Lugano, 6900 Switzerland matteo@swarm.org

#### Bio

Born 1974, Italian citizen.

### Research interests

Complex Systems, Complex Networks, Agent-Based Modeling, Machine Learning, Computational Economics, Econometrics, Operational Research, Data Mining.

### Education

**2017** PhD in Computer Science, on "Des Outils pour Comprendre les Dynamiques des Réseaux Sociaux". École Doctorale d'Informatique et Mathématiques, Ecole Normale Supérieure, Lyon, France.

2001 MS in Economics. Università degli Studi, Torino, Italy.

# **Employment history**

#### Current positions

2020-present Credimi s.p.a., Data Scientist, Milan, Italy.

2020-present Yodh Research s.a., Data Scientist, Lugano, Switzerland.

#### Previous positions

**2018-2020** Universität Koblenz-Landau, E-Government Research Group at the Institut für Wirtschafts- und Verwaltungsinformatik, postdoctoral researcher, Koblenz, Germany.

2008-2019 University of Torino, Department of Economics and Statistics, tenured research scientist, Torino, Italy.

**2008** University of Milan, Department of Information Technologies, "Simulation and Optimization Models for EMS Management" fellowship, Milano, Italy.

**2004** Exystence Thematic Institute for Complexity and Innovation, member of the Regional Innovation Systems and Complexity WG, ARC Systems Research, Vienna, Austria.

**2001-2008** LABORatorio – Centre for Employment Studies Riccardo Revelli – Collegio Carlo Alberto Foundation, researcher; Institute for Scientific Interchange Foundation Progetto Lagrange scholarship, Moncalieri, Italy.

**2001-2004** EU-FP5 "Penelope Project", leader (Agent-Based supply chain simulator), Torino, Italy; Barcelona, Spain; Saarbrücken, Germany; Athens, Greece.

## Visiting and other positions

2018 Visiting scholar, National Institute of Informatics, Tokyo, Japan.

2016 Santa Fe Institute CSSS, Santa Fe, NM.

2014-present Member of the board of directors, Vice president (since 2015), Swarm Development Group.

# Teaching Activities

2018-2020 Computer Science for Socio-Economic Research, University of Turin, Italy.

2016-2020 Agent-Based Models, Master in Data Science for Complex Systems, Collegio Carlo Alberto, Turin, Italy.

2013-2016 Modelling Complex Systems, Master in Economics and Complexity, Collegio Carlo Alberto, Turin, Italy.

# Major Ongoing Collaborations

**2017-present** "Graph-based Semi-Supervised Learning", originally based at the ENS Lyon, with Sarah De Nigris; graph partitioning by biased random walks.

**2016-present** "Devising Null Models of Lexicostatistics and Glottochronology", based at the Santa Fe Institute, with David Wolpert, William Croft, Richard Blythe, et al.; Agent-Based modelling of language evolution.

**2016-present** "Temporal Evolution of Scientific Communities", based at the ENS Lyon, with Patrick Flandrin; graph-based reconstruction of the history of science, with a scientometrics approach.

**2015-present** "Agent-Based Modeling of Research Hierarchies Driving Scientific Discovery", based at the Harvard Medical School, with Alex Lancaster.

**2015-present** "Japanese Business Networks", based at the ENS Lyon, with Jean-Pascal Bassino; finding evidence of the unbreakable ties and the nature of "Big-6" keiretsu-style industries in Japan.

