVUE) of the reliability which in clinical trial studies could be considered as the chances of increased side effects due to a particular procedure compared to another. The results developed apply to both univariate and multivariate situations. Also, for the univariate situations we develop simple to use lower confidence bounds for the reliability. We conduct simulation studies to evaluate the procedures developed and also to compare the MLE and the UMVUE. Further, we consider the cases when both stress and strength constitute time dependent processes. We define the future reliability and obtain methods of constructing lower confidence bounds for this reliability. Finally, several examples are considered to demonstrate the applications of the results.

A Class Of Selection Procedures For Locations Parameters Using Sub-Sample Medians

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ABSTRACT

Let (I_1, \dots, I_k) be k independent populations and let $F_i(x) = F(x - I_i)$ be the absolutely continuous cumulative distribution function (cdf) associated with the population $(i, I_i = 1, \dots, k)$. The problem is to select a subset of k populations containing the one associated with the largest location parameter. A class of subset selection procedures based on sub-sample medians for unequal sample sizes is proposed and compared with the existing procedures in the sense of Pitman asymptotic relative efficiency (ARC), with the help of existing tables. Simulation study is carried out to know the sample size required for the implementation of the proposed class of procedures. This work will be mainly based on joint work with V. Kumar and G. P. Mehta.

Toolbook Instructor, MathWright and HyperStudio

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A multimedia presentation software is a very important tool in making an effective presentation, whether it is marketing, research, classroom teaching, or self tutoring. This presentation will examine the needs of a mathematical presentation. We will focus on three multimedia presentation software, namely Toolbook Instructor, MathWright, and HyperStudio. We will compare these software for their merits, simplicity, and mathematical suitability. Depending upon the availability of resources a short presentation made with each of the three software will also be demonstrated.

Quantile Estimation for a Selected Normal Population

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ABSTRACT

Suppose independent random samples are drawn from k normal populations with unknown and possibly different means and variances. The population corresponding to the largest sample mean is selected as the best population. We consider estimation of quantiles of the selected population when the loss function is taken to be the squared error. Admissibility and inadmissibility of a natural estimator for the quantile is investigated in certain subclasses of linear and affine equivariant estimators.

Studies on the Natural Variability of Vital Rates

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Salem 636010

ABSTRACT

A linear point process is, roughly speaking, a countable random collection of points on the real line. Any sequence of time epochs at which some events occur can be thought of as a realization of a linear point process. So the sequence of time epochs at which births or deaths occur can be studied through the theory of point processes. Vital statistics are the data on the fundamental events of human lives - events such as birth, death, marriage, and the like. Demography literally means the quantitative and qualitative study of the population. The basic characteristic of a population is indicated by mortality, fertility and migration and their joint effect which affects the growth of a population. In general, the changes in the mortality, fertility or migration are measured quantitatively as the probability of a death, the probability of a birth, or the probability of a person migrating from the population during a specified period of time. So it is not surprising if one is tempted to connect the demographic problems with the more general properties of the point processes. Brillinger (1986) has made the first attempt in this direction. He argues that assuming Poisson birth times and independent life times, the number of deaths and the corresponding mid year population have a bivariate Poisson distribution. He has further shown in a theorem that when the coefficient of variation of the population size variable is small, one can use a Poisson approximation for the distribution of the mortality rates. But usually the fertility and the mortality rates differ between the two sexes. It is unsatisfactory in a stochastic model to have to ignore such a departure. In this paper the results of Brillinger (1986) have been generalized in two directions. In one direction Brillinger's conceptual model for the description of the natural variability of certain vital statistics are modified so that it could accommodate the sex factor. In this other direction it is improved to take care of multiple births.

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Phase Synchronization in Coupled Complex Systems

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ABSTRACT

The effect of phase synchronization in weakly coupled chaotic systems is described. It is shown that phase can be defined for dynamical chaotic systems and the effect of phase and frequency locking can be observed. We propose some methods for a reliable detection of synchronous epochs in noisy nonstationary bivariate data. These techniques are applied to several neurophysiological data.

A Generalized Randomization Model to Correct for Phylogenetic and Spatial Autocorrelation in the Analysis of Ecological Data

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ABSTRACT

Given a series of ecological observations gathered from a set of populations sampled at various locations, it is implicitly assumed that these observations are independent and identically distributed (i.i.d.) when computing a statistical test. This assumption is rarely justified, however, because such ecological data are always correlated in time and space. It implies that closely related populations are more likely to share similar attributes than are distant ones (phylogenetic autocorrelation), and also that populations gathered at neighboring sites are more likely to be similar than those obtained from distant locations (spatial autocorrelation). Thus, the non-independence among ecological observations is the result of both spatial and phylogenetic autocorrelation, and statistical analyses of such data may provide spurious results. Permutation tests could be used to solve this problem. In theory, all possible permutations among different populations could be performed by assigning every observation to each and every population in turn, or a subset of permutations could be performed by sampling from the set of all permutations. Usually, the sampling universe is based on the EL model, which considers all permutations as Equally Likely. However, this model is not satisfactory when dealing with autocorrelated data. To account for the non-independence among observations, a modified permutation procedure is required. In this paper, I will introduce a generalized permutation model to do so. This method is based on probabilistic permutations and includes the EL model as a special case. The new permutation test will be applied to various ecological data sets and compared to standard statistical procedures for i.i.d. observations.

Hypergroup-based Stationarity Properties of Stochastic Processes

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University of Delhi, INDIA

ABSTRACT

Let K be a hypergroup. R.Lasser and M.Leitner (J.Theoretical Probability, 1989) defined and studied K -weakly stationary processes, common estimates for the mean of a stationary process being the motivating example. J.C.Hardin and A.G.Miamee defined correlation autoregressive processes as another variant of the stationarity with applications to helicopter noise. We find sets of necessary conditions and of sufficient conditions for estimates of stationary processes with moving centres and oscillating lengths to be K -weakly stationary. We also determine when certain K -weakly stationary processes are correlation autoregressive, in particular for those related to Tchebychev polynomials and Dunkl-Ramirez' example arising from p -adic numbers.

Stable Spherical Tests versus Multivariate Least Squares Inference

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Institut fuer Biometrie und Medizinische Informatik
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Since 1995, we have developed a principle of multivariate testing that is based on the derivation of left-spherically distributed linear scores from the given variables (Läuter, 1996; Läuter, Glimm, and Kropf, 1996, 1998). Thus, an alternative to the least-squares- and maximum-likelihood strategies of classical multivariate analysis has been created. In this talk, we demonstrate the admissibility of the correlation test which uses the eigenvector corresponding to the largest eigenvalue as its coefficient vector d . Here, admissibility is meant in the decision-theoretic sense, refers to the test's power and to comparison of all possible definitions of d .

Läuter, J., 1996: Exact t and F tests for analyzing studies with multiple endpoints. *Biometrics* **52**, 964-970.

Läuter, J., Glimm, E., and Kropf, S., 1996: New multivariate tests for data with an inherent structure. *Biometrical Journal* **38**, 1, 5-23.

Läuter, J., Glimm, E., and Kropf, S., 1998: Multivariate tests based on left-spherically distributed linear scores. *The Annals of Statistics* **26**, No. 5 (in press).

**Optimal Ordering Policies under Conditions of
Extended Payment Privileges for Deteriorating Items**

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ABSTRACT

This paper develops optimal order quantities for firms, where units in inventory are subject to deterioration at a constant for an order of a commodity. Such delayed payment reduces purchase cost which is a function of the return available on alternative investments, the number of units ordered, and the length of the extended period. Optimal order quantities are developed for extended payment privileges that occur at a reorder point of between reorder points. Four supplier's extended payment scenarios are evaluated. An analysis is conducted to determine the sensitivity of derived model to changes in the various input parameters.

Modeling With TI-83

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A graphing calculator is a very handy, affordable and portable tool, which is being increasingly used in teaching/learning process. It is like a hand-held computer which can be programmed too. It brings the application of mathematics and statistics to real life situations within the reach of a classroom setting or even an individual learner. There are very sophisticated graphing calculators available in the market. This presentation will use a comparatively simpler and affordable graphing calculator TI-83. In this presentation, we will use real life data to demonstrate how graphing calculator TI-83 can be used for modeling, and for applying statistical techniques including sampling.

On Line Recursive Script Recognition: Some New Approaches

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ABSTRACT

This paper addresses the recognition of cursive handwritten scripts using a mouse interface. On-line script recognition is gaining more importance in recent times because it helps the clients to give instructions using local languages. It should also be possible to give commands to robots in local languages. On-line script recognition methods basically depend on the availability of dynamic information. This comprises the order in which the strokes forming the scripts are written along with the direction of the strokes. In general these features remain more or less constant for a given handwriting.

