

5th Workshop on Probabilistic and Statistical Methods

February 6-8, 2017
ICMC/USP, São Carlos, SP, Brazil

Invited Speakers

Carlos A. Abanto-Valle
Universidade Federal do Rio de Janeiro (UFRJ)

Christophe Frédéric Galesco
Universidade Estadual de Campinas (UNICAMP)

Fabio Prates Machado
Universidade de São Paulo (IME/USP)

Josemar Rodrigues
Universidade de São Paulo (ICMC/USP)

Laura L. Ramos Rifo
Universidade Estadual de Campinas (UNICAMP)

Marcos Oliveira Prates
Universidade Federal de Minas Gerais (UFMG)

Reinaldo Arellano-Valle
PUC-Chile

Scientific Committee

Adriano Polpo de Campos
Universidade Federal de São Carlos (UFSCar)

Antonio Galves
Universidade de São Paulo (IME/USP)

Carlos Alberto de Bragança Pereira
Universidade de São Paulo (IME/USP)

Victor Leiva
Universidad Adolfo Ibáñez

Organizing Committee

Juliana Cobre
Universidade de São Paulo (ICMC/USP)

Luis Ernesto Salazar
Universidade Federal de São Carlos (UFSCar)

Pablo Martin Rodriguez
Universidade de São Paulo (ICMC/USP)

Renato Gava
Universidade Federal de São Carlos (UFSCar)

Vicente Garibay Cancho
Universidade de São Paulo (ICMC/USP)

Minicourse

Elements of Computational Statistics
Francisco Cribari-Neto (Universidade Federal de Pernambuco - UFPE)

Further information and registration:
<http://estatisticaverao.icmc.usp.br/>

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Programa Interinstitucional de Pós-graduação em Estatística - PIPGEs



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PROGRAM

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About the 5th Workshop on Probabilistic and Statistical Methods

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The Workshop on Probabilistic and Statistical Methods is an initiative of the Programa Interinstitucional de Pós-graduação em Estatística (PIPGEs ICMC/USP and UFSCar), which brings together the Statistics and Probability research groups from ICMC/USP and UFSCar, in São Carlos, SP, Brazil.

This meeting intends to discuss new developments in Statistics, Probability and their applications. Activities include invited plenary sessions, short talks, two poster sessions and one short course. The topics of this meeting include Probability and Stochastic Processes, Statistical Inference, Regression Models, Survival Analyses and Complex Stochastic Systems. The aim of the workshop is to provide a unique opportunity for researchers and students to exchange experiences and start collaborations.

Invited Speakers

Anatoli Iambartsev, IME/USP, Brazil

Daiane Aparecida Zuanetti, UFSCar, Brazil

Fabio Prates Machado, IME/USP, Brazil

Josemar Rodrigues, ICMC/USP, Brazil

Laura L. Ramos Rifo, UNICAMP, Argentine

Marcos Oliveira Prates, UFMG, Brazil Reinaldo Arellano-Valle, PUC-Chile, Chile

Minicourses

Francisco Cribari-Neto, UFPE, Brazil

Scientific Committee

Adriano Polpo de Campos, UFSCar, Brazil

Antonio Galves, IME/USP, Brazil

Carlos Alberto de Bragança Pereira, IME/USP, Brazil

Victor Leiva, Universidad Adolfo Ibáñez, Chile

Organizing Committee

Juliana Cobre, ICMC/USP (chair)

Luis Ernesto Bueno Salazar, UFSCar

Pablo Martin Rodriguez, ICMC/USP

Renato Gava, UFSCar (chair)

Vicente Garibay Cancho, ICMC/USP

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SCHEDULE

ICMC/USP and DEs/UFSCar

5th Workshop on Probabilistic and Statistical Methods

February 6–8, 2017 – ICMC/USP, São Carlos, SP, Brazil

Time	Monday (2/6)	Tuesday (2/7)	Wednesday (2/8)
08h00 - 09h00	Registration		
09h00 - 10h00	Talk: Machado	Talk: Arellano-Valle	Talk: Rodrigues
10h00 - 10h30	<i>Coffee Break</i>	<i>Coffee Break</i>	<i>Coffee Break</i>
10h30 - 11h00	MC: Cribari-Neto	MC: Cribari-Neto	Short Talk 4
11h00 - 12h10	MC: Cribari-Neto	MC: Cribari-Neto	Talk: Iambartsev
12h10 - 14h00	—Lunch—	—Lunch—	—Lunch—
14h00 - 15h00	Talk: Zuanetti	Talk: Rifo	
15h00 - 15h30	Short Talk 1	Short Talk 2	
15h30 - 16h30	<i>Coffee Break & Posters</i>	<i>Coffee Break & Posters</i>	
16h30 - 17h00	MC: Cribari-Neto	Short Talk 3	
17h00 - 18h00	MC: Cribari-Neto	Talk: Prates	

MC: Mini course.
Short Talks: 20 minutes each.

Mini course

- Francisco Cribari-Neto - *Elements of Computational Statistics*.

Talks

- Anatoli Iambartsev - *Stochastic Ising model with plastic interactions*.
- Daiane Aparecida Zuanetti - *A generalized mixture model applied to diabetes incidence data*.
- Fabio Prates Machado - *Dispersion as a survival strategy*.
- Josemar Rodrigues - *Counter your customers: Who are they and what they do in the future?*
- Laura L. Ramos Rifo - *Bayesian analysis for the long-memory of a gamma-modulated process*.
- Marcos Oliveira Prates - *Where geography lives? A projection approach for spatial confounding*.
- Reinaldo Arellano-Valle - *Scale and shape mixtures of multivariate skew-normal distributions*.

