PERSONAL INFORMATION   Elisa Varini

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Nationality Italian

Current Position Researcher at CNR-IMATI in Milano

RESEARCH INTERESTS

Summary

My research interests concern the stochastic modelling of seismic sequences and the exploration of the statistical tools for the prediction. I focus on the point processes and their use in dynamical modelling of complex multiscale systems (self-correcting and self-exciting point processes, Markov modulated Poisson processes, hidden Markov models, generalized Weibull failure models).

I apply Bayesian statistical methods to make inference on these complex models; I extensively use the Markov Chain Monte Carlo and the sequential Monte Carlo methods in order to obtain the estimate and the uncertainty measure of target quantities. In the frame of the European project UPStrat-MAFA, I was involved in modelling the attenuation of macroseismic intensity through a Beta-Binomial model with application to several European countries.

I am also interested in clustering methods as regards the identification of earthquake clusters and the characterization of their topological structure through network theory.

I am currently involved in: - the implementation of a procedure, based on statistical methodologies, for the multi-hazard risk assessment of residential buildings, able to consider the cascade effects related to the phenomenon of volcanic eruptions (lava flows, ash, pyroclastic flows and earthquakes), - the analysis of temporal variations of seismic parameters as possible precursors of earthquakes, - the analysis of the statistical properties of earthquake sequences within the epidemic-type models, - the development of a Bayesian approach to the adaptive monitoring of environmental data.

WORK EXPERIENCE

From 16/11/2011 to today

CNR Researcher (Ricercatore a tempo indeterminato)

CNR – IMATI Milano

- Stochastic modelling of seismic sequences and statistical tools for the prediction, in an attempt to incorporate physical conjecture/information into the probabilistic framework
- Point processes, especially the self-exciting and the self-correcting point processes, and their use in dynamical modelling (hidden Markov models, state-space models)
- Bayesian statistics, Markov Chain Monte Carlo and sequential Monte Carlo methods for uncertainty assessment/analysis
- Probabilistic modelling of macroseismic attenuation and forecast of damage scenarios
- Clustering methods
- Analysis of temporal variations of seismicity through probability distributions inspired by non-extensive statistical physics
- Multi-hazard risk assessment of buildings, in particular as regards probabilistic aspects
- Adaptive monitoring of environmental data through a Bayesian approach

From Feb 2011 to May

Research activity (Collaborazione di ricerca)

CNR – IMATI Milano

- Development of advanced methods for the Bayesian inference of Markov models in environmental applications

From Jun 2010 to Dec 2010

Research grant (Borsa-lavoro)

CNR – IMATI Milano

Funded by the Councilwomen of Equality and by AFOL of the Province of Milan

- Unsupervised learning and stochastic modelling for the analysis of macroseismic data in order to improve the ground-motion relations in the Province of Milan

From Jul 2010 to Nov 2010	### Research activity (Collaborazione di ricerca)

CNR – IMATI Milano

- Software development of estimation methods of hidden Markov and semi-Markov models by particle filtering and Monte Carlo techniques, for environmental applications and climate data analysis

From Jan 2009 to Apr 2010	### Temporary research position (Ricercatore a tempo determinato)

CNR – IMATI Milano

Funded by the Italian Department of the Civil Protection (DPC) in the frame of the 2007-2009 Agreement with the National Institute of Geophysics and Volcanology (INGV).
- Development of hidden Markov models for seismic sequences

From 2004 to 2008	### Research grant (Assegno di ricerca)

CNR – IMATI, Milan

Partially funded by DPC in the frame of the 2004-2006 DPC-INGV Agreement.

- Analysis of sequential estimation methods applied to state-space models for seismic sequences

From 2000 to 2001	### Research activity (Incarichi di collaborazione professionale)

CNR – IMATI Milano

- Development of Fortran software for Bayesian analysis of point processes and application to seismic sequences

EDUCATION AND TRAINING

2000, March 28	### Degree in Mathematics

University of Parma

- Thesis: Fast algorithm for the solution of Hessenberg linear system

2005, March 18	### PhD in Statistics

University Bocconi, Milano

- PhD thesis: Sequential estimation methods in continuous-time state-space models

NATIONAL AND INTERNATIONAL PROJECTS

2022-2024	Responsible for CNR-IMATI of the PRIN 2022 PNRR project SMILE "Statistical Machine Learning for Exposure development", Prot. P202247PK9 (CUP B53D23029430001)
2022-2025	Responsible for CNR-IMATI of the project "CN HPC - National Centre for HPC, Big Data and Quantum Computing, Spoke 5 - Environment & Natural Disasters" (CUP B93C22000620006), funded by the European Union - NextGenerationEU.
2022-2025	Participant in the project "RAISE - Robotics and AI for Socio-economic Empowerment", spoke 3: "Sustainable environmental caring and protection technologies" (CUP B33C22000700006), funded by the European Union – NextGenerationEU.
2021-2022	Responsible for CNR-IMATI of the Research agreement between INGV (Italian Institute of Geophysics and Volcanology) and IMATI-CNR in the frame of Project INGV Pianeta Dinamico (CUP D53J19000170001) supported by MIUR (Fondo finalizzato al rilancio degli investimenti delle amministrazioni centrali dello Stato e allo sviluppo del Paese, legge 145/2018), Tema 8 – PANACEA 2021.
2019-2021	Participant in Working Program 2: Volcanoes. Task 13: Seismic hazard assessment induced by local events in Ischia, Agreement B2 2019-2021 between the Italian Institute of Geophysics and Volcanology (INGV) and the Italian Civil Protection Department (DPC).

