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Effects of prior distributions: An application to pipedwater demand

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Abstract. In this paper, we analyze the effect on posterior parameter distributions of four possible alternative prior distributions, namely Normal-Inverse Gamma, Normal-Scaled Beta two, Student's t -Inverse Gamma and Student's t -Scaled Beta two. We show the effects of these prior distributions when there is apparently conflict between the sample information and the elicited hyperparameters. In particular, we show that there is not systematic differences of posterior parameter distributions associated with these four priors using data of piped water demand in a linear model with autoregressive errors. To test the hypothesis that this result is due to using a moderate sample size and a relatively high level of expert's uncertainty, we perform some simulation exercises assuming smaller sample sizes and lower expert's uncertainty. We obtain the general same pattern, although Student's t models are slightly less affected by prior information when there is a high level of expert's certainty, and Scaled Beta two models exhibit a higher level of posterior dispersion of the variance parameter.

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Key words and phrases. Autoregressive model, Bayesian analysis, elicitation, robustness analysis.

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Weighted Weibull distribution: Bivariate and multivariate cases

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Abstract. Gupta and Kundu (*Statistics* **43** (2009) 621–643) introduced a new class of weighted exponential distribution and established its several properties. The probability density function of the proposed weighted exponential distribution is unimodal and it has an increasing hazard function. Following the same line Shahbaz, Shahbaz and Butt (*Pak. J. Stat. Oper. Res.* **VI** (2010) 53–59) introduced weighted Weibull distribution, and we derive several new properties of this weighted Weibull distribution. The main aim of this paper is to introduce bivariate and multivariate distributions with weighted Weibull marginals and establish their several properties. It is shown that the hazard function of the weighted Weibull distribution can have increasing, decreasing and inverted bathtub shapes. The proposed multivariate model has been obtained as a hidden truncation model similarly as the univariate weighted Weibull model. It is observed that to compute the maximum likelihood estimators of the unknown parameters for the proposed p -variate distribution, one needs to solve $(p + 2)$ non-linear equations. We propose to use the EM algorithm to compute the maximum likelihood estimators of the unknown parameters. We obtain the observed Fisher information matrix, which can be used for constructing asymptotic confidence intervals. One data analysis has been performed for illustrative purposes, and it is observed that the proposed EM algorithm is very easy to implement, and the performance is quite satisfactory.

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Key words and phrases. Hidden truncation model, maximum likelihood estimator, failure rate, EM algorithm, bootstrap confidence intervals.

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Improved estimation in a general multivariate elliptical model

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Abstract. The problem of reducing the bias of maximum likelihood estimator in a general multivariate elliptical regression model is considered. The model is very flexible and allows the mean vector and the dispersion matrix to have parameters in common. Many frequently used models are special cases of this general formulation, namely: errors-in-variables models, nonlinear mixed-effects models, heteroscedastic nonlinear models, among others. In any of these models, the vector of the errors may have any multivariate elliptical distribution. We obtain the second-order bias of the maximum likelihood estimator, a bias-corrected estimator, and a bias-reduced estimator. Simulation results indicate the effectiveness of the bias correction and bias reduction schemes.

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Key words and phrases. Bias correction, bias reduction, elliptical model, maximum likelihood estimation, general parameterization.

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Improved inference for the generalized Pareto distribution

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Abstract. The generalized Pareto distribution is commonly used to model exceedances over a threshold. In this paper, we obtain adjustments to the generalized Pareto profile likelihood function using the likelihood function modifications proposed by Barndorff-Nielsen (*Biometrika* **70** (1983) 343–365), Cox and Reid (*J. R. Stat. Soc. Ser. B. Stat. Methodol.* **55** (1993) 467–471), Fraser and Reid (*Utilitas Mathematica* **47** (1995) 33–53), Fraser, Reid and Wu (*Biometrika* **86** (1999) 249–264) and Severini (*Biometrika* **86** (1999) 235–247). We consider inference on the generalized Pareto distribution shape parameter, the scale parameter being a nuisance parameter. Bootstrap-based testing inference is also considered. Monte Carlo simulation results on the finite sample performances of the usual profile maximum likelihood estimator and profile likelihood ratio test and also their modified versions is presented and discussed. The numerical evidence favors the modified profile maximum likelihood estimators and tests we propose. Finally, we consider two real datasets as illustrations.

