



Complex networks: theory, methods and applications II

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Complex networks: theory, methods, and applications (2nd edition)

Villa del Grumello, Como, Italy, 16-20 May 2016

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.

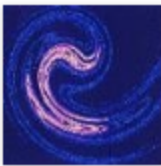
This is the 2nd edition of the school: [click here](#) to visit the website of the 1st edition (2015).

Download the [mini-poster](#) (pdf) of the school.

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Complex Systems Society



SICC – Italian Society for Chaos and Complexity



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Organizing Committee



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<http://www.bf.uzh.ch/cms/de/battiston.stefano.html>



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<http://www.epicx-lab.com/vittoria-colizza>



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Sungkyunkwan University
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Yamir Moreno
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Lecturers



Alain Barrat

Centre de Physique Théorique, Marseilles, and ISI Foundation, Turin

<http://www.cpt.univ-mrs.fr/~barrat/>



Marc Barthélemy

Institut de Physique Theorique, CEA Saclay

<http://www.quanturb.com/>



Javier M. Buldú

URJC & Center for Biomedical Technology, Madrid

<http://www.complexity.es/jmbuldu>



Ernesto Estrada

Department of Mathematics & Statistics, University of Strathclyde, Glasgow

<http://www.estradalab.org>



Marcus Kaiser

Newcastle University

<http://www.dynamic-connectome.org>



Esteban Moro

Department of Mathematics, Universidad Carlos III de Madrid

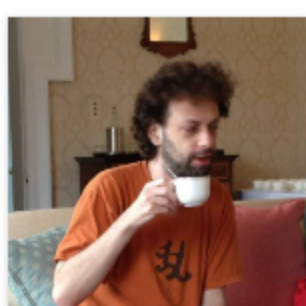
<http://www.estebanmoro.org/>



Tiago de Paula Peixoto

University of Bremen

<http://skewed.de/tiago>



Mason A. Porter

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<http://people.maths.ox.ac.uk/porterm/>



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Program

(updated March 21, 2016)

Monday, 16 May, morning (9.30-12.30)

Structural network theory: Traditional vs. non-traditional methods (Estrada): Introduction to degree distributions, assortativity, communication by shortest paths, etc. Difficulties for their application, implementation and applications. Non-traditional methods based on algebraic, graph-theoretic and topological approaches. Answering questions about: How to compare degree heterogeneities in the presence of scarce data? What is the structural meaning of degree assortativity? How can you navigate a network without knowing the shortest paths?, etc.

Monday, 16 May, afternoon

no lectures

Tuesday, 17 May, morning (9.30-12.30)

Spatial networks: theory and applications (Barthélemy): Characterization of spatial networks: tools and some important null models. Empirical measures and application to urban systems: time evolution of road, subway and railway networks; mobility networks in large cities.

Tuesday, 17 May, afternoon (14.30-17.30)

Temporal networks (Barrat): Introduction. Empirical data and characterization of temporal networks (metrics, structures). Comparison with randomized data sets (null models). Models of temporal networks. Using temporal network data in data-driven models of epidemic processes.

Wednesday, 18 May, morning (9.30-12.30)

Mesoscale structures in networks (Porter): Summary. Introduction. Community structure. Roles and positions. Block models. Stochastic block models. Core-periphery structure. Extensions when considering temporal, multilayer, and spatial networks.

Wednesday, 18 May, afternoon (14.30-17.30)

Statistical inference of generative network models (Peixoto): Fundamental generative models: exponential random graphs; stochastic block models; latent space models. The stochastic block model (SBM): microcanonical vs canonical models; degree-correction; optimal inference; belief propagation; undetectability transition; efficient Monte-Carlo algorithms. Model selection: Occam's razor; Bayesian inference and the minimum description length principle; prior information and the resolution limit; the nonparametric hierarchical SBM. Layered and temporal SBMs; generalized community structure. Prediction of spurious and missing links.