A number of versions of recognizers of cursive scripts have been developed by the European project called PAPHYRUS. Some of the prominent approaches reported are based on strokes, character recognition and neocognition, etc. Most of the stroke-based methods are based on the kinematics of the strokes, i.e., pieces of handwriting movements bounded by a minimum and a maximum. In character based recognition methods, either euclidean distance or any other norm is used [1]. Recently, neural network approaches are also being tried and good results are reported [2,3,4]. Most recently, Rashmi et al. [5] have used spline interpolation technique for script recognition. These have been implemented under DSO environment that poses a restriction on number of samples for efficient recognition system. In this research work, we propose an on-line script recognition system under UNIX environment. Two novel approaches, one based on Quadrant approach and the other based on Vectorized Bitmap approach is presented. It has been found that the proposed approaches have several advantages over other methods proposed in the literature. Results are presented for different Kannada scripts. Our future work includes development of efficient neural network structure for cursive script recognition.

For a First Friendly Contact between Young People (of all ages) and Statistics

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ABSTRACT

The author stresses the fact that there exists one culture only. To insist on the distinction between the humanistic culture and the scientific, number-oriented culture is negative for both, and limits imagination and innovation. Examples of people of talent in the area of philosophy and mathematics or geometry simultaneously are given to support this point of view. Children can be taught the rudiments of statistics in the early stages of their schooling, as part of a general view of the world, of which statistical thinking is undoubtedly part. In this way, it is also possible to gain the trust of those who believe they are excluded from anything that has to do with numbers. The author illustrates how the arithmetic average (including the trimmed average) and the median and harmonic averages can be introduced to young children through stories with which they can easily relate. The same procedure can be used for variability and correlation, and for explaining how to formulate questions in a questionnaire to avoid unclear or, worse, biased answers. The whole approach can be adapted to interactive telematic applications with graphical content.

Tolerance Regions for a Multivariate Normal Population

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ABSTRACT

In the talk, we shall compare several approximation methods for computing the tolerance factors for a multivariate normal population. These approximate methods are evaluated by comparing the Monte Carlo estimates of the coverage probabilities with those of the specified ones. Numerical studies indicate that, in general, the tolerance factors based on an approximate method given by John (1963, Sankhya), which is commonly used in the literature, are inaccurate when the number of variates is greater than or equal to two; but another approximation (which is also due to John) with slight modification gives better results. Using the idea of John, we also suggest some new approximations, which give satisfactory results. Two of the new approximations emerge as satisfactory candidates for practical use. Our fairly extensive numerical results provide guidelines regarding the choice of the tolerance factor for practical applications.

Modular Test Plans for Certification of Software Reliability

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ABSTRACT

This paper considers the problem of certifying the reliability of a software system that can be decomposed into a finite number of modules. It uses a Markov model for the transfer of control between modules in order to develop the expression for the system reliability in terms of the module reliabilities. A test procedure is considered in which only the individual modules are tested and the system is certified if and only if no failures are observed. The minimum number of tests required of each module is determined such that the probability of certifying a system whose reliability falls below a specified value is less than a given small fraction. The sample size determination problem is formulated as a two-stage mathematical program and an algorithm is developed for solving the problem.

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Asymptotic Mean and Variance of Electric Power Generation System Production Costs

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ABSTRACT

Electricity cannot be conveniently stored and therefore at each instant of time there should be enough power generation to meet the demand. The cost of electric power production during a given time horizon is a random variable because it depends upon the availability of the generating units as well as the magnitude of the demand. Based upon a Markov model, we present a recursive scheme for estimating the asymptotic mean and variance of the production cost. The formulas require the knowledge of the fundamental matrix of the Markov chain which is usually obtained by the inversion of a matrix whose dimension depends on the size of the state space. In most realistic systems the state space is very large. The proposed recursive relations preclude the need for such matrix inversion.

On Spectral Multiplicity of Some Gaussian Processes

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ABSTRACT

In this talk we consider some Gaussian second-order stochastic processes (continuous left and purely nondeterministic), in a separable Hilbert space and analyze conditions for these processes to be multiplicity of one. Also, we connect some results of H. Cramer (1971) concerning this problem.

Geometric Max Semi-stable Laws, Geometric Max Domains of Attraction and of Partial Attraction

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ABSTRACT

In this paper geometric max semi-stable laws are introduced and studied. Geometric max domains of attraction and of partial attraction are discussed and relations between Geometric max domains of attraction/partial attraction and max domains of attraction /partial attraction are established.

Estimation Problems for Random Fields on a Sphere

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ABSTRACT

Let S_n be a unit sphere in the n -dimensional Euclidean space. We call a mean-square continuous random field $X_i(t,x)$, for t in R^1 , and x in S_n homogeneous isotropic on a sphere if $E[X_i(t,x)] = 0$ and $E[X_i(t,x)X_i(s,y)] = B(t-s, \langle x, y \rangle)$, where $\langle x, y \rangle$ is the "angular" distance between the point x, y in S_n . Spectral representation of a homogeneous isotropic on a sphere random field as well as its correlation function is used to find solutions of the following statistical problems: estimating of the unknown expectation of the field, extrapolation, interpolation and filtering, construction of the confidence region for estimates of the covariance function and the expectation of the field. The classical Wiener-Kolmogorov theory of extrapolation, interpolation and filtering requires exact knowledge of signal and noise spectral densities. In the case where only some partial spectral information available it is reasonable to search for estimation which behave uniformly well over a certain class of spectral densities. The least favorable spectral densities are derived for various classes of possible spectral densities. Spectral characteristic that is minimax-robust in the sense that it minimizes the maximal mean-square error, where the maximum is taken over all spectral densities, is determined too. Exponential type estimates for the joint distribution of estimates of covariance functions and the mean values of the homogeneous isotropic on a sphererandom fields based on the properties of the square-Gaussian random vectors are derived.

Optimality and Combinatorial Issues for Block Designs When Binarity and Near-Symmetry Cannot Co-exist

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ABSTRACT

There is now a considerable body of optimality theory for block design settings where binarity and symmetry or near-symmetry of the concurrence matrix are simultaneously achievable. When binarity forces greater spread in the concurrence counts, relatively little is known. Several of these latter settings will be examined, some optimality results offered, and attendant combinatorial issues explored. Included is a discussion of BIBD settings where no BIBD exists.

Selection Procedures for Count Data

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ABSTRACT

Typically binomial, Poisson and negative binomial distributions are used to describe count data. The problem of selecting a best population among the k available populations using independent random samples of size n from each population is studied. Fixed-sample-size procedures with indifference zone approach are considered. Interesting differences and similarities exhibited by these three distributions in the existence of selection procedures and the consistency of selection procedures with respect to two distance measures are discussed. These distributions are used in managerial applications to study consumer behavior, in entomological and ecological applications to study species' behavior and in quality control applications to study systems' behavior.

On The Residual Entropy of Conditional Distributions

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ABSTRACT

In the present paper we look into the problem of characterizing certain life distributions based on the form of the residual entropy function associated with conditional distributions.

Extreme Value Theory for Ordered Random Variables

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Abstract

Nadarajah, Anderson and Tawn (1998) developed a new branch of extreme value theory for random vectors (X, Y) constrained by the linear ordering $X < Y < mX$, $m > 1$. In this talk I will describe the main results of this work and some extensions of it.

Pattern Analysis and Phonetic Knowledge Base for Deciphering Phonetic Words in Pitman Shorthand

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ABSTRACT

The effort to automate the complete process of recognition of Pitman shorthand notation is an ambitious research target, which requires several phases. The present paper illustrates the most important phases viz. Pattern shape analysis and interpretation of phonetic words using phonetic knowledge base. Through a lot of pioneering work is reported pertaining to shape analysis with regard to character recognition in general, almost no literature is traced with regard to Pitman shorthand. Some primitive is reported by Leedham et al. Nagabhushan & Hemantha Kumar have suggested three different methods for shape analysis. In this paper we describe one of the methods for pattern shape analysis. This produces shape descriptors of the patterns used in Pitman shorthand. But this does not imply the building of the textual composition. This paper proposes to devise a suitable phonetic knowledge base to derive correct textual words from pattern shape prescriptors. Construction of the knowledge base is not a simple task, since such a knowledge base should overcome the problems of spelling and homophones. In brief, a two-stage procedure is presented to decipher phonetic words in Pitman shorthand.

Object Recognition through the Analysis of Spatial Relationships: A Study of Two Models

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ABSTRACT

Feature extraction in 2D-object recognition is a basic problem in pattern recognition and computer vision. The perception of spatial relationships among the components of an object is one of the important selection criteria to discriminate objects. Based on 9DLT (Nine Directional Lower Triangular) matrix, a matrix which preserves pairwise spatial relationships among the components of an object, algorithms for object recognition are proposed. However, the algorithms are not invariant to object transformations. In this paper, an alternate method for object recognition is proposed by transforming the physical image of an object into symbolic image, a logical image, by employing a knowledge base. A new concept called Triangular Spatial Relationship is used as an improved method over 9DLT methods to take care of object transformations.