# Selected publications and presentations

### Books, book chapters, journal articles, working papers and technical reports

"Swarms Dynamics Approach to Behavioral Economy: Theoretical Tools and Price Sequences", Networks and Heterogeneous Media, American Institute of Mathematical Sciences, Volume 15, Number 3, September 2020, doi:10.3934/nhm.2020022, (with N. Bellomo, S. De Nigris, D. Knopoff, P. Terna)

"Rethinking Macroeconomics with Endogenous Market Structure", Cambridge University Press, ISBN 978-11-0869701-9, 2019 (with M. Mazzoli, P. Terna)

*"Personal Income Tax Reforms: a Genetic Algorithm Approach"*, European Journal of Operational Research, Volume 264, Issue 3, pp. 994-1004, doi:10.1016/j.ejor.2016.07.059, Elsevier Publishing, **2018** (with S. Pellegrino)

"Business Cycle in a Macromodel with Oligopoly and Agents' Heterogeneity: an Agent-Based Approach", Italian Economic Journal, available online, doi:10.1007/s40797-017-0058-y, Springer, 2017 (with P. Terna, M. Mazzoli)

"Detecting Global Bridges in Networks", Journal of Complex Networks, Volume 4, Issue 3, pp. 319-329, doi:10.1093/comnet/cnvo22, **2016**, Oxford University Press (with P. Jensen, T. Venturini, A. Vespignani, M. Jacomy, J.-P. Cointet, P. Mercklé, M. Karsai, E. Fleury)

"Agent-based Dynamic Optimization of Fiscal Systems", in "Agent-based Models of the Economy. From Theories to Applications", Palgrave Macmillan, London, 2015 (with S. Pellegrino)

"The Emergence of Cooperation", in "Agent-based Models of the Economy. From Theories to Applications", Palgrave Macmillan, London, 2015

"Agent-based Models of the Economy. From Theories to Applications", Palgrave Macmillan, London, ISBN 978-1-349-67406-0, 2015 (with R. Boero, M. Sonnessa, P. Terna)

"Employment Security and Employability: A Contribution to the Flexicurity Debate", European Foundation for the Improvement of Living and Working Conditions Report, ISBN 978-92-897-0828-9, 2008 (with F. Devicienti, A. Maida, A. Poggi, P. Vesan)

*"Modelli per la complessità, la simulazione ad agenti in economia"*, il Mulino, Bologna, ISBN 978-88-15-10988-0, **2006** (with P. Terna, R. Boero, M. Sonnessa, eds.)

#### Conference Papers

Sep 23-28 2018: CSS2018, Thessaloniki, Greece, "Graph Semi-Supervised Learning through Bridgeness-Biased Random Walks", (with S. De Nigris)

Feb 6-8, 2018: BIFI2018, Complexity, Networks and Collective Behaviour, Zaragoza, Spain, "A Simple Model of Coevolution for Macroscopic and Microscopic Levels", (with S. De Nigris)

Nov 29-31, 2017: Complex Networks 2017, Lyon, France, "The Evolution of Japanese Business Networks in ASEAN Countries Since the 1960s", in Complex Networks & Their Applications VI, Proceedings of Complex Networks 2017, pp. 1065-1075 (with J.-P. Bassino, P. Jensen)

**Jul 10-13, 2017:** IC2S2, International Conference on Computational Social Science, Gesis, Leibniz Institute for the Social Sciences, Cologne, Germany, "A Mesoscale Description of Networks' Dynamics Through Continuous Partitioning" (with P. Jensen, E. Fleury, M. Karsai)

May II, 2017: Trajectoires et dynamiques des réseaux: approches quantitatives, ENS Lyon, France, "Emergence d'un nouveau domaine scientifique : les ondelettes" (with P. Jensen, P. Flandrin)

Jul 30-Aug 3, 2016: SwarmFest2016, University of Vermont, Burlington, VT, "Agent-Based Modeling of Research Hierarchies Driving Scientific Discovery" (with A. Lancaster)

Jul 11-13, 2016: Complex Networks, From Theory to Interdisciplinary Applications, Satellite meeting of StatPhys26, Marseille, France, "Detecting Global Bridges in Networks"

Nov 25, 2015: Journée Data Science - Social Science, Science des données et humanités numeriques, Institut des Systèmes Complexes Paris-Île de France (ISC-PIF), Paris, France, "Bridgeness and Scientometrics"