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Key words and phrases. Bootstrap, generalized Pareto distribution, likelihood ratio test, maximum likelihood estimation, profile likelihood.

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Nonlinear measurement errors models subject to partial linear additive distortion

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Abstract. We study nonlinear regression models when the response and predictors are unobservable and distorted in a multiplicative fashion by partial linear additive models (PLAM) of some observed confounding variables. After approximating the additive nonparametric components in the PLAM via polynomial splines and calibrating the unobserved response and unobserved predictors, we develop a semi-parametric profile nonlinear least squares procedure to estimate the parameters of interest. The resulting estimators are shown to be asymptotically normal. To construct confidence intervals for the parameters of interest, an empirical likelihood-based statistic is proposed to improve the accuracy of the associated normal approximation. We also show that the empirical likelihood statistic is asymptotically chi-squared. Moreover, a test procedure based on the empirical process is proposed to check whether the parametric regression model is adequate or not. A wild bootstrap procedure is proposed to compute p -values. Simulation studies are conducted to examine the performance of the estimation and testing procedures. The methods are applied to re-analyze real data from a diabetes study for an illustration.

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Key words and phrases. Bootstrap approximation, confounding variables, covariate-adjusted regression, distorting function, empirical likelihood, empirical process, measurement errors models, model checking, multiplicative effect, regression spline.

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On the exit time from an orthant for badly oriented random walks

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Abstract. It was recently proved that the exponential decreasing rate of the probability that a random walk stays in a d -dimensional orthant is given by the minimum on this orthant of the Laplace transform of the random walk increments, provided that this minimum exists. In other cases, the random walk is “badly oriented” and the exponential rate may depend on the starting point x . We show here that this rate is nevertheless asymptotically equal to the infimum of the Laplace transform, as some selected coordinates of x tend to infinity.

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Noise-indicator nonnegative integer-valued autoregressive time series of the first order

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Abstract. This paper presents a modification and, at the same time, a generalization of the linear first order nonnegative integer-valued autoregressive processes, well-known as INAR(1) processes. By using the so-called Noise-Indicator, a nonlinear model with the threshold regime and with more complex structure than the appropriate linear models was obtained. The new model, named NIINAR(1) process, has been investigated in terms of the most general, the power series distribution of its innovations. Basic stochastic properties of the NIINAR(1) model (e.g., correlation structure, over-dispersion conditions and distributional properties) are given. Also, besides of some standard parameters estimators, a novel estimation techniques, together with the asymptotic properties of the obtained estimates is described. At last, a Monte Carlo study of this process is also given, as well as its application in the analysis of dynamics of two empirical dataset.

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Hölderian weak invariance principle under the Maxwell and Woodroofe condition

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Abstract. We investigate the weak invariance principle in Hölder spaces under some reinforcement of the Maxwell and Woodroofe condition. Optimality of the obtained condition is established.

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Key words and phrases. Invariance principle, martingales, Hölder spaces, strictly stationary process.

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Abrupt convergence for a family of Ornstein–Uhlenbeck processes

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Abstract. We consider a family of Ornstein–Uhlenbeck processes. Under some suitable assumptions on the behaviour of the drift and diffusion coefficients, we prove profile cut-off phenomenon with respect to the total variation distance in the sense of the definition given by Barrera and Ycart [*ALEA Lat. Am. J. Probab. Math. Stat.* **11** (2014) 445–458]. We compute explicitly the cut-off time, the window time, and the profile function. Moreover, we prove that the average process satisfies a profile cut-off phenomenon with respect to the total variation distance. Also, a sample of N Ornstein–Uhlenbeck processes has a window cut-off with respect to the total variation distance in the sense of the definition given by Barrera and Ycart [*ALEA Lat. Am. J. Probab. Math. Stat.* **11** (2014) 445–458]. The cut-off time and the cut-off window for the average process and for the sampling process are the same.

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Key words and phrases. Cut-off phenomenon, total variation distance, Ornstein–Uhlenbeck processes.

A Skellam GARCH model

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Abstract. This paper considers the modeling of nonstationary integer valued time series with conditional heteroskedasticity using Skellam distribution. Two approaches of estimation of the model's parameters are treated and discussed. The obtained results are verified through some numerical simulation. In addition, the proposed model is applied to real time series.

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Key words and phrases. Generalized autoregressive conditional heteroskedastic, ARCH, Skellam, Poisson, negative binomial, nonstationary.

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