Short Talks

1. Démerson André Polli - *Avaliação de produtos através da verificação da presença de $m \geq 1$ quesitos*.
2. André Felipe B. Menezes - *Monte Carlo study of multiple comparisons corrections in t-test*.
3. Aline Piroutek - *Inference in probabilistic context neighborhood*.
4. Amanda M. E. D'Andrea - *Estimation methods for Kumaraswamy exponential distribution applied survival data*.

Conferences

1. Anatoli Iambartsev, IME/USP, Brazil
Stochastic Ising model with plastic interactions
2. Daiane Aparecida Zuanetti, UFSCar, Brazil
A generalized mixture model applied to diabetes incidence data.
3. Fabio Prates Machado, IME/USP, Brazil
Dispersion as a survival strategy.
4. Josemar Rodrigues, ICMC/USP, Brazil
Counter your customers: Who are they and what they do in the future?
5. Laura L. Ramos Rifo, UNICAMP, Brazil
Bayesian analysis for the long-memory of a gamma-modulated process.
6. Marcos Oliveira Prates, UFMG, Brazil
Where geography lives? A projection approach for spatial confounding.
7. Reinaldo Arellano-Valle, PUC-Chile, Chile
Scale and shape mixtures of multivariate skew-normal distributions.

Minicourse

1. Francisco Cribari-Neto, UFPE, Brazil
Elements of Computational Statistics.

Oral Communications

1. Amanda Morales Eudes D'Andrea, Vera Lucia Damasceno Tomazella and Cirdêmia Costa Feitosa
PIPGEs UFSCar ICMC/USP, UFSCar and PIPGEs UFSCar ICMC/USP, Brazil
Estimation methods for Kumaraswamy exponential distribution applied survival data
2. Aline Piroutek, Denise Duarte, Caio T. M. Alves, Renato M. Assunção and Aluísio Pinheiro
IMECC/UNICAMP, UFMG, Universitat Leipzig, UFMG and IMECC/UNICAMP, Brazil, Brazil, Germany, Brazil, Brazil
Inference in probabilistic context neighborhood
3. Démerson André Polli and Carlos Alberto Ribeiro Diniz
PIPGEs UFSCar ICMC/USP and UFSCar, Brazil
Avaliação de produtos através da verificação da presença de $m \geq 1$ quesitos

4. Vinícius Basseto Félix and André Felipe B. Menezes
UEM, Brazil
Monte Carlo study of multiple comparisons corrections in t -test

Poster Session

1. Afonso F. Vaz, Rafael Izbicki and Rafael Stern
PIPGEs UFSCar, UFSCar and UFSCar, Brazil
The ratio estimator for quantification task under prior probability shift
2. Amanda Buosi Gazon, Luis Ernesto Bueno Salazar and Adriano Polpo de Campos
PIPGEs UFSCar ICMC/USP, UFSCar and UFSCar, Brazil
Functional data analysis and meta-analysis: An application to human gait data
3. Caio Moura Quina
ICMC/USP, Brazil
Branching processes: Applications and simulations
4. Cleber Martins Xavier and Ricardo S. Ehlers
PIPGEs UFSCar ICMC/USP and ICMC/USP, Brazil
A study Hamiltonian Monte Carlo methods in univariate GARCH models
5. Daiane de Souza, Vicente G. Cancho, Josemar Rodrigues
PIPGEs ICMC/USP, ICMC/USP and ICMC/USP, Brazil
Testes de hipóteses para o parâmetro de dispersão da distribuição hiper-Poisson
6. Danilo C. Nogarotto, Caio L.N. Azevedo and Jorge L. Bazán
School of Technology/UNICAMP, Department of Statistics/UNICAMP and ICMC/USP, Brazil
Bayesian estimation, residual analysis and prior sensitivity study for zero-one augmented beta regression model with an application to psychometric data
7. Diego Mattozo B. Silva and Gustavo H. A. Pereira
PIPGEs UFSCar ICMC/USP and UFSCar, Brazil
Um método de categorização de variáveis baseado no ajuste de modelos de regressão para variáveis binárias
8. Diego Nascimento, Anderson Ara and Francisco Louzada
PIPGEs UFSCar ICMC/USP, ICMC/USP and ICMC/USP, Brazil
Feature selection approach with missing values conducted for statistical learning - A case study of entrepreneurship survival dataset
9. Diego Nascimento, Jose Augusto Fiorucci, Francisco Louzada and Clausius Duque Reis
PIPGEs UFSCar ICMC/USP, ICMC/USP, ICMC/USP and PPG-CCMC ICMC/USP,

- Brazil
Wilcoxon test for transformation on soundscape: A feature extraction task
10. Eduardo Schneider Bueno de Oliveira, Marcelo Andrade da Silva and Jorge Luis Bazán
PIPGEs UFSCar ICMC/USP, PIPGEs UFSCar ICMC/USP and ICMC/USP, Brazil
Bayesian estimation of DINA model using no-U-turn Hamiltonian Monte Carlo
 11. Fabiano Rodrigues Coelho and Cibele Maria Russo
PIPGEs UFSCar ICMC/USP and ICMC/USP, Brazil
Variable selection in generalized linear mixed models applied to educational data
 12. Glauber Márcio Silveira Pereira and Carlos Alberto Ribeiro Diniz
PIPGEs UFSCar ICMC/USP and UFSCar, Brazil
COM-Poisson bivariate correlated distribution
 13. Helton Saulo, N. Balakrishnan, Xiaojun Zhu, Jhon F. B. Gonzales and Jeremias Leão
UFG and McMaster Universit, McMaster Universit, McMaster Universit, UFSCar, UFAM, Brazil, Canada, Canada, Brazil
Estimation in generalized bivariate Birnbaum-Saunders models
 14. Ian M Danilevicz, Ricardo S Ehlers and David S Dias
PIPGEs UFSCar ICMC/USP, ICMC/USP and PIPGEs UFSCar ICMC/USP, Brazil
Outlier identification in spatial models
 15. Juliana Scudilio, Vinicius F. Calsavara, Ricardo Rocha, Francisco Louzada, Vera Tomazella and Agatha S. Rodrigues
PIPGEs UFSCar ICMC/USP, A. C. Camargo Cancer Center, ICMC/USP, ICMC/USP, UFSCar and IME/USP UFSCar, Brazil
Defective models induced by gamma frailty term for survival data with cured fraction
 16. Lorena Cáceres Tomaya and Mário de Castro
PIPGEs UFSCar ICMC/USP and ICMC/USP, Brazil
Maximum penalized likelihood inference in classical errors-in-variables model
 17. Marcela A. G. Machado and Antônio F. B Costa
UNESP-Guaratinguetá, Brazil
Monitoring bivariate processes with a synthetic control chart based on sample ranges

