

Springer Proceedings in Mathematics & Statistics

Volume 118

More information about this series at <http://www.springer.com/series/10533>

Springer Proceedings in Mathematics & Statistics

This book series features volumes composed of select contributions from workshops and conferences in all areas of current research in mathematics and statistics, including operation research and optimization. In addition to an overall evaluation of the interest, scientific quality, and timeliness of each proposal at the hands of the publisher, individual contributions are all refereed to the high quality standards of leading journals in the field. Thus, this series provides the research community with well-edited, authoritative reports on developments in the most exciting areas of mathematical and statistical research today.

Adriano Polpo • Francisco Louzada
Laura L. R. Rifo • Julio M. Stern
Marcelo Lauretto
Editors

Interdisciplinary Bayesian Statistics

EBEB 2014

 Springer

Editors

Adriano Polpo
Federal University of Sao Carlos
Sao Carlos
Brazil

Francisco Louzada
University of Sao Paulo
Sao Carlos
Brazil

Laura L. R. Rifo
Campinas State University
Campinas
Brazil

Julio M. Stern
Dept. of Applied Mathematics
University of Sao Paulo Institute of Mathematics
and Statistics
Sao Paulo, São Paulo
Brazil

Marcelo Lauretto
School of Arts, Sciences and Humanities
University of Sao Paulo
Sao Paulo, São Paulo
Brazil

ISSN 2194-1009

ISSN 2194-1017 (electronic)

Springer Proceedings in Mathematics & Statistics

ISBN 978-3-319-12453-7

ISBN 978-3-319-12454-4 (eBook)

DOI 10.1007/978-3-319-12454-4

Springer Cham Heidelberg New York Dordrecht London

Library of Congress Control Number: 2014956382

© Springer International Publishing Switzerland 2015

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Foreword

It is a great pleasure to preface EBEB 2014, the proceedings of the 12th Brazilian Meeting on Bayesian Statistics, which was attended by the ever-growing community of Brazilian researchers in Bayesian Statistics and by colleagues and collaborators from around the world.

From March 10th to 14th at a beautiful resort in Atibaia, EBEB hosted fine presentations in lecture (33) and poster (39) formats of researchers from institutions in Belgium, Canada, Chile, Finland, India, Italy, Peru, Saudi Arabia, Switzerland, UK, USA, and Brazil. The tradition of meeting participants serving as referees for the selection of papers submitted to be included in this book was maintained. This was not an easy task, as the quality of submission was very high. The EBEB 2014 organizers made sure that graduate students had financial support for active engagement in the meeting activities; presenting their research and interacting with researchers from other institutions. This support is always a sound investment for the development of Bayesian Statistics.

High-quality publications of proceedings, as of EBEB 2012 by AIP (The American Institute of Physics) and of EBEB 2014 by Springer, motivate researchers and enrich the EBEBs. Editing such proceedings is a tradition inspired by the Valencia and MaxEnt series, arguably two of the most influential and long-standing meetings in Bayesian Statistics. This requires a lot of time, great effort, and also knowledge and experience.

Another tradition of the Brazilian Bayesian community is to invite illustrious professors who discuss our research and suggest new directions to explore. First and foremost among those were Dev Basu and Dennis Lindley, as I will comment in the sequel. We look forward to maintaining that tradition at the next EBEBs. We also see as a positive sign of maturity, the increasing number of international researchers that spontaneously attend EBEB, as one expects from prestigious international meetings in well-developed areas of scientific research. This trend is a direct consequence of the existence of high-quality proceedings, and vice-versa, exactly as it is in MaxEnt and used to be in Valencia.

The increasing presence at EBEB of several emergent centers of research in Brazil spreads our Bayesian activities outside the Rio and São Paulo axis. Some of these emerging centers are strongly inserted and well connected internationally, but are

also becoming increasingly capable of self-steering, exhibiting the high degree of autonomy that is so characteristic of genuine scientific research.