Thursday, 19 May, morning (9.30-12.30)

Social and economical networks from (big-)data (Moro): Introduction to geo/social/economical (big-)data. Modeling human behavior at society scale. (Big-)data tools for Network Analysis. Applications and examples. Open problems and future challenges.

Thursday, 19 May, afternoon

no lectures

Friday, 20 May, morning (9.30-12.30)

The human structural connectome: organisation, development, and dynamics (Kaiser): The lecture covers development and evolution, hierarchical and modular organisation, and structure-dynamics relationships of structural (anatomical) human brain connectivity. Some time is also devoted to practical exercises with Matlab on how to analyse brain networks.

Friday, 20 May, afternoon (14.30-17.30)

Functional brain networks (Buldú): Functional networks account for the neurodynamical interactions between neural regions. In this lecture, we will overview how network science is used to analyse functional brain networks. Specifically we will focus on: (i) how to construct networks from brain activity and (ii) how to analyse functional networks. Finally, we will discuss about what are the current limitations of network science applied to the brain analysis and suggest alternative approaches.



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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.

HOW TO APPLY: Prospective participants have to fill out and **submit the form** below, and **upload a 1-page letter** succinctly describing their educational background, current position, research interests, and motivations for participating in the School.

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.

Deadlines

- Student application: March 13, 2016
- Notification of acceptance: April 3, 2016
- Registration (only accepted students): April 17, 2016

The [Complex Systems Society](#) (CSS), in the framework of the [TSS Program](#), grants 3 fee waivers to support the attendance of PhD students and Junior Post Doctoral researchers (no more than three years from their PhD completion) 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, email carlo.piccardi@polimi.it) requiring the fee waiver, providing evidence of their eligibility. The acceptance will be notified together with the admission to the school (before April 3, 2016).

SUMMER SCHOOL APPLICATION CLOSED

The application form for Complex networks: theory, methods, and applications (2nd edition) is currently closed.

For information, please contact the Organizing Secretariat

(Mariagiovanna Falasconi – email: mariagiovanna.falasconi@fondazionealessandrovolta.it)



