



Big Data <-> Big Networks

Albert Díaz Guilera

- “Donat el caràcter i la finalitat exclusivament docent i eminentment il·lustrativa de les explicacions a classe d'aquesta presentació, l'autor s'acull a l'article 32 de la Llei de propietat intel·lectual vigent respecte de l'ús parcial d'obres alienes com ara imatges, gràfics o altre material contingudes en les diferents diapositives”
- “Dado el carácter y la finalidad exclusivamente docente y eminentemente ilustrativa de las explicaciones en clase de esta presentación, el autor se acoge al artículo 32 de la Ley de Propiedad Intelectual vigente respecto al uso parcial de obras ajenas como imágenes, gráficos u otro material contenidos en las diferentes diapositivas”.

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UNIVERSITAT
BARCELONA

Complex Networks: Course and Resources

Albert Díaz Guilera
<http://diaz-guilera.net>
@anduviera

C lab B complexity lab barcelona

COMPLEXITAT

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Our course

- Foundations of Data Science:
- Complex Networks
- Data <=> Networks

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Reviews

The Structure and Function of Complex Networks*

M. E. J. Newman[†]

14024 citations

Available online at www.sciencedirect.com
SCIENCE DIRECT[®]
Physics Reports 424 (2006) 175–308
www.elsevier.com/locate/physrep

Complex networks: Structure and dynamics

S. Boccaletti^{a,*}, V. Latora^{b,c}, Y. Moreno^{d,e}, M. Chavez^f, D.-U. Hwang^a

6324 citations

REVIEWS OF MODERN PHYSICS, VOLUME 74, JANUARY 2002

Statistical mechanics of complex networks

Réka Albert* and Albert-László Barabási
Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556
(Published 30 January 2002)

16774 citations

Advances in Physics 51 1079 (2002)
Evolution of networks

S.N. Dorogovtsev^{1,2,*} and J.F.F. Mendes^{3,†}
¹ Departamento de Física and Centro de Física do Porto, Faculdade de Ciências, Universidade do Porto
Rua do Campo Alegre 687, 4169-007 Porto, Portugal
² A.F. Ioffe Physico-Technical Institute, 194021 St. Petersburg, Russia

3014 citations

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The image shows a screenshot of the "Network Science" book website. At the top left is a network graph icon, and at the top right is the name "Albert Díaz Guilera". The main title "Barabasi book" is displayed prominently in blue text. Below the title is a blue bullet point followed by the URL <http://barabasi.com/networksciencebook/>. To the right is a dark-themed page for the book "Network Science" by Albert-László Barabási. The page features a list of 10 chapters on the right side, each with a curved line pointing to the corresponding chapter title. A "Start Reading" button is located at the bottom left of the page. The chapters listed are:

1. Introduction
2. Graph Theory
3. Random Networks
4. The Scale-Free Property
5. The Barabási-Albert Model
6. Evolving Networks
7. Degree Correlations
8. Network Robustness
9. Communities
10. Spreading Phenomena

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<https://textbooks.opensuny.org/introduction-to-the-modeling-and-analysis-of-complex-systems/>

Introduction to the Modeling and Analysis of Complex Systems

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Author(s): Hiroki Sayama

Keep up to date on *Introduction to Modeling and Analysis of Complex Systems* at <http://bingweb.binghamton.edu/~sayama/textbook/>

Introduction to the Modeling and Analysis of Complex Systems introduces students to mathematical/computational modeling and analysis developed in the emerging interdisciplinary field of Complex Systems Science. Complex systems are systems made of a large number of microscopic components interacting with each other in nontrivial ways. Many real-world systems can be understood as complex systems, where critically important information resides in the relationships between the parts and not necessarily within the parts themselves. This textbook offers an accessible yet technically-oriented introduction to the modeling and analysis of complex systems. The topics covered include: fundamentals of modeling, basics of dynamical systems, discrete-time models, continuous-time models, bifurcations, chaos, cellular automata, continuous field models, static networks, dynamic networks, and agent-based models. Most of these topics are discussed in two chapters, one focusing on computational modeling and the other on mathematical analysis. This unique approach provides a comprehensive view of related concepts and techniques, and allows readers and instructors to flexibly choose relevant materials based on their objectives and needs. Python sample codes are provided for each modeling example.

This textbook is available for purchase in both grayscale and color via Amazon.com and CreateSpace.com.

