

Research group in Statistics

Department of Economics, Management and Statistics

September 24 2019

People

Faculty

1. Riccardo Borgoni
2. Matteo Borrotti
3. Federico Camerlenghi
4. Nicola Lunardon
5. Sonia Migliorati
6. Gianna S. Monti
- (7. Bernardo Nipoti)
8. Andrea Ongaro
9. Piero Quatto
10. Aldo Solari

Post doc

1. Roberto Ascari
2. Antonella Carcagnì
3. Riccardo Corradin
4. Agnese Maria Di Brisco

Bayesian/frequentist

Bayesian

1. Federico Camerlenghi
2. Sonia Migliorati
3. Bernardo Nipoti
4. Andrea Ongaro
5. Roberto Ascari
6. Riccardo Corradin
7. Agnese Maria Di Brisco

Frequentist

1. Riccardo Borgoni
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3. Nicola Lunardon
4. Gianna S. Monti
5. Piero Quatto
6. Aldo Solari
7. Antonella Carcagnì

Subjects

- ① Spatial statistics
- ② Data mining, machine learning, computational statistics
- ③ Bayesian nonparametrics
- ④ Asymptotic theory
- ⑤ Compositional data analysis
- ⑥ Multiple testing
- ⑦ Selective inference
- ⑧ Permutation tests
- ⑨ ...

Fairly balanced mixture of theory and applications

Riccardo Borgoni



Current position

Associate Professor

Past positions

Assistant Professor, Milano-Bicocca

Lecturer, University of Southampton (UK)

Research Scientist, Max Plank Institute for
Demographic Research (Rostock, Germany)

Ph.D.

University of Padua

Research interests

- Spatial data analysis and sampling
- Industrial statistics
- Quantile and M-quantile regression

Funded projects

2016-18: *Multidimensional poverty estimation using small area estimation*. DAAD-MIUR Joint Mobility Program

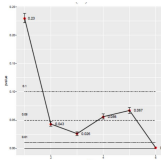
Theory

- Optimal spatial sampling and updating of monitoring networks
- Semiparametric M-quantile regression

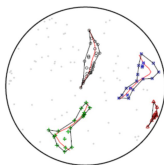
Application: environment, industry and socio-economic issues

- Defectivity and predictive maintenance in microelectronics
- Housing price modelling, well-being evaluation, crimes and policy intervention
- Analysis of natural radioactivity

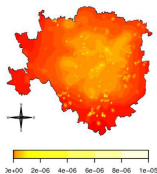
p-value control chart for spatial defectivity clustering



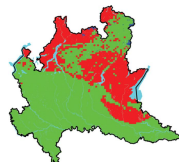
Defects cluster reconstruction in microelectronics



Crime intensity in Milan



Radon-prone areas in Lombardy
Region Semiparametric M-quantile model



Matteo Borrotti



Current position

Assistant Professor

Past positions

Data Scientist @ Energia Crescente

Researcher @ IMATI-CNR

Ph.D.

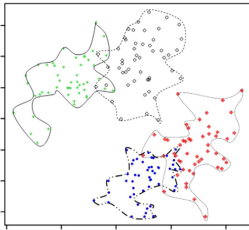
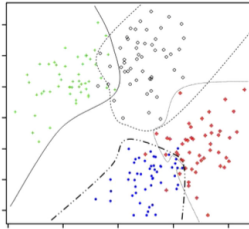
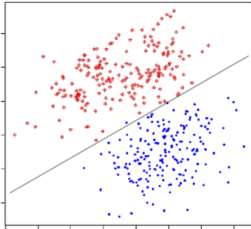
University of Bologna

Research interests

- Design of experiments
- Data mining and Machine learning
- Applied and computational statistics

Application: Multi-class imbalanced learning problem

- Deal with multi-class imbalanced data for classification purpose.
- The goal is to correctly classify a new observation with the right class C_i , where $i > 2$.

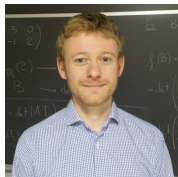


Binary class

Multi-class class

QCC space decomposition

Federico Camerlenghi



Current position

Other affiliations

Past positions

Ph.D.