Motion Planning for Autonomous Vehicles

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ABSTRACT

The autonomous vehicles in sentrying the forward areas and ammunition factories will have a great value as we can avoid human lives being at risk. In this paper a new approach is presented to identify the sensitive points of sentrying, planning its motion, finding the shortest path from one point to the other, and minimum number of autonomous vehicles to cover the entire restricted area. The free space associated with the sensitive points for motion planning of the autonomous vehicle is found using the cellular automata. The cellular automata evolve from the boundary of the sensitive points in four directions to form a Voronoi diagram. From the Voronoi diagram we define a symmetric Di-hypergraph and explain the sentrying and efficient motion planning of the autonomous vehicle.

Distributed Computing for Recognition of Occluded Object Patterns

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ABSTRACT

Recognition of occluded objects is still generally an open problem. The proposed work concerns with recognizing occluded objects. Occlusion occurs when two or more objects in a given image touch or overlap with one another. This problem has been reported as one among the more difficult of problems related to automatic assembly in production industry. A subtask associated with this concerns with problem of using computer vision to recognize and locate overlapping parts as the bin contains many parts . In any recognition system the type of objects that might appear in image dictates the type of knowledge that is needed to recognize object. The relationship between the features describes the object. We have adopted a method using local features to identify the occluded objects. A local feature is a feature that depends only on a subset of the object. If an object in the scene is only partially visible it can still be recognized using local features that do not depend upon the hidden parts of the object

In this paper we discuss a new method to recognize objects called the Future indexed hypotheses method. This avoids some of the problems of earlier methods. Recognition time grows only as the square root of the object set, and unique features are not required, which may be difficult to find. Instead of unique features, features common to several objects in the object set are used. For each feature, a list is kept where it occurs in each object type. When a match is found for a feature in an image, objects are hypothesized for each object identity and orientation in feature's list. Each of these objects is then tested using matching procedure to determine which, if any, are correct. Feature matches can be slow because often the entire image must be searched, and the matching process at each image point is trivial. Hypothesis tests can be faster because no search is involved.

Concomitants of Order Statistics

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ABSTRACT

Let (X, Y) be a random vector having an absolutely continuous cdf $F(x, y)$. Suppose we have a random sample of size n from F . For $1 \leq i \leq n$, the Y value associated with the i -th X order statistic is known as the concomitant of the i -th order statistic or the i -th induced order statistic. These sample statistics play a useful role in several areas, for example in (genetic) selection and breeding experiments, inference on correlation and regression coefficients, the analysis of censored bivariate data, ranked-set sampling, bootstrapping, and in file-matching procedures. We provide a brief historical review of the research in the area of concomitants of order statistics and describe the basic distribution theory. We also introduce several useful functions of the concomitants and discuss their properties and applications. Furthermore, we discuss recent developments in the theory and applications of concomitants, and of bivariate vectors consisting of selected order statistics and their concomitants.

Stochastic Modeling For HIV/Aids Endemic

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ABSTRACT

India is the most densely populated country in Asia and the second most populous country in the world with about 1000 million people. The rapidly spreading HIV syndrome is expected to place enormous demands on healthcare facilities. Statistical modeling of the disease is very useful for estimation of current and future numbers of HIV seropositives and forecasting healthcare needs. This paper discusses the need for and various types of modeling of the virus infection and points out their limitations. Due to the presence of chance variation in the disease process the need for stochastic modeling is stressed. Use of models, like stochastic carrier model and Markov models are illustrated. This article also highlights features of a good model apart from indicating the policy implications and difficulties of modeling for the available AIDS data in India.

Wavelet Based Parallel Solution to Boundary Value Problems

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Electrical Engineering
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ABSTRACT

Wavelet based solution to two point boundary problems is explored in this paper. Since the application of the wavelet solution to boundary value problems is new and recent, only simpler cases of boundary value problems whose solutions are known in literature have been attempted to establish the suitability of the method. Galerkin's Method has been used to solve the systems that are paralyzed at the time of solution of systems of equations to find the connection coefficients and the filter coefficients.

Moments based goodness-of-fit tests for the inverse Gaussian model

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ABSTRACT

The inverse Gaussian (IG) distribution, which was discovered by Schrodinger (1915) in the Brownian motion context and introduced in statistics as the limiting distribution of average sample number (ASN) in sequential analysis [Wald (1947)], is now widely used to model asymmetric data. The most recent application is in the context of Internet, see Huberman et al. (1998). This class of distributions shares considerable analytical elegance and many inferential similarities with the Gaussian distribution; see Folks and Chhikara (1978), Iyengar and Patwardhan (1988) and Mudholkar and Natarajan (1998). In this paper we develop goodness-of-fit tests for the inverse Gaussian assumption using sample version of the IG-skewness coefficient and of the IG-kurtosis coefficient, both introduced by Mudholkar and Natarajan (1998). The measures are functions of positive and negative sample moments, and have exactly the same asymptotic null distributions as their classical counterparts. We develop and examine use of these coefficients separately and jointly for detecting non-IG alternatives. The work is similar to that involving test statistics by Mudholkar, Marchetti and Lin (1998) for detecting non-normal alternatives. For references on the similar use of sample coefficients of skewness and kurtosis to test normality; see Chapter 7 in D'Agostino and Stephens (1986) by Bowman and Shenton.

Gracefulness of N-Cone $C_n K_n$

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ABSTRACT

Recently, in February 1998, in his survey, J. A. Gallian noted that the gracefulness of a double cone, $C_2(K_2)$ is not known. In this paper, this problem is solved partially. It is proved that $C_n(K_2)$ is not graceful for any $n \equiv 0$ or $3 \pmod{12}$. Also it is verified that, $C_2(K_2)$ is always graceful when $n \equiv 2 \pmod{4}$.

Almost Sure Limit Points of Record Values From Two Independent Populations

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ABSTRACT

In this paper almost sure limit points of record values from two independent populations are obtained

Growing Organizational Need for Quantitative Research In Information Processing: New Challenges and Opportunities for Statisticians

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Data collection and processing has long been an established organizational activity. With the growth in storage technology and a rapid decline in cost, organizations have accumulated massive amounts of data which are now appropriately referred to as data warehouses. It is believed that these data warehouses contain information of great strategic value. The question is how to find the appropriate information efficiently. In this context, a new approach known as 'data mining' has become increasingly popular. While data mining requires a multidisciplinary approach, its search engines are highly quantitative, relying heavily upon mathematical and statistical techniques. This paper will discuss new opportunities and challenges for applied research for mathematicians and statisticians to meet this new demand. The paper will further explore how collaborative research can be mutually beneficial to both organizations and professional mathematicians and statisticians.

A WWW Based Development Environment of Fourier Transform For Asynchronous and Distance Learning

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ABSTRACT

WWW based development environments for asynchronous learning or for distance learning, are tools on which increasing interest is mounting all over the world, both in university teaching and industry formation. The rapid growth of the Internet and of the multimedial extensions of the WWW allows new developments in the way knowledge can be transferred from teachers to students. Fourier transforms are important basic tools to be met in a great variety of applications going from the general signal theory to the specialized pattern recognition techniques. We have developed an interactive environment for Fourier transforms in Java language, using Applet forms as computational and graphic applications. In this environment, several kinds of Fourier transforms, both one-dimensional and two-dimensional, can be implemented and executed in HTML documents to be distributed on the WWW. The students can connect to the HTML documents through their browsers; they can activate the Applets, choosing the functions to be transformed and their meaningful parameters. The original function and the transform are computed and graphically visualized on the document. By changing the parameters, the student learns visually the classical properties of the Fourier transform theory. This WWW tool is going to be used in next spring as a side tool for students in an Image Processing course for electronics engineers at the University of Rome 3.

Order Restricted Inference in Balanced Mixed Models

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ABSTRACT

The randomized complete block design is one of the most widely used experimental designs to systematically control the variability arising from known nuisance sources. The balanced mixed effects model is usually appropriate for such an experiment when the blocks used in the experiment are randomly chosen. In applications with increasing or decreasing treatment levels, there is sometimes prior knowledge about the ordering of the treatment effects. The most commonly seen orderings include simple ordering, simple tree ordering and umbrella orderings with known or unknown peaks. A natural question is how to incorporate the prior ordering information in estimating the parameters in a balanced mixed effects model so that the estimated treatment effects are consistent with the prior information and the estimated variances of the block effects and experiment errors are nonnegative. In this paper we derive the maximum likelihood estimators of the parameters in a balanced mixed model subject to any partial ordering of the treatment effects, which includes the usual maximum likelihood estimators as a special case. An example is provided to illustrate the results.

