



COMPLEX NETWORKS: THEORY, METHODS, AND APPLICATIONS

Lake Como School of Advanced Studies - May 13-17, 2019

Complex networks: theory, methods, and applications (5th edition)
Villa del Grumello, Como, Italy, May 13-17, 2019

Many real systems can be modeled as networks, where the elements of the system are nodes and interactions between elements are edges. An even larger set of systems can be modeled using **dynamical processes on networks**, which are in turn affected by the dynamics. Networks thus represent the backbone of many **complex systems**, and their theoretical and computational analysis makes it possible to gain insights into numerous applications. **Networks permeate almost every conceivable discipline** —including sociology, transportation, economics and finance, biology, and myriad others — and the study of “network science” has thus become a crucial component of modern scientific education.

The school “**Complex Networks: Theory, Methods, and Applications**” offers a succinct education in network science. It is open to all aspiring scholars in any area of science or engineering who wish to study networks of any kind (whether theoretical or applied), and it is especially addressed to **doctoral students** and **young postdoctoral scholars**. The aim of the school is to deepen into both theoretical developments and applications in targeted fields.

This is the **5th edition** of the school: [click here](#) to visit the website of the **4th edition** (2018).

Download the [leaflet](#) (pdf) of the school.

Sponsored by





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Application

The School will be open to 50 qualified and selected students.

Registration fee: **500 euro**, VAT 22% included.

The fee covers all lectures; course material; wi-fi connections; lunches and coffee breaks; social dinner.

HOW TO APPLY: Prospective participants have to fill out and **submit the form** below, and **upload a 1-page letter** (pdf) organized as follows:

- name, department/university, current position (PhD student, postdoc, other)
- educational background
- research activity and interests
- motivations for participating in the school

Please note that **any page after the first one** will be automatically deleted.

PREREQUISITES: Basic notions and metrics on complex networks are required to be able to follow the entire course.

SELECTION CRITERIA: In addition to applicant quality, the Organizing Committee will consider a number of features including: the coherence of the motivation with the aim and scope of the school, the potential benefit for the student's research, the timeliness for the development of the student's career. Preference will be given to applicants not participating in the previous edition (2018) of the school.

SHORT TALKS: Participants who intend to give a short talk (4 minutes) on **Wednesday, May 15, afternoon**, should declare it in the **application form** (see below) and provide a **title** and a list of **keywords** (from 3 to 5). As there will be room for no more than 25-30 talks, in case of a larger number of proposals the Organizing Committee will select on the basis of the potential interest to the audience, the coherence with the aim and scope of the school, and the diversification of topics.

Deadlines

- Student application: **February 17, 2019**
- Notification of acceptance: **March 11, 2019**
- Registration (only accepted students): **March 25, 2019**

CSS-TSS fee waivers

The Complex Systems Society (CSS), in the framework of the Thematic School Support (TSS) Program 2019, grants 2 fee waivers to support the attendance of PhD students and Junior Post Doctoral researchers who are members of the CSS.

Prospective participants who are eligible for the TSS grant should accompany their application (see the form below) with an email to the Organizing Committee (Carlo Piccardi, carlo.piccardi@polimi.it) requiring the fee waiver, providing evidence of their eligibility (academic status and CSS membership, holding at the application deadline, February 17, 2019) and motivations for their request. The acceptance will be notified together with the admission to the school (March 11, 2019).

SICC fee reduction

Members of the Italian Society for Chaos and Complexity (SICC) are entitled for a discount of 50 euros on the admission fee. After the notification of acceptance, please contact Carlo Piccardi (carlo.piccardi@polimi.it) to inform about your membership.

APPLICATION FORM

The application form for Complex networks: theory, methods, and applications (5th edition) is currently closed.

For information, please contact the Organizing Secretariat (Ms. Alessandra Cazzaniga – email: alessandra.cazzaniga@fondazionealessandrovolta.it).





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Contacts

For enquiries about the **scientific aspects of the school**, please contact Carlo Piccardi (carlo.piccardi@polimi.it) or any other member of the [Organizing Committee](#).