Assistant Professor

Collegio Carlo Alberto

Post doc, University of Bologna

Post doc, Bocconi University

University of Pavia

Research interests

- Bayesian nonparametrics
- Partial exchangeability
- Species sampling models
- Differential privacy

ERC consolidator grant 2019-2024 *Nonparametric Bayes and empirical Bayes for species sampling problems*

- Team members: Federico Camerlenghi, Emanuele Dolera, Stefano Favaro (PI).
 - Research topics: species sampling models, feature models, differential privacy.
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Dependent structures in Bayesian nonparameterics

- *Problem*: Construction of Bayesian nonparametric priors to model observations coming from different, though related, experiments.
- *Solution*: Processes based on hierarchical and nested structures

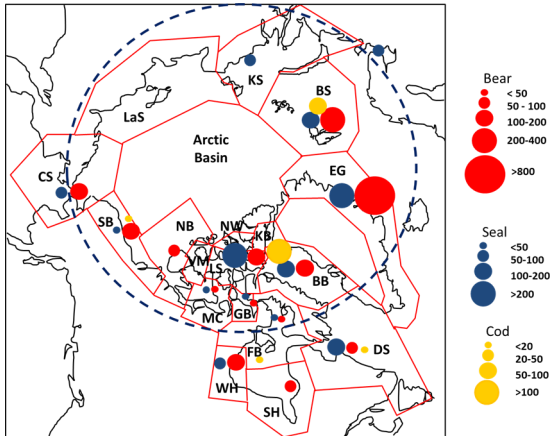
Sonia Migliorati

Current position	Full Professor
Past positions	Associate Professor, University of Milano-Bicocca Assistant Professor, University of Milano-Bicocca and University of Milano
Ph.D.	University of Trento

Research interests

- Bayesian models
- Statistical models for Ecotoxicology
- Interval hypothesis testing

Application: estimation of ecotoxicological risk for bear cubs fed with contaminated milk (penalized regression smoothers, generalized additive models)



Gianna S. Monti



Current position

Assistant Professor

Past positions

Post doc at

University of Milano-Bicocca

Ph.D.

University of Milano-Bicocca

Research interests

- Compositional Data Analysis
- Statistical Ecotoxicological Modelling

Theory: Statistical analysis of compositional data with special emphasis on:

- Distributions for modelling compositional vectors
 - Robust sparse estimation for log-ratio models
-

Application: Statistical ecotoxicological modelling

- Risk prediction modelling
- Ecotoxicological risk assessment for chemicals using species sensitivity distributions.

Andrea Ongaro

Current position	Full Professor
Past positions	Associate Professor, University of Milano-Bicocca Assistant Professor, University of Padua Visiting scholar Aarhus University, Denmark
Ph.D.	University of Padua

Research interests

- Compositional data
- Bayesian nonparametrics
- Interval hypothesis testing

Theory 1: Bayesian nonparametrics

- *Problem:* How to model data which do not have a known simple structure?
 - *Solution:* Go nonparametric and Bayesian by developing infinite dimensional priors with good theoretical properties, interpretability as well as computational tractability
-

Theory 2: Regression models for compositional data

- *Problem:* how to properly and flexibly model vectors of proportions (e.g. portfolio compositions) possibly depending on covariates?
- *Solution:* suitable finite mixtures of Dirichlet (regression) models allow for general dependence structures, multi-modality, outlier robustness and cluster modellization

Piero Quatto

Current position	Associate Professor
Education	M.Sc. in Mathematics
Ph.D.	University of Milano-Bicocca

Research interests

- Mathematical Statistics
- Statistical Inference
- Test of Hypothesis
- Multiple Testing

Local True Discovery Rate

In a multiple testing framework, the aim of the Local True Discovery Rate (LTDR) is to represent the posterior chance of incurring in a true discovery given the observed p-value. This is of particular interest in the case of functional Magnetic Resonance Imaging (fMRI) and ElectroEncephaloGraphy (EEG) time series as for each test the LTDR informs on the strength of the posterior probability of the alternative hypothesis. Since the estimation of the density function of the p-values is challenging in the development of LTDR estimators, I will tackle this problem by studying a flexible solution that makes use of mixtures with known and unknown components.

This project presents challenges that are important to a potentially wide range of disciplines and are becoming particularly demanding in light of the “big data” revolution; tackling such tasks would yield significant and timely developments as well as provide essential tools to the neuroscientific community.

