

# Lucia Paci

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Department of Statistical Sciences  
Università Cattolica del Sacro Cuore  
Largo Gemelli, 1 - 20123 Milan, Italy

Email: [lucia.paci@unicatt.it](mailto:lucia.paci@unicatt.it)  
Phone: +39 02 72342491  
Web: <https://luciapaci.github.io/>

## RESEARCH INTERESTS

Bayesian inference of spatio-temporal modeling, graphical modeling, and mixture modeling, with applications to ecological and environmental processes, social and life sciences.

## CURRENT POSITION

*Senior Assistant Professor in Statistics* May, 2020 - present  
(Ricercatore SECS-S/01, Legge 240/10 tipo B)  
Department of Statistical Sciences, Università Cattolica del Sacro Cuore (Milano).

## PAST POSITION

*Junior Assistant Professor in Statistics* December, 2016 - April, 2020  
(Ricercatore SECS-S/01, Legge 240/10 tipo A)  
Department of Statistical Sciences, Università Cattolica del Sacro Cuore (Milano).

*Post-doctoral Research Fellow in Statistics* November, 2013 - October, 2016  
Department of Statistical Sciences, University of Bologna.

## EDUCATION

*Ph.D. in Statistics* January, 2014  
Department of Statistical Science, University of Bologna.

*M.Sc. in Statistical and Economic Sciences* January, 2010  
Faculty of Statistical Science, University of Bologna.

*B.Sc. in Statistics, Business and Markets* October, 2007  
Faculty of Statistical Science, University of Bologna.

## TEACHING

### Università Cattolica del Sacro Cuore

Master's degree in Data analytics for business

- Vice-Coordinator of the M.Sc. (since 2020)
- *Applied linear models* (AY 2021/22, 2020/21 - 60 hours)
- *Time series and spatial data analysis* (AY 2021/22 - 30 hours)
- Supervisor of Internship, Research assistantship and Field project (AY 2021/22)

Master's degree in Statistical and actuarial sciences

- *Empirical research* (AY 2020/21, 2019/20 - 36 hours, 2018/19 - 24 hours)
- *Statistical modelling* (AY 2017/18 - 30 hours; teaching assistant AY 2019/20, 2018/19, 2016/17)
- Supervisor of Internship, Research assistantship and Project (AY 2020/21, 2019/20, 2018/19)

Bachelor's degree in Economics and Management

- *Statistics* (teaching assistant AY 2021/22, 2019/20, 2018/19, 2017/18)

Master in Data Science for Management

- *Preliminary course in Statistics* (AY 2021, 2020, 2019, 2018, 2017 - 14 hours)

## University of Bologna

Master's degree in Statistics

- *Bayesian inference* (teaching assistant AY 2016/17, 2015/16, 2013/14, 2012/13, 2011/12)
- *Principles and Methods of Sampling* (teaching assistant AY 2015/16)

Bachelor's degree in Statistics

- *Survey Sampling* (teaching assistant AY 2015/16, 2014/15)
- *Environmental Statistics* (teaching assistant AY 2015/16)
- *R laboratory* (teaching assistant AY 2014/15)

## PhD program

- Course *Statistics for spatio-temporal data* (december 2020 - 15 hours), PhD program in Economics and Statistics, University of Milan-Bicocca
- Course *Statistical models for spatio-temporal data* (february 2020 - 14 hours), PhD program in Engineering and applied sciences, University of Bergamo
- Member of the Scientific Committee of the PhD program in Economics and Statistics, University of Milan-Bicocca (since AY 2018/2019 to present)
- Member of the Scientific Committee of the PhD program in Statistics and Mathematics for Finance, University of Milan-Bicocca (AY 2017/18 - 2019/20)

## RESEARCH EXPERIENCE

*Visiting Scholar*

February, 2016 - April, 2016

Facultad de Economía y Empresa, Universidad de Zaragoza.

*Research Fellow*

October, 2014 - December, 2014

Statistical and Applied Mathematical Sciences Institute (SAMSI), Research Triangle Park, USA.

*Visiting Scholar*

January, 2012 - November, 2012

Department of Statistical Science, Duke University, Durham, NC, USA.

*Research assistant*

March, 2010 - July, 2010

Department of Statistical Science, University of Bologna.