Conservative Diffusions and Applications

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ABSTRACT

The stochastic differential equation of the Ito type involves multiplicative noise term driven by Brownian motion. The stochastic integral involved here ceases to exist as a Riemann-Stieltjes integral, since the Brownian noise is of unbounded variation. The core of Ito calculus is the integration by parts formula, with an additional quadratic variation term indicating time asymmetry, due to Levy's oscillation property of the Brownian paths. The usual Leibniz rule does not hold in Ito calculus. Yet, the Ito integral being a Martingale integral has its own advantages. The Stratonovich integral is a symmetric integral, with its integrand jutting out both in future and past directions being averaged. This calculus follows the rules of ordinary calculus, but this is not a martingale. A conformal martingale is a complex Brownian motion obeying the rules of ordinary calculus, in contrast to real Brownian motion. It can also be represented by a time change of complex Brownian motion. Skew product representation of Brownian motion enriches the beauty of conformal martingales in the study of stochastic differential equations. This representation enjoys homotopic aspects in the universal covering space and it is a suitable candidate for the analysis of topological problems. Space-time transformations are equivalent to the change of drift and time of the underlying diffusion processes coming under the family of conservative diffusions. The core of the analysis is that a standard Brownian motion is converted into the conservative diffusion with a Brownian speed measure and scale. We conclude this study with applications in Stochastic quantum mechanics.

Three Dimensional Hydro-magnetic Stagnation Flow of a Newtonian Conducting Fluid

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ABSTRACT

An analytical solution is presented for the steady flow of an incompressible, electrically conducting viscous fluid between two finite disks enclosed by a cylindrical container for small Reynolds number ($Re < 10$) in the presence of magnetic field. It is seen that low Reynolds number flow plays an important role in the centrifugal separation of fluid particles under micro-gravity conditions and also in micro-mechanics due to the miniaturization of fluid mechanical part. In this situation, the governing equations become linear and analytical solution is possible. The effect of the magnetic field on the tangential velocity is discussed in this problem for different value aspect ratio and rotation parameter.

Reproductive Rights and Reproductive Health: Structural Equation Analysis of Cross National Data from Developing Countries

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This paper attempts to empirically evaluate a pervasive public health model which argues that reproductive rights are essential for reproductive health. Yet, there has been no attempt to evaluate this proposition empirically. We attempt to develop scales using confirmatory factor analysis approach to measure reproductive health and reproductive rights. We will attempt to establish the reliability and validity of these scales. We further develop a model of the reproductive health and provide an empirical evaluation of the model using linear structural equation methods. Policy implications of the findings will also be presented"

On A Generalized R-Norm Entropy

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ABSTRACT

In this present communication we generalize R-norm information measure of a discrete probability distribution introduced by Boukee and Lubbe (1980). We characterize the proposed measure by applying infimum operation and axiomatically through a functional equation. We also discuss some algebraic and analytic properties of this measure.

Maximum Likelihood Estimation of Scale Parameter of Exponential Distribution Under The K Outlier Exchangeable Model

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ABSTRACT

This paper deals with the maximum likelihood estimation of scale parameter of exponential distribution under the exchangeable model with k outliers. Some results concerning ML estimators of (are obtained. It is shown that \bar{x} is the local ML estimator of (if $s < \bar{x}$, where \bar{x} is that sample mean and s is the standard deviation of a sample x_1, \dots, x_n from k outlier exchangeable exponential model with scale parameter.)

Evolutionary Spectral Methods for the Analysis of Climate Variables

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ABSTRACT

Time series methods are often used for analyzing many climatic variables, such as temperatures, rainfall and precipitation etc. In recent years the main concern is to find methods to detect changes, and if there are changes to find, what causes these changes. In particular we are concerned here in the analysis of global temperatures and Northern Hemisphere temperatures. Using evolutionary spectral representation, and the tests of nonstationarity of Priestley and Subba Rao, we show that both series are nonstationary, in other words, there is evidence that there is a structural change in the two series considered here. We also describe a statistical test for the change points, and this is based on a CUSUM test described by Subba Rao (1981). We also investigate the possibility of long range dependence in the series.

Certain Properties of Statistical Manifolds of Weighted Distributions and Related Estimation Problems

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ABSTRACT

In this paper, the differential geometrical properties of the statistical manifolds of the weighted distributions are presented. The concept of weighted distribution [Rao (1965)] is well recognized in applied statistics for modeling the size-biased data. While applying this concept, the experimenter, based on his knowledge about the possible sources of errors that produce the size-biasedness in the observations, selects the weight function for constructing the parametric model. Thus, the model actually used for the data analysis is a weighed version of the original model of interest. The selected weight function, often a function of a random variable that is being studied, becomes an in-built component of the weighted distribution and changes the structure of the original parameter space (i.e.the parameter space of the original population of interest). As a result the statistical manifold associated with the weighted distribution is a distorted version of the original manifold that is of primary interest to the experimenter. Therefore, understanding the effects of these structural changes on the estimation procedure becomes necessary. The differential geometrical properties, such as the Riemann-Christoffel curvature of a manifold, provides an important information about the distortion in the manifold. In particular, the knowledge about the variation in the curvature of a statistical manifold associated with different weight functions is useful in parameter estimation. Here, the curvature tensors for the weighted lognormal, inverse Gaussian and gamma manifolds associated with different weight functions are derived and the related implications on the parameters are discussed.

ON CIRCULAR ASYMMERTIC DISTRIBUTIONS

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In the literature on directional data, von Mises and Bingham distributions have been studied extensively. These distributions are symmetric. Many a times, the collected data clearly indicate the asymmetry property of the distribution. Hence it is essential to develop circular asymmetric models which include symmetric distributions. We establish some properties of circular symmetric distributions which can be used to identify whether a given circular distribution is symmetric or not. The proposed models are based on circular symmetric distribution(s) and an asymmetry-parameter. We develop asymmetric models by considering an asymmetry parameter and using: a) a unimodal symmetric distribution b) two unimodal symmetric distributions c) the technique of conditioning on a bivariate random vector and d) closed contours.

Computer Science Teaching a Fundamental Question

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ABSTRACT

Among different problems concerning education and technology, a difficulty is faced everywhere in the world and is particularly perceived in the developing countries where problems of capacity and access in relation to computers infrastructures are experienced. An obstacle emerges in Computer Science teaching (Di89) and is expected to be resolved. Difficulties in terminology, in lessons' definition, in the introduction to topics are faced in any school (Sc93). Technical equipment are stated as facts and are not deduced from general principles. Informatics teaching is concerned on specific and operating contents better than on conceptual bases. Informatics lessons are centered on "how to do it" rather than "why to do it", and knowledge is based more upon memory than upon reasoning. All these are examples of substantial and not psychological or expressive problems.

Prediction of Future Order Statistics and Pseudo Complete Sample Technique in Type II Censored Sample - A Comparison With Reference to Some Life Testing Models

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ABSTRACT

An iterative procedure is considered to calculate the missing order statistics in a type II right censored sample from exponential, rayleigh and logistic distributions thereby making the corresponding sample a pseudo complete sample in each case. The respective scale parameters of the distributions are then estimated by employing standard complete sample estimators to make a comparative study.

On Markovian Behavior of Daily Rainfall at Hisar

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ABSTRACT

Simple Markov chain models has been used in the past to describe rainfall occurrences, which tend to reveal the existence of stochastic dependence. Such Markov chain models give the basic probable representation for the distribution of dry and wet days conditional upon the previous day. But there have been instances in the literature that the simple Markov chain model is not able to depict the daily rainfall properly and second or higher order Markov chain models are preferred. With this background, this study was undertaken to determine the proper order of the Markov chain that would be appropriate to represent conditional dependence of daily rainfall at Hisar during southwest monsoon period (June-September). Further, an attempt has also been made in this paper to find out other properties of rainfall occurrence patterns and the effect of sample size on the order of the Markov chain.

The transitional probabilities were estimated for the Markov chain-of-order one, two, three, four and five. To form a decision procedure for the identification of the order of the Markov chain, a loss function has been defined which is composed of two counter-acting terms representing the log-likelihood ratio and the degrees of freedom. The selected order of the Markov chain is the one that minimizes the sum of these two terms. Daily rainfall data of Hisar for 25 years (1972-96) for S. W. Monsoon period were collected and analyzed for the illustration. Data were grouped into blocks of 5, 10, 15, 20, and 25 years. A 4th order Markov chain model has been selected as the best choice to depict the daily rainfall dependence process of Hisar. Regarding the effect of sample size on the order of Markov chain it has been found that as the sample size increased from 5 to 15 years, the order of Markov chain increased from 2 to 4 and then it is stabilized afterwards. The minimum sample size that yields a stable estimate of the proper order is estimated to be 15 years.

A Solution to TSP through the Concept of Mutual Nearest Neighborhood

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ABSTRACT

Several algorithms have been put forward to solve TSP. One would still prefer to employ an improved search strategy such as Branch and Bound, which is a pseudo exhaustive search strategy. The major thrust in employing such algorithms is to reduce the time of computation, which certainly exhibits a trade off with the solution optimality. In this research work, we have proposed an alternate approach, which has its origin in Pattern Recognition application. In the field of Pattern Recognition, newer and newer distance measures are proposed for cluster analysis, the sole aim of which is to bring together, those set of points which are highly similar. In other words in the terminology of geometry, they are the points that are in close proximity with each other. One of the successful distance measures is called mutual nearest value (MNV) defined on the basis of mutual nearest neighborhood. Mutual nearest distance value focuses on two way nearness between the points which is more philosophical and practical than one way nearness, which is perhaps an oversimplified model to reduce the implementation difficulties. The proposed new approach employs MNV to link two mutually nearest points. The process is methodically nested, again based on MNV, to establish links between already linked set of points, ultimately generating a feasible solution to TSP. The superiority of the proposed Pattern Recognition based (MNV based) method is brought out by comparing the performance of the method with the performance of a classical method based on Branch and Bound strategy.