Oct 29-Nov 1, 2015: The Computational Social Sciences Society of the Americas, CSSSA 2015, Santa Fe, NM, "A Simple Model of Coevolution for Macroscopic and Microscopic Levels" (with P. Jensen)

**Sep 15-18, 2015:** Historical Network Research Conference, Lisbon, Portugal, "The Evolution of Japanese Business Networks in ASEAN Countries since the 1960s" (with J.-P. Bassino, P. Jensen)

July 10-12, 2015: SwarmFest2015, University of South Carolina, Columbia, SC, "A Simple Model of Coevolution for Macroscopic and Microscopic Levels" (with P. Jensen)

September 22-26, 2014: ECCS14, European Conference on Complex Systems, Lucca, Italy, "Bridgeness: A Novel Centrality Measure to Detect Global Bridges" (with P. Jensen, T. Venturini, A. Vespignani, M. Jacomy, J.-P. Cointet, P. Mercklé, M. Karsai, E. Fleury)

June 29-July 1, 2014: SwarmFest2014, University of Notre Dame, IN, "Taking Genetic Algorithms and Personal Income Tax Reforms One Step Beyond: Enter Agents" (with S. Pellegrino)

**June 2, 2014:** TopoNets'14, NetSci'14 Satellite, University of California, Berkeley, CA, "A New Measure to Detect Global Bridges" (with P. Jensen, T. Venturini, A. Vespignani, M. Jacomy, J.-P. Cointet, P. Mercklé, M. Karsai, E. Fleury)

**July 8-9, 2013:** SwarmFest2013, Complex Adaptive Systems Laboratory, UCF Orlando, FL, "Doing more with less? An Agent-Based Tale of Emergency Medical Services and Shrinking Budgets in Piedmont, Italy" (with M. Bortolin)

October 23-24, 2009: NAACSOS 2009, North American Association for Computational Social and Organizational Sciences, Arizona State University, Tempe, AZ, "Minimal Group Phenomena in Harvesting Games" (with U. Merlone, P. Terna)

# Editorial/Refereeing activities

Winter Simulation Conference, Computational Social Science Society of the Americas, KI - Künstliche Intelligenz, Simulation&Games, SIMULTECH, SwarmFest, Mind&Society, Italian Journal of Public Economics, Bureau for Research in Innovation, Complexity and Knowledge (BRICK), Journal of Economic Interaction and Coordination.

# Languages

Italian: native language

English and French: full professional proficiency

Spanish: limited working proficiency

## CS skills

I develop novel algorithms and metrics (graph-based semi-supervised learning through enhanced diffusion regimes, and bridging measures of network centralities are examples of the former and the latter, respectively) from the ground up, and also am a proficient user of the standard python (pandas, numpy, scipy, scikit-learn, keras, ...) Machine Learning libraries. In developing network-based algorithms, metrics and visualizations, I am familiar and rely on Python, Java, C, C++, Objective C, Fortran; (non-)relational database solutions (e.g. Postgre/MySQL, MongoDB); other useful tools include R, Gephi, the Swarm, Repast, Mason libraries; I prefer working under UNIX major flavours, GNU/Linux in particular. In coding Agent-Based Models, I tend to start prototyping in NetLogo, then move to a middle-ground object-oriented language (Python being my current choice), if needed also implementing distributed computing (e.g. Spark), eventually down to a lower-level language (C++). I also happen to take care of data ETL myself, in calibrating and validating. I also had experienced working with the SAS suite (Base/STAT) on legacy data projects.

My Erdős Number is 3, by the route Erdős-Chung Graham-Vespignani detailed below:

- 1. Y. Alavi et al., Highly Irregular Graphs, JGT, 1987
- 2. D.V. Krioukov at al., The Workshop on Internet Topology (WIT) Report, ACM SIGCOMM CCR, 2007
- 3. P. Jensen et al., Detecting Global Bridges in Networks, JCN, 2015