University of Ljubljana, Faculty of Social Sciences
Fondazione "Franca e Diego de Castro", Italy
Statistical Society of Slovenia

AUSTRIAN, CROATIAN, HUNGARIAN, ITALIAN, AND SLOVENIAN

YOUNG STATISTICIANS MEETING

PROGRAM and ABSTRACTS

IN HONOR OF DIEGO DE CASTRO

October 19 – 21, 2007

Hotel Piran

Piran, Slovenia

12th

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Supported by

Faculty of Social Sciences, University of Ljubljana

Fondazione "Franca e Diego de Castro", Italy

Statistical Society of Slovenia

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Program

FRIDAY, October 19, 2007

17.00 – 18.30 Arrival, registration in Hotel Piran
19.00 Reception in Honor of Diego de Castro
(Comunita degli Italiani "Giuseppe Tartini"di Pirano)

SATURDAY, October 20, 2007

8.00 - 9.00 Registration in Hotel Piran

9.15 - 9.30 Opening in GEA College (Kidričevo nabrežje 2, Piran)
Anuška Ferligoj (Organizer)
Andrej Blejec (President of Statistical Society of Slovenia)
Irena Križman (Director of Statistical Office of Republic of Slovenia)

9.30-11.00 *Chair: Maurizio Brizzi*

1. **Bayesian Nonparametric Methods for Prediction in EST Analysis**
   Igor Pruenster, University of Torino, Torino, Italy
2. **Time Course Gene Expression Data Analysis**
   Ana Rotter, National Institute of Biology, Ljubljana, Slovenia
3. **An Application of the Multilevel Ecological Model**
   Csaba Mérő, Eötvös Loránd University, Budapest, Hungary

11.00-11.30 Coffee Break

11.30-13.00 *Chair: Dario Gregori*

1. **Bayesian Nonparametric Methods for Prediction in EST Analysis**
   Tina Žagar, Institute of Oncology, Ljubljana, Slovenia
2. **Carbohydrates Data Analysis**
   Nataša Tepić and Marijan Ahel, Department for Marine and Environmental Research, Institute Rudjer Bošković, Zagreb, Croatia
3. **Semiparametric Models for Regression Analysis of Competing Risks Data**
   Pierpaolo De Blasi, University of Torino, Torino, Italy

13.00-14.30 Lunch

14.30-16.00 *Chair: Janez Stare*

1. **Persistence of Employment Spells. A Survival Analysis Based on Micro-Census Data**
   Justus Henke, Statistics Austria, Direktion Bevoelkerung, Vienna, Austria

2. **Ruin Probability and Risky Investments**
   Vedran Horvatić, Faculty of Economics Zagreb, Zagreb, Croatia

3. **Statistical Inference in an Interest Rate Model**
   Erika Fülöp and Gyula Pap, Faculty of Informatics, University of Debrecen, Debrecen, Hungary

16.00-16.30 Coffee Break

16.30-17.30 *Chair: Tibor Poganj*

1. **A Strong Consistency Result for Fuzzy Relative Frequencies Interpreted as Estimator for the Fuzzy-Valued Probability**
   Wolfgang Trutschnig, Department of Statistics and Probability Theory, Vienna University of Technology, Vienna, Austria

2. **A Few Algorithms for Generating Mann-Whitney-Wilcoxon Distribution**
   Ivo Ugrina, Faculty of Natural Sciences and Mathematics, University of Zagreb, Zagreb, Croatia

19.00 Conference Dinner

SUNDAY, October 21, 2007

9.00-10.00 *Chair: Támas Rudas*

1. **The Impact of Missing Data Treatments on the Results of the Ward Hierarchical Clustering**
   Anja Žnidaršič, Tanja Garvas, and Saša Planinc, Statistical Office of the Republic of Slovenia, and University of Primorska, Turistica - College of Tourism, Portorož, Slovenia

2. **Considering Measurement Error of Covariates in Capture-Recapture Estimation of Closed Populations**
   Aniko Balogh, Eőtvős Loránd University, Budapest, Hungary

10.00-10.30 Coffee Break

10.30-11.30 *: Herwig Friedl*

1. **Bias in Fitting Linear Models to Transformed Responses**
   Ileana Baldi, Francesco Bassi, and Dario Gregori, University of Torino, Torino, Italy

2. **An Overview of Estimation Procedures for Generalized Linear Mixed Models**
   Ahmad Basheer, Institute of Statistics, Graz University of Technology, Graz, Austria