18. Marcelo A. da Silva and Jorge Luis Bazán
PIPGEs UFSCar ICMC/USP and ICMC/USP, Brazil
Choosing between two polytomous IRT models using no-U-turn Hamiltonian Monte Carlo with application to the study of depression
19. Milton Miranda Neto and Ricardo De Carli Novaes
PIPGEs UFSCar ICMC/USP and PIPGEs UFSCar ICMC/USP, Brazil
Strong Law of Large Numbers for dependent Bernoulli random variables
20. Rafael de Carvalho Ceregatti, Luis Ernesto Bueno Salazar and Rafael Izbicki
PIPGEs UFSCar ICMC/USP, UFSCar and UFSCar, Brazil
A new evidence index for Bayesian nonparametric two-sample tests
21. Rafael Soares Paixão and Ricardo Sandes Ehlers
PIPGEs UFSCar ICMC/USP and ICMC/USP, Brazil
Bayesian Inference for GJR-GARCH models via Hamiltonian Monte Carlo
22. Ricardo Felipe Ferreira and Alessandro Giacomo Grimbert Gallo
PIPGEs UFSCar ICMC/USP and UFSCar, Brazil
On existence of invariant measures of stochastic chain with unbounded memory
23. Rosineide F. da Paz, Narayanaswamy Balakrishnan and Jorge Luis Bazán
PIPGEs UFSCar ICMC/USP, McMaster University and ICMC/USP, Brazil, Canada and Brazil
The L -logistic distribution under Bayesian approach
24. Sandra Cristina de Oliveira, Juliana Cobre and Taiane de Paula Ferreira
UNESP-Tupã, ICMC/USP and UNESP-Tupã, Brazil
Bayesian inference for the reliability of scientific co-authorship networks with emphasis on edges or co-authorship relations
25. Susan A. Chumbimune Anyosa, Jorge Luis Bazán
PIPGEs UFSCar ICMC/USP and ICMC/USP, Brazil
Ligações potência e potência reversa: Uma aplicação a dados educacionais
26. Themis C. Abensur, Mário de Castro and Alina A. von Davier
PIPGEs UFSCar ICMC/USP, ICMC/USP and ACT Inc, Brazil and USA
Singularity points and vanishing tetrads in factor analysis
27. Thiago Gottardi and Rosana T. V. Braga
ICMC/USP and ICMC/USP, Brazil
A formalization for software process discovery and comparison metric

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ABSTRACTS

ICMC/USP and DEs/UFSCar

Minicourse

Elements of Computational Statistics

Francisco Cribari-Neto
UFPE, Brazil

Abstract In this mini course some topics of computational statistics will be covered. We will introduce programming concepts in Ox, a matrix programming language, and in R. We will also present some important algorithms that are commonly used in scientific computation. The Monte Carlo method will be introduced and discussed. It will be used to evaluate the performance of the pontual and interval estimators and also to the integrals evaluation. Finally, the bootstrap sampling method will be presented with application to the bias correction for estimators, to the obtaining of confidence intervals, and to the conducting of hypothesis test.

References

1. Doornik, J.A. (2006). An Object-oriented Matrix Programming Language - Ox 4. Londres: Timberlake Consultants & Oxford: <http://www.doornik.com>.
2. Frery, A.C.; Cribari-Neto, F. (2005). Elementos de Estatística Computacional Usando Plataformas de Software Livre/Gratuito. Rio de Janeiro: Instituto de Matemática Pura e Aplicada.
3. Nocedal, J.; Wright, S.J. (2006). Numerical Optimization, 2a ed. New York: Springer-Verlag.
4. Ross, S.M. (2012). Simulation, 5a ed. New York: Academic Press.

Conferences

Stochastic Ising model with plastic interactions

Anatoli Iambartsev
IME/USP, Brazil

Abstract We propose a new model based on the Ising model with the aim to study synaptic plasticity phenomena in neural networks. It is today well established in biology that the synapses or connections between certain types of neurons are strengthened when the neurons are co-active, a form of the so called synaptic plasticity. Such mechanism is believed to mediate the formation and maintenance of memories. The proposed model describes some features from that phenomenon. Together with the spin-flip dynamics, in our model the coupling constants are also subject to stochastic dynamics, so that they interact with each other. The evolution of the system is described by a continuous-time Markov jump process. This is a joint work with Guillem Via and Eugene Pechersky.

A generalized mixture model applied to diabetes incidence data

Daiane Aparecida Zuanetti
UFSCar, Brazil

Abstract We present a generalization of the usual (independent) mixture model to accommodate a Markovian first-order mixing distribution. We propose the data-driven reversible jump, a Markov chain Monte Carlo (MCMC) procedure, for estimating the a posteriori probability for each model in a model selection procedure and estimating the corresponding parameters. Simulated data sets show excellent performance of the proposed method in the convergence, model selection and precision of parameters estimates. Finally, we apply the proposed method to analyze USA diabetes incidence data sets.

