



BOOK OF ABSTRACTS AND SHORT PAPERS

13th Scientific Meeting of the Classification and Data Analysis Group Firenze, September 9-11, 2021

edited by

Giovanni C. Porzio Carla Rampichini Chiara Bocci



PROCEEDINGS E REPORT

ISSN 2704-601X (PRINT) - ISSN 2704-5846 (ONLINE)

- 128 -

SCIENTIFIC PROGRAM COMMITTEE

Giovanni C. Porzio (chair) (University of Cassino and Southern Lazio - Italy)

Silvia Bianconcini (University of Bologna - Italy) Christophe Biernacki (University of Lille - France) Paula Brito (University of Porto - Portugal) Francesca Marta Lilja Di Lascio (Free University of Bozen-Bolzano - Italy) Marco Di Marzio ("Gabriele d'Annunzio" University of Chieti-Pescara - Italy) Alessio Farcomeni ("Tor Vergata" University of Rome - Italy) Luca Frigau (University of Cagliari - Italy) Luis Ángel García Escudero (University of Valladolid - Spain) Bettina Grün (Vienna University of Economics and Business - Austria) Salvatore Ingrassia (University of Catania - Italy) Volodymyr Melnykov (University of Alabama - USA) Brendan Murphy (University College Dublin -Ireland) Maria Lucia Parrella (University of Salerno - Italy) Carla Rampichini (University of Florence - Italy) Monia Ranalli (Sapienza University of Rome - Italy) J. Sunil Rao (University of Miami - USA) Marco Riani (University of di Parma - Italy) Nicola Salvati (University of Pisa - Italy) Laura Maria Sangalli (Polytechnic University of Milan - Italy) Bruno Scarpa (University of Padua - Italy) Mariangela Sciandra (University of Palermo - Italy) Luca Scrucca (University of Perugia - Italy) Domenico Vistocco (Federico II University of Naples - Italy) Mariangela Zenga (University of Milan-Bicocca - Italy)

LOCAL PROGRAM COMMITTEE

Carla Rampichini (chair) (University of Florence - Italy)

Chiara Bocci (University of Florence - Italy) Anna Gottard (University of Florence - Italy) Leonardo Grilli (University of Florence - Italy) Monia Lupparelli (University of Florence - Italy) Maria Francesca Marino (University of Florence - Italy) Agnese Panzera (University of Florence - Italy) Emilia Rocco (University of Florence - Italy) Domenico Vistocco (Federico II University of Naples - Italy)

CLADAG 2021 BOOK OF ABSTRACTS AND SHORT PAPERS

13th Scientific Meeting of the Classification and Data Analysis Group Firenze, September 9-11, 2021

> edited by Giovanni C. Porzio Carla Rampichini Chiara Bocci

FIRENZE UNIVERSITY PRESS 2021

CLADAG 2021 BOOK OF ABSTRACTS AND SHORT PAPERS : 13th Scientific Meeting of the Classification and Data Analysis Group Firenze, September 9-11, 2021/ edited by Giovanni C. Porzio, Carla Rampichini, Chiara Bocci. — Firenze : Firenze University Press, 2021. (Proceedings e report ; 128)

https://www.fupress.com/isbn/9788855183406

ISSN 2704-601X (print) ISSN 2704-5846 (online) ISBN 978-88-5518-340-6 (PDF) ISBN 978-88-5518-341-3 (XML) DOI 10.36253/978-88-5518-340-6

Graphic design: Alberto Pizarro Fernández, Lettera Meccanica SRLs Front cover: Illustration of the statue by Giambologna, *Appennino* (1579-1580) by Anna Gottard



CLAssification and Data Analysis Group (CLADAG) of the Italian Statistical Society (SIS)

FUP Best Practice in Scholarly Publishing (DOI https://doi.org/10.36253/fup_best_practice) All publications are submitted to an external refereeing process under the responsibility of the FUP Editorial Board and the Scientific Boards of the series. The works published are evaluated and approved by the Editorial Board of the publishing house, and must be compliant with the Peer review policy, the Open Access, Copyright and Licensing policy and the Publication Ethics and Complaint policy.

Firenze University Press Editorial Board

M. Garzaniti (Editor-in-Chief), M.E. Alberti, F. Vittorio Arrigoni, E. Castellani, F. Ciampi, D. D'Andrea, A. Dolfi, R. Ferrise, A. Lambertini, R. Lanfredini, D. Lippi, G. Mari, A. Mariani, P.M. Mariano, S. Marinai, R. Minuti, P. Nanni, A. Orlandi, I. Palchetti, A. Perulli, G. Pratesi, S. Scaramuzzi, I. Stolzi.