My good friend and colleague Josemar Rodrigues received a most deserved accolade at this EBEB. Josa's drive for research produces many papers by himself, his students, and colleagues. Having become a good friend of Professor Basu, Josa was also deeply influenced by him in his move from a good frequentist to a superb Bayesian.

In a way, Dev is a Founding Father of Brazilian Bayesianism. His visit to USP in the eighties left seeds which became important Bayesian trees. This process was also caused by the visit of Dennis, who sadly passed away in 2013. The Brazilian Bayesian community owes gratitude to the two gurus and dedicates this volume to their memory.

Fabio Spizzichino and Claudio Macci's paper in this book is a Brazilian contribution to the celebrations of the 250th anniversary of the publication of (ultimately the reason for us to gather at Atibaia) "An Essay towards Solving a Problem in the Doctrine of Chances" by Our Reverend Thomas Bayes.

São Paulo
January 2015

Sergio Wechsler

Preface

This volume of the “Springer Proceedings in Mathematics & Statistics” contains selected articles from EBEB 2014. The home page of the event is available at <http://www.ime.usp.br/~isbra/eb/eb2014>.

- The main promoters of EBEB 2014 were
 - ISBrA—Brazilian chapter of the International Society for Bayesian Analysis (ISBA)
 - INCTMat—National Institute of Mathematical Science and Technology
 - Interinstitutional Graduate Program in Statistics of UFSCar/ICMC-USP
 - Graduate Program in Statistics of IME-USP
 - IME-USP—Institute of Mathematics and Statistics of University of São Paulo
- Organizing Committee
 - Adriano Polpo (UFSCar)
 - Carlos Alberto de Bragança Pereira (IME-USP)
 - Franciso Louzada Neto (ICMC-USP)
 - Julio Stern (IME-USP)
 - Laura Letícia Ramos Rifo (UNICAMP)
 - Marcelo Lauretto (EACH-USP)
 - Teresa Cristina Martins Dias (UFSCar)
- Scientific Committee
 - Adriano Polpo (UFSCar / Brazil)
 - Alexandra M. Schmidt (UFRJ / Brazil)
 - André Rogatko (Cedars-Sinai / US)
 - Carlos Alberto de Bragança Pereira (IME-USP / Brazil)
 - Carlos A. R. Diniz (UFSCar / Brazil)
 - Cassio de Campos (IDSIA / Switzerland)
 - Dani Gamerman (IM-UFRJ / Brazil)
 - Debajyoti Sinha (FSU / US)
 - Francisco Louzada Neto (ICMC-USP / Brazil)
 - Julio Stern (IME-USP / Brazil)
 - Laura Letícia Ramos Rifo (IMECC-UNICAMP / Brazil)
 - Marcelo Lauretto (EACH-USP / Brazil)
 - Márcia D’Elia Branco (IME-USP / Brazil)

- Marcio Alves Diniz (UFSCar / Brazil)
- Rosangela H. Loschi (UFMG / Brazil)
- Victor Fossaluzza (IME-USP / Brazil)
- Executive committee
 - Bruno Borcado (Supremum Assessoria / Brazil)
 - Lourdes Vaz da Silva Netto (IME-USP / Brazil)
 - Sylvia Regina A. Takahashi (IME-USP / Brazil)

The organizers thank the first president of ISBrA, Professor Sergio Wechsler, for the Foreword and the reviewers for their careful work in selecting the papers. This book is a consequence of the great and hard work of all people involved in the organization of EBEB: colleagues, administrators and the convention center/hotel employers.