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Protected: Registration

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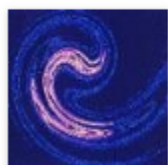
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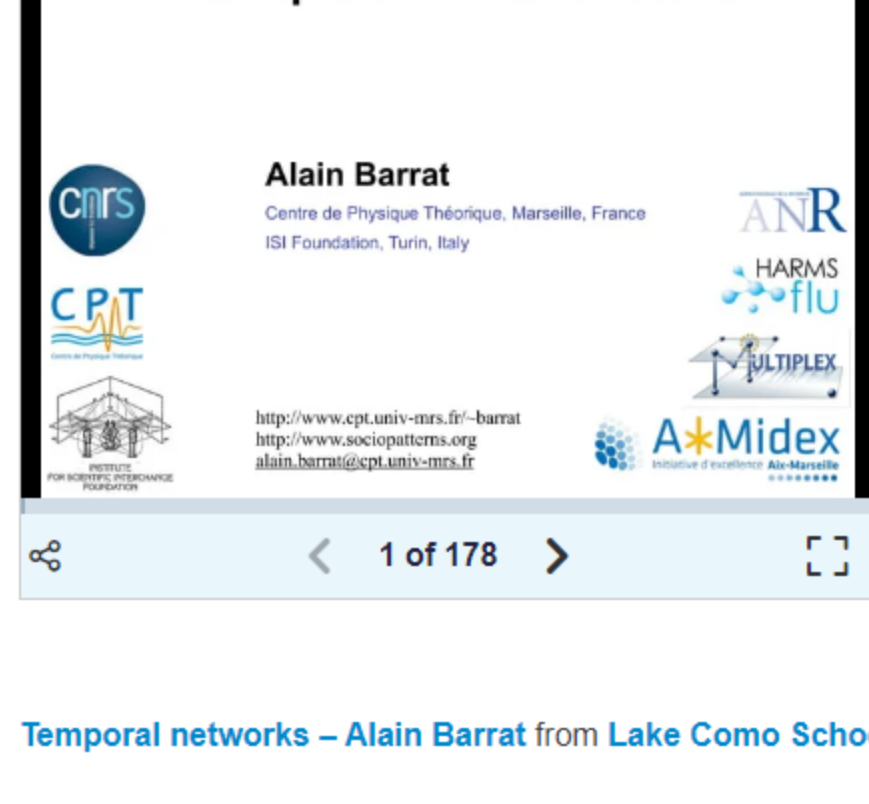
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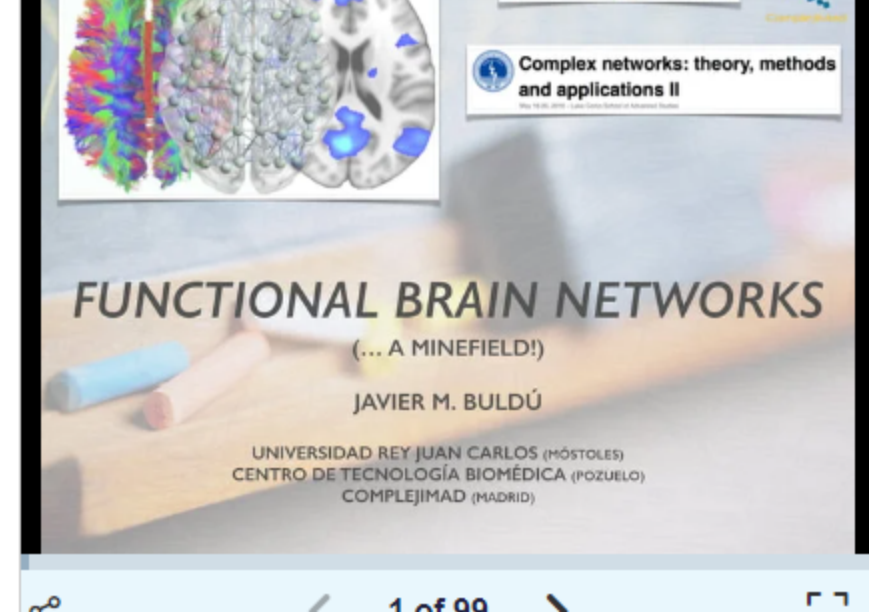
Temporal networks – Alain Barrat from Lake Como School of Advanced Studies



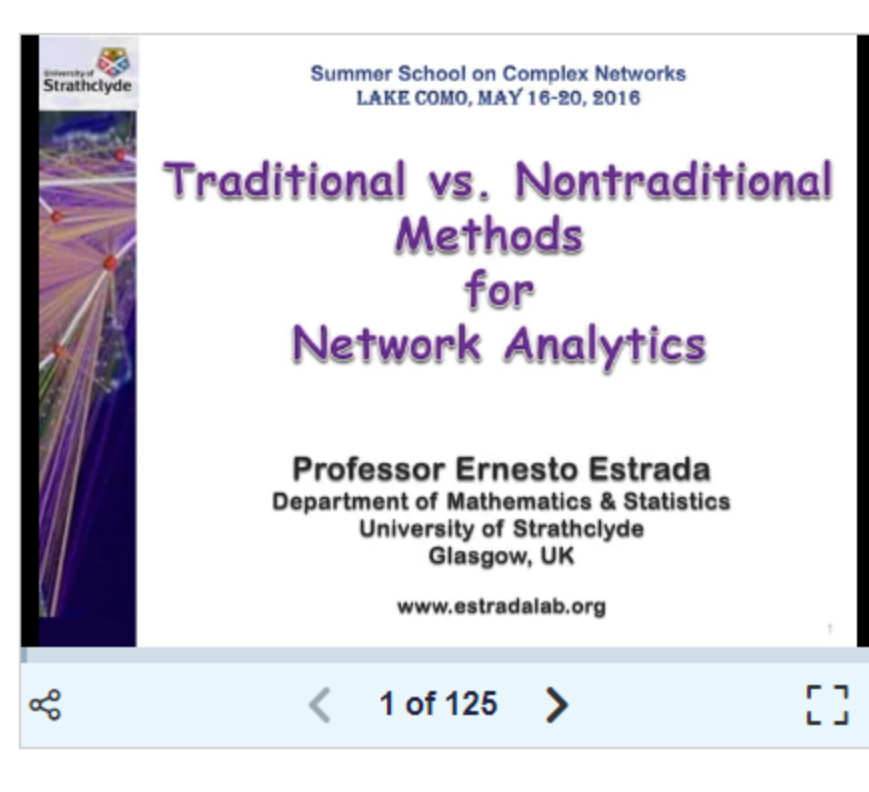
Spatial network, Theory and applications – Marc Barthelemy from Lake Como School of Advanced Studies