An Example of the Use of Computer Applications for Education to a Problem on Inverse Probability Measures

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ABSTRACT

We show in an example how computer applications for education can help heuristic and teaching of mathematics. We consider the subject of inversion of measures and in particular probability measures. Two measures are said to be inverse measures if their cumulant functions (the natural logarithm of their Laplace transform) are inverse functions, i.e. their composition is equal to identity function. The most famous example of inverse measures is given perhaps by the Gaussian and Inverse Gaussian. The problem regarding the inversion of a positive measure is that its inverse measure is not, in general, a positive measure. A probabilistic interpretation can be given in some cases to inversion but in general is still lacking. We develop some examples, using the software Mathematica, on positive measures with inverse measures positive and others non-positive. The heuristic leads to the rigorous proof of following result: if a is a real number larger than 0 and less or equal to 1, then every measure concentrated on the numbers $a, a-1, a-2, a-3, \dots$ has the inverse positive measure. Moreover the inverse measure is explicitly computed.

Moment Invariants and Legendre Moments in Pattern Recognition

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ABSTRACT

This paper discusses the use of moment invariants and orthogonal moments in pattern recognition. Moment invariants, based on the algebraic invariants, are used to recognize binary patterns. Seven moment invariants defined by Hu are used in the experiment and their performance are examined both in noise free and noisy environments. The experiments are conducted using nine binary patterns A, B, C, D, E, F, J, K, 8. The patterns are represented in 15(15 pixel frame. For each pattern five error contaminated patterns are generated by introducing error which is Gaussian with mean zero and variance four. The paper also discusses the advantages of use of orthogonal moments in pattern recognition over ordinary and central moments. Few functions of orthogonal (Legendre) moments are proposed for recognition of patterns both in noise free and noisy environments. The performance of the proposed functions of orthogonal moments are compared with that of moment invariants.

A Note on Central Limit Theorems for Lattice Models

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ABSTRACT

This paper introduces the m -dependence concept for two dimensional lattice models. The central limit theorem for (m_1, m_2) dependent two dimensional lattice models under very mild conditions is presented. A weighted central limit theorem for the (m_1, m_2) dependent two dimensional models is also established under some conditions on the weights. The results are useful in inference related problems involving lattice models. Some simulation results are presented.

Confidence Bounds for Isotonic Functions with a Focus on Partially Ordered Sets

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ABSTRACT

A brief review of known results for simultaneous confidence bands on isotonic functions of one variable is given from a unified viewpoint. Several modifications of Lee's (JASA 1996) procedure are discussed. New simultaneous confidence bands are given for isotonic functions on partial orders, with particular attention paid to p -dimensional Euclidean space.

On Ifr (Dfr) Classes of Distributions

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ABSTRACT

In this paper we give a characterization using mean residual life function for IFR (DFR) classes of distributions in the Pearson family. We also develop an analogous result for the discrete Pearson system

A Note on Complements in N-Groups with Fgd and Related Graph

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ABSTRACT

The set of all complement ideals of an N-group H (where N is a near-ring) with finite Goldie dimension was considered. An equivalence relation on this set was defined and the related equivalence classes were obtained; a directed graph on a set of equivalence classes was obtained; and finally it was proved that the graph obtained is a directed hypercube of dimension n, where n is the Goldie dimension of H.

A Note on Directed Hypercubes of Dimension N

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ABSTRACT

Let X be a set with $|X| = n$. Take $V = \{x\}$, the power set of X and $E = \{AB \mid |A| = |B| + 1 \text{ and } A \supset B\}$. Then the graph $G = (V, E)$ is a directed hypercube of dimension n. It was proved that $d(P, Q) = |P \setminus Q|$ is true, for any vertices P, Q in a directed hypercube of dimension n. This result was applied to the directed hypercube of some class of equivalence classes of components in N-groups where N is a near-ring and obtained some consequent results.

Estimation of Non – Identifiable Parameters in a Series System

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ABSTRACT

In reliability theory we often encounter situations in which minimum of the lifetime of the components of the system is only observable. In many such situations parameters of the life distributions of the components are non-identifiable. A well-known example is a series system with two independent components. When the life times of the components are exponential with parameters λ and μ (respectively, the parameters are non-identifiable by observing $X = \min(Y, Z)$, where $Y \sim E(\lambda)$ and $Z \sim E(\mu)$ are the life times of the components. We suggest a method to obtain consistent estimators of the parameters λ and μ . The method that we are proposing is to replace the model $X = \min(Y, Z)$ by $X = \min(Y, Z(\alpha))$, where $Z(\alpha)$ is a Pareto type variable which converges in distribution to Z as α becomes large. We show that in the probability model of X the parameters λ and μ are identifiable. Estimators of λ and μ are proposed and their properties are discussed. A method to determine the value of α is also discussed.

Support Regularity of A Graph

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ABSTRACT

Let $G(V,E)$ be a connected graph. For a vertex $v \in V$, the support of v , $S(v)$, is defined as the sum of the degrees of its neighbors. A graph G is said to be support regular if the support of all the vertices are same and G is said to be highly unbalanced if the support of all the vertices are distinct. A graph G is said to be biregular if the degree set of G contains only two elements and any two adjacent vertices of G have different degrees. In this paper the following results are obtained. There is no highly unbalanced tree. For any $n \geq 6$, there exists a highly unbalanced graph of order n . $K_{1,n-1}$ is the only regular support regular tree. G is a support regular graph if and only if G is either regular or biregular. Moreover, many facts and observations on the support regularity of a graph are observed in this paper.

Mathematical Modeling of Bionet

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ABSTRACT

This paper deals with mathematical modeling of Bionet. Bionet is a new artificial neural network model developed for diagnosis of diseases. It is a feed-forward neural network model having adaline type neurons. Bionet has been developed based on the neurophysiology of the human nervous system which are given as hypotheses for the development of Bionet. Bionet has been proved to be a successful neural network for diagnosis of diseases.

Whether Combinatorics in Nonparametrics: The Lost Horizons

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ABSTRACT

In the early developments of nonparametrics, under the disguise of distribution-free methods, the combinatorics played a dominant role. Although some of the basic methodology has gone through an evolutionary uplift with permutational central limit theorems in their diversities, as well as in more recent works on martingales for lattice-path counting and other combinatorial setups, in a broader nonparametric perspective (where robustness dominates over distribution-freeness), there is a profound need to de-emphasize combinatorics to a certain extent and to allow asymptotics to come up with more adoptable resolutions. A critical appraisal of the basic combinatorial tools in modern nonparametrics is made with due emphasis on applications in clinical trials and reliability models. The impact of contiguity of probability measures is studied in combinatorial martingale theorems, and applications to statistical inference are stressed.

Biorthogonal Polynomial Distribution and its Application in the Reliability

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ABSTRACT

Kobayashi (1991) has defined generalized gamma function with its possible application in Reliability theory. He also studied displacement phenomenon of the corrosion problem in a new machine or metal fatigue also discussed. Recently Agarwal and Kalla (1996) have defined generalized gamma functions, by slightly modifying the form of Kobayashi's generalised gamma functions. In this paper, we define a new type of generalized gamma distribution involving biorthogonal polynomial $Z_n(\cdot)$ as suggested by Laguerre polynomial for univariate. Almost all classical probability distributions are obtained as special cases including Kobayashi (1991) and Agarwal and Kalla (1996). Expressions for r th order raw moment about origin and moment generating function, mean, variance, characteristic function, hazard function and integral transforms have been worked out for generalized gamma distribution involving $Z_n(\cdot)$.

Comparison of Linear Discriminant Analysis and Neural Networks

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ABSTRACT

In this paper we have made an attempt to study the performance of a Neural Network (NN) with that of a linear discriminant (LD) approach on a comparative basis. In this we implemented a NN (Back Propagation Algorithm) for three physical science problems. The three basic problems we have classified and predicted are some properties and crystal structure of the elements in the periodic table, and classification of stars in an Hertzsprung & Russell H.N. (H-R) diagram. For the first problem we have taken eighteen independent physical parameters for each element and trained the network from atomic number (AN) 1 to 95. And based on this trained network, predicted the behavior from AN 96 to 105 and achieved 100 percent accuracy, subsequently we extended it to predict the properties of elements from AN 106 to 120. Classification parameters are the nature of the elements (Superconductor (SC) or becomes SC at high temperature or undergoes magnetic ordering or SC at very low temperature), number of isotopes it has, number of stable nuclei, its spin and parity. In the second problem of crystal classification we trained the NN from AN 1 to 84, based on this trained network the crystal structure of elements from AN 96 to 120 are generated. The third problem is related to the classification of stars in an H-R diagram. In this case we have taken five different classes viz., White dwarfs, Hot Subdwarfs, Main sequence, Normal giants and Red giants, for each class we have taken B-V color index, Absolute magnitude and Absolute temperature as the input features. For classifying the output we have taken 28 stars belonging to all five classes and achieved accuracy of 86.6 %. We trained the supervised NN by taking the input features of each class in max-min-max sub-array in a Generalized Delta Rule. We would like to call this algorithm as max-min-max Generalized Delta Rule (GDR). The same problems were tested on LD method. Finally the results of NN and LD are compared and we found that the supervised NN performs much better than LD.