Dispersion as a survival strategy

Fábio Prates Machado

IME/USP, Brazil

Abstract We consider stochastic growth models to represent population subject to catastrophes. We analyze the subject from different set ups considering or not spatial restrictions, whether dispersion is a good strategy to increase the population viability. We find out it strongly depends on the type of populational behaviour when it faces a disaster, the spatial constraints of the environment and the probability that each exposed individual survives when a disaster strikes.

Counter your customers: Who are they and what they do in the future?

Josemar Rodrigues
ICMC/USP, Brazil

Abstract Usually the market is interested to know the profile of his client and to predict when will leave of purchasing the product. To identify the client is essencial for the industry to formulate preventive strategies to be sure of the success of the product in the market. The advantages and disadvantages of the statistical models used in this area and alternative flexible Poisson models will be discussed for future researches. These statistical models are essencial for the industry to analyze and update his data and to identify active/inactive and the retail customers. Nowadays, it is an important topic which focalizes the relevance of the statistical models for the industry and we hope to motivate the best young talents to work in this area.

Bayesian Analysis for the long-memory of a gamma-modulated process

Laura L. Ramos Rifo
UNICAMP, Brazil

Abstract In this work, we propose a Bayesian methodology to make inferences for a class of Gamma processes, the trajectories of which exhibit long memory behavior and heteroscedasticity. Its path properties are used to implement an approximate Bayesian computation and MCMC scheme to obtain posterior estimates. We test our method with data from the big earthquake occurred in 2010 in Chile. This is a joint work with Plinio Andrade, Soledad Torres and Francisco Torres-Avilés.

Where geography lives? A projection approach for spatial confounding

Marcos Oliveira Prates
UFMG, Brazil

Abstract Spatial confounding between the spatial random effects and fixed effects covariates has been recently discovered and showed that it may bring misleading interpretation to the model results. Solutions to alleviate this problem are based on decomposing the spatial random effect and fitting a restricted spatial regression. In this paper, we propose a different approach: a transformation of the geographic space to ensure that the unobserved spatial random effect added to the regression is orthogonal to the fixed effects covariates. Our approach, named SPOCK, has the additional benefit of providing a fast and simple computational method to estimate the parameters. Furthermore, it does not constrain the distribution class assumed for the spatial error term. A simulation study and a real data analysis are presented to better understand the advantages of the new method in comparison with the existing ones. Joint work with Renato Martins Assunção and Erica Castilho Rodrigues.

Scale and shape mixtures of multivariate skew-normal distributions

Reinaldo B. Arellano-Valle
PUC-Chile, Chile

Abstract In this paper we introduce a broad and flexible class of multivariate distributions obtained by both scale and shape mixtures of multivariate skew-normal distributions. We present the probabilistic properties of this family of distributions in detail and lay down the theoretical foundations for subsequent inference with this model. In particular, we study linear transformations, marginal and conditional distributions, stochastic representations, hierarchical representations, selection representations, moments and Mardia's measures of multivariate skewness and kurtosis. We also describe an EM-type algorithm for maximum likelihood estimation of the parameters of the new model. Our family of multivariate distributions unifies many existing models of the literature that can be seen as submodels of our novel proposal.

Oral Communications

Estimation methods for Kumaraswamy exponential distribution applied survival data

Amanda Morales Eudes D'Andrea
PIPGEs UFSCar ICMC/USP, Brazil

Abstract In the literature, several known distributions are used to accommodate data of failure times, however, most of these distributions is not able to accommodate not monotonous failure rates. Kumaraswamy [1] proposed a new probability distribution able to accommodate these rates and, based on it, most recently Cordeiro and de Castro [2] proposed a new family of generalized distributions, the Kumaraswamy generalized (Kum-G). This distribution besides being flexible, contains distributions with unimodal and bathtub-shaped hazard functions, as shown by de Pascoa et al. [3]. In this paper, we present the Kumaraswamy exponential (Kum-Exp) distribution to analyze data on the lifetime of individuals at risk, and this model is a particular case of the family of Kum-G distributions. Some properties of this distribution will be presented as well as the appropriate method of estimation for the model parameters, the classic and Bayesian approach. The new distribution is illustrated with two data sets in the literature and a simulation study is done to verify the frequentist properties.

Inference in probabilistic context neighborhood

Aline Piroutek
IMECC/UNICAMP, Brazil

Abstract We introduce the Probabilistic Context Neighborhood model for two dimensional lattices as an extension of the Probabilistic Context Tree model in one dimensional space preserving some of its interesting properties. This model has a variable neighborhood structure with a fixed geometry but varying radius. In this way we are able to compute the cardinality of the set of neighborhoods and use the Pseudo-Likelihood Bayesian Criterion to select an appropriate model given the data. We represent the dependence neighborhood structure as a tree making easier to understand the model complexity. We provide an algorithm to estimate the model that explores the sparse tree structure to improve computational efficiency. We also propose a statistical hypothesis test in order to decide whether a given sample was

generated or not by a specific PCN. To this end we propose a dissimilarity measure between two trees and show that two PCN's are equal if and only if this dissimilarity is zero. This result allows us to implement a test to verify if a given sample comes from a specific PCN. The proposed hypothesis test can be also applied to PCT's in the one dimensional case.

Avaliação de produtos através da verificação da presença de $m \geq 1$ quesitos

Démerson André Polli
PIPGEs UFSCar ICMC/USP, Brazil

Abstract Este trabalho apresenta dois modelos simples, construídos a partir de misturas de distribuições discretas, para a modelagem de avaliações de produtos ou serviços através de uma nota associada a $m \geq 1$ quesitos que podem ser julgados satisfatórios ou não. A nota final atribuída pelos avaliadores é o número de quesitos (dentre m) julgados como satisfatórios. Os modelos apresentados baseiam-se na premissa que as avaliações podem ser feitas de forma consciente, avaliando os quesitos, ou aleatoriamente, inclusive com inflação em uma determinada nota $0 \leq N \leq m$.