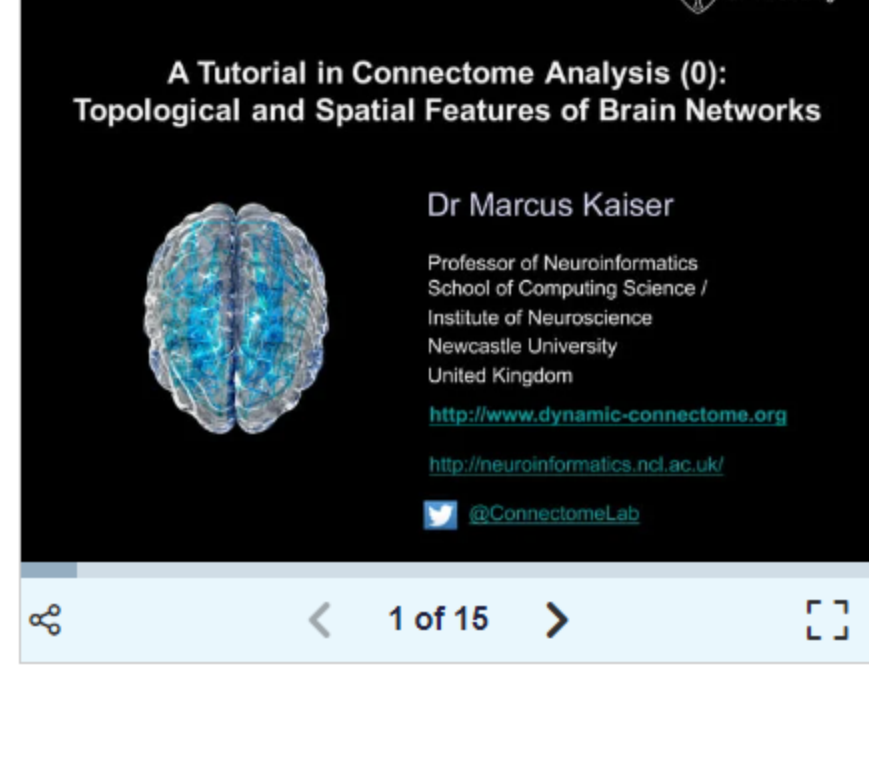
Spatial network, Theory and applications – Marc Barthelemy II from Lake Como School of Advanced Studies