**Generalized Exponential Autoregressive Modeling:
A Paradigm Combining Statistical Model and Neural Network**

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ABSTRACT

This paper proposes to consider the task to specify the state-dependent coefficients of the state-dependent model as a problem of function approximation, and then neural network function approximation is naturally introduced to the problem solution without any loss of generality. Here we apply the Gaussian radial basis function (RBF) to specify the state-dependent coefficients, and accordingly the state-dependent AR model can be rewritten as RBF-based AR (RBF-AR) model. It is found that the RBF-AR model is practically equivalent to the generalized exponential autoregressive (GExpAR) model provided by Ozaki by taking the original idea of the classic exponential autoregressive (ExpAR) model. Moreover, by comparing with the directly RBF neural network modeling for some complex data sets, it has been also found that the GExpAR model has much better performance than the RBF neural network for its smaller predicting error and especially for the problem reduction of "the curse of dimensionality" which is regarded as one of the potential difficulties in RBF neural network modeling.

**Instantaneous Failures of Components in Freund's Bivariate Exponential Model
For Two Components Parallel System**

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ABSTRACT

In the class of bivariate lifetime distributions, bivariate exponential distributions (BVEDs) play a central role in life testing, reliability and other fields of applications. Freund (1961) introduced a BVED as a model for the distribution of (X, Y) the failure times of dependent components (C_1, C_2) . This model is appropriate in the more usual situations, where failure of one component weakens a second, so shortening its life without actually causing catastrophic failure. In reliability and life testing experiments on two component systems many times instantaneous failure of one or both components are observed. This phenomenon may be due to faulty construction or may be defective parts or may be due to a fatal external shock. In this paper we have proposed a mixture failure model to accommodate instantaneous failures. Various statistical properties of the model are investigated, including maximum likelihood estimates of the parameters and their distributions.

Availability Analysis of Container Manufacturing Plant

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ABSTRACT

A container (used in sugar industry) manufacturing plant is analyzed for its availability. The plant consists of three main parts namely, (i) main shell construction unit, (ii) dish construction unit and (iii) dish fitting unit. Out of these units the main shell construction unit is the major and important unit of the plant and is the topic for discussion of this paper. Birth and death equations governing the system are formed, taking constant failure and repair rates, using Markov method. These equations are solved to obtain the expression for availability function of the system. System behavior study is given followed by special cases along with tables for plant situated in Haryana. The results so obtained are useful for reliability engineers.

Stochastic Modeling and Analysis of A Mixer-Crane System of Steel Melting Shop Area in an Integrated Steel Plant

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ABSTRACT

This paper deals with the stochastic modeling and analysis of a Mixer-Crane system which plays an important role in the steel melting shop area which is comprised of mixer, furnace, stripper yard and mould yards. This mixer-crane system is helpful in the process of making blooms that is the raw material in the manufacturing of rails and structural. Two mixers are installed in this area that work parallel and help to maintain the temperature and composition of pig iron which is obtained from the blast furnace area in liquid form. One crane is attached to each mixer that helps in pouring the liquid pig-iron into the mixer. Once the composition of the hot metal is changed inside the mixer, it is sent for further purification. Besides regular repair; cold repair, capital repair and shut down repairs are also performed. Failure time distributions are taken to be negatively exponential, whereas repair time distributions are taken to be arbitrary. Using regenerative point technique, several system characteristics that are useful to the system managers and designers are evaluated. At last some graphs are plotted in order to highlight the important results.

On Some Properties of the Modified Generalized Gamma Distribution

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ABSTRACT

Statistical distribution such as gamma, weibull, exponential have many applications in reliability and diffraction theory. These distributions are reasonable models for the life distribution of a device. Agarwal and Kalla (1996) considered a new generalization of gamma distribution that generates a family of gamma distributions. The properties such as skewness kurtosis and general moments of this model have been studied in this paper. In the wave scattering, diffraction and reliability theory, generalized gamma models have shown considerable applications.

AGARWAL S.K. and S.L.KALLA 1996:A generalized distribution and its applications in reliability, Communications in Stat. Theory and Methods, 25(1), pp.201-210.

Statistical Methods for Comparing Expert Opinions

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I propose to review the literature on probabilistic and inferential methods for comparing expert opinions. Interesting open problems will be presented

An Elimination Type Sequential Procedure for Partitioning a Set of Normal Populations Having a Common Variance

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ABSTRACT

In this article we revisit the problem of partitioning a set of normal populations, with respect to a control population, into two subsets according to their unknown means, under the indifference zone formulation. For this problem Tong (1969) constructed a two-stage and purely sequential procedures and recently Datta and Mukhopadhyay (1998) have considered various multistage methodologies emphasizing the second-order asymptotics. However, all the sampling designs available in the literature, for given values of design parameters, determine the sample size N , a random number, common to all the populations. And then based on N measurements from the each population, regardless of how "superior" or "inferior" some populations are with respect to the control, a correct partition is obtained with the prespecified probability of correct partition. We propose truncated elimination type sequential procedure using Paulson's (1964) elimination idea, which has the desirable property of maintaining the sample size to be the smaller from such "superior" or "inferior" populations. Theoretical results are obtained to show that the proposed elimination-type procedures maintain the probability of correct partition above a prespecified level. The proposed procedures are studied and compared via the Monte Carlo simulation studies with other competitive procedures known in the literature, under both the LFC and some non-LFC configurations. The proposed elimination-type truncated procedures are found to be vastly more efficient than its competitors.

Statistical Analysis of United States Postal Addresses

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ABSTRACT

This paper studies the information content in the United States postal addresses and the use of information to rank processing priority for handwritten address interpretation. Two types of information are analyzed, information from postal address directories and information from mail stream. The information interaction of any combination of digits and characters in five-digit ZIP Codes and state abbreviations was investigated to show the average number of candidate values for each condition. The provided information can suggest efficient ways for determining digit values and interpreting character strings. For example, if the value of the first ZIP-Code digit needs to be determined, excluding the recognition of the digit itself, the average number of candidate values in this digit position is 1.032 if a state abbreviation is recognized, the number is 1.016 if a state abbreviation and the second ZIP-Code digit are recognized, and the number is 1.008 if a state abbreviation and the third ZIP-Code digit are recognized. It indicates that the recognition of a state abbreviation can greatly reduce the uncertainty of the first ZIP-Code digit value and the recognition of the third digit is more effective than that of the second digit in this case. By ranking the average number of candidate values for every condition, the rank of processing priority is also formed. This scheme can interactively suggest processing flow based on already available information. This work will be extended to carry out the study on the delivery points in the United States.

Orthogonal Graphs

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ABSTRACT

In this paper we define an inner product among graphs and study the property of orthogonality among graphs.

Domination Number of the Pieces Used in Aadu Puli Aattam (Goat-Tiger Game)

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ABSTRACT

Rural people in Tamilnadu play a game called the Aadu Puli Aattam (Goat-Tiger game). It is a popular game where we use two types of pieces called Tiger and Goat. There will be three pieces of Tiger and nine pieces of Goat. A person playing with Goat is said to win if he places his Goats in such a way that the Tigers are immobilized. A person playing with Tiger is said to win if all the Goats are killed. A special type of board is used with 23 points of intersection. Pieces are placed only on points of intersection. A Tiger can eat an adjacent Goat if there is a vacant point next to Goat. Our aim is to determine the domination numbers of Tiger and Goat. The differences between this problem and the usual chess problem are that the purposes of the two players in the Goat - Tiger problem are different.

Mathematical Modeling of Bionet

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ABSTRACT

This paper deals with mathematical modeling of Bionet. Bionet is a new artificial neural network model developed for diagnosis of diseases. It is a feedforward neural network model having adaline type neurons. Bionet has been developed based on the neurophysiology of the human nervous system which are given as hypotheses for the development of Bionet. Bionet has been proved to be a successful neural network for diagnosis of diseases.

Biorthogonal Polynomial Distribution and its Application in the Reliability

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ABSTRACT

Kobayashi (1991) has defined generalized gamma function with its possible application in Reliability theory. He also studied displacement phenomenon of the corrosion problem in a new machine or metal fatigue also discussed. Recently Agarwal and Kalla (1996) have defined generalized gamma functions, by slightly modifying the form of Kobayashi's generalized gamma functions. In this paper, we define a new type of generalized gamma distribution involving biorthogonal polynomial $Z_n(\cdot)$ as suggested by Laguerre polynomial for univariate. Almost all classical probability distributions are obtained as special cases including Kobayashi (1991) and Agarwal and Kalla (1996). Expressions for r th order raw moment about origin and moment generating function, mean, variance, characteristic function, hazard function and integral transforms have been worked out for generalized gamma distribution involving $Z_n(\cdot)$.