REVIEWS:

Hiroki Sayama's book "Introduction to the Modeling and Simulation of Complex Systems" is ... a unique and welcome addition to any instructor's collection. What makes it valuable is that it not only presents a state-of-the-art review of the domain but also serves as a gentle guide to learning the sophisticated art of modeling complex systems. -Muaz A. Niazi, *Complex Adaptive Systems Modeling* 2016 4:3







42604

Downloads from Open SUNY Textbooks



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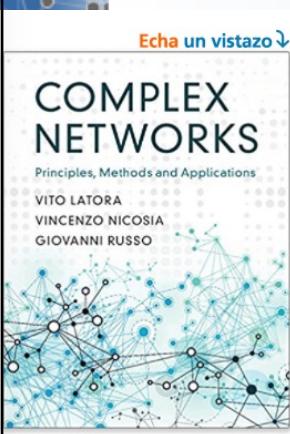
2017: Latora, Nicosia, Russo



Echa un vistazo ↓

COMPLEX NETWORKS
Principles, Methods and Applications

VITO LATORA
VINCENZO NICOSIA
GIOVANNI RUSSO



Complex Networks: Principles, Methods and Applications
(Inglés) Tapa dura – 28 sep 2017
de Vito Latora (Autor), Vincenzo Nicosia (Autor), Giovanni Russo (Autor)
Sé el primero en opinar sobre este producto

Ver los 2 formatos y ediciones

Versión Kindle EUR 37,01	Tapa dura EUR 66,75 ✓prime
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Ler con nuestra App gratuita 8 Nuevo desde EUR 62,08

¿Quieres recibirlo el viernes 16 feb.? Cómpralo antes de 3 hrs y 33 mins y elige Envío 1 día al completar tu pedido. Ver detalles

Nota: Otros vendedores ofrecen este producto a un precio inferior, potencialmente sin las ventajas de Amazon Prime.

Networks constitute the backbone of complex systems, from the human brain to computer



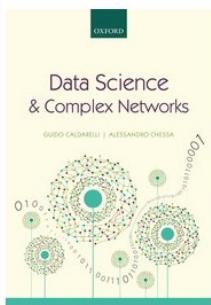
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Caldarelli & Chessa

- Books
 - foundations: any of the books shown before
 - applications: <http://book.complexnetworks.net/>



Data Science and Complex Networks

Real Case Studies with Python

Guido Caldarelli and Alessandro Chessa

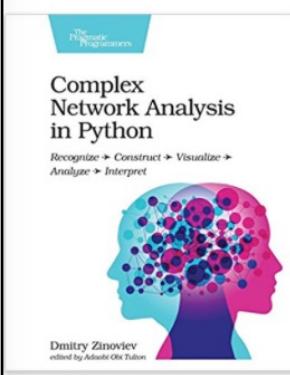
- Clearly presents the theoretical concepts
- Exposition is based on Data
- Every concept is shown with code (Python)
- Dedicated companion website for download of code, data, and platform to test personal progress

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New new (2018)



Complex Network Analysis in Python (Inglés) Tapa blanda – 29
ene 2018
de Dmitry Zinoviev ▾ (Autor)
Sé el primero en opinar sobre este producto

Ver los formatos y ediciones

Tapa blanda
EUR 34,60
3 Nuevo desde EUR 34,01

Recíbelo entre el 27 feb. - 5 mar. al elegir **Entrega estándar** durante la tramitación del pedido. [Ver detalles](#)

Nota: Este producto no disfruta de las ventajas de Amazon Prime ([más información](#)). Ofertas con envío gratuito de Amazon Prime disponibles en [otras opciones de compra](#).

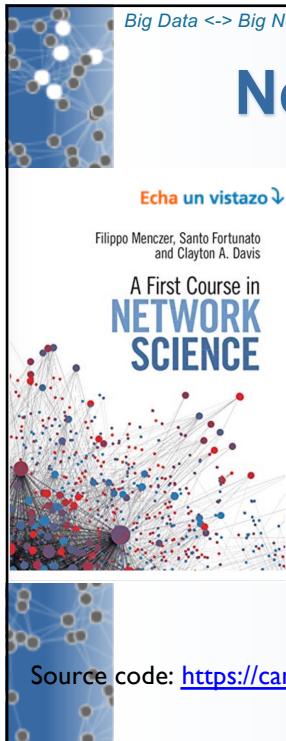
PDF book available:

<https://pragprog.com/book/dzcnapy/complex-network-analysis-in-python>
 Source code: https://pragprog.com/titles/dzcnapy/source_code

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New new new (2020)