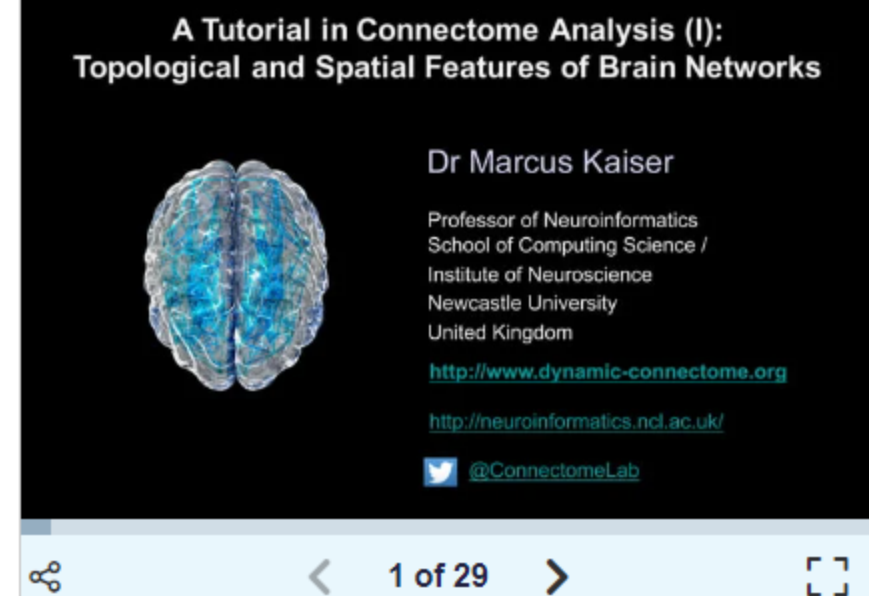
Functional Brain Networks – Javier M. Buldu from Lake Como School of Advanced Studies



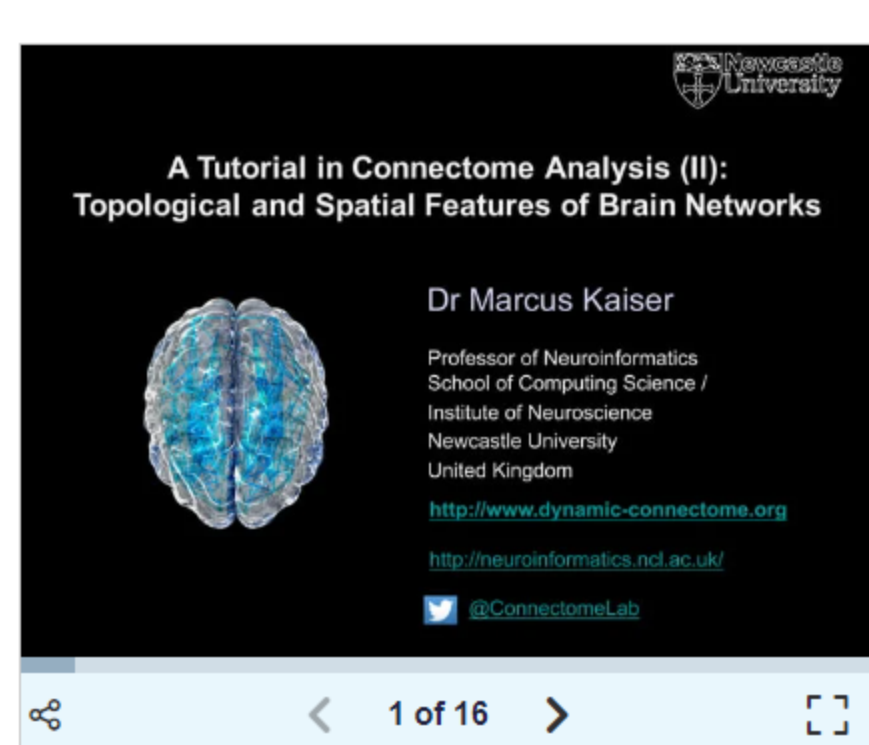
Traditional vs Nontraditional Methods for Network Analytics – Ernesto Estrada from Lake Como School of Advanced Studies