ð The online digital edition is published in Open Access on www.fupress.com.

Content license: except where otherwise noted, the present work is released under Creative Commons Attribution 4.0 International license (CC BY 4.0: http://creativecommons.org/licenses/by/4.0/ legalcode). This license allows you to share any part of the work by any means and format, modify it for any purpose, including commercial, as long as appropriate credit is given to the author, any changes made to the work are indicated and a URL link is provided to the license.

Metadata license: all the metadata are released under the Public Domain Dedication license (CC0 1.0 Universal: https://creativecommons.org/publicdomain/zero/1.0/legalcode).

© 2021 Author(s)

Published by Firenze University Press Firenze University Press Università degli Studi di Firenze via Cittadella, 7, 50144 Firenze, Italy www.fupress.com

This book is printed on acid-free paper Printed in Italy

INDEX

Preface

Keynote Speakers

lean-Michel Loubes Optimal transport methods for fairness in machine learning Peter Rousseeuw. Iakob Ravmaekers and Mia Hubert	
Peter Rousseeuw, Jakob Raymaekers and Mia Hubert Class maps for visualizing classification results	6
Robert Tibshirani, Stephen Bates and Trevor Hastie Understanding cross-validation and prediction error	7
Cinzia Viroli Quantile-based classification	8
<i>Bin Yu</i> Veridical data science for responsible AI: characterizing V4 neurons through deepTune	9

1

Plenary Session

Daniel Diaz A simple correction for COVID-19 sampling bias	14
<i>Jeffrey S. Morris</i> A seat at the table: the key role of biostatistics and data science in the COVID-19 pandemic	15
Bhramar Mukherjee Predictions, role of interventions and the crisis of virus in India: a data science call to arms	16
Danny Pfeffermann Contributions of Israel's CBS to rout COVID-19	17

Invited Papers

Claudio Agostinelli, Giovanni Saraceno and Luca Greco Robust issues in estimating modes for multivariate torus data	
Emanuele Aliverti	41
Bayesian nonparametric dynamic modeling of psychological traits	25

FUP Best Practice in Scholarly Publishing (DOI 10.36253/fup_best_practice)

Giovanni C. Porzio, Carla Rampichini, Chiara Bocci (edited by), CLADAG 2021 Book of abstracts and short papers. 13th Scientific Meeting of the Classification and Data Analysis Group Firenze, September 9-11, 2021, © 2021 Author(s), content CC BY 4.0 International, metadata CC0 1.0 Universal, published by Firenze University Press (www.fupress.com), ISSN 2704-5846 (online), ISBN 978-88-5518-340-6 (PDF), DOI 10.36253/978-88-5518-340-6

Andres M. Alonso, Carolina Gamboa and Daniel Peña Clustering financial time series using generalized cross correlations	27
Raffaele Argiento, Edoardo Filippi-Mazzola and Lucia Paci Model-based clustering for categorical data via Hamming distance	31
Antonio Balzanella, Antonio Irpino and Francisco de A.T. De Carvalho Mining multiple time sequences through co-clustering algorithms for distributional data	32
Francesco Bartolucci, Fulvia Pennoni and Federico Cortese Hidden Markov and regime switching copula models for state allocation in multiple time-series	36
Michela Battauz and Paolo Vidoni Boosting multidimensional IRT models	40
<i>Matteo Bottai</i> Understanding and estimating conditional parametric quantile models	44
Niklas Bussmann, Roman Enzmann, Paolo Giudici and Emanuela Raffinetti Shapley Lorenz methods for eXplainable artificial intelligence	45
Andrea Cappozzo, Ludovic Duponchel, Francesca Greselin and Brendan Murphy Robust classification of spectroscopic data in agri-food: first analysis on the stability of results	49
Andrea Cerasa, Enrico Checchi, Domenico Perrotta and Francesca Torti Issues in monitoring the EU trade of critical COVID-19 commodities	53
Marcello Chiodi Smoothed non linear PCA for multivariate data	54
Roberto Colombi, Sabrina Giordano and Maria Kateri Accounting for response behavior in longitudinal rating data	58
Claudio Conversano, Giulia Contu, Luca Frigau and Carmela Cappelli Netwok-based semi-supervised clustering of time series data	62
Federica Cugnata, Chiara Brombin, Pietro Cippà, Alessandro Ceschi, Paolo Ferrari and Clelia Di Serio	
Characterising longitudinal trajectories of COVID-19 biomarkers within a latent class framework	64
Silvia D'Angelo Sender and receiver effects in latent space models for multiplex data	68
Anna Denkowska and Stanisław Wanat DTW-based assessment of the predictive power of the copula-DCC- GARCH-MST model developed for European insurance institutions	71
Roberto Di Mari, Zsuzsa Bakk, Jennifer Oser and Jouni Kuha Two-step estimation of multilevel latent class models with covariates	75
Marie Du Roy de Chaumaray and Matthieu Marbac Clustering data with non-ignorable missingness using semi-parametric mixture models	79

