Manlio **De Domenico**

Complex Systems Scientist

Fondazione Bruno Kessler

Via Sommarive 18
38123 Povo (TN)
Italy

Phone
+39 0461 314544

E-mail
mdedomenico@fbk.eu

Google Scholar
KhJ4UFIAAAAJ

ORCID
0000-0001-5158-8594

ResearcherID
B-5826-2014

ACADEMIC PATH

De Domenico is a physicist, currently Senior Researcher at *Fondazione Bruno Kessler*, where he leads the Complex Multilayer Network Lab.

He obtained his PhD in Physics from *Scuola Superiore di Catania* in February 2012. His research on complex systems started at the Laboratory of Complex Systems in Catania (2008-2011), after which he was a postdoc in the School of Computer Science at the *University of Birmingham* (2012) and at the *Universitat Rovira i Virgili* (2013-2015), funded by research fellowships granted by national and EU competitive programs. In the latter, he was "Juan de la Cierva" Research Assistant Professor (2016-2017).

RESEARCH

De Domenico's research is focused on the study of phenomena emerging from natural and artificial interdependent systems. He is mostly known for leading contributions to modeling and analysis of multilayer networks, with foundational works on their structure, dynamics, information capacity and resilience to perturbations.

His studies deal with a variety of disciplines, in particular improving our understanding of socio-technical networks (human behavior, communication) and biological systems (human brain, multi-omics), with impact in personalized medicine, smart city engineering and policy-making in response to epidemics spreading.

SHORT SUMMARY

De Domenico's research – 94 papers with more than 9500 citations (Google Scholar) published on prestigious journals including *Nature* (2016), *Nature Physics* (2016), *Nature Comm.* (2015, 2015), *PNAS* (2014, 2016, 2018), *Physical Review X* (2013, 2015, 2016) and Physical Review Letters (2017) – has been recognized by the community with prestigious prizes, visiting positions and invited seminars in top-tier institutions and conferences, as well as key roles in international scientific events in the fields of Complex Systems and Network Science.

He is Director of the Mediterranean School of Complex Networks; President of the Italian Chapter of the Complex Systems Society (CSS/Italy); Editor and Reviewer for leading peer-reviewed journals; elected member of the Complex Systems Society Council.

He also serves as Scientific Advisor for companies in application-oriented projects.

PROFESSIONAL EXPERIENCE: GRANTS AND POSITIONS

2018 -	**Senior Researcher**	Fondazione Bruno Kessler
	ICT Center	Trento, Italy
	Head of the "Complex Multilayer Networks" Research Unit	
2016 - 2017	**Research Assistant Professor**	Universitat Rovira i Virgili
	School of Computer Science and Mathematics	Tarragona, Spain
	MINECO Program: "*Juan de la Cierva*" (Senior)	
2013 - 2016	**Postdoctoral Fellow**	Universitat Rovira i Virgili
	School of Computer Science and Mathematics	Tarragona, Spain
	Project: "*PLEXMATH: Mathematical framework for multiplex networks*"	
2012 - 2013	**Postdoctoral Fellow**	University of Birmingham
	School of Computer Science	UK
	Project: "*The uncertainty of identity: linking spatiotemporal information between virtual and real worlds*"	

EDUCATION

2008 - 2011	**PhD in Physics**	University of Catania
	Department of Physics and Astronomy Laboratory of Complex Systems, "Scuola Superiore"	Catania, Italy
	Score: Doctorate *cum Laude* (maximum honors)	
2005 - 2008	**MSc in Physics**	University of Catania
	Department of Physics and Astronomy	Catania, Italy
	Score: 110/110 *Magna cum Laude* (maximum honors)	
2002 - 2005	**BSc in Physics**	University of Catania
	Department of Physics and Astronomy	Catania, Italy
	Score: 110/110 *Magna cum Laude* (maximum honors)	

RESEARCH STAGES ABROAD (*two months or less*)

2016	**Visiting Researcher**	Max Planck Institute (Physics of Complex Systems)	Dresden, Germany
2014	**Visiting Researcher**	Brain & Spine Institute (Pitié-Salpêtrière)	Paris, France
2011	**Visiting Scholar**	Institut de Physique Nucléaire d'Orsay	Paris, France
2009	**Visiting Scholar**	Institute for Nuclear Theory	Seattle, WA
2008	**Visiting Scholar**	Pierre Auger Observatory	Malargüe, Argentina

