

# Gestión de Información en la Web

## Máster en Ingeniería Informática

### Parte II: Redes Sociales On-line

#### Seminario 2: Herramientas de Análisis de Redes

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# HERRAMIENTAS PARA EL ANÁLISIS DE REDES COMPLEJAS (1)

La creciente necesidad de minería y visualización de redes complejas ha derivado en el desarrollo de una gran colección de herramientas software

Algunas son más técnicas y están dirigidas a programadores mientras que otras son más intuitivas y, por tanto, más adecuadas para usuarios de las ciencias sociales

La mayoría permiten el cálculo de medidas locales y globales de la red, su visualización gráfica y la detección de comunidades y, en general:

- Creación de redes,
- Visualización y manipulación de redes,
- Análisis cualitativo y cuantitativo/estadístico de redes,
- Detección de comunidades,
- Análisis predictivo (modelos de contagio, predicción de enlaces, etc.)

Los más populares pueden ser Gephi, Pajek, UCInet, NodeXL y las distintas bibliotecas desarrolladas en R (igraph, sna, tnet, statnet y NetworkX)

# HERRAMIENTAS PARA EL ANÁLISIS DE REDES COMPLEJAS (2)

## Paquetes Software de Visualización y cálculo de medidas básicas:

Herramientas intuitivas, con GUI y sin necesidad de conocimientos de programación (dirigidas a usuarios de áreas generales)

**Gephi:** <http://gephi.org/>



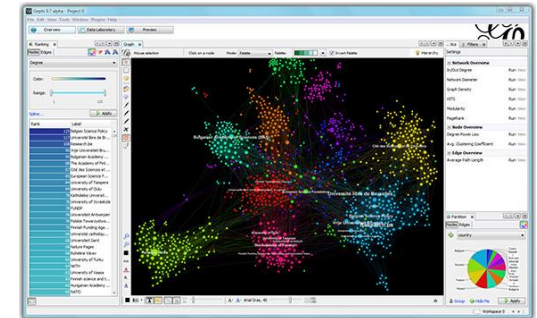
**Será el que usemos nosotros.**

Tutorial: <http://gephi.org/users/quick-start/>

**Gephi** is an interactive visualization and exploration platform for all kinds of networks and complex systems, dynamic and hierarchical graphs, endowed with a three-dimensional render engine to display real-time evolving networks

Developed in Java. Runs on **Windows**, **Linux** and **Mac OS X**. Gephi is open-source

Bastian M., Heymann S., Jacomy M. (2009). Gephi: an open source software for exploring and manipulating networks. International AAAI Conference on Weblogs and Social Media



# HERRAMIENTAS PARA EL ANÁLISIS DE REDES COMPLEJAS (3)

- **NodeXL**: <http://nodexl.codeplex.com/>



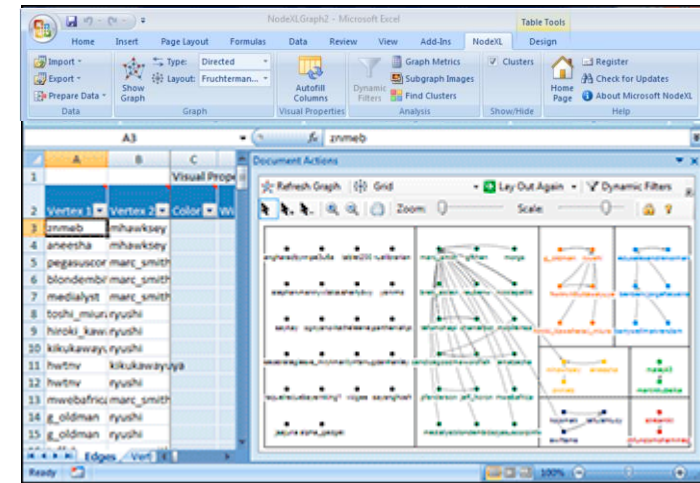
**NodeXL** is a freely available add-in to Microsoft Excel 2007, 2010, 2013 and 2016 for the overview, discovery and exploration of networks

With NodeXL, you can enter a network edge list in a worksheet, click a button and see your graph, all in the familiar environment of the Excel window

It does not require any programming skills and it is very user friendly

**Not suitable for the analysis of large networks**

Smith M et al. Analyzing (social media) networks with NodeXL.  
In: Fourth International Conference on Communities and Technologies. New York, NY: ACM 2009, 255–264



