Andrea Santoro

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06/May/1993

Resume

I am a mathematician with a strong interest in applied sciences. My research interests include complex networks, data science, optimisation, and information theory, with particular attention to multiplex networks and their application to large-scale systems. My work consists in analysing and developing computational methodologies for extracting mesoscopic information from large-scale multi-dimensional datasets, distinguishing what is relevant from redundant information.

Education

Oct 18 - Oct 19 **Enrichment Student**, *The Alan Turing Institute*, UK.

Sep 16 - present **PhD in Mathematics**, *Queen Mary University of London*, UK.
Complex Systems and Network Research Group
Supervisors: Vincenzo Nicosia, Lucas Lacasa
Topic: Optimisation and information-theoretic principles in multiplex networks.

Jun 18 - Jul 18 **Complex Systems Summer School Graduate**, *Santa Fe Institute, NM*, USA.

Sep 11 - Feb 18 **Diploma di Licenza (with honors)**, *Scuola Superiore di Catania*, Italy.
70/70 cum laude (max grade)
Thesis Title: Spectral Embedding of Multiplex Network
This "School" is a higher education institution in which only a handful of students are admitted in their first year of University, after passing competitive admission exams. Admission to the Scuola Superiore provides students with supplementary courses and it grants a scholarship, which lasts for the duration of the degree subject to each recipient being able to maintain very high academic standing in the exams (an average of at least 27/30).

Oct 14 – Jul 16 **MSc. in Applied Mathematics (with honors)**, *University of Catania*, Italy.
110/110 cum laude (max grade)
Thesis Title: Pareto Strategies for Air Transportation Networks.
Supervisors: Giuseppe Nicosia, Vincenzo Nicosia, Vito Latora, Vittorio Romano

Oct 11 - Jul 14 **BSc. in Mathematics (with honors)**, *University of Catania*, Italy.
110/110 cum laude (max grade)
Thesis Title: Sensitivity Techniques for Effective Optimization of Tandem Thin-Film Silicon Solar Cells.
Supervisors: Giuseppe Nicosia, Vittorio Romano, Antonino La Magna

Sep 06 - Jul 11 **Scientific high school diploma**, *Liceo Scientifico "Archimede"*, Messina, Italy.
100/100

Experience

Oct 16 – present **Postgraduate Researcher**, *School of Mathematical Sciences, QMUL, London, UK.*

Mar 16 - Jul 16 **Visiting Researcher**, *Queen Mary University of London* , UK.
Complex Systems and Network Research Group
Research Supervisors: Vincenzo Nicosia, Vito Latora
- Predictive modelling for transportation networks.
- Evolutionary optimization of real-world networks.
- Analysis of multi-relational real data.

Sep 14 - Dec 14 **Visiting Researcher**, *Queen Mary University of London*, UK.
Complex Systems and Network Research Group
Research Supervisors: Vincenzo Nicosia, Vito Latora
- Statistical modelling and evaluation of real-world systems.
- Development of a multiplex model for transportation networks.

Nov 13 - Jul 14 **Student Intern**, *University of Catania - Scuola Superiore di Catania*, Italy.
Research Supervisor: Giuseppe Nicosia
- Multi-objective optimisation and Pareto optimality in synthetic bacteria design.
- Robustness and sensitivity analysis of synthetic organisms

Nov 12 - Oct 13 **Student Intern**, *University of Catania*, Italy.
Research Supervisors: Giuseppe Nicosia, Vittorio Romano
- Multi-objective optimisation of solar cell topologies
- Evolutionary optimisation of thin-film silicon solar cell.
- Robustness and sensitivity analysis of solar cell devices.

Teaching

Jan 19 - Feb 19 **Teaching Assistant**, *School of Electronic Engineering and Computer Science, QMUL.*
Network Modelling and Performance

Jan 18 - Apr 18 **Teaching Assistant**, *School of Mathematical Sciences, QMUL.*
Complex Networks

Jan 17 - Apr 18 **Teaching Assistant (Semester B)**, *School of Mathematical Sciences, QMUL.*
Introduction to Statistics

Jan 17 - Feb 17 **Teaching Assistant**, *School of Electronic Engineering and Computer Science, QMUL.*
Network Modelling and Performance

Mar 15 - Jul 15 **Teaching Assistant**, *Mathematical Department of the University of Catania,Italy.*
C Programming Undergraduate Course

Awards

Apr 19 **Small Grant Scheme**, *The Institute of Mathematics and its Applications, UK (600 £).*
Awarded for attending CCS 2018 in Thessaloniki

Jun 18 **yrCSS Fund**, *Scholarships for Events on Complex Systems (SECS) (300 €).*
Awarded for attending CCS 2018 in Thessaloniki

Apr 18 **Turing PhD Enrichment Scheme**, *The Alan Turing Institute, London, UK.*

Apr 18 **Ann Cook Prize**, *QMUL, UK (£150).*
Awarded for the best poster presentation in the School of Mathematical Sciences, QMUL.