11.30 Closing

Abstracts

Bias in Fitting Linear Models to Transformed Responses

Ileana Baldi, Francesco Bassi, and Dario Gregori

University of Torino, Italy

Objectives
In case of skewed data, the most common approach is to fit a linear model to log-transformed data, with the parameters being eventually evaluated after a back-transformation on the original scale. This method is known to be biased, in particular in repeated measurement studies, with the bias increasing with the heterogeneity in data. An alternative approach based on the Generalized Linear Mixed Model (GLMM) is therefore hereby proposed.
Methods
We provide evidence on the performance of the GLMM model with log link function and Gamma distribution in terms of bias and precision under a variety of data generating mechanisms and compare it to that of the Linear Mixed Effect Model on the log-transformed response (log-LME).
In a case study from fixed prosthodontics, the comparison of impression materials on a sample of 180 repeated measures is analyzed under both GLMM and log-LME model.
Results
The simulation study shows that the method of fitting linear models to a log-transformed response may have relatively little bias if the gamma shape parameter is constant, but suffers from substantial bias if the shape parameter varies with the covariate.
Conclusions
No single alternative is best under all the conditions examined in this paper. However, the gamma regression model with a log link seems to be more robust to alternative data generating mechanisms than either log-LME

Considering Measurement Error of Covariates in Capture-Recapture Estimation of Closed Populations

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Most common approaches and applications of the capture-recapture estimators of closed populations do not allow for measurement error of the covariates or auxiliary variables, which can result in estimation bias.
The incorporation of covariance measurement error will be introduced and a regression-based parameter estimator method will be proposed. A simulation study will compare the error-free and error-incorporated models in favour of the latter one.

An Overview of Estimation Procedures for Generalized Linear Mixed Models

Ahmad Basheer

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The Generalized Linear Mixed Model (GLMM) is a natural extension and mixture of a Linear Mixed Model and a Generalized Linear Model. The conditional mean of the response given the random effect(s) is linked to the linear predictor. The linear predictor comprises of xed effects and random effects. The basic considerations or assumptions to construct a GLMM are (i) What is the distribution of the response? (ii) What is the distribution of the random effects? (iii) What kind of link is feasible between the conditional mean and the linear predictor? The model parameters can be estimated in closed form only for some very specic situations, like normal-normal, beta-binomial or gamma-poisson mixtures. But in other mixtures, especially when the number of nested random effects are more than two or the random effects are crossed, the closed form solutions are not possible or they are very complicated or tedious to obtain. In such situations, some approximation procedures are currently in practice. Penalized Quasi-Likelihood by Breslow, N. E. (2003), Expectation Maximization (EM) algorithm by Dempster, A. P. et al. (1977), Monte Carlo EM, Simulated Maximum Likelihood and Monte Carlo Newton Raphson by McCulloch, C. E. (1997) and Stochastic Approximation EM by Jank, W. (2006) are mostly used estimation procedures. The main features of these procedures will be highlighted and also an application of the techniques to a real data problem will be discussed.

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1. Breslow, N. E. (2003). Whither PQL? [Biostatistics Working Paper Series, University of Washington]. (192).

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3. Jank, W. (2006). Implementing and Diagnosing the Stochastic Approxima- tion EM Algorithm. Journal of Computational and Graphical Statistics, 15 (4), 127.

4. McCulloch, C. E. (1997). Maximum Likelihood Algorithms for Generalized Linear Mixed Models. Journal of the American Statistical Association, 92 (437), 162-170.

Semiparametric Models for Regression Analysis of Competing Risks Data

Pierpaolo De Blasi

University of Torino, Italy

We develop a semiparametric formulation of the competing risks model, where cause-specific hazards (CSHs) are modelled via the conditional probability of a failure type and the overall hazard rate. Such formulation is then adopted in a proportional regression model on CSHs with a logistic relative risk function. Frequentist estimation based on the partial likelihood is described together with the derivation of large sample properties. We also study the tail behaviour of the partial likelihood by giving sufficient conditions for exponentially decreasing tails. For illustration, we consider the estimation of the prevalence of risks in a carcinogenesis experiment.

Statistical Inference in an Interest Rate Model

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We consider some statistical questions arising in a discrete time Heath-Jarrow-Morton (HJM) type forward interest rate model, where the interest rate curves are driven by a geometric spatial autoregression field. Such models were proposed by Gáll, Pap and Zuijlen [2].
Our aim is to test the autoregression parameter ϱ. In the stable ($|\varrho| < 1$) and unstable ($|\varrho| = 1$) cases we showed local asymptotic normality (LAN) of the sequence of the related statistical experiments in [1] in the sense of Le Cam [3], see also Van der Vaart [4]. The main gain of this result is that we obtain at once asymptotically optimal tests.