Echa un vistazo ↗
Filippo Menczer, Santo Fortunato and Clayton A. Davis
A First Course in NETWORK SCIENCE

[Ver los 2 formatos y ediciones](#)

Versión Kindle 31,85 €	Tapa dura 38,31 €
Leer con nuestra App gratuita	
1 Usado desde 94,99 € 6 Nuevo desde 38,31 €	

Networks are everywhere: networks of friends, transportation networks and the Web. Neurons in our brains and proteins within our bodies form networks that determine our intelligence and survival. This modern, accessible textbook introduces the basics of network science for a wide range of job sectors from management to marketing, from biology to engineering, and from neuroscience to the social sciences. Students will develop important, practical skills and learn to

PDF book available:
On request
Source code: <https://cambridgeuniversitypress.github.io/FirstCourseNetworkScience/>

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Computational Tools in Complex Networks

NETWORKS

A. Arenas
A. Díaz-Guilera
S. Gómez
J. Gómez-Gardeñes
Y. Moreno

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Datasets

- Alex Arenas website
(<http://deim.urv.cat/~alexandre.arenas/data/welcome.htm>)

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Alex Arenas Website

Active projects

1. PLEXMATH: Mathematical foundations of multiplex networks European Commission FET-Proactive Project (Grant No. 317614)(2013-2015)
2. MULTIPLEX: Foundational research on multilevel complex networks and systems European Commission FET-Proactive Project (Grant No. 317532)(2013-2016)

Community detection software

Radatools
Radatools is a set of freely distributed Windows, Linux and Mac OSX programs to analyze Complex Networks developed by our group. In particular, it includes a very useful program for Community Detection and Mesoscales Determination.

[Go to Radatools page](#)

Network data sets

E-mail network URV
List of edges of the network of e-mail interchanges between members of the University Rovira i Virgili (Tarragona). Data compiled by members of our group. Please cite R. Guilera, L. Danon, A. Diaz-Guilera, F. Giralt and A. Arenas, *Physical Review E*, vol. 68, 065103(R), (2003).

Jazz musicians network
List of edges of the network of Jazz musicians. Data compiled by members of our group. Please cite P. Giesler and L. Danon , *Adv. Complex Syst.* 6, 585 (2003).

PGP network
List of edges of the giant component of the network of users of the Pretty-Good-Privacy algorithm for secure information interchange. Data compiled by members of our group. Please cite M. Boguña, R. Pastor-Satorras, A. Diaz-Guilera and A. Arenas, *Physical Review E*, vol. 70, 056122 (2004).

C. elegans metabolic network
List of edges of the metabolic network of *C.elegans*. Data processed by members of our group. Please cite Community identification using Extremal Optimization J. Duch and A. Arenas, *Physical Review E*, vol. 72, 027104, (2005).

Other network data repositories:

Mark Newman's network data repository
Santo Fortunato benchmarks
Uri Alon datasets
László Barabási's network data collection
Duncan Watts' network data sets
Vladimir Batagelj and Andrej Mrvar's graph files Pajek
Vladimir Batagelj graph files UCINET
Indiana University databases

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KONECT: The Koblenz Network Connection

- <http://konect.uni-koblenz.de/>

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The Koblenz Network Collection

KONECT (the Koblenz Network Collection) is a project to collect large network datasets of all types in order to perform research in network science and related fields, collected by the Institute of Web Science and Technologies at the University of Koblenz–Landau.

KONECT contains several hundred network datasets of various types, including directed, undirected, bipartite, weighted, unweighted, signed and rating networks. The networks of KONECT cover many diverse areas such as social networks, hyperlink networks, authorship networks, physical networks, interaction networks, and communication networks. The KONECT project has developed free software network analysis tools which are used to compute network statistics, to draw plots and to implement various link prediction algorithms. The result of these analyses are presented on these pages. Whenever we are allowed to do so, we provide a download of the networks.

KONECT currently holds 261 networks, of which

- 63 are undirected,
- 107 are directed,
- 91 are bipartite,
- 125 are unweighted,
- 90 allow multiple edges,
- 6 have signed edges,
- 10 have ratings as edges,
- 3 allow multiple weighted edges,
- 18 allow positive weighted edges,
- and 89 have edge arrival times.