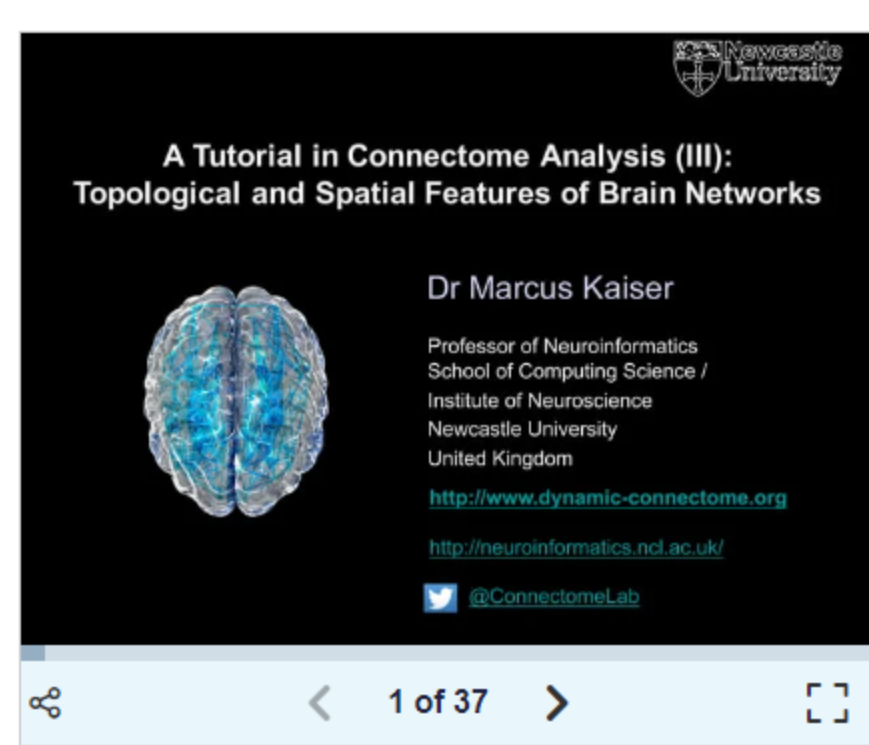
A tutorial in Connectome Analysis (0) – Marcus Kaiser from Lake Como School of Advanced Studies



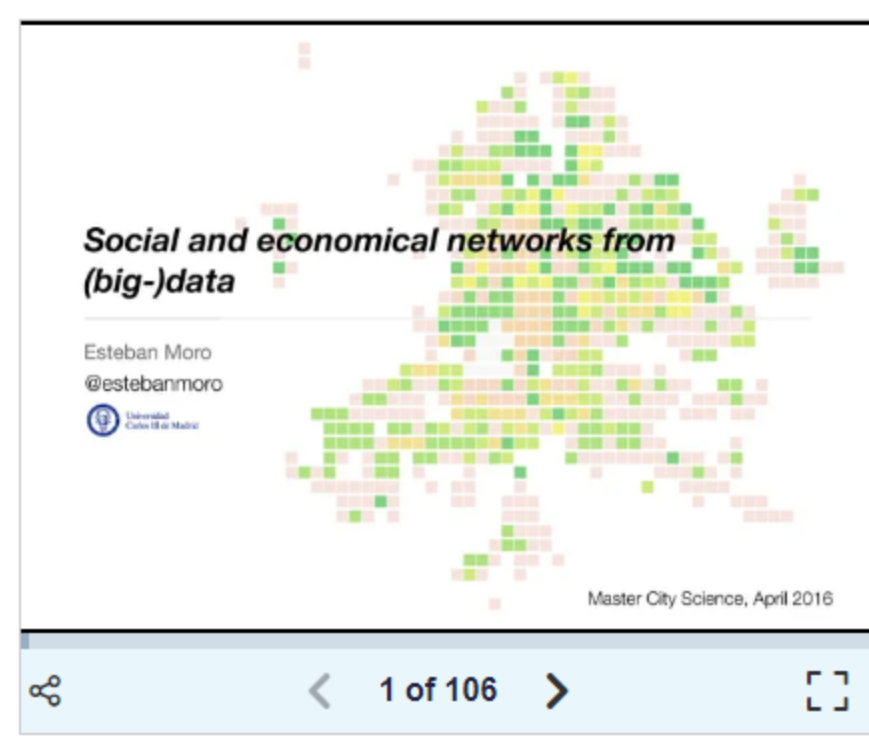
A tutorial in Connectome Analysis (1) – Marcus Kaiser from Lake Como School of Advanced Studies