Diagnosing Appreciable Difference between Two Estimates

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ABSTRACT

This paper proposes a new criterion to judge the superiority of one estimator over the other for applied workers.

(M, M) Machine Repair Problem with Spares And Reneging

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ABSTRACT

In this paper, we develop a machine repair model with reneging for (m, M) system wherein the system will fail when all spares are being used and there are less than m machines in the system, In case of all busy repairmen, the repair rate of failed machines are assumed to be the faster than the situation when at least one repairman is free. The transient analysis has been provided by solving a set of linear equations in terms of Laplace transformation of the state probabilities.

Modeling Hospital Discharge Counts across Zip Code Areas in Alabama

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ABSTRACT

Studies have indicated variations and related reasons for the utilization of hospital services and health care medical facilities by community residents. This paper models hospital discharge counts data using generalized Poisson regression (GPR) models. The GPR models are used to model data that shows over-dispersion or under-dispersion or equi-dispersion. The models have been shown to have statistical advantages over Poisson regression, compound Poisson regression, inverse-Gaussian-Poisson, and negative binomial regression models. The effects of selected covariates on three categories of diagnosis-related groups (DRGs) hospital discharges across zip code areas in two Alabama counties have been modeled using both Poisson regression and GPR models. The GPR models outperformed Poisson regression models except where the variation in DRGs hospital discharge counts across zip code areas is relatively small. The results of this study show that household size, education, and income are positively related to DRGs hospital discharges. Also, the results support the hospital discharge findings of Wilson and Tedeschi (1984), Kudur and Demlo (1985), Wennberg and Freeman (1987), Wolfe et al. (1991), and Gittlesohn et al. (1991). The models are estimated by the method of maximum likelihood. Approximate tests for the dispersion and goodness-of-fit measures for comparing Poisson regression and GPR models are discussed

A Multiple Three-Decision Procedure: Exponential Case

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ABSTRACT

Let an observation from population i follow exponential distribution with probability density function (pdf) $f(x|i) = (1/\theta_i) \exp[-(x-\theta_i)/\theta_i] I_{\theta_i}(x)$, where $I_{\theta_i}(x)$ is the indicator function, $i = 0, 1, \dots, k$. Population $i=0$ is called the treatment (control) population, $i = 1, \dots, k$. A multiple three decision procedure based on equal sample sizes say n from the treatment populations and a sample size n_0 (possibly different from n) from the control population, for two sided comparisons of treatments better than the control ($\theta_i - \theta_0 > 0$) and the treatments worse than the control ($\theta_i - \theta_0 < 0$), on the lines of Bohrer (1979), Bohrer et al. (1981) and Liu (1997) will be proposed such that the probability of no misclassification is at least $1 - \alpha$ ($0 < \alpha < 1$) irrespective of the configuration of $\theta = (\theta_0, \theta_1, \dots, \theta_k)$. Scale version of this problem will also be dealt with separately. Constants necessary for the implementation of the proposed procedure for the location as well as the scale parameter cases will be provided.

Approximation of a Harmonizable Isotropic Random Field

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ABSTRACT

The class of harmonizable processes and fields are a natural extension of the class of stationary processes and fields. Random fields admit an additional property called isotropy. Harmonizable isotropic random fields have been recently developed by M. M. Rao and R. J. Swift. In this talk, a method of approximating a harmonizable isotropic random field by a stochastic series is considered. Error estimates for this approximation are obtained. The results are directly related to the numerical simulation of a harmonizable isotropic field.

A Hierarchical Clustering Technique in Biological Sequence Analysis

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ABSTRACT

The cluster analysis or the unsupervised classification has been one of the most prolific areas of the multivariate statistics for the last few decades, whose development was triggered by the advances made in computational technologies. Now the molecular biology is generating a huge amount of data that need to be analyzed, and a large proportion of these data consists of biological sequences. The aim of this paper is to present one of the hierarchical clustering techniques based on a probabilistic measure of similarity between objects and an aggregation criterion consistent with that framework. Biological sequences are a very special kind of data that need a special treatment. This paper then deals with the problem of measuring similarity between the biological sequences - before or after they have been aligned - and also of tuning the various parameters. One of the applications illustrating the use of such methods concerns the phylogenetic trees obtainable from a classification of a set of proteins coming from various organisms. A more recent application is concerned with the functional prediction of a protein from the MIP (Major Intrinsic Protein) family using the sequence classification method and the selection of a meaningful similarity matrix between amino acids. The problem is the following. Presently, two functional types have been well characterized in the MIP family: (1) the specific water transport by the aquaporins (AQP) and (2) the small neutral solutes transport, like glycerol by the glycerol facilitators (GLPF). This application shows how the hierarchical classification method presented earlier may be used for predicting the function of a particular protein given its sequence. Moreover, the automation of the parameter tuning procedure will render this tool very helpful in data mining in biological databases.

Image Recognition and Segmentation

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ABSTRACT

The general problem of image recognition and segmentation is solved using two different neural algorithms. The application to face recognition is explained as an example. Other important issues which can be treated with these two powerful algorithms are medical images, images from near field microscope, teaching. The face recognition is the most difficult problem and it will be used as a template problem. First is considered the case of a face which had local transformation like smile or rotations with a uniform background. The Dynamic Link Network algorithm of von der Malsburg is described as a useful approach for tackling this problem and some results are given. The mathematical problems connected with this algorithm are explained. The stability of certain neural configurations (blobs) are discussed and the use of stochastic dynamics to overcome the difficulties of the recognition process is shown. The problem of non uniform background is dealt with the use of a particular dynamic of relaxation oscillators introduced by Wang and Teman. This dynamic is able to extract different homogeneous parts (segmentation) of an image. We show a modification of this algorithm which has been shown useful for the application of medical images and images from the near field microscope (STM, FEM, SNOM).

Estimation of Parameters under Structural Change

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ABSTRACT

In this article the linear regression model with structural change due to unequal variances is considered. Assuming the variance – covariance matrix of the population is unknown, a feasible version of generalized least squares estimator is developed. The efficiency properties of these estimators are studied. The large sample asymptotic approximation theory is employed to derive the efficiency properties of feasible generalized least squares estimator under two cases, viz, when the observations in both the halves increases and when the observations in one half are fixed and the observations of other half becomes large.

The Definition of Probability as a Result of the Communication Learning Process.

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ABSTRACT

The objective frequentistic approach and the subjective one are considered as part of the learning process. In order to explain-justify the process result to other persons a subjective intuition has to become objective argument. A definition is proposed to combine effectively the richness of the subjective knowledge and the need of objectivity.

Modeling Intervention when the Pre- and Post-Counts are Correlated

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ABSTRACT

Most experiments in the biological and engineering sciences yield data in the form of counts. Examples include the number of individuals suffering from a disease, number of defective items produced by a manufacturing process etc. In such experiments, it is often necessary to intervene to postpone or possibly stop the failure of the component or individual. For example, public health officials might resort to preventive measures like inoculation to prevent outbreaks of diseases like cholera or malaria. In manufacturing processes, changes or adjustments to the components of the manufacturing line or even repairs are often made to improve the quality. The models currently in use for intervention are based on the Poisson distribution under the assumption of independence of pre and post counts. Based on a bivariate Poisson distribution that accommodates dependence of pre and post intervention data, we derive the distribution of the total number of counts. Maximum likelihood estimators of the model parameters will be obtained and hypothesis tests developed to assess the effectiveness of the intervention. Examples will be provided for the procedures developed.

Limit Results of Moving Max and Moving Mex

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ABSTRACT

In this paper, the almost sure limit results of properly normalized moving max and moving mex of i.i.d non-negative integer random variables having an exponential decay rate are discussed.

Density Convergence under Geometric Domain of Attraction

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ABSTRACT

In this paper, density convergence has been established for the normalized geometric sums of sequence of i.i.d random variables with a common distribution function belonging to the geometric domain of attraction of n geometric stable law. The generalization to geometric domain of partial attraction of geometric semi-stable laws is discussed

Recent Developments on Estimation after Subset Selection

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ABSTRACT

Let $(1, 2, \dots, k)$ denote k populations, where (i) involves the unknown parameter (i) . Let X_i denote the sufficient statistic for (i) , $i = 1, 2, \dots, k$, based on a sample of size n from the i th population. Suppose a subset of random size is selected from the given k populations using Gupta's subset selection procedure. The problems of the simultaneous estimation of the parameters associated with the selected populations will be addressed. These problems, called "estimation after subset selection", are of recent origin and arise in various practical situations. Recent developments in this area will be discussed in detail. Special emphasis will be given to the case when (i) is a gamma population with (i) as the unknown scale parameter and with known shape parameter. The empirical Bayes estimator for the selected scale parameters are obtained. It is established that the empirical Bayes estimator is inadmissible and the improved estimators are also derived.

