

Paolo Barucca | Lecturer

University College London, Gower Street 66-72, WC1E 6EA London (UK)

☎ +44 7498902545 • ✉ p.barucca@ucl.ac.uk

Directions of research

- Statistical physics of disordered systems and its application on the analysis of rugged free energy landscapes, non-ergodicity phenomena, and modeling of memory and machine learning
- Many-variables stochastic processes, neural networks, and random matrix theory for time series prediction, correlation analysis, and inverse problems
- Random graph ensembles in connection to link prediction, detectability transition, community detection, modeling of dynamic networks, and identification of hierarchical structures
- Stochastic and network analysis for financial stability and systemic risk evaluation

Research positions & education

- **2018-Present, Financial Computing & Analytics Group, Dpt. Computer Science, University College London (UCL), London (UK)**
Lecturer, researching *neural networks, times series prediction, and systemic risk* and collaborating with the Bank of England.
- **2015-2017, FINEXUS: Center for Financial Networks and Sustainability, Dpt. Banking and Finance, University of Zurich, Zurich (CH) - London Institute for Mathematical Sciences, London (UK)**
Postdoctoral researcher, working with Prof. Stefano Battiston and Prof. Guido Caldarelli on *null-models of weighted directed networks, and contagion processes for monitoring financial stability and quantifying systemic risk* in collaboration with the Bank of England.
- **2016-Present, INET-Oxford, University of Oxford, Oxford (UK)**
Research associate, working with Prof. Doyne Farmer on *evolution of the joint distribution of age and income in the UK in relation to inter-generational inequality*.
- **2014-2015, Quant Lab, Scuola Normale Superiore, Pisa (IT)**
Postdoctoral researcher, working with Prof. Fabrizio Lillo on *community detection in financial networks for modeling behavior in money markets*.
- **2011-2014, Statistical Physics group, Sapienza University, Rome (IT)**
PhD thesis supervised by Prof. Giorgio Parisi and Dr. Tommaso Rizzo on *Quenched heterogeneities in disordered systems* PhD defended at the Sapienza University of Rome in front of the jury composed of Silvio Franz, Gaetano Senatore, and Riccardo Zecchina.
- **2009-2011, Sapienza University, Rome (IT)**
Master thesis supervised by Prof. Giorgio Parisi on *Large bistable populations of spiking neurons*.
- **2006-2009, Sapienza University, Rome (IT)**
Bachelor thesis supervised by Prof. Bruno Maraviglia on *Removal of physiological artifacts in fMRI data*.

Teaching & supervision

- **2017, UCL, London (UK)** Supervision of Master Theses on *risk management, pricing theory, and machine learning* for the Financial Risk Management and Computational Finance Master Degrees, in collaboration with Prof. Tomaso Aste.
- **2017, FINEXUS, Zurich (CH)** Invited Lecturer for the Big Data Finance Winter School on *contagion processes and systemic risk modeling*.
- **2016, UCL, London (UK)** Supervision of Master Theses on *autoregressive models, extreme value theory, and machine learning* for the Financial Risk Management and Computational Finance Master Degrees, in collaboration with Prof. Tomaso Aste.
- **2016, UCL, London (UK)** Seminar on *community detection in financial networks* for the students and researchers of the Financial Risk Management and Computational Finance Master Degrees.
- **2016, Sapienza University, Rome (IT)** Supervision of a Master Thesis on *realistic neural networks* for the Physics Bachelor Degree, in co-supervision with Prof. Giorgio Parisi.

- 2015, **Scuola Normale Superiore, Pisa (IT)** Seminar on *belief propagation for bayesian inference* for the students of the PhD programme in Mathematical Finance.
- 2014, **Sapienza University, Rome (IT)** Teaching assistant for the course *Analysis I* for Bachelor students.
- 2011, **Centro Studi Pallai, Rome (IT)** Courses in professional private school in Physics (100+ hours of teaching).
- 2006-2011, **Rome (IT)** Private courses in Physics and Mathematics for STEM students.

Doctoral schools & Intensive courses

- 2017, **Deep Learning School, NVIDIA (UK)** *Accelerating Deep Learning with TensorFlow*.
- 2016, **XII Brunel-Bielefeld Workshop, Brunel University (UK)** *Random Matrix Theory*.
- 2015, **Beg-Rohu summer school (FR)** *Statistical physics, biology, inference and networks*.
- 2014, **Cargèse summer school (FR)** *Spin glasses and beyond*.
- 2013, **High Performance Computing (HPC), CINECA (IT)** *Scientific Calculus in C++*.
- 2013, **Beg-Rohu summer school (FR)** *Disordered systems*.
- 2011, **VIII Brunel-Bielefeld Workshop, Brunel University (UK)** *Random Matrix Theory*.

