

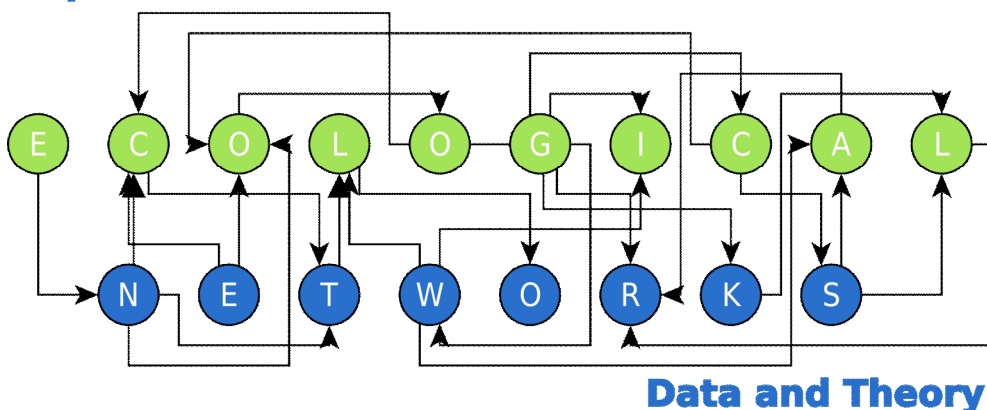
PHD PROGRAM: EVOLUTIONARY BIOLOGY AND ECOLOGY UNIVERSITY OF PARMA AND FERRARA (ITALY)

JUNE 10-12, 2014

CAMPUS, PARCO AREA DELLE SCIENZE

INTERNATIONAL SUMMER SCHOOL

A primer in



June 10-12, 2014 University of Parma (Italy)

"There are always connections; you have only to want to find them."

Umberto Eco - Foucault's Pendulum

Course Description

Networks are a paradigmatic example of complex system in nature. They have been used to represent species and their relationships (ecological networks), social interactions (social networks), protein interaction and gene regulatory networks (biological networks). The last frontiers of ecological, biological and social research identify networks as the ideal means to understand the complexity hidden in ecological, biological and social systems and that is responsible for their functioning.

The summer school aims to introduce network analysis to graduate students and early postdocs but participation is possible to anyone who has interest in studying networks: from data collection to theoretical analysis, using a wide array of network types (food webs, ecosystem models, gene regulatory, and protein-protein interaction networks, social networks) as well as mathematical and statistical tools to investigate them.

Instructors

Marco Scotti: GEOMAR Helmholtz-Zentrum für Ozeanforschung, Duesternbrooker Weg 20, D-24105 Kiel, Germany

Louis Felix Beriser: University of Fribourg Department of Biology Unit of Ecology & Evolution Fribourg Switzerland

Stefano Allesina: Department of Ecology and Evolution, University of Chicago, Chicago IL USA

Antonio Bodini: Department of Life Sciences, University of Parma, Parma, Italy

Syllabus

General concepts (*Bodini*)

Matrices and graphs

Networks and topology

Basic graph theory definitions and properties of interest

Random, scale free and small world networks

Biological Networks (*Scotti*)

Network analysis in systems biology:

- General principles of network theory to characterize the biological properties of metabolic, gene regulatory, and protein-protein interaction networks
- Network medicine: human disease network and disease-gene network
- Biological function of network modules: the predominant role of metabolism-associated biological processes terms in Alzheimers disease
- Modelling cellular compartmentation in one-carbon metabolism

Ecological Networks (*Allesina-Beriser-Bodini*)

Basics of graph theory

- types of graphs (directed-undirected, weighted, unipartite, [WINDOWS-1252?]bipartite™)
- describing graphs (degrees, centrality, nestedness, modularity)
- null models (random graphs, swap algorithm)

A short history of the study of ecological networks

- From Camerano to MacArthur

The search for regularities in the structure of food-webs

- Scaling laws
- Interspecificity
- Sensitivity to sampling effort

- Quantitative food-webs

Models of food-web structure

- Cascade model
- Niche model
- Nested hierarchy model
- Minimum potential niche model

Statistical models to study network structure

- allometric diet breadth model
- optimal body-size and latent traits models
- matching-centrality model

Local stability analysis, stability of large networks, circular/elliptic laws.
Metapopulation networks, Levins model, the Hanski-Ovaskainen model, new extensions.

Registration

Enrollment is restricted to the first 30 registrants. Enrollment is free of charge but candidates are requested to provide on their own for travel and living expenses. Registration will be open until the school opening (June 10, 2014). Earlier registration can be achieved by electronic mail to antonio.bodini@unipr.it (Antonio Bodini, director of the school)

Date and Location

The course will be held June 10-12, 2014 at the University Campus, Edificio Polifunzionale della Didattica (see map below) Parco Area delle Scienze, Parma (Italy)

CAMPUS MAP