## PUBLICATIONS

Gasperoni F., Luati A., Paci L., D'Innocenzo E. (2021) Score driven modeling of spatio-temporal data, *Journal of the American Statistical Association*, in press.

Paci L., Consonni G. (2020) Structure discovery of contemporaneous dependencies in graphical VAR models, *Computational Statistics & Data Analysis*, 144, 106880.

Paci L., Beamonte M. A., Gelfand A. E., Gargallo P., Salvador M. (2020) Spatial hedonic modeling adjusted for preferential sampling, *Journal of the Royal Statistical Society: Series A*, 183, 169-192.

Finazzi F., Paci L. (2020) Kernel-based estimation of individual location densities from smartphone data. *Statistical Modelling*, 6, 617-633.

Finazzi F., Paci L. (2019) Quantifying personal exposure to air pollution from smartphone-based location data, *Biometrics*, 75, 1356-1366.

Paci L., Finazzi F. (2018) Dynamic model-based clustering for spatio-temporal data, *Statistics and Computing*, 28, 359-374.

Paci L., Beamonte M. A., Gelfand A. E., Gargallo P., Salvador M. (2017) Analysis of residential property sales using space-time point patterns, *Spatial Statistics*, 21, 149-165.

Paci L., Gelfand A. E., Beamonte M. A., Rodrigues M., Pérez-Cabello F. (2017) Space-time model for post-fire vegetation recovery. *Stochastic Environmental Research and Risk Assessment*, 31 (1), 171-183.

Paci L., Gelfand A. E., Cocchi D. (2015) Quantifying uncertainty for temperature maps derived from computer models. *Spatial Statistics*, 12, 96-108.

Paci L., Gelfand A. E., Holland D. M. (2013) Spatio-temporal modeling for real-time ozone forecasting. *Spatial Statistics*, 4, 79-93.

Bruno, F., Cocchi, D., Paci L. (2013) A practical approach for assessing the effect of grouping in hierarchical spatio-temporal models. *ASTA Advances in Statistical Analysis*, 97 (2), 93-108.

### **Books and chapters in books**

Paci L. (2019) Bayesian space-time data fusion for real-time forecasting and map uncertainty, *Best Ph.D. Thesis in Applied Statistics*, Cleup.

Canale A., Durante D., Paci L. Scarpa B. (Edited by) (2018) ‘Studies in Neural Data Science’, Series Springer Proceedings in Mathematics and Statistics.

Paci L., Trivisano C., Cocchi D. (2018) Multivariate Stochastic Downscaling for Semicontinuous Data. In: Mola F., Conversano C., Vichi M. (Eds) *Classification, (Big) Data Analysis and Statistical Learning. Studies in Classification, Data Analysis, and Knowledge Organization*. Springer, pp 107-115.

Paci L., Bonafé G., Trivisano C. (2016) Dynamic data fusion approach for air quality assessment. In Steyn D., Chaumerliac N. (Eds) *Air Pollution Modelling and its Application XXIV - Proceedings of ITM 2015*, Springer, pp 629-633.

Bruno F., Paci L. (2014) Spatio-temporal model for short-term predictions of air pollution data. In Lanzarone E., Ieva F. (Eds) *The contribution of Young Researchers to Bayesian Statistics - Proceedings of BAYSM 2013*, Springer, pp 91-94.

### **Pre-prints**

Codazzi, L., Colombi, A., Gianella, M., Argiento, R., Paci, L., Pini, A. Functional graphical model for spectrometric data analysis *Submitted*, arXiv:2103.11666.

Argiento R., Filippi-Mazzola E., Paci L., Model-based clustering for categorical data via Hamming distance, *In preparation*.

### **Peer-reviewed conference proceedings**

Costa Fontichiarì P., Giuliani M., Argiento R., Paci L., (2021) Group-dependent finite mixture model. In Porzio G. C., Rampichini C., Bocci C. (Eds), CLADAG 2021 Book of abstracts and short papers, Firenze University Press, pp 304-307.

Filippi-Mazzola E., Argiento R., Paci L., (2021) Clustering categorical data via Hamming distance. In Perna C., Salvati N., Schirripa Spagnolo F. (Eds), Book of short papers SIS 2021, Pearson, pp 752-757.