Monte Carlo study of multiple comparisons corrections in t -test

André Felipe B. Menezes
UEM, Brazil

Abstract Multiple comparisons of treatments means are common in several fields of knowledge. The Student's t -test is one of the first procedure developed, however the p -values associated with the t -test are inaccurate, since there is no control on the familywise Type I error. To solve this problem several corrections were developed for the t -test. In this work, based on Monte Carlo simulations, we evaluated the t -test and the following corrections: Bonferroni, Holm, Hochberg, Hommel, Benja-mini-Hochberg (BH) and Benjamini-Hochberg-Yekutieli (BY) with respect to the power and type I error rate. The study was lead varying the sample size, the sample distribution and the degree of variability. For all instances we regard three balanced treatments, beside that, the probability distributions considered were: Normal, Logistic and Gumbel. Although the corrections are approaching when the sample size increase, our study revels that the BH correction provide the best experimentwise type I error rate and the second overall most powerful correction.

Posters

The ratio estimator for quantification task under prior probability shift

Afonso F. Vaz, Rafael Izbicki and Rafael Stern
PIPGEs UFSCar, UFSCar and UFSCar, Brazil

Abstract In many statistical learning applications, we use classifiers as a way of estimating the proportion (or distribution, or prevalence) of a given class in the target sample. This task is named “quantification”. For instance, one company may be interested in estimating the proportion of positive reviews in a page such as Facebook or Twitter about a given product. A naive approach to dealing with this problem is: (i) Estimate a classifier using one labeled training sample such as Google Shopping reviews, (ii) apply this classifier to Facebook or Twitter reviews about the target product and (iii) use the positive classification number to estimating the proportion. This approach is called “classify and count”. Unfortunately, it may lead to wrong results because it does not consider that the distribution in the training and target samples may be substantially different. This fact is known as “domain shift” (or domain drift). In this study, we propose an estimator named “ratio estimator”. We consider the domain shift problem under the prior probability shift assumption. Moreover, we study its theoretical properties and compare the method to the classify and count estimator via simulation studies. Finally, we discuss a real application.

Functional data analysis and meta-analysis: An application to human gait data

Amanda Buosi Gazon, Luis Ernesto Bueno Salasar and Adriano Polpo de Campos
PIPGEs UFSCar ICMC/USP, UFSCar and UFSCar, Brazil

Abstract Functional data consist on a sample in which each observation is a real valued function. An application of functional data analysis is the human gait. The human gait analysis is the measurement, description and systematic assessment of data that characterize human locomotion. It has fundamental importance in the study and treatment of pathologies involving the locomotor system. In this work we consider the knee flexionextension movement data and combine the tools of functional data analysis and the meta-analysis, under a bayesian approach, to obtain desired estimates and build credibility bands for the posterior mean curve of an individual.

Branching processes: Applications and simulations

Caio Moura Quina
ICMC/USP, Brazil

Abstract Historically motivated by a survival problem of a surname in a population after several generations, the branching processes can model several problems. In this work, we present some applications and simulate them with R language. Before, we present briefly theoretical results that support the simulation procedures. This work is part of the scientific initiation of the author under the guidance of Prof. Dr. Pablo M. Rodríguez.

A study Hamiltonian Monte Carlo methods in univariate GARCH models

Cleber Martins Xavier and Ricardo S. Ehlers
PIPGEs UFSCar ICMC/USP and ICMC/USP, Brazil

Abstract One of the most important informations in financial markets is the variability of an asset. Several models have been proposed in literature with a view to evaluate this phenomenon. Among them we have the GARCH models and stochastic volatility models. Since then several computational Bayesian methods based on Markov chain Monte Carlo algorithms have been employed for estimation of parameters and model comparison. In this work we perform a simulation study to compare Bayesian estimates in univariate GARCH models. Our main goal is to study the possible computational gains in using Hamiltonian Monte Carlo methods relative to the commonly employed Metropolis-Hastings algorithm which is adopted for example by the R package `BayesDccGarch`. We use 500 artificial time series and different sizes of the Markov chains to compare the results of these methods.

Testes de hipóteses para o parâmetro de dispersão da distribuição hiper-Poisson

Daiane de Souza, Vicente G. Cancho, Josemar Rodrigues
PIPGEs ICMC/USP, ICMC/USP and ICMC/USP, Brazil

Abstract The Poisson distribution is widely used to deal with count data. However, this model has as a drawback the assumption of equidispersion. The hyper-Poisson model which is described here, generalizes it and allows for over-and-under-dispersion. The purpose of this work is to analyze the performance of classic score statistics, likelihood ratio and Wald along with the gradient statistics, recently introduced in the literature, to test hypotheses regarding the dispersion parameter of the hyper-Poisson model

Bayesian estimation, residual analysis and prior sensitivity study for zero-one augmented beta regression model with an application to psychometric data

Danilo C. Nogarotto, Caio L.N. Azevedo and Jorge L. Bazán
School of Technology/UNICAMP, Department of Statistics/UNICAMP and
ICMC/USP, Brazil

Abstract The interest on the analysis of the zero-one augmented beta regression (ZOABR) model has been increasing over the last years. In this work we developed Bayesian inference for parameter estimation for ZOABR model through MCMC algorithms, providing some contributions, namely: we explored the using of Jeffreys-rule and independence Jeffreys prior for some of the parameters, we performed a sensitivity study of prior choice, we compared the Bayesian estimates with the maximum likelihood ones and we measured the accurate of the estimates under several scenarios of interest. The results indicate, in a general way, that: the Bayesian approach, under the Jeffreys-rule prior, was as accurate as the ML one. In addition, as expected, the larger the sample size and the lower the variability of the data the more accurate are the parameter estimates. Also, we use the predictive distribution of the response to implement some available residual techniques (previously developed under the frequentist approach). To further illustrate the advantages of our approach, we conduct an analysis of a psychometric real data set including Bayesian residual analysis, where is showed that misleading inference can be obtained when the data is transformed. That is, when the zeros and ones are transformed to suitable values and the usual beta regression model is considered, instead using the ZOABR model. Finally, future developments are discussed.