We also thank the support of the following promoters:



Contents

1	What About the Posterior Distributions When the Model is Non-dominated?	1
	Claudio Macci and Fabio Spizzichino	
2	Predictive Inference Under Exchangeability, and the Imprecise Dirichlet Multinomial Model	13
	Gert de Cooman, Jasper De Bock and Márcio Diniz	
3	Bayesian Learning of Material Density Function by Multiple Sequential Inversions of 2-D Images in Electron Microscopy	35
	Dalia Chakrabarty and Shashi Paul	
4	Problems with Constructing Tests to Accept the Null Hypothesis	49
	André Rogatko and Steven Piantadosi	
5	Cognitive-Constructivism, Quine, Dogmas of Empiricism, and Münchhausen’s Trilemma	55
	Julio Michael Stern	
6	A Maximum Entropy Approach to Learn Bayesian Networks from Incomplete Data	69
	Giorgio Corani and Cassio P. de Campos	
7	Bayesian Inference in Cumulative Distribution Fields	83
	Ricardo Silva	
8	MCMC-Driven Adaptive Multiple Importance Sampling	97
	Luca Martino, Víctor Elvira, David Luengo and Jukka Corander	
9	Bayes Factors for Comparison of Restricted Simple Linear Regression Coefficients	111
	Viviana Giampaoli, Carlos A. B. Pereira, Heleno Bolfarine and Julio M. Singer	

10	A Spanning Tree Hierarchical Model for Land Cover Classification .	125
	Hunter Glanz and Luis Carvalho	
11	Nonparametric Bayesian Regression Under Combinations of Local Shape Constraints	135
	Khader Khadraoui	
12	A Bayesian Approach to Predicting Football Match Outcomes Considering Time Effect Weight	149
	Francisco Louzada, Adriano K. Suzuki, Luis E. B. Salazar, Anderson Ara and José G. Leite	
13	Homogeneity Tests for 2×2 Contingency Tables	163
	Natalia Oliveira, Marcio Diniz and Adriano Polpo	
14	Combining Optimization and Randomization Approaches for the Design of Clinical Trials	173
	Victor Fossaluzza, Marcelo de Souza Lauretto, Carlos Alberto de Bragança Pereira and Julio Michael Stern	
15	Factor Analysis with Mixture Modeling to Evaluate Coherent Patterns in Microarray Data	185
	Joao Daniel Nunes Duarte and Vinicius Diniz Mayrink	
16	Bayesian Hypothesis Testing in Finite Populations: Bernoulli Multivariate Variables	197
	Brian Alvarez R. de Melo and Luis Gustavo Esteves	
17	Bayesian Ridge-Regularized Covariance Selection with Community Behavior in Latent Gaussian Graphical Models	207
	Lijun Peng and Luis E. Carvalho	
18	Bayesian Inference of Deterministic Population Growth Models	217
	LuiZ Max Carvalho, Claudio J. Struchiner and Leonardo S. Bastos	
19	A Weibull Mixture Model for the Votes of a Brazilian Political Party	229
	Rosineide F. da Paz, Ricardo S. Ehlers and Jorge L. Bazán	
20	An Alternative Operational Risk Methodology for Regulatory Capital Calculation	243
	Guaraci Requena, Débora Delbem and Carlos Diniz	
21	Bayesian Approach of the Exponential Poisson Logarithmic Model .	253
	José Augusto Fioruci, Bao Yiqi, Francisco Louzada and Vicente G. Cancho	

22 Bayesian Estimation of Birnbaum–Saunders Log-Linear Model 263
 Elizabeth González Patiño

23 Bayesian Weighted Information Measures 275
 Salimeh Yasaei Sekeh

**24 Classifying the Origin of Archeological Fragments with Bayesian
 Networks** 291
 Melaine Cristina de Oliveira, Andressa Soreira and Victor Fossaluzza

**25 A Note on Bayesian Inference for Long-Range Dependence of a
 Stationary Two-State Process** 301
 Plinio L. D. Andrade and Laura L. R. Rifo

**26 Bayesian Partition for Variable Selection in the Power Series Cure
 Rate Model** 311
 Jhon F. B. Gonzales, Vera. L. D. Tomazella and Mário de Castro