PRIZES, AWARDS AND OTHER ACHIEVEMENTS

2017 **USERN Prize in Formal Science**
Universal Scientific Education and Research Network
International prize for *"Modeling the Complexity of Systems of Systems"* Kharkiv, Ukraine

2017 **National Scientific Habilitation (ASN) as Full Professor in Applied Physics (02/D1)**
Ministry of Education, Universities and Research (MIUR)
Research accreditation for permanent position that certifies achievement of degree of excellence — Rome, Italy

2017 **National Scientific Habilitation (ASN) as Associate Professor in Theoretical Physics of Fundamental Interactions (02/A2)**
Ministry of Education, Universities and Research (MIUR)
Research accreditation for permanent position that certifies achievement of degree of excellence — Rome, Italy

2016 **Junior Scientific Award**
Complex Systems Society
International prize for *"a number of important contributions to the field of multilayer complex networks, including pioneering works on their mathematical formulation"* — Amsterdam, Netherlands

2016 **Second Prize**
Sage Bionetworks
Disease Module Identification DREAM (International) Challenge 2016 with a project about identifying communities of proteins related to human diseases from multivariate genetic data — Phoenix, AZ

2015 **Accreditation of Associate Professor**
Agency for the Quality of University (AQU) of the Government of Catalonia
Research accreditation for permanent position that certifies achievement of degree of excellence — Barcelona, Spain

2013 **"Bruno Rossi" Prize**
Italian National Institute of Nuclear Physics (INFN)
Best Italian PhD thesis in Nuclear and Particle Astrophysics

2012 **First Prize**
Orange Corporation
Data for Development Challenge (200+ participants) with a project about exploitation of cellular data to model, by means of a multilayer network, the spreading of diseases and targeted information campaigns for their containment. Featured by Wall Street Journal, Time Magazine and Italian media. — Cambridge, MA

2012 **First Prize**
Nokia Corporation
Nokia Mobile Data Challenge (700+ participants) with an Open Track project about exploitation of mobile phone data to predict human mobility. Featured by BBC, NBC, Slate, Wired and Italian media. — Newcastle, UK

PUBLICATIONS *(selection)*

Since 2009 I have published 94 journal articles and 21 technical documents, collecting more than 9500 citations and yielding a H-index of 44 (Google Scholar). Among these papers, 24 are "highly cited", with more than 100 citations each. A selection is listed below:

Bots increase exposure to negative and inflammatory content in online social systems
PNAS 115, 12435 (2018)
Stella, M., Ferrara, E. and De Domenico, M.

Multilayer network modeling of integrated biological systems
Phys. of Life Rev. 24, 149 (2018)
De Domenico, M.

Diffusion geometry unravels the emergence of functional clusters in collective phenomena
Phys. Rev. Lett. 118, 168301 (2017) [On the Cover]
De Domenico, M.

Multilayer modeling and analysis of human brain networks
GigaScience 6, 1-8 (2017)
De Domenico, M.

Modeling Structure and Resilience of the Dark Network
Phys. Rev. E 95, 022313 (2017) [featured in Nature 543, 153 (2017) & APS Physics]
De Domenico, M. and Arenas, A.

Researcher incentives: EU cash goes to the sticky and attractive
Nature 531, 580 (2016)
De Domenico, M. and Arenas, A.

Spectral entropies as information-theoretic tools for complex network comparison
Phys. Rev. X 6, 041062 (2016)
De Domenico, M. and Biamonte, J.

The physics of spreading processes in multilayer networks
Nature Physics 12, 901 (2016)
De Domenico, M., Granell, C., Porter, M.A and Arenas, A.

Multiplex social ecological network analysis reveals how social changes affect community robustness more than resource depletion
PNAS 113, 13708 (2016)
Baggio, J.A., BurnSilver, S.B., Arenas, A., Magdanz, J.S., Kofinas, G.P. and De Domenico, M.

Mapping multiplex hubs in human functional brain network
Frontiers in Neuroscience 10, 326 (2016)
De Domenico, M., Sasai, S. and Arenas, A.