# HERRAMIENTAS PARA EL ANÁLISIS DE REDES COMPLEJAS (4)

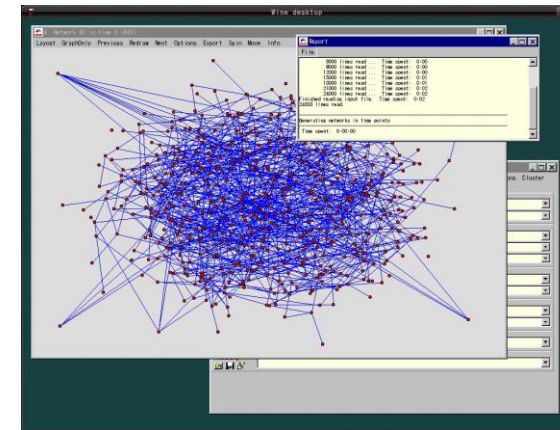
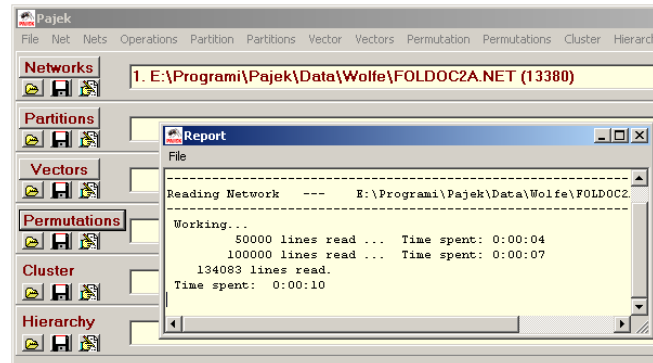
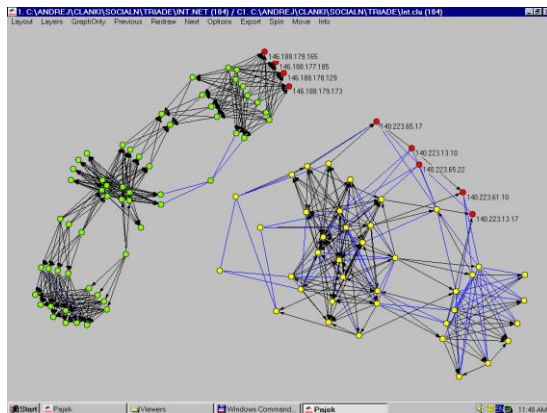
- **Pajek**: <http://pajek.imfm.si/doku.php>



**Pajek** (Slovene word for Spider) is a program, for **Windows**, for analysis and visualization of large-scale networks. It is freely available, for noncommercial use

Very extensive functionality via drop-down menus

Batagelj V., Mrvar A.: Pajek - Analysis and Visualization of Large Networks. in Jünger, M., Mutzel, P., (Eds.) Graph Drawing Software. Springer, Berlin 2003. pp. 77-103



# HERRAMIENTAS PARA EL ANÁLISIS DE REDES COMPLEJAS (5)

## Herramientas de Programación:

Herramientas más técnicas dirigidas a usuarios con conocimientos de programación de ordenadores:

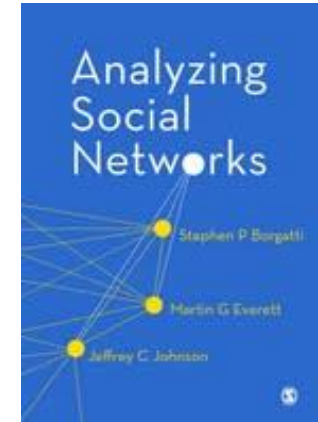
- **UCInet:** <https://sites.google.com/site/ucinetsoftware/home>

**UCINET 6 for Windows** is a **commercial** software package for the analysis of social network data. It was developed by Lin Freeman, Martin Everett and Steve Borgatti. It comes with the **NetDraw** network visualization tool

Especially suitable for statistical and matricial analyses

The program can be downloaded and used for free for 90 days

Borgatti SP, Everett MG, Freeman LC. Ucinet for Windows: Software for social network analysis. Harv Anal Technol 2002, 2006





# HERRAMIENTAS PARA EL ANÁLISIS DE REDES COMPLEJAS (6)

- **Igraph**: <http://igraph.sourceforge.net/>



**Igraph** is a free software package for creating and manipulating undirected and directed graphs. It includes implementations for classic graph theory problems like minimum spanning trees and network flow, and also implements algorithms for some recent network analysis methods, like community structure search

It contains functions for generating regular and random graphs, manipulating graphs, assigning attributes to vertices and edges. It can calculate various structural properties, graph isomorphism, includes heuristics for community structure detection, supports many file formats. **The R and Python interfaces support visualization**

igraph runs on most modern machines and operating systems, and it is tested on **MS Windows, Mac OSX and various Linux versions**. The software you need for installing igraph depends on whether you want to use the **C library, the R package or the Python extension**; and may vary depending on your platform

# HERRAMIENTAS PARA EL ANÁLISIS DE REDES COMPLEJAS (7)

- **NetworkX**: <http://networkx.github.io/>

**NetworkX** is a **Python** language software package for the creation, manipulation, and study of the structure, dynamics, and functions of complex networks