Pierpaolo D'Urso, Livia De Giovanni and Vincenzina Vitale Spatial-temporal clustering based on B-splines: robust models with applications to COVID-19 pandemic	83
Leonardo Egidi, Roberta Pappadà, Francesco Pauli and Nicola Torelli PIVMET: pivotal methods for Bayesian relabelling in finite mixture models	87
Tahir Ekin and Claudio Conversano Cluster validity by random forests	91
Luis Angel García-Escudero, Agustín Mayo-Iscar and Marco Riani Robust estimation of parsimonious finite mixture of Gaussian models	92
Silvia Facchinetti and Silvia Angela Osmetti A risk indicator for categorical data	93
Matteo Fasiolo Additive quantile regression via the qgam R package	97
Michael Fop, Dimitris Karlis, Ioannis Kosmidis, Adrian O'Hagan, Caitriona Ryan and Isobel Claire Gormley Gaussian mixture models for high dimensional data using composite likelihood	98
Carlo Gaetan, Paolo Girardi and Victor Muthama Musau On model-based clustering using quantile regression	102
Carlotta Galeone Socioeconomic inequalities and cancer risk: myth or reality?	106
Michael Gallaugher, Christophe Biernacki and Paul McNicholas Parameter-wise co-clustering for high dimensional data	107
Francesca Greselin and Alina Jędrzejczak Quantifying the impact of covariates on the gender gap measurement: an analysis based on EU-SILC data from Poland and Italy	107
Alessandra Guglielmi, Mario Beraha, Matteo Giannella, Matteo Pegoraro and Riccardo Peli A transdimensional MCMC sampler for spatially dependent mixture models	112
Christian Hennig and Pietro Coretto Non-parametric consistency for the Gaussian mixture maximum likelihood estimator	116
Yinxuan Huang and Natalie Shlomo Improving the reliability of a nonprobability web survey	120
Maria lannario and Claudia Tarantola A semi-Bayesian approach for the analysis of scale effects in ordinal regression models	124
Jayant Jha Best approach direction for spherical random variables	128

Maria Kateri Simple effect measures for interpreting generalized binary regression models	129
Shogo Kato, Kota Nagasaki and Wataru Nakanishi Mixtures of Kato-Jones distributions on the circle, with an application to traffic count data	133
John Kent How to design a directional distribution	137
Simona Korenjak-Černe and Nataša Kejžar Identifying mortality patterns of main causes of death among young EU population using SDA approaches	141
Fabrizio Laurini and Gianluca Morelli Robust supervised clustering: some practical issues	142
Daniela Marella and Danny Pfeffermann A nonparametric approach for statistical matching under informative sampling and nonresponse	146
Mariagiulia Matteucci and Stefania Mignani Investigating model fit in item response models with the Hellinger distance	150
Matteo Mazziotta and Adriano Pareto PCA-based composite indices and measurement model	154
Marcella Mazzoleni, Angiola Pollastri and Vanda Tulli Gender inequalities from an income perspective	158
Yana Melnykov, Xuwen Zhu and Volodymyr Melnykov Transformation mixture modeling for skewed data groups with heavy tails and scatter	162
Luca Merlo, Lea Petrella and Nikos Tzavidis Unconditional M-quantile regression	163
Jesper Møller , Mario Beraha, Raffaele Argiento and Alessandra Guglielmi MCMC computations for Bayesian mixture models using repulsive point processes	167
Keefe Murphy, Cinzia Viroli and Isobel Claire Gormley Infinite mixtures of infinite factor analysers	168
Stanislav Nagy, Petra Laketa and Rainer Dyckerhoff Angular halfspace depth: computation	169
Yarema Okhrin, Gazi Salah Uddin and Muhammad Yahya Nonlinear Interconnectedness of crude oil and financial markets	173
<i>M. Rosário Oliveira, Ana Subtil and Lina Oliveira</i> Detection of internet attacks with histogram principal component analysis	174
Sally Paganin Semiparametric IRT models for non-normal latent traits	178