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Persistence of Employment Spells. A Survival Analysis Based on Micro-Census Data

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Studies on job tenure are normally based on actual tenure figures in companies. In recent times other approaches for analysis have become popular. This article examines job tenure on the basis of survival analysis. Its key feature is its capability of measuring short or mid term employment and hence giving evidence on conditional survival probabilities for specific socio-demographic groups. Basis for our empirical framework is the micro-census database of STATISTICS AUSTRIA which is particular insofar as most studies rely on administrative data. The major advantage of this approach is that it allows for a broader range of individual characteristics for analysis. The analysis is carried out by computing Kaplan-Meier survival functions and estimating proportional hazard values according to the Cox regression model. Results point toward heterogeneous structures for age cohorts, education, industries and professional status, and rather homogeneous structures for gender and federal states.

Ruin Probability and Risky Investments

Vedran Horvatić

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In this presentation we deal with ruin probability of an insurance company. If we denote risk reserve process with $(X_t)t \geq 0$, then the probability of ruin is the probability of event $\{X_t < 0 \text{ for some } t > 0\}$. In the classical Cramer-Lundberg model, the claim number process is actually Poisson process, and the claim sizes are positive iid random variables. Under the assumptions of net prot condition and the existance of Lundberg coecient, the ruin probability as a function of the initial capital u decreases exponentially.
It is natural to study ruin problem in application to an insurance company which continuously invests its capital in a risky asset. We assume that the price of this risky asset follows a geometric Brownian motion with mean return $a > 0$ and volatility $\sigma > 0$, which satises the following stochastic differential equation

$$dV_t = V_t(adt + \sigma dW_t)$$

$(W_t)t \geq 0$ is a standard Brownian motion). Now we expect ruin probability to be greater than in the classical Cramer-Lundberg model. Indeed, in the case of small volatility, i.e. $a - \sigma^2/2 > 0$, we find exact the asymptotic upper and lower bounds for the ruin probability $\psi(u)$, as the initial capital u tends to infinity.
We show that, for suficiently large u, $\psi(u)$ is bounded by power functions with the same exponent $\beta := 2a/\sigma^2 - 1$. In the special case of exponential premium rate, we derive the exact asymptotics for the ruin probability. Therefore, we conclude that the ruin probability is no more exponential but a power function of the initial capital. In the case of large volatility, i.e. $a - \sigma^2/2 \leq 0$, we show that ruin probability equals 1 for any $u \geq 0$. We support some of these results by simulations.
This presentation is based on the paper of S. Pergamenshchikov and O. Zeitouny, Ruin probability in the presence of risky investments.

An Application of the Multilevel Ecological Model

Csaba Mérő

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The work is an application of the Multilevel Ecological Model proposed by Wakefield (2004). Wakefields model is claimed to be an improvement over Kings (1997) modell. The main difficulty of ecological studies is the lack of information about the verity of the models assumptions. About the distributional assumptions and the lack of autocorrelation assumption there were couple of symulations carried out by Cho (1998) but no real concern is taken about the lack of aggregation bias assumption. I apply the model on the results of a referendum held in Hungary 2004 December. In the process I discuss the effects of the presence of aggregation bias and show the underlying contextual variable wich possibly accounts for a great part of aggregation bias.

Bayesian Nonparametric Methods for Prediction in EST Analysis

Igor Pruenster

University of Torino, Italy

Expressed sequence tags (ESTs) analyses are an important tool for gene identification in organisms. Given a preliminary EST survey from a certain cDNA library, various features of a possible additional sample have to be predicted. For instance, interest may rely on estimating the number of new genes to be detected, the gene discovery rate at each additional read and the probability of not re-observing certain specific genes present in the initial sample. We propose a Bayesian nonparametric approach for prediction in EST analysis based on nonparametric priors inducing Gibbs-type exchangeable random partitions and derive estimators for the relevant quantities. Several EST datasets are analysed by resorting to the two parameter Poisson-Dirichlet process, which represents the most remarkable Gibbs-type prior. Our proposal has appealing properties over frequentist nonparametric methods, which become unstable when prediction is required for large future samples.