Codazzi L., Colombi A., Gianella M., Argiento R., Paci L., Pini A., (2020) Functional Graphical Model for Spectrometric Data Analysis. In Pollice A, Salvati N., Schirripa S. (Eds), Book of short papers SIS 2020, Pearson, pp 852-856.

Finazzi F., Paci L. (2018) A comparison of statistical methods for estimating individual location densities from smartphone data. In Valenzuela O., Rojas F., Pomares H., Rojas I. (Eds), Proceedings of ITISE 2018, pp 1471-1482.

Paci L., Consonni G. (2018) A note on objective Bayes analysis for graphical vector autoregressive models. In Abbruzzo A., Brentari E., Chiodi M., Piacentino D. (Eds), Book of short Papers SIS

2018, Pearson, pp 1580-1585.

Finazzi F., Paci L. (2017) Space-time clustering for identifying population patterns from smartphone data. In Petrucci A., Verde R. (Eds) Proceedings of SIS 2017, Firenze University Press, pp 423-428.

Paci L., Gelfand A.E., Beamonte M.A., Gargallo P., Salvador M. (2016) Bayesian modeling of spatio-temporal point patterns in residential property sales. In Pratesi M., Perna C. (Eds) Proceedings of SIS 2016, pp 1-6.

Cocchi D., Paci L., Trivisano C. (2015) Multivariate downscaling for non-Gaussian data. In Mola F., Conversano C. (Eds) Proceedings of CLADAG 2015, CUEC Editrice, pp 191-194.

Paci L., Cocchi D., Gelfand A.E. (2014) Quantifying uncertainty associated with a numerical model output. In Cabras S., Di Battista T., Racugno W. (Eds) Proceedings of SIS 2014, CUEC Editrice, pp 1-6.

Bruno F., Paci L. (2013) Hierarchical spatio-temporal models for short-term predictions of air pollution data. In Brentari E., Carpita M. (Eds), Advances in Latent Variables - Proceedings of SIS 2013, Vita e Pensiero, pp 1-6.

Bruno F., Paci L. (2011) A comparison between hierarchical spatio-temporal models in presence of spatial homogeneous groups: the case of Ozone in the Emilia-Romagna Region. In Cafarelli B. (Eds), Proceedings of Spatial2, CDP Service Edizioni, pp 1-4.

## Software

Finazzi F., Paci L. (2017) *DYSC - DYnamic Spatiotemporal Clustering*. <https://github.com/graspa-group/DYSC>.

Paci L., Bonafé G. (2015) *R-package PESCO*. DOI: 10.5281/zenodo.19829. <https://github.com/jobonaf/pesco>.

## Dissemination

Canale A., Durante D., Paci L., Scarpa B. (2018) Connecting statistical brains. *Significance*, 15, pp 38-40.

Amorati R., Deserti M., Minguzzi E., Stortini M., Paci L. (2017) Prevedere per prevenire e gestire le emergenze. *Ecoscienza*, 1, pp 20-21, 2017 (in Italian).

## CONFERENCES

### Invited presentations

*ISBA 2021*. June 23 - July 2, 2021. Virtual meeting. Talk: Model-based clustering for categorical data via Hamming distance.

*O'BAYES 2019*. June 28 - July 2, 2019. Warwick, UK. Plenary talk with discussant: Structural learning of contemporaneous dependencies in graphical VAR models.

*ERCIM 2018*. December 14-16, 2018. Pisa, Italy. Talk: Quantifying personal exposure to air pollution from smartphone-based location data.

*ISBA 2018*. June 24-29, 2018. Edinburgh, UK. Talk: Dynamic model-based clustering for spatio-temporal data.

*The 26th Annual TIES Conference*. July, 18-22, 2016. Edinburgh, UK. Talk: Assessing common spatio-temporal patterns in large environmental datasets.

*The 25th Annual TIES Conference*. November 22-25, 2015. Al Ain, United Arab Emirates University, UAE. Talk: Space-time modeling for post-fire vegetation recovery.

*CLADAG 2015 Conference*. October 8-10, 2015. Santa Margherita di Pula, Cagliari, Italy. Talk: Multivariate downscaling for non-Gaussian data.

Workshop on Spatio-temporal modeling and its applications. September 24-25, 2015. Department of Economics, University G. d'Annunzio Chieti-Pescara, Italy. Talk: Joint stochastic modeling for downscaling temperature and precipitation maps.