For enquiries about the **venue** of the school, **travel**, **accommodation**, and **application** procedure, please contact Alessandra Cazzaniga (alessandra.cazzaniga@fondazionealessandrovolta.it) at Fondazione Alessandro Volta, Como.





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Lecturers



Iain Couzin

Max Planck Institute for Ornithology, and University of Konstanz
collectivebehaviour.com/people/couzin-ian



Tina Eliassi-Rad

Northeastern University
eliassi.org



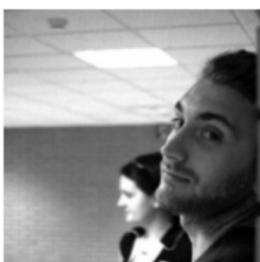
Sonia Kéfi

CNRS, Université de Montpellier
sonia.kefi.fr



Vito Latora

Queen Mary University of London
www.maths.qmul.ac.uk/~latora



Giovanni Petri

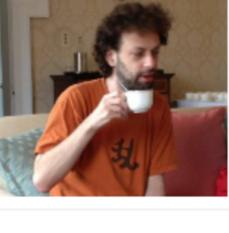
ISI Foundation, Turin
lordgrilo.github.io



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Organizing Committee

	<p>Stefano Battiston <i>University of Zurich</i> www.bf.uzh.ch/cms/de/battiston.stefano.html</p>
	<p>Ginestra Bianconi <i>Queen Mary University of London</i> www.maths.qmul.ac.uk/~gbianconi/</p>
	<p>Vittoria Colizza <i>INSERM and Sorbonne Université, Paris</i> www.epicx-lab.com/vittoria-colizza</p>
	<p>James Gleeson <i>MACSI, Department of Mathematics and Statistics, University of Limerick</i> www.ul.ie/gleesonj</p>
	<p>Petter Holme <i>Tokio Institute of Technology</i> petterhol.me</p>
	<p>Yamir Moreno <i>University of Zaragoza</i> cosnet.bifi.es/people/yamir-moreno</p>
	<p>Carlo Piccardi <i>Politecnico di Milano</i> home.deib.polimi.it/piccardi</p>
	<p>Mason A. Porter <i>UCLA</i> www.math.ucla.edu/~mason</p>





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Program

(updated February 13, 2019)

Monday, 13 May, morning (9.30-12.30)

The New Science of Networks (Latora): Networks constitute the backbone of complex systems, from the human brain to computer communication, transport infrastructures to online social systems and metabolic reactions to financial markets. Characterising their structure improves our understanding of the physical, biological, economic and social phenomena that shape our world. As a result, complex networks have become an essential ingredient in the background of any scientist. In my first lecture I will present an overview of the new theory and methods of network science, of the main results found, and of some of the still open challenges.

Monday, 13 May, afternoon (14.30-17.30)

Network Geometry (Petri): Simplicial complexes and complex systems, a general introduction. Structural properties of simplicial complexes; local and global observables, [basics of homology](#). Models of simplicial complexes: [random null models](#), [configuration](#) and [exponential models](#), [growing models](#). [Complex network geometry and manifolds](#); dynamics of and on simplicial complexes: [activity driven model](#), [percolation](#), [epidemic spreading](#) and [synchronization](#).

Tuesday, 14 May, morning (9.30-12.30)

Complex Networks with Many Layers (Latora): The constituents of a wide variety of real-world complex systems interact with each other in complicated patterns that can encompass multiple types of relationships and can also change in time. In my second lecture I will concentrate on the structure and dynamics of multi-layer networks, discussing cases where the presence of many layers gives rise to the emergence of novel behaviours, otherwise unobserved in single-layer networks. Topics covered: From complex systems to multilayer networks; Structural properties of networks with many layers; Modelling the growth of a multiplex network; Reducibility of multilayer networks; Dynamical properties of multilayer networks.