Invited talks & posters

- 2017, **Budapest (HU)** Contributed speaker at EAEPE 2017.
- 2017, **Indianapolis (US)** Contributed speaker at NetSci 2017 main conference, and at the satellite event *Statistical Inference for Network Models*.
- 2017, **Indianapolis (US)** Organiser of the NetSci 2017 satellite event *2nd Workshop on Statistical Physics for financial and economic networks*.
- 2016, **King's College London (UK)** Organiser of Conference on Global Systems Science and Policy at King's College London.
- 2016, **Scuola Superiore Sant'Anna (IT)** Invited Speaker on *network valuation in financial systems*.
- 2016, **Skema Business School (FR)** Invited Speaker at 6th OFCE-GREDEG-SKEMA Workshop on Complex Evolving System Approach in Economics.
- 2016, **Amsterdam (NL)** Contributed Speaker at CCS 2016.
- 2016, **Université Paris 1 (FR)** Contributed Speaker at Statphys26 Satellite event: *Statistical Physics of Financial and Economic Networks*.
- 2015, **Zaragoza (ES)** Contributed Speaker at NetSci 2015.
- 2013, **Kyoto University (JP)** Contributed Speaker at StatPhys25 Satellite event: *Frontier of Statistical Physics and Information Processing*.

Funding and Academic awards

- FET Grant application (2016)
- Templeton Foundation Grant application (2016)
- Start to Research Grant from Sapienza University (2014 - *granted*)
- Enrico Persico Award from Accademia dei Lincei (2011)
- Outstanding student Award from Sapienza University Master/Bachelor Course (2011/2009)

Referee services

- Physical Review E
- Journal of Statistical Physics
- Plos One
- Scientific Reports
- Journal of Network Theory of Finance
- Journal of Complex Networks

Computer skills & programming

Advanced: Matlab, Mathematica, \LaTeX .

Intermediate: Linux, C, C++, Python, Jupyter, R, Julia

Basic Knowledge: SQL, VBA

Codes development: I wrote an efficient parallel tempering algorithm (C), simulation of Ornstein-Uhlenbeck processes (Matlab), mean-field analysis of an heterogenous Curie-Weiss model (Mathematica), and cross-correlation and spectral analysis of time-series (Matlab) during my PhD Thesis, more recently I developed code for contagion processes on networks (Python) and I am working on the development of a Jupiter notebook on spectral theory of random graphs. (*Github repository*)

List of publications

Book chapter.....

- **Behind the Price: On the Role of Agent's Reflexivity in Financial Market Microstructure.** PB and Fabrizio Lillo. Chapter of *Methods and Finance*, Springer, 2017.

Papers.....

- **Common asset holdings and systemic vulnerability across multiple types of financial institutions.** PB, Tahir Mahmood, Laura Silvestri. *Submitted as Staff Working Paper of the Bank of England*, 2018.
- **Exactly solvable random graph ensemble with extensively many short cycles.** Fabian Aguirre, PB, Mathilde Fekom, ACC Coolen. *Journal of Physics A*, 2018.
- **Resolution of ranking hierarchies in directed networks.** PB, Elisa Letizia, and Fabrizio Lillo. *PLOS One*, 2018.
- **Network models of financial systemic risk: A review** Fabio Caccioli, PB, Teruyoshi Kobayashi. *Journal of Computational Social Science*, 2017
- **The decline of solvency contagion risk** PB, Marco Bardoscia, John Hill, Adam Brinley-Codd. *Staff Working Paper of the Bank of England*, 2017.
- **Network valuation in financial systems** PB, Marco Bardoscia, Fabio Caccioli, Marco D'Errico, Gabriele Visentin, Guido Caldarelli and Stefano Battiston. *Submitted to Journal of Mathematical Finance*, 2017.
- **Spectral partitioning in equitable graphs** PB. *Physical Review E*, 2017.
- **Detectability thresholds in networks with dynamic link and community structure.** PB, Fabrizio Lillo, Piero Mazzarisi, and Daniele Tantari. *Submitted to Journal of Statistical Mechanics: Theory and Experiment*, 2017.
- **Disentangling bipartite and core-periphery structure in financial networks.** PB and Fabrizio Lillo. *Chaos, Solitons & Fractals*, 2016.
- **Centrality metrics and localization in core-periphery networks.** PB, Daniele Tantari, and Fabrizio Lillo. *Journal of Statistical Mechanics: Theory and Experiment*, 2016.
- **The organization of the interbank network and how ECB unconventional measures affected the e-MID overnight market.** PB and Fabrizio Lillo. *Computational Management Science*, 2015.
- **Cross-correlations of American baby names** PB, Jacopo Rocchi, Enzo Marinari, Giorgio Parisi, Federico Ricci-Tersenghi. *Proceedings of the National Academy of Sciences*, 2015.
- **Localization in covariance matrices of coupled heterogenous Ornstein-Uhlenbeck processes** PB. *Physical Review E*, 2014.
- **Temperature chaos and quenched heterogeneities** PB, Giorgio Parisi, and Tommaso Rizzo. *Physical Review E*, 2014.

Languages

Italian: mother tongue.

English: conversationally fluent and advanced writing skills (GRE certification).

Other interests

volunteering; philosophy; creative writing; traveling; football and boxing.

Science communication:

- communication management at the London Institute for Mathematical Sciences (LIMS), content management for the LIMS website

- creator of the science communication project La Scienza Coatta (tr. *The Science of the Street*), +100k readers on social networks (2014-present)

- science commentator at RaiScuola, Italian National television (2014)