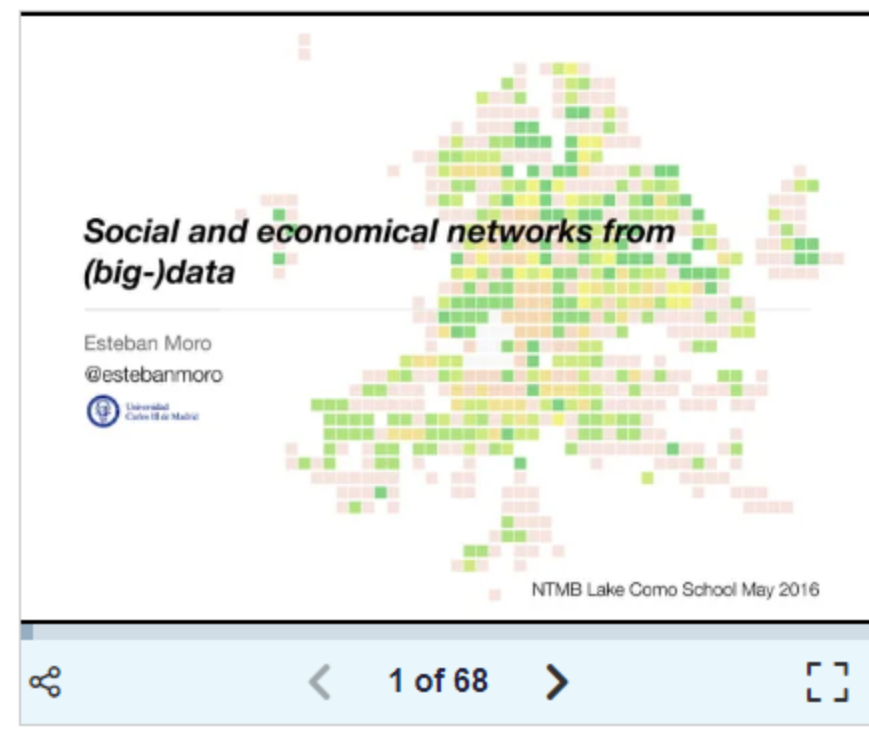
A tutorial in Connectome Analysis (2) – Marcus Kaiser from Lake Como School of Advanced Studies



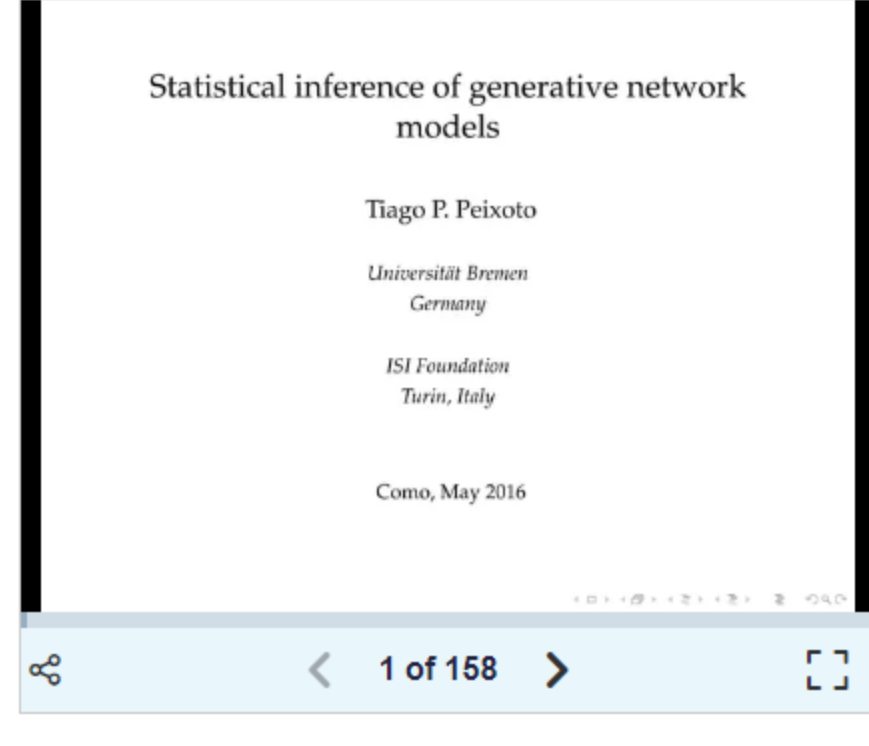
A tutorial in Connectome Analysis (3) – Marcus Kaiser from Lake Como School of Advanced Studies



