

FINAL PROGRAM

THE 2009 INTERNATIONAL WORKSHOP ON COMPLEX NETWORKS

<http://complenet09.diit.unict.it>

Catania, Italy
May 26 - 27, 2009

STEERING COMMITTEE

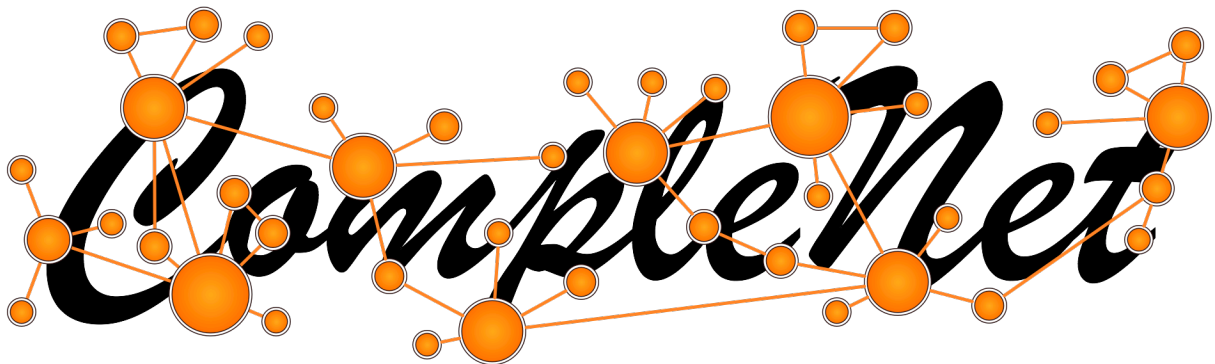
Giuseppe Mangioni
Ronaldo Menezes
Vincenzo Nicosia

PROGRAM CHAIRS

Santo Fortunato
Ronaldo Menezes

LOCAL ORGANIZATION

Vincenza Carchiolo
Alessandro Longheu
Michele Malgeri
Giuseppe Mangioni
Vincenzo Nicosia



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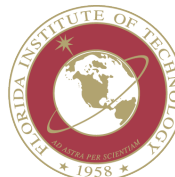
Dipartimento di Ingegneria Informatica e delle Telecomunicazioni
University of Catania, Italy

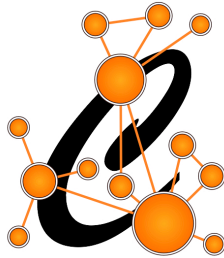
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COMPLENET 2009 INTRODUCTION

The International Workshop on Complex Networks (CompleNet 2009) brings together researchers and practitioners working on areas related to complex networks. In the past two decades we have been witnessing an exponential increase on the number of publications in this field. From biological systems to computer science, from economic to social systems, complex networks are becoming pervasive in many fields of science. It is this interdisciplinary nature of complex networks that this workshop aims at addressing. CompleNet 2009 features 2 world-renowned keynote speakers: Prof. José Mendes (University of Aveiro) and Prof. Alessandro Vespignani (Indiana University and Institute for Scientific Interchange (ISI), Torino). The Technical Program offers 18 papers on two full days. The program starts at 9:00.

General Chair

Giuseppe Mangioni
University of Catania, Italy

Program Chairs

Santo Fortunato
Institute for Scientific Interchange (ISI), Torino, Italy
Ronaldo Menezes
Florida Institute of Technology, USA

Program Committee

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Florida Institute of Technology, USA
Mariangeles Serrano
IFISC (CSIC-UIB), Maiorca, Spain
Igor Sokolov
Humboldt University, Berlin, Germany
Bosiljka Tadic
Jozef Stefan Institute, Ljubljana, Slovenia
Andres Upegui
HEIG-VD, Switzerland
Soon-Hyung Yook
Kyung Hee University, Seoul, Republic of Korea

Local Organization

Vincenza Carchiolo
University of Catania, Italy
Alessandro Longheu
University of Catania, Italy
Michele Malgeri
University of Catania, Italy
Giuseppe Mangioni
University of Catania, Italy
Vincenzo Nicosia
University of Catania, Italy