Ultramine Spaces in Statistics

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ABSTRACT

Statistics is the first field of science where the notion of ultrametricity appeared, outside mathematics. While the structure produced by an ultrametric function and its role in statistics are known, it is interesting to consider the dual space of ultrametrics, by substituting the ultrametric inequality with the ultramine one. The ultramine function have been utilized to improve hierarchical representations or to evaluate the "shape" of the data, before calculating any approximation of initial data set in a cluster analysis context. In this paper some properties of ultramine functions are analyzed and some algorithms are proposed to derive different ultramine approximation matrices of the initial dissimilarities between elements. The aim is to stress the validity of ultramines as representations of the proximities, which can be used both as an alternative to or jointly with the ultrametrics ones.

Circulant Graph Isomorphisms – Type II

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ABSTRACT

In this paper a new type of isomorphism different from isomorphism which is taken as type I isomorphism is defined and considered as the type II isomorphism between special type of circulant graphs and listed all pairs of type II isomorphic circulant graphs on 16 points.

Analysis of Extended Nonlinear Dynamical Systems with Nonparametric Regression

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ABSTRACT

We present a method for the identification of nonlinear spatiotemporal dynamics from experimental data [1]. We use a model in the form of a partial differential equation (PDE) and formulate an optimization problem for its estimation from data. The solution is found as a multivariate nonlinear regression problem of the partial differential operators that have to be estimated from the data field. It can numerically handled using the ACE--algorithm [Breiman and Friedman, J. Am. Stat. Assoc. 1985]. The result is an estimate of the nonlinear dynamical system (the PDE) in a nonparametric way, i.e., one is not restricted to a certain functional form and can use a quite general ansatz for the model. The method allows for the analysis of high-dimensional chaotic as well as transient dynamics. Since the whole system is reconstructed, the analysis of a single transient state enables one to make predictions also for the possibly not measured asymptotic behavior of the system. The procedure will be applied to several numerical examples and experimental data. Finally, the requirements on the data and issues concerning the uniqueness and stability of the result are discussed.

[1] H Voss, M J Buenner, and M Abel, Identification of continuous, spatiotemporal systems, Physical Review E 57, 2820-2823 (1998).

Applications of Bootstrap Method in Two-Stage Shrinkage Estimation

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ABSTRACT

In this paper the applications of bootstrap methods in two-stage shrinkage estimation of the mean of a normal distribution are discussed. It is well known that determining the shrinkage factor is an important and at the same time a complex issue in any shrinkage estimation. In particular, since the efficiency of the shrinkage estimator depends on the choice of the shrinkage factor, a large number of papers have appeared in this area [Improving Efficiency by Shrinkage, a Monograph by Marvin H. J. Gruber (1998)]. The bootstrap methodology, due to its generality, is known to have an appeal in many fields of applications. In particular, in complex data analysis problems, when the commonly known statistical methods can not be used for one reason or the other, the researchers seek the solutions using the bootstrap methodology. Therefore, it seems appropriate to revisit the shrinkage estimation in the light of bootstrap philosophy.

The Maximal Energy of a Graph

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ABSTRACT

The energy of a graph G is defined as the sum of the modulus values of the eigenvalues of G . In this paper the maximal energy of various classes of graphs is obtained and compared among the different class of graphs and shown that the energy is not wholly dependent on the number of edges in graphs.

The Energy of a Certain Classes Of Trees

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ABSTRACT

The energy of a graph G is the sum of the modulus of the eigenvalues of G . In this paper, we derive recurrence relations of finding a characteristic polynomial of a tree and thereby, we find the relationship of energies of various class of trees.

The Nth Derivatives of Graph Polynomials

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ABSTRACT

The expressions for the first derivatives of the graph polynomials viz., characteristics polynomial, matching polynomial, independence polynomial, clique polynomial, general graph polynomial are obtained in the literature. In this paper, we obtain the expression for the nth derivatives of these graph polynomials.

**Operational Variants of the Minimum Mean Squared Error Estimator
in Linear Regression Models with Non-spherical Disturbances**

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and

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ABSTRACT

There is a good deal of literature that investigates the properties of various operational variants of minimum mean squared estimator. It is interesting that virtually all of the existing analysis to date is based on the premise that the model's disturbances are i.i.d., an assumption which is not satisfied in many practical situations. In this paper, we consider a linear regression model with non-spherical errors and derive the asymptotic distribution, bias and mean squared error of a general class of feasible minimum mean squared error estimators. A Monte-Carlo experiment is conducted to examine the performance of this class of estimators in finite samples.

Inventory Model For Deteriorating Items When The Quantity Backordered Is Uncertain

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ABSTRACT

An optimal inventory policy where fraction of the backordered demand during the stockout period is uncertain is developed for continuously deteriorating items in this paper. The standard deviation of the quantity backordered (σ) is given by $\sigma = (\sigma_0^2 + (\lambda^2 s^2))^{1/2}$ where s represents the cumulative shortages during the stockout period. Mathematical model is developed to find the expected total cost per unit time which is the objective function and the optimal solution is found. The ordered quantity (Q) and the total shortage(s) are the decision variables. This accounts for both the cases in which λ is independent of the cumulative shortages (when $\lambda = 0$) and is proportional to the cumulative shortages (when $\lambda = 0$). A numerical example is given to illustrate the theory.

An Analysis of Household Trip Frequencies using Generalized Poisson Regression Models

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ABSTRACT

This paper models determinants of household trip frequencies. There are quite a few studies analyzing trip activity of households (Adler and Ben-Akiva, 1976; Horowitz, 1979, 1980; Mannering and Hamed, 1990; Terza and Wilson (1990); and Terza (1998)). Terza and Wilson (1990) applied and compared four approaches, (e.g., multinomial-Poisson, individual Poisson, Poisson-hurdle, and mixed multinomial-Poisson regression models) to the household trip frequency data from Cambridge Systematics Inc. (CSI, 1979) to jointly predict household choices among types of trips and frequency of trips. Using the same data set, Terza (1998) applied full information maximum likelihood, two-stage method of moments, and nonlinear weighted least squares estimation procedures to model determinants of household trip frequencies. Terza extended the count data regression models to account for endogenous switching and its two most common incarnations--endogenous treatment effects and sample selection. He found that both corrected and uncorrected parameter estimates indicate that vehicle ownership exerts a positive and significant influence on trip frequency; the corrected results reject the exogeneity of the ownership of vehicle by a household; and the structural effect of vehicle ownership on trip frequency will be understated if the endogeneity of ownership of vehicle by a household is ignored.

A generalized Poisson model (GPR) Model is used in analyzing the data. We observe: (i) holding the number of adults constant and increasing household members (e.g., adding children), increases the frequency of trips being taken; (ii) an increase in the number of trips for work or school taken by household members tends to decrease the number of trips for personal business or pleasure; (iii) an increase in the number of individuals in households tends to increase the total number of household trips taken; (iv) an increase in the number of fulltime individuals in the households tends to increase the total number of household trips taken; (v) household income is positively related to the number of household trips taken; (vi) the closer household members are to transit stations the more trips are taken; (vii) the number of household trips taken during weekdays are inversely proportional to the number of trips taken during the weekends. The GPR model confirms results from Terza and Wilson (1990) and Terza (1998), and it has been shown to be a better fit model than standard Poisson regression model when estimating determinants of household trip frequencies.

Estimation of Vaccine Efficacy and the Threshold Parameter

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ABSTRACT

Consider the problem of making inference about the efficacy of a vaccination and the associated threshold parameter to prevent the occurrence of a major epidemic for a general epidemic model. Here the theory of martingales is used to derive estimates, and associated standard errors, for the efficacy and the threshold parameters. The asymptotic and small sample properties of the resulting estimators are investigated. A real example on measles is presented.

Classes of Second Order Random Fields on Locally Compact Groups

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ABSTRACT

The talk is concerned with various types of second order stochastic processes indexed by locally compact groups. Let G be a locally compact group and H a complex Hilbert space. Any function X which maps G to H will be called a random field. This abstract setting is motivated by the fact that in classifying second order processes we are mainly interested in their covariance structures. The classes of random fields we study can be characterized in terms of their covariance functions. The type of random fields considered are called left homogeneous, right homogeneous, hemihomogeneous, strongly harmonizable, left harmonizable, right harmonizable, or weakly harmonizable. Various inclusion, representation, and dilation results concerning these are stated, and some of the main results show that inclusions between certain classes of random fields are in many cases strict. Left (resp. right) harmonizable random fields have by definition left (resp. right) homogeneous dilations, and these classes are given various intrinsic characterizations. The techniques are mainly functional analytic, especially C^* -algebra techniques are applied to the group C^* -algebra $C^*(G)$ of G . For example, the notions of left (resp. right) orthogonal scatteredness for Hilbert space valued bounded linear maps on $C^*(G)$ are introduced, and a natural correspondence with left (resp. right) homogeneity for random fields is established.