Ranking in Interconnected Multilayer Networks Unveils Versatility
Nature Communications 6, 6868 (2015)
De Domenico, M., Sole-Ribalta, A., Omodei, E., Gomez, S. and Arenas, A.

Structural Reducibility of Multilayer Networks
Nature Communications 6, 6864 (2015)
De Domenico, M., Nicosia, V., Arenas, A. and Latora, V.

Identifying modular flows on multilayer networks reveals highly overlapping organization in interconnected systems
Phys. Rev. X 5, 011027 (2015) [featured in Science 348:6230, 89 (2015)]
De Domenico, M., Lancichinetti, A., Arenas, A. and Rosvall, M.

Navigability of interconnected networks under random failures

PNAS 111, 8351 (2014)
De Domenico, M., Sole-Ribalta, A., Gomez, S. and Arenas, A.

Mathematical Formulation of Multi-Layer Networks
Phys. Rev. X 3, 041022 (2013)
De Domenico, M. et al

Featured by: Nature, Science, New Scientist, Le Scienze, BBC, NBC, The Wall Street Journal, Time Magazine, El Pais, La Repubblica, The Hindu, La Croix, Panorama, La Sicilia, Gazzetta del Sud, Birmingham Post, United Nations Global Pulse, MIT Tech. Review, Slate, Wired UK, Phys.org.

INVITED TALKS AND SEMINARS

10/2018	*Structure and Dynamics of Multilayer Networks* International School on Informatics and Dynamics in Complex Networks	Catania, Italy
06/2018	*Multilayer network maps of functional human brain* Padova Neuroscience Center	Padova, Italy
03/2018	*Modeling integrated and interdependent systems with complex multilayer networks* Center for Complexity and Biosystems	Milan, Italy
02/2018	*Modeling integrated and interdependent systems with complex multilayer networks* NASA Jet Propulsion Laboratory	Los Angeles, USA
02/2018	*Multilayer modeling and analysis of complex (systems) data* SAMSI Workshop on Remote Sensing, Uncertainty Quantification and a Theory of Data Systems, California Institute of Technology	Los Angeles, USA
09/2017	*Modeling structure and resilience of the dark network* Conference on Complex Systems (CCS) 2017	Cancun, Mexico
07/2017	*Multilayer modeling and analysis of complex (systems) data* Fondazione Bruno Kessler	Trento, Italy
04/2017	*Disentangling interactions in online social systems using multiplex networks* University of Salerno	Salerno, Italy
01/2017	*Multilayer network maps of functional human brain* IMT School for Advanced Studies	Lucca, Italy
01/2017	*Physics of multilayer networks (and multidisciplinary applications)* Centre de Physique Théorique	Marseille, France
09/2016	*Disentangling interactions in online social systems using multiplex networks* Computational Social Science: Social Contagion, Collective Behaviour, and Networks (Satellite of CCS 2016)	Amsterdam, Netherlands
06/2016	*Mapping multiplex hubs in human functional brain network* Brain Networks Satellite of NetSci	Seoul, Korea
06/2016	*Assessing reliable human mobility patterns from higher-order memory in mobile communications* Higher-Order Models in Network Science Satellite of NetSci	Seoul, Korea
05/2016	*Mapping multiplex hubs in human functional brain network* EPFL	Lausanne, Switzerland
04/2016	*Mapping multiplex hubs in human functional brain network* Universitat de Barcelona	Spain

01/2016	*Visualization and analysis of multiplex networks* Winter Workshop on Complex Systems	Madrid, Spain
09/2015	*Multilayer modeling and analysis of real-world complex networks* Mediterranean School of Complex Networks	Salina, Italy
07/2015	*Data Science of Multilayer networks* "Mathematics and Physics of Multilayer Complex Networks" Max Planck Institute for the Physics of Complex Systems	Dresden, Germany
06/2015	*Inferring human mobility from mobile phone data: an adaptive memory-driven model* Higher-Order Models in Network Science Satellite of NetSci	Zaragoza, Spain
06/2014	*Mathematical formulation, navigability and robustness of multilayer networks* Mediterranean School of Complex Networks	Salina, Italy
05/2014	*Exploiting mobile phone and user-generated data* "Big Data and Smart Cities", Universitat de Barcelona	Spain
03/2014	*From centrality to versatility in interconnected multilayer networks* Institute des Systemes Complexes	Paris, France