27 Bayesian Semiparametric Symmetric Models for Binary Data 323
 Marcio Augusto Diniz, Carlos Alberto de Braganca Pereira
 and Adriano Polpo

28 Assessing a Spatial Boost Model for Quantitative Trait GWAS 337
 Ian Johnston, Yang Jin and Luis Carvalho

**29 The Exponential-Poisson Regression Model for Recurrent Events: A
 Bayesian Approach** 347
 Márcia A. C. Macera, Francisco Louzada and Vicente G. Cancho

**30 Conditional Predictive Inference for Beta Regression Model with
 Autoregressive Errors** 357
 Guillermo Ferreira, Jean Paul Navarrete, Luis M. Castro
 and Mário de Castro

Contributors

Plinio L. D. Andrade Institute of Mathematics and Statistics, University of São Paulo, São Paulo, Brazil

Anderson Ara Departamento de Estatística, Universidade Federal de São Carlos, São Carlos, SP, Brazil

Yiqi Bao Department of Statistics, Federal University of São Carlos-UFSCar, São Carlos, SP, Brazil

Leonardo S. Bastos Program for Scientific Computing (PROCC) - Oswaldo Cruz Foundation, RJ, Rio de Janeiro, Brazil

Jorge L. Bazán Instituto de Ciências Matemáticas e de Computação. USP, São Carlos, SP, Brazil

Heleno Bolfarine Instituto de Matemática e Estatística, Universidade de São Paulo, Cidade Universitária - São Paulo, SP, Brazil

Cassio P. de Campos Dalle Molle Institute for Artificial Intelligence, Manno, Switzerland

Queen's University, Belfast, UK

Vicente G. Cancho Institute of Mathematics and Computer Science, University of São Paulo-USP, São Carlos, SP, Brazil

ICMC, University of Sao Paulo, Sao Carlos, Brazil

Luis Carvalho Boston University, Boston, MA, USA

Luis E. Carvalho Department of Mathematics and Statistics, Boston University, Boston, MA, USA

Luiz Max Carvalho Program for Scientific Computing (PROCC) - Oswaldo Cruz Foundation, RJ, Rio de Janeiro, Brazil

Luis M. Castro Department of Statistics, Universidad de Concepción, Concepción, Chile

Mário de Castro Instituto de Ciências Matemáticas e de Computação, Universidade de São Paulo, São Carlos, SP, Brazil

Dalia Chakrabarty Department of Statistics, University of Warwick, Coventry, UK

Department of Mathematics, University of Leicester, Leicester, UK

Jukka Corander Department of Mathematics and Statistics, University of Helsinki, Helsinki, Finland

Giorgio Corani Istituto Dalle Molle di studi sull'Intelligenza Artificiale (IDSIA), Scuola universitaria professionale della Svizzera italiana (SUPSI), Università della Svizzera italiana (USI), Manno, Switzerland

Jasper De Bock Ghent University, SYSTeMS Research Group, Zwijnaarde, Belgium

Gert de Cooman Ghent University, SYSTeMS Research Group, Zwijnaarde, Belgium

Débora Delbem Department of Statistics, Federal University of São Carlos, São Paulo, Brazil

Carlos Diniz Department of Statistics, Federal University of São Carlos, São Paulo, Brazil

Márcio Diniz Ghent University, SYSTeMS Research Group, Zwijnaarde, Belgium
Federal University of Sao Carlos, Sao Carlos, SP, Brazil

Marcio Augusto Diniz Institute of Mathematics and Statistics, University of São Paulo, São Paulo, Brazil

Joao Daniel Nunes Duarte Departamento de Estatística, ICEx, UFMG, Belo Horizonte, MG, Brazil

Ricardo S. Ehlers Instituto de Ciências Matemáticas e de Computação. USP, São Carlos, SP, Brazil

Víctor Elvira Department of Signal Theory and Communications, Universidad Carlos III de Madrid, Leganés, Spain