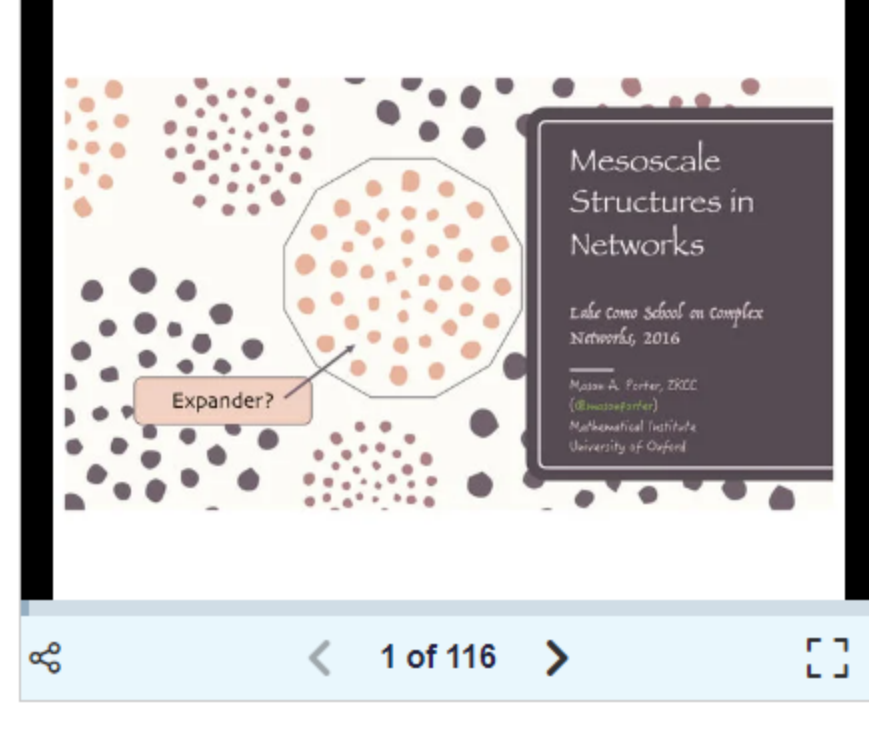
Social and economical networks from (big-)data – Esteban Moro from Lake Como School of Advanced Studies



Social and economical networks from (big-)data – Esteban Moro II from Lake Como School of Advanced Studies



Statistical inference of generative network models – Tiago P. Peixoto from Lake Como School of Advanced Studies



Mesoscale Structures in Networks – Mason A. Porter from Lake Como School of Advanced Studies



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Venue

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 **37 euros** per night (breakfast not included; a kitchen for self preparing breakfast is available).

A few rooms have been blocked in 3- and 4-star **hotels in Como**, with rates ranging from 70 to 138 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](#) before April 17, 2016.



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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 Mariagiovanna Falasconi (mariagiovanna.falasconi@fondazionealessandrovolta.it) at Fondazione Alessandro Volta, Como.