ORAL CONTRIBUTIONS TO PEER-REVIEWED CONFERENCES *(selection)*

06/2018	*Spectral entropy: an information-theoretic approach to complex network comparison* NetSci	Paris, France
02/2018	*Multilayer modeling and analysis of complex (systems) data* SAMSI Workshop on Remote Sensing, Uncertainty Quantification and a Theory of Data Systems	Caltech, Los Angeles, USA
09/2016	*The diffusion manifold of complex networks* Conference on Complex Systems	Amsterdam, Netherlands
09/2016	*Mapping multiplex hubs in human functional brain network* Conference on Complex Systems	Amsterdam, Netherlands
09/2016	*Spectral entropies as information-theoretic tools for complex network comparison: theory and applications* Information Processing in Complex Systems: Classical and Quantum (Satellite of CCS 2016)	Amsterdam, Netherlands
03/2016	*An information-theoretical approach to reduce the structure of multilayer networks* 7th Workshop on Complex Networks (Complenet)	Dijon, France
06/2015	*Structural reducibility of multilayer networks* NetSci	Zaragoza, Spain
06/2015	*Identifying modular flows on multilayer networks reveals highly overlapping organization in interconnected systems* International Conference on Computational Social Science	Helsinki, Finland
09/2014	*Navigability of interconnected networks under random failures* European Conference on Complex Systems	Lucca, Italy
09/2013	*Super-diffusive random walkers on multiplex networks* European Conference on Complex Systems	Barcelona, Spain

06/2013 *Super-diffusive random walkers on multiplex networks* — Copenaghen, Denmark
Dynamic Information and Communication Networks (Satellite of NetSci)

TEACHING ACTIVITIES

09/2018 - 12/2018	*Structure and Dynamics of Complex Networks* course as part of Master's Degree in Physics of Condensed Matter	University of Trento
05/2018 - 05/2018	*Multilayer Networks* course as part of ICT International Doctoral School	University of Trento
02/2017 - 06/2017	*Complex Networks* course as part of Master's Degree in Computer Security Engineering and Artificial Intelligence	Universitat Rovira i Virgili

SUPERVISION ACTIVITIES (*past and current*)

2018–2021	**Coordinator of the FBK Flagship Project** (*Computational Human Behavior*	
	Coordinated with Prof. Pier Luigi Sacco.	Fondazione Bruno Kessler
2018–2019	**Supervisor of postdoc** (Oriol Artime)	
	Research activity on complex multilayer networks.	Fondazione Bruno Kessler
2018–2020	**Supervisor of postdoc** (Valeria D'Andrea)	
	Research activity on human mobility.	Fondazione Bruno Kessler
2018–2021	**Advisor of PhD student** (Barbara Benigni)	
	With Stefano Merler; Dept. of Information Engineering, University of Trento. Thesis: "*Neurocognitive networks for modeling and analysis of Alzheimer's disease*".	Fondazione Bruno Kessler
2018–2021	**Advisor of PhD student** (Giulia Bertagnolli)	
	Dept. of Mathematics, University of Trento. Thesis: "*Network geometry*".	Fondazione Bruno Kessler
2018–2021	**Advisor of PhD student** (Sebastian Raimondo)	
	Dept. of Mathematics, University of Trento. Thesis: "*Network modeling of large-scale human mobility*".	Fondazione Bruno Kessler
2019	**Tutor of MSc student** (Giuseppe Lupo)	
	Dept. of Sociology, University of Trento. Internship: "*Collective human behavior in online social systems*".	Fondazione Bruno Kessler
2017–2018	**Supervisor of postdoc** (Massimo Stella)	
	Research activity on complex multilayer networks.	Fondazione Bruno Kessler
2018	**Co-advisor of MSc student** (Giulia Bertagnolli)	
	With Claudio Agostinelli, Dept. of Mathematics, University of Trento. Thesis: "*Network Depth*".	Fondazione Bruno Kessler
2018	**Tutor of MSc student** (Arsham Ghavasieh)	