Apr 18 **QJMAM Fund for Applied Mathematics**, *Institute of Mathematics and its Applications (£1500).*
Selected based on high application standards to attend the Complex System Summer School in Santa Fe, US

Mar 18 **Postgraduate Research Funding grant**, *QMUL, UK (£1000).*
Award based on high application standards to attend the Complex System Summer School in Santa Fe, US

Apr 16 **Queen Mary Principal's Award**, *Research Studentship, QMUL, UK.*

Jan 16 **"Erasmus Plus" scholarship**, *University of Catania (1920 €).*
Award based on academic performance to visit the Complex Networks group at QMUL for four months

Sep 14 **"Placement Abroad" scholarship**, *University of Catania (1440 €).*
Award based on academic performance to visit the Complex Networks group at QMUL for three months

Oct 11 - Oct 15 **"Premio di Studio" scholarship**, *University of Catania(4000 €).*
Award based on academic performance for each academic year (1000 €)

Skills

OSes Microsoft Windows, Linux (Mint, Ubuntu, Debian, Manjaro, CentOS), OS X

Languages	C/C++ (OpenMP, MPI), Python (Numpy, Pandas, Scikit-learn), Matlab, Mathematica, R, HTML/CSS
Tools	Bash, Awk, Sed, Git
Softwares	LaTeX, Minitab, Gnuplot, Gephi, SageMath, Microsoft Office, InDesign

Languages

Italian	Native Speaker
English	Fluent - Academic IELTS score 7.0 (2016)

Talks & Seminars

Mar 19	Complenet19, Tarragona, Spain
Oct 18	2^{nd} Network Science Workshop, London, UK
Sep 18	CCS 2018, Thessaloniki, Greece
Jun 18	Complex System Summer School, Santa Fe, NM, USA
Feb 18	BIFI International Conference 2018, Zaragoza, Spain
Oct 17	Engineering Applications of Networks Workshop, Bristol, UK
Sep 16	PhysPlex - Satellite of CCS'16, Amsterdam, Netherlands
Sep 16	CCS warm-up 2016, Amsterdam, Netherlands
Jul 15	ICSI 2015, International Congress on Systems Immunology, Immunoinformatics & Immune-computation, Taormina, Italy
Jun 14	ECMI 2014, 18th European Conference on Mathematics for Industry, Taormina, Italy

Courses & Conferences

Jul 19	**3^{nd} Network Science Workshop**, Leeds, UK
Jun 19	**Complexity 72h**, Lucca, IT
Oct 18	**2^{nd} Network Science Workshop**, London, UK
Sep 18	**CCS 2018**, Thessaloniki, Greece
Jun 18	**Complex System Summer School**, Santa Fe, NM, USA
Feb 18	**BIFI 2018**, International Conference, Zaragoza, Spain.
Oct 17	**Workshop**, Engineering Applications of Networks Workshop, Bristol, UK.
Jun 17	**Cambridge Networks Day 2017**, University of Cambridge, UK.
May 17	**Big Data** *by Mark Briers*, LTCC, London, UK
Nov 16	**Multilayer Networks**, *by Ginestra Bianconi*, LTCC, London, UK.
Sep 16	**CCS 2016** - Conference on Complex Systems, Amsterdam, The Netherlands.
Sep 15	**MSCx 2015** - Mediterranean School on Complex Networks, Salina, Italy.
Jul 15	**MOD 2015** - International Workshop on Machine Learning, Optimization and Big Data, Taormina, Italy.
Jul 15	**ICSI 2015** - International Congress on Systems Immunology & ImmunoInformatics, Taormina, Italy.
Jul 15	**SSBSS 2015** - International Synthetic and Systems Biology Summer School, Taormina, Italy.
Jul 14	**SIMAI 2014** - Taormina, Italy.
Jun 14	**SSBSS 2014** - International Synthetic and Systems Biology Summer School, Taormina, Italy.
Jun 14	**ECMI 2014** - The 18^{th} European Conference on Mathematics for Industry, Taormina, Italy.
Sep 13	**ECAL 2013** - 12^{th} European Conference on Artificial Life, Taormina, Italy.
Apr - Sep 12	**Rhetoric** - *by Laurent Pernot*, Scuola Superiore di Catania, Italy.

Papers & Preprints

[1] A. Santoro and V. Nicosia. Optimal percolation in correlated multilayer networks with overlap. *Physical Review Research*, 2:033122, 2020.