Um método de categorização de variáveis baseado no ajuste de modelos de regressão para variáveis binárias

Diego Mattozo B. Silva and Gustavo H. A. Pereira
PIPGEs UFSCar ICMC/USP and UFSCar, Brazil

Abstract Modelos de regressão para variáveis binárias são comuns em diversas áreas de conhecimento. Para a obtenção de um melhor ajuste e ao mesmo tempo facilitar a interpretação das estimativas dos parâmetros do modelo, é comum a realização de categorização de variáveis preditoras quantitativas. A maior parte dos métodos de categorização propostos na literatura não leva em consideração a correlação existente entre as covariáveis. Neste trabalho, propomos um método de categorização em que essa correlação é considerada a partir do ajuste de inúmeros modelos de regressão. Os resultados obtidos a partir da aplicação do método proposto em 3 bases de dados da área de risco de crédito sugerem que o novo método apresenta performance superior a métodos de categorização muito usados na prática

Feature selection approach with missing values conducted for statistical learning - A case study of entrepreneurship survival dataset

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Abstract In this article, we investigate the features which enhanced discriminate the survival in the micro and small business (MSE) using the approach of data mining with feature selection. According to the complexity of the data set, we proposed a comparison of three data imputation methods such as mean imputation (MI), k-nearest neighbor (KNN) and expectation maximization (EM) using mutually the selection of variables technique, whereby t-test, then through the data mining process using logistic regression classification methods, naïve Bayes algorithm, linear discriminant analysis and support vector machine hence comparing their respective performances. The experimental results will be spread in developing a model to predict the MSE survival, providing a better understanding in the topic once it is a significant part of the Brazilian' GPA and macro economy.

Wilcoxon test for transformation on soundscape: A feature extraction task

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Abstract This work aimed to apply a blind source separation, targeting to segregate different sound events. Using a Non-Negative Matrix Factorization combined with the Wilcoxon test, and considering a 1% of significance, we obtained 4 relevant groups from the original sound, eliminating (by grouping) most of the rain noise from the sample. The challenge came from the La Selva Biological Research Station located in Costa Rica, the full database is from the period of MAR/06/2015 to APR/20/2015 in which for every 15 minutes were collected a minute, generating 3,061 records or 8,108 minutes in total to be analyzed. This methodology shows good results which can provide researchers a look at the pre-processed data in order to get a better assessment to clean soundscape scenarios.

Bayesian estimation of DINA model using no-U-turn Hamiltonian Monte Carlo

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Abstract The deterministic inputs, noisy “and” gate (DINA) model is a popular Cognitive Diagnosis Models (CDMs) used to classify individuals in Psychometry. In this work we propose to use the NoU-Turn Sampler (NUTS) algorithm, an extension to Hamiltonian Monte Carlo (HMC) method, in order to fit the DINA model. A simulation study is performed with the purpose to evaluate the parameter recovery and efficiency of this MCMC method and compare it with a frequentist method, Metropolis Hastings and Gibbs sampling algorithms. The results indicated that NUTS algorithm employed in the DINA model recovers properly all parameters and is more efficient and accurate than the other known methods used in the comparison.

Variable selection in generalized linear mixed models applied to educational data

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Abstract This aim of this work is to apply variable selection with Lasso methods in generalized linear mixed models with random intercepts. Initially proposed by Tibshirani (1996), it minimizes the sum of squares of the differences between the observed result and the fitted model, under the condition that the sum of the coefficients module is less than some value s . In our case we use the ascending gradient algorithm proposed in Groll & Tutz (2014). For a large set of explanatory variables, it imposes a penalty of the form $\|\beta\|_1 \leq s$, during the estimation process in the likelihood function, where $s \geq 0$ e $\|\cdot\|_1$ denote the norm L_1 , in other words, is $\hat{\beta}$ estimated from $\max_{\beta} [l(\beta) - \lambda \|\beta\|_1]$, where $l(\beta)$ denotes the log-likelihood function of the model. In this process some coefficients are estimated as zero, making the associated variables ignored in the construction of the parsimonious model. We apply the method to a set of educational data, referred to as PROVA BRASIL 2011 which is part of the SAEB (National System for Basic Education Evaluation). The most interesting feature of this method is that, in the estimating procedure, we can point out which predictors are essential for the construction of the model, unlike other methods that, after estimation, it is still necessary to apply model selection methods. This database contains information of students of the 9th grade of elementary school in the state of São Paulo, where a sample of 12.280 students was allocated in 614 schools sampled proportionally in each administrative region of the state. The response variable to be analyzed is the proficiency in Mathematics, which is assumed to have a gaussian distribution. An important step is the choice of λ , which here is done by AIC. The ascending gradient algorithm selected a few variables from an initial set of 67 explanatory covariates, including failure, mother’s education level, father’s education level, among others.

COM-Poisson bivariate correlated distribution

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Abstract This work presents a new distribution proposal. The COM-Poisson bivariate correlated distribution ($CPCB((\lambda_1, \lambda_2, \lambda_3), (\nu_1, \nu_2, \nu_3), (\rho_1, \rho_2, \rho_3))$). It is a generalization of the COM-Poisson bivariate distribution (a generalization of Poisson distribution, Selers et al. 2012). We calculate the mass probability function for all distributions with two parameterization. The distribution was defined using an expansion made by Luceño 1995 in the construction of widespread correlated Poisson distribution. We have calculated Generating Functions and moments for the two parameterization.