	Dept. of Physics, University of Trento. Internship: "*Quantum-inspired Statistical Physics of Multilayer Networks*".	Fondazione Bruno Kessler
2018	**Tutor of MSc student** (Sebastiano Bontorin)	
	Dept. of Physics, University of Trento. Internship: "*Nonlinear Dynamics of Bio-molecules*".	Fondazione Bruno Kessler
2017	**Co-advisor of PhD student** (Massimo Stella)	
	With Markus Brede, Institute for Complex System Simulations (University of Southampton). Thesis: "*Structure and Dynamics of Empirical Multiplex Networks*".	Universitat Rovira i Virgili
2017	**Co-advisor of PhD student** (Leyla Naghipour)	
	With Afshin Behmaram, Department of Water Engineering, Faculty of Civil Engineering (University of Tabriz). Thesis: "*Multilayer analysis and modeling of complex climate networks*"	Universitat Rovira i Virgili
2017	**Visiting graduate student** (Marco Buzzanca from University of Catania)	
	Multilayer network approach to disambiguation in bibliometrics datasets.	Universitat Rovira i Virgili
2016	**First-year postdoc** (Elisa Omodei)	
	Analysis of multiplex social networks dynamics during exceptional events; published in *Frontiers in Physics*. Development of a network descriptor to measure the interdisciplinarity of authors of scientific papers; published in *Network Science*.	Universitat Rovira i Virgili
2016	**Visiting graduate student** (Hongrun Wu from Wuhan University)	
	Mathematical modeling of information spreading in socio-technical multiplex networks.	Universitat Rovira i Virgili
2015	**Visiting graduate student** (Salvatore Catanese from University of Catania)	
	Mathematical approach to embed multilayer networks into Euclidean space and an algorithm for their visualization.	Universitat Rovira i Virgili
2014	**PhD student** (Joan Matamalas)	
	Modeling human mobility from cellular data. Project finalist at D4D international challenge organized by `Orange`. Published in the *Journal of Royal Society Interface*.	Universitat Rovira i Virgili
2012	**Master student** (Vineetha Venugopalan)	
	Mathematical and computational approach to identify fake accounts and automated bots in the microblogging platform Twitter. She is now Senior Technical Operations Developer at `Network Rail`.	University of Birmingham
2012	**PhD student** (Antonio Lima)	
	Mathematical model for human mobility and containment of disease spreading in developing countries. Award-winning project at the D4D international challenge organized by `Orange`. Published in *Scientific Reports*. He is now Data Science Research Fellow at `Nesta` (London).	University of Birmingham

INDUSTRIAL PROJECTS

06/2018	**Foreknow Inc. at Fondazione Bruno Kessler**
05/2020	FOREMOB: forecasting human mobility and social dynamics
05/2018	**Turk Telekom at Fondazione Bruno Kessler**

10/2018	Big Data Challenge: Quantifying epidemics spreading risk in Turkey for hosting refugees
01/2014	**Telecom at University Rovira i Virgili**
06/2014	Big Data Challenge: Personalized Routing for Multitudes in Smart Cities
05/2014	**Orange at University Rovira i Virgili**
12/2014	D4D: Assessing reliable human mobility patterns from higher-order memory in mobile communications
03/2012	**Orange at University of Birmingham**
05/2012	D4D: Exploiting Cellular Data for Disease Containment and Information Campaigns Strategies in Country-Wide Epidemics
03/2012	**Nokia at University of Birmingham**
06/2012	Mobile Data Challenge: Interdependence and Predictability of Human Mobility and Social Interactions

ACADEMIC AND OTHER PROFESSIONAL SERVICES

DIRECTOR

09/2019	Mediterranean School of Complex Networks	Salina, Italy
09/2018	Mediterranean School of Complex Networks	Salina, Italy
09/2017	Mediterranean School of Complex Networks	Salina, Italy
08/2016	Mediterranean School of Complex Networks	Salina, Italy
09/2015	Mediterranean School of Complex Networks	Salina, Italy
06/2014	Mediterranean School of Complex Networks	Salina, Italy