Tuesday, 14 May, afternoon

no lectures

Wednesday, 15 May, morning (9.30-12.30)

Topological Data Analysis (Petri): Topological simplification ([Mapper](#)), optimization and [automatic parameter selection](#); statistical validation and applications to social and biological systems; introduction to [persistent homology](#), [robustness](#) and [localization](#), distances between homological summaries; applications to the structure of networks, embeddings of dynamical processes, brain imaging data and neural networks.

Wednesday, 15 May, afternoon (14.30-17.30)

short talks by students (see page [Application](#))

Wednesday, 15 May, evening (20.00)

social dinner

Thursday, 16 May, morning (9.30-12.30)

Machine Learning and Networks (Eliassi-Rad): Supervised and semi-supervised learning in networks: [relational dependency](#), [collective classification](#), and [network sampling](#); unsupervised learning in networks: [community discovery](#), [role discovery](#), [graph representation learning](#), and [anomaly detection](#).

Thursday, 16 May, afternoon

no lectures

Friday, 17 May, morning (9.30-12.30)

Ecological Networks (Kéfi): Networks provide powerful tools to visualize and quantify the complexity of ecological systems. In this lecture, I'll present some of the broad questions that have been addressed with networks in ecology. I'll give an overview of recent (and less recent) studies on the structural regularities of ecological networks, and what we know about the links between these structural properties and ecological network dynamics, and in particular their resilience to perturbations.

Friday, 17 May, afternoon (14.30-17.30)

Collective Sensing and Decision-Making in Animal Groups: From Fish Schools to Primate Societies (Couzin): Understanding how social influence spreads in networks is a key challenge in the study of collective behaviour. I will demonstrate new imaging and virtual reality technology that allows us to reconstruct (automatically) the dynamic, time-varying sensory networks by which social influence propagates in groups. I will show how this allows us to identify, for any instant in time, the most socially-influential individuals, and to predict the magnitude of complex behavioral cascades within groups before they actually occur. I will address how structural properties of real social networks impact the coupling between spatial and information dynamics, and will reveal the importance of uninformed nodes in facilitating fast and effective collective decision-making.





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Protetto: Registration

Il contenuto è protetto da password. Per visualizzarlo inserisci di seguito la password:

Password:

Invio





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Venue and Accommodation

The School is housed in [Villa del Grumello](#), Como, which is set in a park over Como lake.



How to get there

[Click here for information on how to reach Como](#)

Villa del Grumello is 20 min on foot from Como city center – you can also take a bus, lines 6 and 11 (bus stop: “Como Via Regina Piscine Villa Olmo”, just after “Villa Olmo”).

From the main Train Station (Como S. Giovanni), the nearest bus stop to catch line 6 and 11 is “Piazzale Rocchetto”.

[Click here for a map](#)

Accommodation

Villa del Grumello has a **guest house** (“foresteria”) with 19 beds in 2- or 4-bed rooms. The rate is **36,30 euros** per night (breakfast not included; a kitchen for self preparing breakfast is available). Please notice that **only shared accommodation with other students is allowed** (no accompanying persons).

UPDATE! 21 March 2019 – Please note: the guesthouse is already fully booked. If you are looking for a low price accommodation, we suggest you the youth hostel OSTELLO BELLO (<https://ostellobello.com/it/ostello/ostello-bello-como-lake/>; email: booking.como@ostellobello.com) prices from EUR 36,90 per night and person (shared dorms). The hostel is 15 minutes on foot from Villa del Grumello.

A few rooms have been blocked in 3-star **hotels in Como**, with rates ranging from 80 to 120 euros per night (breakfast included).

The **School Secretariat** will take care of the accommodation of the accepted students who have accomplished the payment of the fee, and who have filled out and sent a [suitable accommodation form](#) as specified in the acceptance letter.

Important! For all school speakers and attendees!

We have learned that third part companies are contacting school speakers and attendees offering to make travel arrangements (hotel and flight bookings) on our behalf and asking for credit card details in order to proceed. PLEASE NOTE these agencies are not authorized by us, this is most likely a fraud.

For any doubt do not hesitate to contact us. Thank you!