*SIS 2013 Conference: Advances in Latent Variables.Methods, models and applications* June 19-21, 2013. Department of Economics and Management, Brescia, Italy. Talk: Hierarchical spatio-temporal models for short-term predictions of air pollution data.

### **Contributed presentations**

*COSTNET19 Meeting*. October 9-11, 2019. Bilbao, Spain. Talk: Graphical model selection for air quality time series.

*GRASPA 2019 Conference*. July 15-16, 2019. Pescara, Italy. Poster: Graphical model selection for air quality time series.

*COSTNET18 Meeting*. September 26-28, 2018. Warsaw, Poland. Talk: Objective Bayes analysis for graphical vector autoregressive models.

*SIS 2018 Scientific Meeting*. June 20-22, 2018. Palermo, Italy. Poster: A note on objective Bayes analysis for graphical vector autoregressive models.

*Workshop on Verification Intercomparison*. September 21-23, 2016. ARPAE, Bologna, Italy. Poster: Validation of an air quality probabilistic Bayesian model for Emilia-Romagna.

*Bayesian Young Statistician Meeting 2016*. June 19-21, 2016. Firenze, Italy. Talk: Dynamic clustering for spatio-temporal data.

*SIS 2016 Scientific Meeting*. June 8-10, 2016. Salerno, Italy. Talk: Bayesian modeling of spatio-temporal point patterns in residential property sales.

*GRASPA 2015 Conference*. June 15-16, 2015. Università degli Studi di Bari Aldo Moro, Italy. Poster presentation no. 1: Hierarchical space-time model for post-fire vegetation recovery. Poster presentation no. 2: Joint downscaling of temperature and precipitation.

*G70 Conference*. April 19-22, 2015. Department of Statistical Science, Duke University, Durham, USA. Poster presentation: Hierarchical space-time model for post-fire vegetation recovery.

*SIS 2014 Scientific Meeting*. June 11-13, 2014. University of Cagliari, Italy. Talk: Quantifying uncertainty associated with a numerical model output.

*Bayesian Young Statistician Meeting 2013*. June 5-6, 2013. CNR-IMATI, Milan, Italy. Poster presentation: Spatio-temporal model for short-term predictions of air pollution data.

*Spatial Data Methods for Environmental and Ecological Processes, 2nd Edition*. September 1-2, 2011. Foggia, Italy. Poster presentation: A comparison between hierarchical spatio-temporal models in presence of spatial homogeneous groups: the case of Ozone in Emilia-Romagna region.

### **SEMINARS AND INVITED TALKS**

*Bayesian Nonparametrics for Complex Data*. Department of Statistical Sciences, University of Padova, January 24, 2020. Talk: Graphical model selection for air quality time series.

*Bocconi University*. Department of Decision Sciences, June 13, 2019. Talk: Bayesian graphical model selection for multiple time series.

*StaTalk @Unibo*. Department of Statistical Sciences, University of Bologna, March 29, 2019. Talk: Quantifying personal exposure to air pollution from smartphone-based location data.

*Connecting Things and Data with Google*. Google Milan, April 12, 2018. Talk: Data Science: education and applications.

*University of Padova*. Department of Statistical Sciences, October 14, 2016. Talk: Space-time point pattern analysis of residential property sales.

*Workshop on Assistance for Air Quality Forecast and Simulation Project in Beijing Municipality.* May 20, 2014. ARPA-SIMC Emilia Romagna, Bologna, Italy. Talk: Improving the statistical postprocessing tool (PESCO).

*First Workshop of StEPHI project.* February 6, 2013. Department of Statistical Sciences, University of Bologna, Italy. Talk: Ozone data (monitoring site and Chimere model data) for the Emilia Romagna region.

*STATMOS Meeting.* April 12, 2012. Department of Statistical Science, Duke University, Durham, USA. Talk: Spatio-temporal modeling for real-time ozone forecasting.

*Applied Bayesian Statistic School: Hierarchical modeling for environmental processes.* June 20-24, 2011. EURAC, Bolzano, Italy. Talk: A comparison between hierarchical spatio-temporal models in presence of spatial homogeneous groups: the case of Ozone in Emilia-Romagna Region.

## AWARDS

National Scientific Qualification for Associate professor in Statistics (Abilitazione Scientifica Nazionale a professore di II fascia, settore 13/D1), from 20/12/2019 to 20/12/2028.