[2] A. Santoro and V. Nicosia. Algorithmic complexity of multiplex networks. *Physical Review X*, 10:021069, 2020.

[3] J. C. W. Billings, M. Hu, G. Lerda, A. N. Medvedev, F. Mottes, A. Onicas, A. Santoro, and G. Petri. Simplex2vec embeddings for community detection in simplicial complexes. arXiv:1906.09068, 2019.

[4] A. Santoro, V. Latora, G. Nicosia, and V. Nicosia. Pareto optimality in multilayer network growth. *Physical Review Letters*, 121(12), 2018.

[5] A. Patané*, A. Santoro*, A. L. Magna, V. Romano, and G. Nicosia. Enhancing quantum efficiency of thin-film silicon solar cells by pareto optimality. Journal of Global Optimization, 72(3):491–515, 2018.

[6] A. Patané, A. Santoro, P. Conca, G. Carapezza, A. L. Magna, V. Romano, and G. Nicosia. Multi-objective optimization and analysis for the design space exploration of analog circuits and solar cells. *Engineering Applications of Artificial Intelligence*, 62, 2017.

[7] A. Patanè, A. Santoro, J. Costanza, G. Carapezza, and G. Nicosia. Pareto optimal design for synthetic biology. *IEEE Transactions on Biomedical Circuits and Systems*, 9(4), 2015.

Conference Proceedings & Conference Projects

[C1] K. N. Aronis, A. Salova, A. Venegas-Li, A. Santoro, *Characterizing Atrial Fibrillation Dynamics using Multiplex Visibility Graphs*, **Complex Systems Summer School Santa Fe [Group project]**, 2018.

[C2] A. Aloric, J. Garcia-Bernardo, P. Krafft, A. Morgan, Z. Neu, A. Santoro, *Collective Information Processing in Human Rumor Spreading Networks: An experimental Study of Rumor Content Fusion and Propagation*, **Complex Systems Summer School Santa Fe [Group project]**, 2018.

[C3] K. N. Aronis, A. Salova, A. Venegas-Li, A. Santoro, *Investigating Phase Transitions in a Cardiac System through Informational Properties of Renewal Process Models*, **Complex Systems Summer School Santa Fe [Group project]**, 2018.

[C4] C. Perret, G. St-Onge, Z. Neu, A. Santoro, *Talking Loud Or Talking Often: How the Interplay Between Network Structure and Agent Influence Affects the Time to Reach Consensus in Collective Decision-Making*, **Complex Systems Summer School Santa Fe [Group project]**, 2018.

[C5] A Patané, P. Conca, G. Carapezza, A. Santoro, J. Costanza, G. Nicosia. *Metabolic Circuit Design Automation by Multi-objective BioCAD*, International Workshop on Machine Learning, Optimization and Big Data, 30-44, 2016.

[C6] A. Patané, A. Santoro, G. Carapezza, A. La Magna, V. Romano, G. Nicosia. *A multi-objective clonal selection algorithm for analog circuit and solar cell design,* 2015 International Workshop on Artificial Immune Systems (AIS), 1-7, 2015.

Abstracts & Posters

A. Patané, A. Santoro, J. Costanza and G. Nicosia. *Minmcell: Designing Minimal Microbial Cells* - International Synthetic and Systems Biology Summer School (SSBSS), Taormina, Italy, 2015

J. Costanza, A. Patané, A. Santoro, L. Zammataro and G. Nicosia. *A class of Pareto optimal Escherichia coli strains for production of 1,4-butanediol* - International Synthetic and Systems Biology Summer School (SSBSS), Taormina, Italy, 2015

* equal contribution

A. Patané, A. Santoro, J. Costanza and G. Nicosia. *Pareto Optimal Essential Genes in Minimal Bacterial Cells* - 2nd Synthetic Biology Congress, London, UK 2015

A. Patané, A. Santoro, J. Costanza and G. Nicosia. *Minmcell: Designing Minimal Microbial Cells* - Synthetic Biology, Engineering, Evolution & Design (SEED), Boston, USA, 2015

J. Costanza, A. Patané, A. Santoro, L. Zammataro and G. Nicosia. *A class of Pareto optimal Escherichia coli strains for production of 1,4-butanediol* - Precision Genome Engineering and Synthetic Biology - Keystone Symposia on Molecular and Cellular Biology, Montana, USA, 2015

A. Patané, A. Santoro, G. Carapezza, V. Romano, A. La Magna and G. Nicosia. *Sensitivity Techniques for Effective Optimization of Tandem Thin-Film Silicon Solar Cells* - The 10^{th} International Conference on Scientific Computing in Electrical Engineering (SCEE), Wuppertal, Germany, 2014