Estimation in generalized bivariate Birnbaum-Saunders models

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UFG and McMaster Universit, McMaster Universit, McMaster Universit, UFSCar, UFAM, Brazil, Canada, Canada, Brazil

Abstract In this paper, we propose two moment-type estimation methods for the parameters of the generalized bivariate Birnbaum-Saunders distribution by taking advantage of some properties of the distribution. The proposed moment-type estimators are easy to compute and always exist uniquely. We derive the asymptotic distributions of these estimators and carry out a simulation study to evaluate the performance of all these estimators. The probability coverages of confidence intervals are also discussed. Finally, two examples are used to illustrate the proposed methods.

Outlier identification in spatial models

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Abstract In this work we adopt a Bayesian approach to spatial models for data collected in different locations and our main goal is to identify possible outliers to prevent potentially wrong model choices. We propose two techniques to accomplish this. One is an application of the Jackknife method and the second one was inspired by Banerjee's discussion about island on geo-reference problems. So we redesign our data to create artificial islands and then run the spacial models. To understand

the efficiency of our corrections, we employ two Bayesian information criteria. The yet well know Deviance Information Criterion (DIC) and a generalization of it, the Watanabe-Akaike Information Criterion (WAIC), which has a handy particularity, it works well even if the posterior is multi-modal or strongly scattered. We have already test the proposed techniques on real data, known as Sustainable Development Indexes (SDI). This is a new class of index which was inspired by XXI United Nations (UN) agenda and adapted by Instituto Brasileiro de Geografia e Estatística (IBGE) to the Brazilian reality. These preliminary tests show some coherence between theory and practical results and encouraged us to keep studying forms of outlier identification in spatial data. We simulated values from the joint posterior distribution using Hamiltonian Monte Carlo (HMC) methods and Stan which is the standard software to implement these methods. HMC are in general more efficient than standard Markov chain Monte Carlo methods in terms of faster convergence to the target distribution.

Maximum penalized likelihood inference in classical errors-in-variables model

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Abstract In parametric likelihood problems, the maximum likelihood estimator has bias that declines with the sample size. In practice, this bias is often small relative to the standard errors and is typically ignored. However, in many settings, bias may be considerable in infinite samples. In these cases, a bias corrected estimator is useful for comparison purposes and may offer appreciable improvements in mean-squared error, standard deviation and/or coverage probability to the uncorrected maximum likelihood estimator. In this work, we present inference based on maximum penalized likelihood developed by Firth (1993) in errors-in-variables-model. The methodology is illustrated with a simulation study and an application with real dataset in the literature.

Monitoring bivariate processes with a synthetic control chart based on sample ranges

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Abstract The RMAX chart was proposed to control the covariance matrix of two quality characteristics. The monitoring statistic of the RMAX chart is the maximum of two standardized sample ranges from bivariate observations of two quality characteristics. In this article, we investigate the performance of two synthetic RMAX

charts. The first synthetic chart signals when a second point, not far from the first one, falls beyond the warning limit. The second synthetic chart additionally signals when a sample point falls beyond the control limit. The performance of the synthetic RMAX charts are compared with the performance of the standard RMAX chart.

Choosing between two polytomous IRT models using no-U-turn Hamiltonian Monte Carlo with application to the study of depression

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Abstract Item response theory (IRT) models aims to estimate latent variables, also called latent traits, which are characteristics that are not observed and measured directly, e.g., proficiency in an educational assessment, satisfaction of customers and employees, measures of depressive symptoms, among others. According to the item type, IRT models can be divided into two distinct classes. The first class comprises dichotomous models, where their items have only two categories and the second class comprises the polytomous models, where their items have more than two categories, such as the graded response model (GR model) and generalized partial credit model (GPC model), among others. When a researcher is faced with this situation where items are ordered polytomous, a common question is about which model to use. This is evident in mental health articles with depression data. There are works that use the GR model to fit the Beck Depression Inventory (BDI) data and there are works that use the GPC model. The purpose of this study is to investigate how the performance of the recovery of items and individuals' parameters for two ordinal-polytomous IRT models: GR model and GPC model, from the Bayesian viewpoint. The No-U-Turn Sampler (NUTS) algorithm, an adaptive variant of Hamiltonian Monte Carlo, is used via the Stan software to estimate the parameters of both models. We also conduct a performance study of the five model comparison criteria available in the literature for choosing the best fit to the data: DIC, EAIC, EBIC, WAIC and LOO. For this, we simulated 50 samples of each model, we fitted the data using both models and calculate the 5 considered model comparison criteria in this study. Obviously, it would be expected that the criteria selected the model that initially simulated the data, though this did not occur with 100% frequency. However, the model comparison criterion provided bigger frequency was the criterion DIC. Furthermore, it can be seen that for a small quantity of items, the criteria "hit" the model with a lower frequency. Finally, we apply real data from the BDI to evaluate characteristics of depression in order to verify the model that is best fit to the data, presenting a way to justify the choice of the appropriate model to be used in a research. We using real data from 1, 111 responses of college students from the BDI. A version with 21 items of the BDI which evaluate characteristics of depression (symptoms and attitudes) with intensities

ranging from neutral to a maximum level of severity, ranked from 0 (low intensity) to 3 (high intensity) was used for data collection. We fit this data with both models and then choose the GR model considering the model comparison criteria. The GR and GPC models were chosen for the study because researchers have difficulty in choosing an appropriate model to fit a set of data in the area of mental health as is the case of depression.

Strong Law of Large Numbers for dependent Bernoulli random variables

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Abstract This poster considers a sequence of Bernoulli random variables which are dependent in a way that the success probability of a trial conditional on the previous trials depends on the total number of successes achieved prior to the trial. We study the strong law of large numbers and the central limit theorem from the paper by Lan Wu, Yongcheng Qi and Jingping Yang (2012) and generalize their results concerning the strong law of large numbers.