Giuseppe Pandolfo A graphical depth-based aid to detect deviation from unimodality on hyperspheres	182
Panos Pardalos Networks of networks	186
Xanthi Pedeli and Cristiano Varin Pairwise likelihood estimation of latent autoregressive count models	187
Mark Reiser and Maduranga Dassanayake A study of lack-of-fit diagnostics for models fit to cross-classified binary variables	191
Giorgia Rivieccio, Jean-Paul Chavas, Giovanni De Luca, Salvatore Di Falco and Fabian Capitanio Assessing food security issues in Italy: a quantile copula approach	195
Nicoleta Rogovschi Co-clustering for high dimensional sparse data	199
Massimiliano Russo Malaria risk detection via mixed membership models	203
Paula Saavedra-Nieves and Rosa M. Crujeiras Nonparametric estimation of the number of clusters for directional data	207
Shuchismita Sarkar, Volodymyr Melnykov and Xuwen Zhu Tensor-variate finite mixture model for the analysis of university professor remuneration	208
Florian Schuberth Specifying composites in structural equation modeling: the Henseler- Ogasawara specification	209
Jarod Smith, Mohammad Arashi and Andriette Bekker Network analysis implementing a mixture distribution from Bayesian viewpoint	210
Paul Smith, Peter van der Heijden and Maarten Cruyff Measurement errors in multiple systems estimation	211
Valentin Todorov and Peter Filzmoser Robust classification in high dimensions using regularized covariance estimates	215
Salvatore Daniele Tomarchio, Luca Bagnato and Antonio Punzo Clustering via new parsimonious mixtures of heavy tailed distributions	216
Agostino Torti, Marta Galvani, Alessandra Menafoglio, Piercesare Secchi and Simone Vantini A general bi-clustering technique for functional data	217
Laura Trinchera Developing a multidimensional and hierarchical index following a composite-based approach	220

Rosanna Verde, Francisco T. de A. De Carvalho and Antonio Balzanella A generalised clusteriwise regression for distributional data	223
Marika Vezzoli, Francesco Doglietto, Stefano Renzetti, Marco Fontanella and Stefano Calza A machine learning approach for evaluating anxiety in neurosurgical	
patients during the COVID-19 pandemic	227
Isadora Antoniano Villalobos, Simone Padoan and Boris Beranger Prediction of large observations via Bayesian inference for extreme- value theory	231
Maria Prosperina Vitale, Vincenzo Giuseppe Genova, Giuseppe Giordano and Giancarlo Ragozini	
Community detection in tripartite networks of university student mobility flows	232
Ernst Wit and Lucas Kania Causal regularization	236
Qiuyi Wu and David Banks Minimizing conflicts of interest: optimizing the JSM program	240

Contributed Papers

Antonino Abbruzzo, Maria Francesca Cracolici and Furio Urso Model selection procedure for mixture hidden Markov models	243
Roberto Ascari and Sonia Migliorati A full mixture of experts model to classify constrained data	247
Luigi Augugliaro, Gianluca Sottile and Angelo Mineo Sparse inference in covariate adjusted censored Gaussian graphical models	251
Simona Balzano, Mario Rosario Guarracino and Giovanni Camillo Porzio Semi-supervised learning through depth functions	255
Lucio Barabesi, Andrea Cerasa, Andrea Cerioli and Domenico Perrotta A combined test of the Benford hypothesis with anti-fraud applications	256
Chiara Bardelli Unabalanced classfication of electronic invoicing	260
Claudia Berloco, Raffaele Argiento and Silvia Montagna Predictive power of Bayesian CAR models on scale free networks: an application for credit risk	264
Marco Berrettini, Giuliano Galimberti and Saverio Ranciati Semiparametric finite mixture of regression models with Bayesian P- splines	268

<i>Giuseppe Bove</i> A subject-specific measure of interrater agreement based on the homogeneity index	272
Antonio Calcagni Estimating latent linear correlations from fuzzy contingency tables	276
Andrea Cappozzo, Alessandro Casa and Michael Fop Model-based clustering with sparse matrix mixture models	280
Andrea Cappozzo, Luis Angel Garcìa Escudero, Francesca Greselin and Agustìn Mayo-Iscar Exploring solutions via monitoring for cluster weighted robust models	284
Maurizio Carpita and Silvia Golia Categorical classifiers in multi-class classification problems	288
Gianmarco Caruso, Greta Panunzi, Marco Mingione, Pierfrancesco Alaimo Di Loro, Stefano Moro, Edoardo Bompiani, Caterina Lanfredi, Daniela Silvia Pace, Luca Tardella and Giovanna Jona Lasinio Model-based clustering for estimating cetaceans site-fidelity and abundance	292
Carlo Cavicchia, Maurizio Vichi and Giorgia Zaccaria Model-based clustering with parsimonious covariance structure	296
Francesca Condino Clustering income data based on share densities	300
Paula Costa Fontichiari, Miriam Giuliani, Raffaele Argiento and Lucia Paci Group-dependent finite mixture model	304
Salvatore Cuomo, Federico Gatta, Fabio Giampaolo, Carmela Iorio and Francesco Piccialli A machine learning approach in stock risk management	308
Cristina Davino and Giuseppe Lamberti Pathmox segmentation trees to compare linear regression models	312
Houyem Demni, Davide Buttarazzi, Stanislav Nagy and Giovanni Camillo Porzio Angular halfspace depth: classification using spherical bagdistances	316
Agostino Di Ciaccio Neural networks for high cardinality categorical data	320
F. Marta L. Di Lascio, Andrea Menapace and Roberta Pappadà Ali-Mikhail-Haq copula to detect low correlations in hierarchical clustering	324
Maria Veronica Dorgali, Silvia Bacci, Bruno Bertaccini and Alessandra Petrucci Higher education and employability: insights from the mandatory notices of the ministry of labour	328
Lorenzo Focardi Olmi and Anna Gottard An alternative to joint graphical lasso for learning multiple Gaussian graphical models	332