PROGRAM/ORGANIZING COMMITTEE

05/2019	Intern. School and Conference on Network Science (NetSci)	Burlington, USA
05/2019	SIAM Workshop on Network Science	Snowbird, USA
09/2018	10th Social Informatics 2018	Saint Petersburg, Russia
09/2018	Conference on Complex Systems	Thessal., Greece
07/2018	9th International Conference on Complex Systems	Cambridge, MA, USA
07/2018	4th International Conference on Computational Social Science	Evanston, IL, USA
07/2018	SIAM Workshop on Network Science	Portland, USA
06/2018	Intern. School and Conference on Network Science (NetSci)	Paris, France
04/2018	International Workshop on Mining Attributed Networks (MATNet WWW2018)	Lyon, France
01/2018	Intern. School and Conference on Network Science X (NetSciX)	Hangzhou, China
09/2017	9th Social Informatics 2017	Oxford, UK
09/2017	Conference on Complex Systems	Cancun, Mexico
07/2017	SIAM Workshop on Network Science	Pittsburgh, USA
06/2017	Intern. School and Conference on Network Science (NetSci)	Indianapolis, USA
03/2017	8th Workshop on Complex Networks	Dubrovnik, Croatia
09/2016	Conference on Complex Systems	Amsterdam, Netherlands

03/2016	7th Workshop on Complex Networks	Djon, France
08/2015	Multiplex & Attributed Network Mining (Internat. Conference on Advances in Social Networks Analysis and Mining Satellite)	Paris, France
06/2015	At the crossroads: lessons and challenges in Computational Social Science (NetSci Satellite)	Zaragoza, Spain
07/2014	Multiplex Network Mining (6th Internat. Conference on Computational Aspects of Social Networks Satellite)	Porto, Portugal
06/2014	Physics of multilayered interconnected networks (NetSci Satellite)	Berkeley, CA, USA

CO-ORGANIZER

07/2019	Italian Conference on Complex Systems (CCS/Italy)	Trento, Italy
09/2018	Information Processing in Complex Systems: Classical and Quantum (Conference on Complex Systems Satellite)	Thessaloniki, Greece
09/2018	Brain Computing: Theoretical Neuroscience and its Applications (Conference on Complex Systems Satellite)	Thessaloniki, Greece
06/2018	Multilayer Networks: Network Science for Multidimensional Data Analysis (International School and Conference on Network Science)	Paris, France
06/2018	Blockchain and Fintech Network Science (International School and Conference on Network Science)	Paris, France
09/2017	Information Processing in Complex Systems: Classical and Quantum (Conference on Complex Systems Satellite)	Cancun, Mexico
09/2017	Multilayer and Interconnected Networks: Applications II (Conference on Complex Systems Satellite)	Cancun, Mexico
09/2016	Multilayer and Interconnected Networks: Applications I (Conference on Complex Systems Satellite)	Amsterdam, Netherlands
06/2015	Physics of multilayered interconnected networks II" (NetSci Satellite)	Zaragoza, Spain

EDITORIAL BOARDS

Complexity; Journal of Complex Networks; Frontiers in Physics; Frontiers in Blockchain; PLOS One

GUEST EDITOR

Special issue of Physica D on "*Nonlinear Dynamics on Interconnected Networks*" (2016)

REVIEW EDITOR for peer-reviewed journals:

Big Data section of Frontiers in Digital Humanities

Big Data section of Frontiers in ICT

REFEREE

Journals: Nature Physics - Physical Review X - Nature Communications - Physical Review Letters - Science Advances - NeuroImage - eLife - Bioinformatics - Scientific Reports - New Journal of Physics - Journal of Statistical Mechanics - Journal of The Royal Society Interface - Physics Letters A - Physica A - Physical Review E - PLOS One - EPJ Data Science - Europhysics Letters - Journal of Complex Networks - Network Science - Frontiers in Digital Humanities - Chaos Solitons and Fractals - Entropy - IEEE Transactions on Network Science and Engineering - IEICE Transactions on Information and Systems - Information Processing and Management - Machine Learning - International Journal on Artificial Intelligence Tools - IEEE Transactions on Signal and Information Processing over Networks - IEEE Transactions on Knowledge and Data Engineering - Data Mining and Knowledge Discovery - IEEE Transactions on Pattern Analysis and Machine Intelligence;

Conferences: IEEE Workshop on Signal Processing Advances in Wireless Communications - ACM International Joint Conference on Pervasive and Ubiquitous Computing - NetSci - CompleNet;

SCIENTIFIC ADVISOR

Foreknow Inc. (USA): geo-tagged marketing based on mobile phone data

Orange Labs (France): policies to contain the spreading of infectious diseases in developing countries (West Africa) based on mobile phone data