References

S. Sala, P. Quatto, P. Valsasina, F. Agosta, M. Filippi. “pFDR and pFNR estimation for brain networks construction”. Statistics in Medicine, Volume 33, Number 1, 2014.

P. Quatto, N. Margaritella, I. Costantini, F. Baglio. M. Garegnani, R. Nemni, L. Pugnetti. “Brain networks construction using Bayes FDR and Average Power Function”. Statistical Methods in Medical Research, published online 5 December 2018.

Aldo Solari



Current position

Associate Professor

Past positions

Assistant Professor Milano-Bicocca

Visiting scholar Leiden University

Post doc University of Padua

Ph.D.

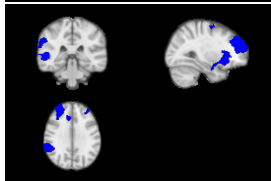
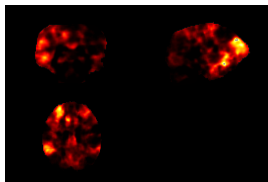
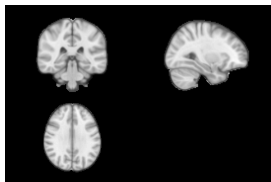
University of Padua

Research interests

- High dimensional data
- Multiple testing
- Selective inference
- Permutation tests

Application: Brain imaging (NeuroMI)

- Analysis of fMRI data supplies an activation map
- The goal is to find regions of activations



Brain

Activation map

Selected regions

Theory: Post-selection inference

- *Problem:* How to assess the significance of selected regions?
Regions are both selected and tested with the same data
- *Solution:* Correcting overoptimism due to data-driven

Nicola Lunardon



Current position

Assistant professor

Past positions

Post-doc, University Ca' Foscari

Post-doc, University of Padua

Post-doc, University of Trieste

Ph.D.

University of Padua

Research interests

- Pseudolikelihood functions
- Estimating functions
- High-order asymptotic theory
- Extreme value theory

Theory

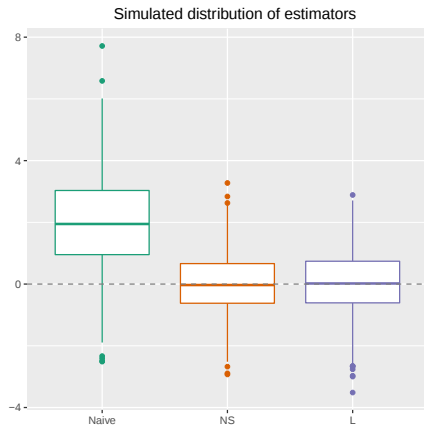
- *Problem*: to lower the bias of point estimators
 - *Solution*: Firth, 1993, *Biometrika*, bias reduction
-

Application

- *Structural vs incidental par.*
Neyman-Scott “paradox”

Some proposals

- Neyman & Scott, 1948,
Econometrica
conditional inference
- Lunardon, 2018, *Biometrika*
bias reduction



Post doc



Ascari
Roberto



Corradin
Riccardo



Di Brisco
Agnese Maria

Carcagnì
Antonella

Roberto Ascari

- Compositional data
- Regression Model
- Bayesian Analysis

Ongaro, A.; Migliorati, S.; **Ascari, R.** (2019) A new mixture model on the simplex. Submitted.

Riccardo Corradin

- Bayesian nonparametrics
- Computational statistics
- Bayesian statistics

Arbel, J; **Corradin, R.**; Nipoti, B. (2019) Dirichlet process mixtures under affine transformations of the data. Submitted

Antonella Carcagnì

- M-quantile regression
- Semiparametric Model

Borgoni, R.; **Carcagnì, A.**; Salvati, N.; Schmid, T. (2019). Analysing radon accumulation in the home by flexible M-quantile mixed effect regression. STOCHASTIC ENVIRONMENTAL RESEARCH AND RISK ASSESSMENT, 1-20.

Agnese Maria Di Brisco

- Compositional data
- Bayesian analysis
- Mixture models

Migliorati S.; **Di Brisco, A.**; Ongaro, A. (2018) A New Regression Model for Bounded Responses. BAYESIAN ANALYSIS 13:845-872