Thematic Course
PhD in "Scienze Economiche e Statistiche"
SEAS Department
University of Palermo

Academic Year	2021-2022
Subject	Networks and Big Data
Instructor	Michele Tumminello
Course description	In this course, we will first provide an overview of "big data" and network theory. We will then focus on real (big) datasets in economics, finance, and other social sciences, and show how network tools, methods, and models might be useful to reveal the emergent properties of investigated systems. We will learn the basic structural and dynamical properties of networks and how to apply these concepts to real systems. We will investigate, starting from real (big) data, the structure and properties of several social networks including financial networks, trading networks, crime networks, and phone-call networks. We will also explore the dynamics of processes occurring on networks, such as market contagion, and macroscopic phenomena related to these processes, including information cascades and herding. Students will be expected to think critically about concepts, models, and empirical evidences presented in class. They will be also expected to apply concepts and analysis tools to real-world networks.
Learning Objectives	Students completing this course should be able to: • Recognize the network structure arising across different economic, financial, and social systems; • Analyze a real world system by identifying its network structure and characterizing features; • Create a network model of a real system capturing a few crucial aspects of the system and ignoring marginal details; •Understand the structure and limitations of data used to monitor the evolution of real world systems. • Apply insights from the theory of networks to cope with real world problems.
Suggested readings	• Networks Crowds and Markets by David Easley and Jon Kleinberg • Six Degrees by Duncan J. Watts • Networks: an Introduction by Mark Newman • Papers in a dedicated dropbox folder
Course Activity (hrs)	15h
Credits	3
Assessment Method	A written report and a presentation on a scientific paper and/or a dataset as agreed with the instructor.
Teaching Methods	Each section utilizes a combination of lecturing, computer lab (learning by doing), and class discussion.
Calendar	April/May 2020
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Calendar of Classes

Lecture	Date	Topic	Duration
1	TBA	Big data and large networks: it's not just size that matters	3h
2	TBA	Networks as a tool to filter out information in complex systems	3h
3	TBA	Network analysis of real world datasets in Economics, Finance, and Social Sciences	3h
4	TBA	Models of network growth: degree distribution, memory, and the issue of modeling communities	3h
5	TBA	Processes running on a network: information cascades, contagion; Project discussion	3h