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The Colorado Index of Complex Networks

- <https://icon.colorado.edu/#/>

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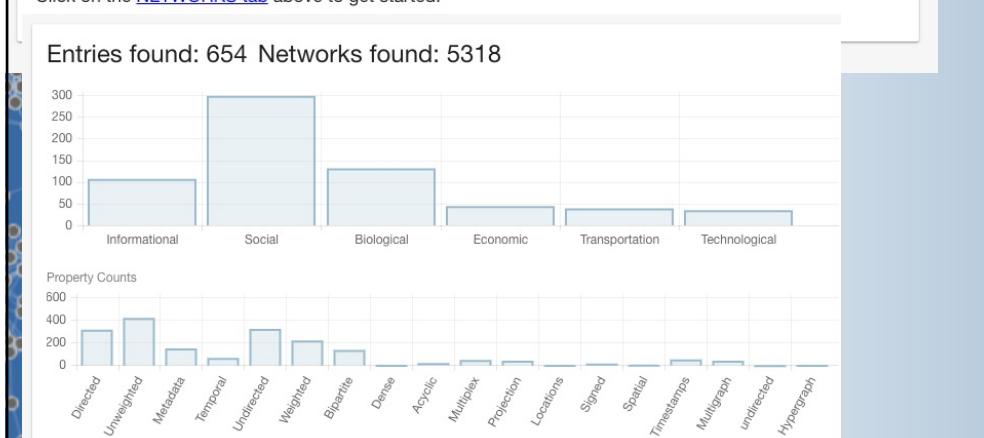
The Colorado Index of Complex Networks (ICON)

ICON is a comprehensive index of research-quality network data sets from all domains of network science, including social, web, information, biological, ecological, connectome, transportation, and technological networks.

Each network record in the index is annotated with and searchable or browsable by its graph properties, description, size, etc., and many records include links to multiple networks. The contents of ICON are curated by volunteer experts from Prof. Aaron Clauset's research group at the University of Colorado Boulder.

Click on the [NETWORKS tab](#) above to get started.

Entries found: 654 Networks found: 5318



Category	Count
Informational	~100
Social	~280
Biological	~120
Economic	~30
Transportation	~20
Technological	~20

Property	Count
Directed	~350
Unweighted	~400
Metadata	~100
Temporal	~10
Undirected	~300
Weighted	~200
Bipartite	~100
Dense	~10
Acyclic	~10
Multiplex	~10
Projection	~10
Locations	~10
Signed	~10
Spatial	~10
Timestamps	~10
Multigraph	~10
undirected	~10
Hypograph	~10

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Code

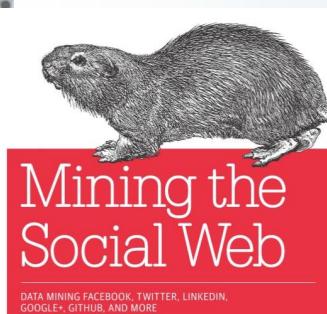
- Python 3.6
- Libraries (included in Anaconda):
 - Numpy
 - Scipy
 - Matplotlib
 - NetworkX
- Other software: Gephi (interactive)

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Data mining: books




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The screenshot shows the Science journal homepage with a sidebar featuring a complex network graph. The main content area displays a perspective article titled "Network analytics in the age of big data" by Nataša Pržulj and Noël Malod-Dognin. The article is dated July 8, 2016, and is available in Volume 353, Issue 6295, pp. 123-124. It includes social sharing icons for Facebook, Twitter, and Google+, and links to see all authors and affiliations.

Physics Reports
Volume 635, 27 May 2016, Pages 1–44
Combining complex networks and data mining: Why and how

M. Zanin^{a, b}, D. Papo^c, P.A. Sousa^b, E. Menasalvas^c, A. Nicchi^d, E. Kubik^e, S. Boccaletti^f
[Show more](#)

<http://dx.doi.org/10.1016/j.physrep.2016.04.005> [Get rights and content](#)

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The diagram illustrates the network of courses on complex networks, mapping the curricular structure and contents of Network Science Courses. It features a central network graph with various clusters of nodes representing different topics:

- Diffusion & influence**: Bayesian learning, cascades, social influence, random walks, convergence.
- Network games**: Network games, complements, substitutes, markov models of behavior.
- Small-world networks**: Watts-Strogatz networks, navigability, friendship, shortest path, clustering coefficient.
- Random networks**: Configuration model, random walks, Erdős-Renyi model.
- Scale-free networks & network growth**: Preferential attachment, network formation, network growth, rewiring, computer simi.

A small inset image shows a map with a red box highlighting a specific location.

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Evaluation

- Choose a network (teams ≤ 2)
- Everyday prepare 1-2 slides about applications of class in your chosen network
- Prepare a final notebook and a presentation
- Focus on preferred details (other than day by day)