Luis Gustavo Esteves Institute of Mathematic and Statistics, University of Sao Paulo, Sao Paulo, Brazil

Guillermo Ferreira Department of Statistics, Universidad de Concepción, Concepción, Chile

José Augusto Fioruci Department of Statistics, Federal University of São Carlos-UFSCar, São Carlos, SP, Brazil

Victor Fossaluzza IME-USP, São Paulo, Brazil

Viviana Giampaoli Instituto de Matemática e Estatística, Universidade de São Paulo, Cidade Universitária - São Paulo, SP, Brazil

Hunter Glanz California Polytechnic State University, San Luis Obispo, CA, USA

Jhon F.B. Gonzales Departamento de Estatística, Universidade Federal de São Carlos, Rod, São Carlos, SP, Brazil

Yang Jin Boston University, Boston, MA, USA

Ian Johnston Boston University, Boston, MA, USA

Khader Khadraoui Department of Mathematics and Statistics, Laval University, Quebec City, QC, Canada

Marcelo de Souza Lauretto IME-USP, São Paulo, Brazil

José G. Leite Departamento de Estatística, Universidade Federal de São Carlos, São Carlos, SP, Brazil

Francisco Louzada Institute of Mathematics and Computer Science, University of São Paulo-USP, São Carlos, SP, Brazil

David Luengo Department of Signal Theory and Communications, Universidad Politécnica de Madrid, Madrid, Spain

Claudio Macci Dipartimento di Matematica, Università di Roma Tor Vergata, Roma, Italia

Márcia A. C. Macera DEs, Federal University of Sao Carlos, Sao Carlos, Brazil

Luca Martino Department of Mathematics and Statistics, University of Helsinki, Helsinki, Finland

Vinicius Diniz Mayrink Departamento de Estatística, ICEX, UFMG, Belo Horizonte, MG, Brazil

Brian Alvarez R. de Melo Institute of Mathematic and Statistics, University of Sao Paulo, Sao Paulo, Brazil

Jean Paul Navarrete Department of Statistics, Universidad de Concepción, Concepción, Chile

Melaine Cristina de Oliveira IME-USP, São Paulo, Brazil

Natalia Oliveira Federal University of Sao Carlos, Sao Carlos, SP, Brazil

Elizabeth González Patiño Instituto de Matemática e Estatística, Universidade de São Paulo, São Paulo, Brazil

Shashi Paul Emerging Technologies Research Centre, De Montfort University, Leicester, UK

- Rosineide F. da Paz** Universidade Federal de São Carlos, São Carlos, Brazil
Instituto de Ciências Matemáticas e de Computação. USP, São Carlos, SP, Brazil
- Lijun Peng** Department of Mathematics and Statistics, Boston University, Boston, MA, USA
- Carlos A. B. Pereira** Instituto de Matemática e Estatística, Universidade de São Paulo, Cidade Universitária - São Paulo, SP, Brazil
- Carlos Alberto de Bragança Pereira** Institute of Mathematics and Statistics, University of São Paulo, São Paulo, Brazil
- Steven Piantadosi** Biostatistics and Bioinformatics Research Center, Cedars-Sinai Medical Center, Los Angeles, CA, USA
- Adriano Polpo** Federal University of Sao Carlos, Sao Carlos, SP, Brazil
- Guaraci Requena** Institute of Mathematics and Statistics, University of São Paulo, São Paulo, Brazil
- Laura L. R. Rifo** Institute of Mathematics and Statistics, University of Campinas, Campinas, Brazil
- André Rogatko** Biostatistics and Bioinformatics Research Center, Cedars-Sinai Medical Center, Los Angeles, CA, USA
- Luis E. B. Salasar** Departamento de Estatística, Universidade Federal de São Carlos, São Carlos, SP, Brazil
- Ricardo Silva** Department of Statistical Science and Centre for Computational Statistics and Machine Learning, University College London, London, UK
- Andressa Soreira** IME-USP, São Paulo, Brazil
- Fabio Spizzichino** Dipartimento di Matematica G. Castelnuovo, Sapienza Università di Roma, Roma, Italia
- Julio Michael Stern** Institute of Mathematics and Statistics (IME-USP), University of São Paulo, São Paulo, Brazil
- Claudio J. Struchiner** Program for Scientific Computing (PROCC) - Oswaldo Cruz Foundation, RJ, Rio de Janeiro, Brazil
- Adriano K. Suzuki** Instituto de Ciências Matemáticas e de Computação-ICMC, Universidade de São Paulo-Campus de São Carlos, São Carlos, SP, Brazil
- Vera. L. D. Tomazella** Departamento de Estatística, Universidade Federal de São Carlos, São Carlos, SP, Brazil
- Salimeh Yasaei Sekeh** Department of Statistics, UFSCar, São Carlos, Brazil