Steering Committee

Giuseppe Mangioni
University of Catania, Italy
Ronaldo Menezes
Florida Institute of Technology, Florida, USA
Vincenzo Nicosia
University of Catania, Italy

MESSAGE FROM STEERING COMMITTEE

Giuseppe Mangioni

University of Catania, Italy

Ronaldo Menezes

Florida Institute of Technology, USA

Vincenzo Nicosia

University of Catania, Italy

Welcome to Catania, Italy, for the first International Workshop on Complex Networks (CompleNet 2009). This workshop series was an initiative of research groups from: Dipartimento di Ingegneria Informatica e delle Telecomunicazioni (DIIT) – University of

Catania – Italy, the Laboratorio sui Sistemi Complessi – Scuola Superiore di Catania, Italy, and the Bio-Inspired Computing Laboratory in the Department of Computer Sciences, Florida Institute of Technology, USA. CompleNet 2009 was hosted by the DIIT, Engineering Faculty, University of Catania, Italy during May 26–27, 2009.

CompleNet aims at bringing together researchers and practitioners working on areas related to complex networks into an intensive 2 days high quality program. Despite the existence of other meetings, this is the first attempt to bring Complex Network researchers into a format long known by the Computer Science and Engineering communities but relatively uncommon for the Sciences (Physics, Biology, Social Sciences, etc.). The main difference lies on the fact that CompleNet requires full papers to be submitted and not only abstracts. We believe this improves the quality of the workshop and the program of CompleNet is proof of this.

In the past two decades we have been witnessing an exponential increase on the number of publications in Complex Networks. From biological systems to computer science, from economic to social systems, complex networks are becoming pervasive in many fields of science. It is this interdisciplinary nature of complex networks that this workshop aims at addressing, as we believe there is still a long fruitful way for us to explore. The exchange of ideas between the areas helps in the acceleration of this process.

We would like to thank first all the authors and participants of the workshop; they are the main reason this event was a success. Putting a workshop together requires a lot of work and dedication particularly when we wanted to make sure the results (this book) would stand on its own. We are particularly grateful to the Program Chairs Santo Fortunato and Ronaldo Menezes for their many contributions and extensive work towards putting together a very successful program. We would like to thank the members of the Program Committee for their dedication and invaluable expert reviews, ensuring a high-quality technical program. We are also particularly grateful to the keynote speakers, José Fernando Mendes and Alessandro Vespignani, for taking the time to participate in this workshop and to share their expertise with us. Last but certainly not least, we would like to give our special thanks to Prof. Vincenza Carchiolo, Prof. Michele Malgeri and Dr. Alessandro Longheu from the DIIT and to those people who have kindly helped us prepare and organize the CompleNet 2009 workshop.

We hope to see you in future editions of this workshop and invite you to consider submitting your work in 2010 and beyond. We hope to see you again at CompleNet 2010!

MESSAGE FROM THE PROGRAM CHAIRS

Santo Fortunato

Institute for Scientific Interchange (ISI), Torino, Italy

Ronaldo Menezes

Florida Institute of Technology, USA

Complexity science is a major scientific revolution of our time. A system is complex if its macroscopic behavior cannot be simply reduced to the microscopic behavior of its constituents. Nonlinear dynamics and feedback effects are the dominant characters of the dynamics of complex systems. A major contribution of the last years is the discovery that many complex systems in biology, physics, social and computer sciences, can be studied through their graph (network) representation, in which the elementary units of a system become nodes and their interactions links connecting nodes. Examples are social networks of acquaintances, protein-

protein interaction networks, food webs, the Internet and the World Wide Web. Networks representing real systems are characterized by a set of common features, which markedly differ from features of simple lattices or random graphs. This is why one refers to them as complex networks. The most striking feature is the fact that the distribution of the number of neighbors of a node (degree) is typically broad, with a tail that often follows a power law. This means that nodes with low degree coexist with nodes with large degree, or hubs. The presence of hubs is responsible for a number of remarkable features of complex networks, like their resilience against random attacks or failures, and the absence of percolation and epidemic thresholds. Another important characteristic of complex networks concerns clustering, i.e. the probability that neighbors of a node are themselves neighbors. Real networks usually display high values for this probability, much higher than in random graphs, and this property plays an important role in spreading phenomena. Finally, complex networks are characterized by short geodesic paths between nodes, i.e. it is possible to reach every node from any other node in a small number of steps, that grows only logarithmically with the size of the system (small-world property). The small-world property holds as well for simple random graphs, but in complex networks geodesic paths are much shorter, due to the presence of the hubs, which are fundamental communication stations.