Time Course Gene Expression Data Analysis

Ana Rotter

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What distinguishes gene expression data analysis from other large datasets is that we are dealing with a large number of variables (counted in thousands) but a relatively limited number of units (counted in tens or even less). For example, when performing time course gene expression experiments with the aim of monitoring changes in gene expression some time after infection of the organism, a few time points only are selected.
This represents a challenge for a data analyt and in the last few a number of approaches for time course gene expression data analysis have been developed. We have chosen an inhouse made experiment in plant physiology, where potato plants, resistant to a viral infection have been monitored at 4 selected time points after the infection.
We have revised the literature where various data analysis approaches have been presented and chosen a few, which in theory would be applicable for datasets we are usually dealing with. These approaches, as well as the results obtained, will be presented.

Carbohydrates Data Analysis

Nataša Tepić and Marijan Ahel

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The distribution of the dissolved and particulate carbohydrates in the River Krka estuary was investigated for the first time. Investigation was performed at three stations, characterized by different environmental conditions, during a four years period. The initial idea was to explore potential differences among the stations and/or depths. Experimental design was performed by taking samples at the different set of depths at each station. For that reason, depth was treated as a covariate in linear regression model and a random coefficients model was applied. This type of model is also known as a hierarchical or multilevel model. Model fit using unstructured and nested covariance matrix structure options for depth and station, treated as random effects, was investigated.

A Strong Consistency Result for Fuzzy Relative Frequencies Interpreted as Estimator for the Fuzzy-Valued Probability

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The unavoidable imprecision of measurements of continuous physical quantities can be modelled by using the concept of fuzzy numbers and fuzzy vectors. Concerning a quantitative usage of such data the classical concept of relative frequencies for real data has to be extended to so-called fuzzy relative frequencies for fuzzy data, whereby the fuzzy relative frequency of a set is a fuzzy number.
Analogous to A. Dempster's interval-valued probabilities induced by multivalued mappings fuzzy-valued probabilities induced by fuzzy random vectors are considered and analyzed. It will be shown that fuzzy relative frequencies can be interpreted as strongly consistent estimator for the corresponding fuzzy-valued probability.

A Few Algorithms for Generating Mann-Whitney-Wilcoxon Distribution

Ivo Ugrina

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Mann-Whitney test (also called the Mann-Whitney-Wilcoxon (MWW) or Wilcoxon rank-sum test) is a non-parametric test for assessing whether two samples of observations come from the same distribution. To use it properly one must have MWW distribution or at least its quantiles. A few algorithms for generating MWW distribution will be shown together with their implementation in C++ using (where possible) library for unlimited precision integers. Also Kolmogorov-Smirnov distance of MWW distribution and Normal distribution, calculated with the help of above routines, will be presented.

Bayesian Nonparametric Methods for Prediction in EST Analysis

Tina Žagar

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Till today many atlases have been prepared to present cancer burden in specific region or country. All are based on aggregated data, while geocoded data are usually used for answering specific research questions. The main reason is that geocoded data are not routinely available as cancer data is. In Slovenia we have the opportunity to obtain geographic coordinates for cancer cases registered in Cancer Registry of Slovenia as well as for population from where these cases emerge. In this presentation we will explore preparation of cancer maps based on geocoded data with emphasis on advantages and disadvantages over maps based on aggregated data. The main motivation is avoiding administrative areas, which are arbitrary when mapping cancer. So we will try to locally estimate standardized incidence ratio (SIR), which takes into account not only distribution of population but also their age structure, because it is well known that cancer is strongly age dependent.

The Impact of Missing Data Treatments on the Results of the Ward Hierarchical Clustering

Anja Žnidaršič[1], Tanja Garvas[2], and Saša Planinc[3]

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Missing data are frequently present especialy in surveys. There are several ways how to treat such data, which give more or less good results when analysing them with a particular statistical method. In the paper some known imputations techniques and two most frequently used treatments casewise (listwise) and pairwise deletion are used and compared. We studied the impact of missing data treatments on the results recieved from hierarchical clustering using Ward method at different conditions. These conditions were obtained by generating two kinds of missing data: missing completely at random (MCAR) and missing at random (MAR) on otherwise complete real data. Different treatments on different percentage of missing data were used. The impact of missing data treatments were then estimated by external and internal cluster validation techniques (criteria). Using external technique (Rand index) we compared if the same units of two diferent partitions (without and with missing data by using a particular treatment), are classified into the same group. By using internal techniques we studied characteristics of particular partition (separation and homogeneity of groups). The aim of the study was to find out, which missing data treatment is the most suitable when analysing data by Ward hierarchical clustering method considering particular percentage of missing data and the type of missing data.

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