About the Editors

Adriano Polpo is Head (2013—) and Associate Professor (2006—) of Statistics at Universidade Federal de Sao Carlos (UFSCar, Brazil), Brazil. He received his PhD in Statistics from University of Sao Paulo (Brazil). He is President of ISBrA—Brazilian Chapter of the International Society for Bayesian Analysis (2012–2014). Polpo is co-author of more than 25 publications in statistical peer—reviewed journals, books, and book chapters. He has supervised more than 15 PhDs, masters and undergraduates.

Francisco Louzada is a Full Professor of Statistics at the Department of Applied Mathematics and Statistics, University of Sao Paulo (USP, Brazil), Research Productivity Fellow of the Brazilian funding agency CNPq, Level 1B, Director for the Center for Risk Analysis (CER), Deputy Director for the Center for Applied Mathematics and Statistics in Industry (CeMEAI), Director of Technology Transfer and Executive Director of External Relations of the Center for Research, Innovation and Dissemination of Mathematical Science in Industry (CEPID-CeMEAI). He received his PhD. degree in Statistics from the University of Oxford, UK. Louzada is single and joint author of more than 150 publications in statistical peer—reviewed journals, books, and book chapters. He has supervised more than 80 assistant researches, post-docs, PhDs, masters and undergraduates.

Laura Rifo is Doctor Professor (2005—) of Statistics at Universidade Estadual de Campinas—Unicamp, Brazil. She received her PhD in Statistics from University of São Paulo, Brazil. She is Treasurer of ISBrA—Brazilian Chapter of the International Society for Bayesian Analysis (2012–2014). Rifo is co-author of about 15 publications in statistical peer—reviewed journals, books, and book chapters, and more than 40 short films, experiments and softwares in scientific divulgation. She has supervised more than 20 assistant researches, PhDs, masters and undergraduates.

Julio Michael Stern is Full Professor of IME-USP, the Institute of Mathematics and Statistics of the University of Sao Paulo, and Level 1 Research Fellow of CNPq, the Brazilian National Council for Science and Technology. He has a Ph.D. in Operations Research from Cornell University. He was the 2010–2012 President of ISBrA, the Brazilian Chapter of the International Society for Bayesian Analysis, and the Organizer of MaxEnt 2008, the 28th International Workshop on Bayesian Inference

and Maximum Entropy Methods in Science and Engineering. He has published several books and many articles in the areas of Epistemology and Logic; Mathematical Modeling and Operations Research; Statistical Theory and Methods; and Sparse and Structured Systems.

Marcelo de Souza Lauretto is Assistant Professor (2009—) and Vice-Coordinator (2013—) of the Bachelor's Degree in Computer Information Systems, at the School of Arts, Sciences and Humanities of the University of Sao Paulo (USP), Brazil. He received his PhD in Bioinformatics from the University of Sao Paulo. Lauretto is co-author of more than 24 publications in peer-reviewed journals, books, and book chapters. He has supervised more than 18 masters and undergraduates.