2019-2023	Participant in the COST Action CA18109 AGITHAR - Acceleration Global science In Tsunami HAzard and Risk analysis, supported by COST (European Cooperation in Science and Technology)
2017-2019	Participant in PRIN 2015 (Progetti di ricerca di Rilevante Interesse Nazionale) "Complex space-time modeling and functional analysis for probabilistic forecast of seismic events", Prot. 20157PRZC4, 3 years, Principal investigator G. Adelfio, Decreto Direttoriale MIUR n.1827 del 20/09/2016.
2016-2019	Participant in the Project MPS19: the update of the Italian seismic hazard maps, Agreement 2015 between Italian Seismic Hazard Center (CPS) of INGV and DPC.
2012-2014	Participant in the Progetti Premiali 2012 - MIUR, Linea di intervento 2, prog. n.24: MATHTECH - La matematica per la società e l'innovazione tecnologica., (3 years), D.M. 25 novembre 2013, prot. n. 973
2012-2013	Participant in the EU research project Urban Disaster Prevention Strategies Using MAcroseismic Fields and FAult Sources (UPStrat-MAFA), (2 years), Grant Agreement n. 230301/2011/613486/SUB/A5.
2007-2009	Participant in the Project S1 - Analysis of the seismic potential in Italy for the evaluation of the seismic hazard, (2 years), funded in the frame of the Agreement 2007-2009 DPC-INGV.
2004-2006	Participant in the Project S2 - Evaluation of seismogenic potential and probability of strong earthquakes in Italy, (2 years), funded in the frame of the Agreement 2004-2006 DPC-INGV.

TEACHING ACTIVITY

2017-2018 2015-2016	Teaching assistant University of Milan – Department of International, Legal, Historical and Political Studies ▪ Course of Statistics.
2007-2008 2006-2007 2004-2005	Teaching assistant & Tutor University Bocconi, Milan – Economic Faculty ▪ Course of Statistics ▪ Course of Statistics-Sample Surveys
2003-2004	Teaching assistant University LIUC Carlo Cattaneo, Castellanza - Economic Faculty ▪ Course of Statistics.

ORGANIZATION OF SCIENTIFIC MEETINGS

2024	Co-convener at the General Assembly of the European Seismological Commission (ESC)
2024, 2021	Chair of the Organizing Committee of BISP – Workshop on Bayesian Inference in Stochastic Processes, organized by CNR-IMATI
2023	Co-organizer of the workshop "La statistica al CNR al servizio del Paese" ("Statistics at CNR at the service of the country"), for the celebration of the 100th anniversary of CNR
since 2021	Executive director of ABS – the Applied Bayesian Statistics School, organized by CNR-IMATI
2022	Co-convener at the Third European Conference on Earthquake Engineering and Seismology (3ECEES)
since 2019	Co-convener at the European Geosciences Union (EGU) General Assembly

FURTHER INFORMATION

Visiting experiences	• Institute of Statistical Mathematics, Tokyo, Japan (2008, 2014, 2018, 2020) as visiting researcher • School of Mathematics, Statistics & Computer Science, Victoria University of Wellington, New Zealand (2006) as visiting researcher • Department of Mathematics, University of Bristol, UK (2004, 2005) as visiting PhD student
Invited talks	• 2023, The 10th International Workshop on Applied Probability (IWAP), Thessaloniki, Greece

- 2022, The International Statistical Seismology (StatSei) conference, Cargèse, France
- 2017, 61th World Statistics Congress – ISI2017, Marrakech, Morocco
- 2017, The 10th International Workshop on Statistical Seismology, Wellington, New Zealand
- 2010, International Workshop on Applied Probability (IWAP), Madrid, Spain
- 2009, Sixth Workshop on Bayesian Inference in Stochastic Processes, Bressanone, Italy

Memberships

- ISI – TIES (International Statistical Institute - International Environmetrics Society)
- ISBA – EnviBayes (International Society for Bayesian Analysis - Environmental Sciences Section)
- EGU (European Geosciences Union)
- SSA (Seismological Society of America)

Digital skills

- Fortran, C++
- R, Matlab

Evaluation of research results

- Referee of journals in Geophysics: Acta Geophysica; Annals of Geophysics; Bulletin of the Seismological Society of America; Journal of Seismology; Nonlinear Processes in Geophysics; Physica A; Pure and Applied Geophysics; Tectonophysics; Chaos, Solitons and Fractals.

- Referee of journals in Statistics: Annals of the Institute of Statistical Mathematics; Applied Mathematics; Computational Statistics and Data Analysis; Digital Signal Processing; Journal of Computational & Graphical Statistics; Methodology and Computing in Applied Probability; Statistics and Computing; Environmental and Ecological Statistics; Computational and Applied Mathematics.

Personal data

According to law 679/2016 of the Regulation of the European Parliament of 27th April 2016, I hereby express my consent to process and use my data provided in this CV