

Workshop 1

A PRIMER IN SCALE-FREE NETWORKS *BASIC DEFINITIONS AND COMMUNITY DETECTION*

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Abstract

The aim of this series of lectures is to present some basic introduction to the field of complex networks from the point of view of definitions, modelling and applications. Amongst the various topics we can list

1. Introduction to graphs
 - 1.1 Graphs, directed graphs, and weighted graphs
 - 1.2 Trees
 - 1.3 Vertex correlation, assortativity
 - 1.4 Hierarchical properties of graphs
 - 1.5 The properties of scale-free networks
 2. Graph structures: communities
 - 2.1 Introduction
 - 2.2 Typical subgraphs, motifs
 - 2.3 Classes of vertices
 - 2.4 Centrality measures, betweenness, and robustness
 - 2.5 Clustering detection, modularity
 - 2.6 Communities in graphs
 3. Scale-invariance, The origin of power-law functions and main models
 - 3.1 Random graph model
 - 3.2 The small-world model
 - 3.3 The Barabási-Albert model
 - 3.4 Modifications to the Barabási-Albert model
 - 3.5 Copying models
 - 3.6 Fitness based model
- Plus a brief description of some real networks.

Biography

Guido Caldarelli is currently Associate Professor in the Centre for Statistical Mechanics of National Research Council in the University "Sapienza" of Rome, Italy. He graduated in the Department of Physics of the same university in 1992, working with L. Pietronero. He received his PhD in Statistical Physics, working on Self-Organised Criticality with A. Maritan. His career includes a post doctoral fellowship position in the Department of Physics, University of Manchester, with A. McKane and in the University of Cambridge with R. Ball. His main research focuses on the analysis of scale-free networks. Beside his scientific publications, he is author or co-author of two textbooks: "Scale free Networks" (Oxford University Press, 2007) and "Large structure and dynamics of complex networks", co-edited with A. Vespignani (World Scientific, Singapore, 2007). The latter is a collection of contributes from participants to European Project COSIN (<http://www.cosinproject.org>) that he coordinated.