A new evidence index for Bayesian nonparametric two-sample tests

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Abstract In this work, we discuss the two-sample problem using a nonparametric bayesian perspective. The two-sample problem consists in testing the difference between two populations P_1 and P_2 when two independent samples drawn from P_1 and P_2 are available. Assuming independent Dirichlet process priors for P_1 and P_2 , we construct an evidence index for the null hypothesis $H_0 : P_1 = P_2$ based on a weighted mean of the posterior survival function of $d(P_1, P_2)$, where d is a metric between probability measures. This evidence index has an intuitive interpretation and is easy to compute. Moreover, its use can be justified via a bayesian decision-theoretic perspective. We apply our methods to a data set of three groups of patients (HC: with healthy cognition, MCI: with mild cognitive decline and DA: with Alzheimer's disease) submitted to a questionnaire for Alzheimer's disease diagnostic. The main idea is to quantify the differences between the groups using our methods.

Bayesian Inference for GJR-GARCH models via Hamiltonian Monte Carlo

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Abstract The main purpose of this work is to develop, compare and apply Markov chain Monte Carlo (MCMC) to estimate the parameters in a GJR-GARCH model. We employed the Bayesian approach using Hamiltonian Monte Carlo (HMC) methods to obtain the approximations to the posterior marginal distributions of interest. We consider a flexible class of heavy-tailed distributions (t -Student and Generalized error distribution). Then these models are compared using the NASDAQ Industrial index daily returns. The obtained results reveal that for this particular data set the GJR-GARCH with t -Student distribution outperforms the other model.

On existence of invariant measures of stochastic chain with unbounded memory

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Abstract Chains of unbounded memory were introduced by Onicescu and Mihoc (1935) and Doeblin and Fortet (1937). They are stochastic process such that transition probabilities may depend on the whole past of the chain and are capable of modeling scientific data in many areas as, for example, in neuroscience. Questions about existence and uniqueness of invariant measure for this class of stochastic process are widely discuss in the literature. In this context, Harris (1955) prove the existence of invariant measure using a markovian transformation. In this work, we study this transformation introduced by Harris and discuss a possible prove to existence of invariant measure more flexible, using concept of Feller chains.

The L -logistic distribution under Bayesian approach

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Abstract A two-parameter distribution on a bounded domain is studied in this work. This distribution, called l-logistic distribution, provides great flexibility and has the uniform distribution as a particular case. Bayesian inference is discussed with non informative and informative prior distributions. Simulation studies considering prior sensitivity analysis show the robustness of the proposed estimation method and the efficiency of the algorithm adopted. Applications to Study Poverty and Inequality in Brazil are performed. The obtained results show that when the contain potential outliers, the l-logistic model provides a better fit for these data than the beta model

Bayesian inference for the reliability of scientific co-authorship networks with emphasis on edges or co-authorship relations

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Abstract The co-authorship among members of a research group commonly is represented by a (co-authorship) graph G with k nodes and m edges. Researchers that make up this group are represented by nodes and the connection between two agents (i.e., the co-authorship between agents) is represented by edges. Current study measures the reliability of networks by taking into consideration perfectly reliable nodes (or researchers) and unreliable edges (co-authorship relations). A Bayesian approach to the reliability of a co-authorship network represented by a research group of UNESP registered at CNPq has been proposed, obtaining Bayesian estimates and credibility intervals for the individual components (co-authorship relations) and the co-authorship network. Informative priors have been assumed and the posterior summaries have been obtained by Monte Carlo-Markov Chain simulation methods. Results showed that the contribution of each researcher is highly relevant for the maintenance of a research group. In addition, the Bayesian methodology was a feasible and easy computational implementation, enabling the incorporation of prior information in the estimation process.

Ligações potência e potência reversa: Uma aplicação a dados educacionais

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Abstract A regressão binária com ligação logit tem sido usada amplamente; porém quando existe desbalanceamento entre zeros e uns e essa ligação não é correta, observa-se a presença de viés na estimação dos parâmetros. Assim, a necessidade de ligações que melhorem a modelagem de dados de resposta binária torna-se importante. Dessa forma, novos modelos de regressão binária com ligações assimétricas potência e potência reversa foram propostos recentemente por Bazán et al. (2016). Neste trabalho, uma aplicação a dados educacionais é desenvolvida modelando os dados considerando as ligações propostas. No conjunto de dados, a resposta binária avalia o bom desempenho em matemática de um estudante de ensino fundamental, as covariáveis inclusas são características do estudante e da sua escola. O processo de estimação é feito sob aproximação bayesiana usando MCMC. Diversas medidas de comparação de modelos são utilizadas.

Singularity points and vanishing tetrads in factor analysis

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Abstract A considerable part of the empirical analysis in various areas of knowledge involves the test of some parametric hypotheses of interest. The null hypothesis can be represented by a constraint on the parameter space. The so-called singular parameter points problem arises when the Jacobian of the tested constraint is rank deficient at some points. In this text we study frequentist and Bayesian solutions to this problem in the case of vanishing tetrads.

A formalization for software process discovery and comparison metric

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Abstract Software development projects can be successful even without a preliminary definition of the employed process. In order to allow reproducibility of these processes, several authors have devised techniques for process discovery and empirical software development collecting data from project executions. During a research effort for empirical process classification, we have identified the need of a formal process discovery algorithm and a metric specific for comparing process executions. In this paper, we formalize a process discovery algorithm based on Markov-Chains and Finite Automata. We also extend the algorithm for creating metrics for empirical software development. By conducting an experimental study it was possible to validate the metric on the development of functional software applications.

Registered Participants

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Anatoli Iabarstev
André Felipe Berdusco Menezes
André Ricardo Tavares
André Yoshida Machado
Andrey Luan Gomes Contel
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