Francesca Fortuna, Alessia Naccarato and Silvia Terzi Functional cluster analysis of HDI evolution in European countries	336
Sylvia Frühwirth-Schnatter, Bettina Grün and Gertraud Malsiner-Walli Estimating Bayesian mixtures of finite mixtures with telescoping sampling	340
Chiara Galimberti, Federico Castelletti and Stefano Peluso A Bayesian framework for structural learning of mixed graphical models	344
Andrea Gilardi, Riccardo Borgoni, Luca Presicce and Jorge Mateu Measurement error models on spatial network lattices: car crashes in Leeds	348
Carmela Iorio, Giuseppe Pandolfo, Michele Staiano, Massimo Aria and Roberta Siciliano	
The L ^p data depth and its application to multivariate process control charts	352
Petra Laketa and Stanislav Nagy Angular halfspace depth: central regions	356
Michele La Rocca, Francesco Giordano and Cira Perna Clustering production indexes for construction with forecast distributions	360
Maria Mannone, Veronica Distefano, Claudio Silvestri and Irene Poli Clustering longitudinal data with category theory for diabetic kidney disease	364
Laura Marcis, Maria Chiara Pagliarella and Renato Salvatore A redundancy analysis with multivariate random-coefficients linear models	368
Paolo Mariani, Andrea Marletta and Matteo Locci The use of multiple imputation techniques for social media data	372
Federico Marotta, Paolo Provero and Silvia Montagna Prediction of gene expression from transcription factors affinities: an application of Bayesian non-linear modelling	376
Francesca Martella, Fabio Attorre, Michele De Sanctis and Giuliano Fanelli High dimensional model-based clustering of European georeferenced vegetation plots	380
Ana Martins, Paula Brito, Sónia Dias and Peter Filzmoser Multivariate outlier detection for histogram-valued variables	384
Giovanna Menardi and Federico Ferraccioli A nonparametric test for mode significance	388
Massimo Mucciardi, Giovanni Pirrotta, Andrea Briglia and Arnaud Sallaberry Visualizing cluster of words: a graphical approach to grapmar	
acquisition	392

Marta Nai Ruscone and Dimitris Karlis Robustness methods for modelling count data with general dependence	
structures	396
Roberta Paroli, Luigi Spezia, Marc Stutter and Andy Vinten Bayesian analysis of a water quality high-frequency time series through Markov switching autoregressive models	400
Mariano Porcu, Isabella Sulis and Cristian Usala Detecting the effect of secondary school in higher education university choices	404
Roberto Rocci and Monia Ranalli Semi-constrained model-based clustering of mixed-type data using a composite likelihood approach	408
Annalina Sarra, Adelia Evangelista, Tonio Di Battista and Damiana Pieragostino Antibodies to SARS-CoV-2: an exploratory analysis carried out through the Bayesian profile regression	412
Theresa Scharl and Bettina Grün Modelling three-way RNA sequencing data with mixture of multivariate Poisson-lognormal distribution	416
Luca Scrucca Stacking ensemble of Gaussian mixtures	420
Rosaria Simone, Cristina Davino, Domenico Vistocco and Gerhard Tutz A robust quantile approach to ordinal trees	424
Venera Tomaselli, Giulio Giacomo Cantone and Valeria Mazzeo The detection of spam behaviour in review bomb	428
Donatella Vicari and Paolo Giordani Clustering models for three-way data	432
Gianpaolo Zammarchi and Jaromir Antoch Using eye-traking data to create a weighted dictionary for sentiment analysis: the eye dictionary	436