The main issues in the theory of complex networks concern their structure and their dynamics. A lot of work has been devoted to describe the structure of complex networks. Local properties like degree, clustering coefficient, node centrality, etc. have been studied, along with their statistical distributions. Moreover, complex networks display interesting structures at the mesoscopic level, consisting in groups of nodes with many links between nodes of the same group and comparatively few between nodes of different groups. Such groups of nodes are called communities, and represent an essential aspect of the organization of networks, which allow to infer nontrivial relationships between the nodes.

As far as the dynamics is concerned, one has to distinguish the dynamics of complex networks, from the dynamics of processes taking place on them. Models of network dynamics have been proposed since the origins of complex networks. They are mostly models of growth, in which nodes are iteratively added to a small initial core. The fat-tailed distributions of degree observed in real systems are produced by the tendency of nodes to set links with nodes with large degree, although several other mechanisms have been proposed. Studying processes taking place on networks is essential to understand how networks function. Many traditional processes, like percolation, spin models dynamics, synchronization, opinion dynamics, epidemic spreading, etc. have been thoroughly analyzed, highlighting the role of hubs as fundamental actors in such processes.

Nowadays network theory is rather developed. Still, there are several open problems and the research activity in this field remains intense. For instance, the problem of detecting communities in networks is still far from being solved and it is now probably the most active research topic in the area. Similarly, a lot of effort has been put in the study of weighted networks, where one is confronted with the issue of the interplay between the strength of the interactions and the network topology. Finally, a recent research direction focuses on the issue of the coevolution of networks and dynamics, i.e. with the issue of the interplay between the evolution of the network and that of dynamical processes taking place on it, when both evolutions occur on comparative time scales.

This program aims at increasing our knowledge on network theory and applications by discussing some very recent results in the field. The papers cover many of the issues above mentioned, and were contributed by a widely interdisciplinary community of scientists, including physicists, mathematicians, computer

sciences, engineers and economists. We distinguish five subject areas for the 18 papers of this program: analysis of real networks (3 papers), community structure (4 papers), network modeling (3 papers), network dynamics (3 papers) and applications (5 papers).

We hope you will enjoy the meeting and have the opportunity to exchange your ideas and make new friends. We also hope you will enjoy your stay in Catania, Italy and take pleasure from the many entertainments and activities that the Sicily has to offer. We look forward to your active participation in future CompleNet workshops.

OTHER ACTIVITIES

CompleNet 2010 Organization Meeting: Aula Magna – Oliveri. Tuesday, May 26, 2009. 17:30 – 18:10. All welcome.

CompleNet Reception: Aula Magna – Lobby. Tuesday, May 26, 2009. 18:15 – 20:00. All welcome.

CompleNet Banquet: TBA.

TUESDAY KEYNOTE ADDRESS

Percolation on Correlated Networks

Prof. José Fernando Mendes
Departamento de Física, Universidade de Aveiro,
Portugal

TUESDAY MAY 26, 2009, 9:00 – 10:00

ROOM
AULA MAGNA - OLIVERI

ABSTRACT

I will present an analytical study of the problem of percolation on an equilibrium random network with degree-degree correlations between nearest-neighboring vertices focusing on critical singularities at a percolation threshold. We obtain criteria for degree-degree correlations to be irrelevant for critical singularities. I will also present examples of networks in which assortative and disassortative mixing leads to unusual percolation properties and new critical exponents.