High quality publication award, Università Cattolica del Sacro Cuore, 2019.

Best PhD Thesis in Applied Statistics, Italian Statistical Society, 2016.

Best poster award, GRASPA, 2015.

G70 Young Investigator Travel award, Duke University, 2015.

SAMSI Research Fellowship, 2014.

Marco Polo Mobility Scholarship, University of Bologna, 2011 and 2015.

## FUNDING

Member of the research project “Towards more Earthquake-resilient Urban Societies through a Multi-sensor-based Information System enabling Earthquake Forecasting, Early Warning and Rapid Response actions” (TURNkey), funded by EU Framework Programme Horizon 2020, PI: Francesco Finazzi (University of Bergamo). 2020-2022

Member of the research project “Real-time Earthquake Risk Reduction for a Resilient Europe” (RISE), funded by EU Framework Programme Horizon 2020, PI: Francesco Finazzi (University of Bergamo). 2020-2022

Member of the research project “Bayesian methods for clustering, functional analysis and structural learning of complex data”, funded by Università Cattolica del Sacro Cuore, PI: Raffaele Argiento (Università Cattolica del Sacro Cuore). 2020

Member of the research project “Bayesian and frequentist methods for high-dimensional data”, funded by Università Cattolica del Sacro Cuore, PI: Guido Consonni (Università Cattolica del Sacro Cuore). 2017-2019

Member of the COST Action (CA15109) “European Cooperation for Statistics of Network Data Science” (COSTNET), funded by EU Framework Programme Horizon 2020, PI: Ernst Wit (Università della Svizzera italiana). 2018-2020

Member of the research project PRIN 2015 “Environmental processes and human activities: capturing their interactions via statistical methods” (EphaStat), funded by the Italian Ministry of Education, Universities, and Research, PI: Daniela Cocchi (University of Bologna). 2016-2020

Member of the research project FIRB 2012 “Statistical modeling of environmental phenomena: pollution, meteorology, health and their interactions” (StEPHI), funded by the Italian Ministry of Education, Universities, and Research, PI: Francesca Bruno (University of Bologna). 2013-2016

## OTHER ACADEMIC ACTIVITIES

Member of the Nominating Committee of OBAYES - ISBA section, 2019 elections.

Member of the Local Organizing Committee of SIS 2019, June 19-21, 2019, Milan, Italy.

Member of the Reference Committee of SUS<sup>5</sup>, June 18, 2019, Milan, Italy.

Joint Organizer of the meeting ‘Start up Research - Follow up’, June 19, 2018, Palermo, Italy.

Co-Organizer of the invited session ‘Young contribution to statistical learning’ at SIS 2018 Conference, June 20-22, 2018, Palermo, Italy.

Chair of the Scientific Committee of the SIS School on ‘Data Science on digital unstructured data’, September 1-8-15-22-29, 2017, Milan, Italy.

Member of the Scientific Committee of SIS 2017 Conference, June 28-30 2017, Florence, Italy.

Chair of the Scientific Committee and the Organizing Committee of Start up Research workshop, June 25-27 2017, Certosa di Pontignano, Siena, Italy.

Member of the Local Organizing Committee of TIES-GRASPA 2017 Conference, July 24-26 2017, Bergamo, Italy.

Member of the Scientific Committee of GRASPA 2015 Conference, June 15-16 2015, Bari, Italy.

Elected Program Chair of the junior section of the International Society for Bayesian Analysis (j-ISBA) from January 2016 to December 2017.

Elected member of the Board of the young section of the Italian Statistical Society (y-SIS) from January 2015 to December 2016.

*Referee for:* Computational Statistics & Data Analysis; Environmetrics; Journal of Agricultural, Biological, and Environmental Statistics; Journal of Royal Statistical Society - Series A; Journal of Royal Statistical Society - Series C; Journal of Statistical Computation and Simulation; Journal of Statistical Software; IMA Journal of Management Mathematics; Metron; Statistical Methods in Medical Research; Statistics and Probability Letters; Statistical Science.

## **AFFILIATIONS**

International Society for Bayesian Analysis (ISBA); Italian Statistical Society (SIS); Research Group for Statistical Applications to Environmental Problems (GRASPA)

Milan, August 2021