WEDNESDAY KEYNOTE ADDRESS

Dynamical Processes in Complex Techno-social Networks

Prof. Alessandro Vespignani
Institute for Scientific Interchange (ISI), Torino,
Italy School of Informatics and
Indiana University, Bloomington, IN, USA

WEDNESDAY MAY 14, 2009, 9:00 – 10:00

ROOM
AULA MAGNA - OLIVERI

ABSTRACT

We live in an increasingly interconnected world where infrastructures composed by different technological layers are interoperating with the social component that drives their use and development. Examples are provided by the Internet, the social Web, the new WiFi communication technologies and transportation and mobility infrastructures. The multi-scale nature

and complexity of these networks are crucial features in the understanding of techno-social systems and the dynamical processes occurring on top of them. I will review the recent advances and challenge in this area. In particular I will present the development of computational models based on the network paradigm and the reaction–diffusion processes framework that allows their theoretical understanding. Finally I will address the central role of complex networks thinking in the definition of predictive large scale computational approaches for the modeling of emergent disease spreading.

COMPLENET 2009 SCHEDULE

TUESDAY MAY 26, 2009

09:00 – 17:00 **LOBBY**

REGISTRATION

08:45 – 09:00 **AULA MAGNA - OLIVERI**

OPENING REMARKS

09:00 – 10:00 **AULA MAGNA - OLIVERI**

KEYNOTE ADDRESS

Percolation on Correlated Networks

Prof. José Fernando Mendes
Departamento de Física, Universidade de Aveiro,
Portugal

10:00 – 10:30 **LOBBY**

COFFEE BREAK

10:30 – 12:00 **AULA MAGNA - OLIVERI**

Analysis of Real Networks

Ronaldo Menezes, Session Chair

(10:30) Dynamics and Evolution of the International Trade Network

Giorgio Fagiolo, *Sant'Anna School of Advanced Studies, Italy*
Javier Reyes, *University of Arkansas, USA*
Stefano Schiavo, *University of Trento, Italy*

(11:10) Correlation Patterns in Gene Expressions along the Cell Cycle of Yeast

Jelena Zivkovic, *Radboud University, The Netherlands*
Marija Mitrovic, *Institute of Physics, Serbia*
Bosiljka Tadic, *Josef Stefan Institute, Slovenia*

(11:40) Small World Behavior of the Planetary Active Volcanoes Network: Preliminary Results

Giuseppe Nunnari, *University of Catania, Italy*
Giuseppe Puglisi, *Ins. Naz. di Geofisica e Vulcanologia, Italy*
Alessandro Bonforte, *Ins. Naz. di Geofisica e Vulcanologia, Italy*
Alessandro Spata, *University of Catania, Italy*

12:00 – 14:00 **LOBBY**

LUNCH BREAK

14:00 – 15:30 **AULA MAGNA - OLIVERI****Applications***José F. Mendes, Session Chair***(14:00) Order-wise Correlation Dynamics in Text Data**

Masatoshi Funabashi, *Ecole Polytechnique, France*
David Chavalarias, *Ecole Polytechnique, France*
Jean-Philippe Cointet, *Ecole Polytechnique, France*

(14:30) Using Time Dependent Link Reduction to Improve the Efficiency of Topic Prediction in Co-Authorship Graphs

Susanne Hoche, *University of Bristol, UK*
David Hardcastle, *University of Bristol, UK*
Peter Flach, *University of Bristol, UK*

(15:00) Fast Similarity Search in Small-World Networks

Kazuo Aoyama, *NTT Communication Science Lab., Japan*
Kazumi Saito, *University of Shizuoka, Japan*
Takashi Yamada, *NTT Communication Science Lab., Japan*
Naonori Ueda, *NTT Communication Science Lab., Japan*

15:30 – 16:00 **LOBBY****COFFEE BREAK**

16:00 – 17:15 **AULA MAGNA - OLIVERI****(16:00) Detection of Packet Traffic Anomalous Behaviour via Information Entropy**

Ana T. Lawniczak, *University of Guelph, Canada*
Hao Wu, *University of Guelph, Canada*
Bruno N. Di Stefano, *Nuptek Systems Ltd., Canada*

(16:30) Identification of Organizational Tension Using Complex Networks

Ben Collingsworth, *Florida Institute of Technology, USA*
Ronaldo Menezes, *Florida Institute of Technology, USA*

17:30 – 18:10 **AULA MAGNA - OLIVERI****COMPLENET 2010 ORGANIZATION MEETING**

18:15 – 20:00 **LOBBY****WELCOME RECEPTION**

WEDNESDAY MAY 27, 2009

09:00 – 17:00 **LOBBY****REGISTRATION**

08:45 – 09:00 **AULA MAGNA - OLIVERI****OPENING REMARKS**

09:00 – 10:00 **AULA MAGNA - OLIVERI****KEYNOTE ADDRESS****Dynamical Processes in Complex Techno-social Networks**

Prof. Alessandro Vespignani
Institute for Scientific Interchange (ISI), Torino,
Italy School of Informatics and
Indiana University, Bloomington, IN, USA

10:00 – 10:30 **LOBBY****COFFEE BREAK**

10:30 – 12:20 **AULA MAGNA - OLIVERI****Network Modeling***Bosiljka Tadic, Session Chair***(10:30) Structural Trends in Network Ensembles**

Ulrik Brandes, *University of Konstanz, Germany*
Jürgen Lerner, *University of Konstanz, Germany*
Uwe Nagel, *University of Konstanz, Germany*
Bobo Nick, *University of Konstanz, Germany*

(11:10) Generalized Attachment Models for the Genesis of Graphs with High Clustering Coefficient

Jens Gustedt, *INRIA Nancy – Grand Est, France*

(11:50) Modeling Highway Networks with Path-Geographical Transformations

Paulino Ribeiro Villas Boas, *University of São Paulo, Brazil*
Francisco Aparecido Rodrigues, *University of São Paulo, Brazil*
Luciano da Fontoura Costa, *University of São Paulo, Brazil*

12:20 – 14:00 **LOBBY****LUNCH BREAK**

14:00 – 15:30 **AULA MAGNA - OLIVERI****Network Dynamics***Vincenzo Nicosia, Session Chair***(14:00) Simplicial Complex of Opinions on Scale-Free Networks**

Slobodan Maletic, *Institute of Nuclear Sciences Vinea, Serbia*
Milan Rajkovic, *Institute of Nuclear Sciences Vinea, Serbia*

**(14:20) An Axiomatic Foundation for Epidemics on
Complex Networks**

Paul Loya, *Binghamton University, USA*
Adam R. Lucas, *Saint Mary's College of California, USA*

**(14:50) Analytical Approach to Bond Percolation
on Clustered Networks**

Sergey Melnik, *University of Limerick, Ireland*
James P. Gleeson, *University of Limerick, Ireland*

15:30 – 16:00

LOBBY

COFFEE BREAK

16:00 – 17:50

AULA MAGNA - OLIVERI

Community Structure

Santo Fortunato, Session Chair

**(16:00) Finding Overlapping Communities Using
Disjoint Community Detection Algorithms**

Steve Gregory, *University of Bristol, England*

**(16:40) Detecting and Characterizing the Modular
Structure of the Yeast Transcription Network**

Alexandre S. Cristino, *University of São Paulo, Brazil*
Roberto F. S. Andrade, *Federal University of Bahia, Brazil*
Luciano da Fontoura Costa, *University of São Paulo, Brazil*

**(17:10) Discovering Community Structure on
Large Networks Using a Grid Computing
Environment**

Dario Fiumicello, *University of Catania, Italy*
Alessandro Longheu, *University of Catania, Italy*
Giuseppe Mangioni, *University of Catania, Italy*

**(17:30) Finding Community Structure Based on
Subgraph Similarity**

Biao Xiang, *University of Science and Technology, China*
En-Hong Chen, *University of Science and Technology, China*
Tao Zhou, *University of Science and Technology, China*

19:00 – 22:00

TBA

BANQUET

END OF COMPLENET 2009 EVENT!

THANK YOU FOR YOUR PARTICIPATION

AND

HOPE TO SEE YOU NEXT YEAR!