Extensive functionality:

- scales to large networks by taking advantage of existing C, Fortran libraries for large matrix computations
- Nodes can be "anything" (e.g. text, images, XML records). Edges can hold arbitrary data (e.g. weights, time-series)
- Generators for classic graphs, random graphs, and synthetic networks
- Standard graph algorithms. Network structure and analysis measures

Open source. Well tested. Additional benefits from Python: fast prototyping, easy to teach, multi-platform

Hagberg AA, Schult DA, Swart PJ. Exploring network structure, dynamics, and function using NetworkX. In: Seventh Python in Science Conference; 2008, 11–15



# HERRAMIENTAS PARA EL ANÁLISIS DE REDES COMPLEJAS (8)

- **D3 (Data Driven Documents):** <http://d3js.org/>



D3 is a **JavaScript visualization library** for manipulating documents based on data using HTML, SVG, and CSS. D3 combines powerful visualization components and a data-driven approach for Document Object Model (DOM) manipulation.

D3 allows us to bind arbitrary data to a DOM and then apply data-driven transformations to the document. E.g., D3 can generate an HTML table from an array of numbers or use the same data to create an interactive SVG bar chart with smooth transitions and interaction

D3 is very fast, supporting **large datasets and dynamic behaviors for interaction and animation**

D3's functional style allows code reuse with many components and plugins

In particular, there are specific components for network layout: `d3.layout.force ()`



# HERRAMIENTAS PARA EL ANÁLISIS DE REDES COMPLEJAS (9)

## Herramienta Mixta y Especializada:

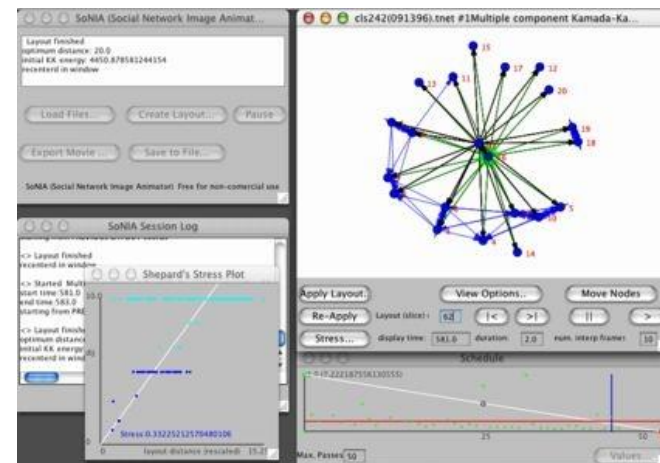


**SoNIA** (<http://www.stanford.edu/group/sonia/>) is a **Java**-based package for **visualizing dynamic network data**. In addition to information about the relations between entities there is also **information about when these relations occur**, or at least the relative order in which they occur

Our intention is to aid the user in constructing "meaningful" layouts and export the resulting images or "**movies**" of the network, along with information about the techniques and parameter settings used to construct the layouts, and some form of statistic indicating the "accuracy" or degree of distortion present in the layout

It also works as a **platform for the development**, testing, and comparison of various static and dynamic layout techniques (modular **OpenSource** project)

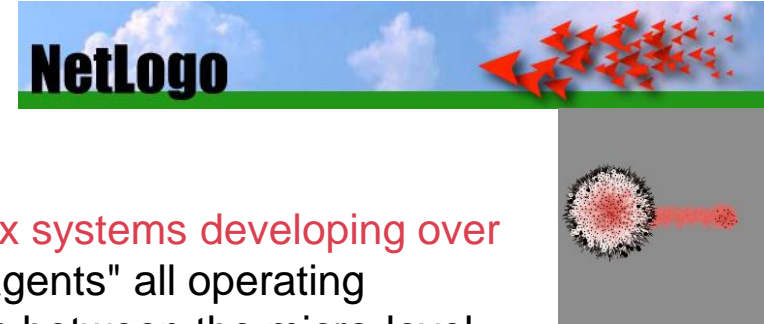
Bender-deMoll S and McFarland DA. The Art and Science of Dynamic Network Visualization. Journal of Social Structure (2006) 7:2



## NetLogo: Modelado de Procesos Dinámicos en Redes

**NetLogo** (<http://ccl.northwestern.edu/netlogo/>) is a multi-agent programmable modeling environment for simulating natural and social phenomena. You can download it free of charge

It is authored by Uri Wilensky and developed at the Center for Connected Learning (CCL) and Computer-Based Modeling, NorthWestern University



NetLogo is particularly well suited for modeling complex systems developing over time. Modelers can give instructions to thousands of "agents" all operating independently. This allows us to explore the connection between the micro-level behavior of individuals and the macro-level patterns emerging from their interaction

NetLogo lets students "play" with simulations, exploring their behavior under various conditions. It is also an authoring environment enabling developers to create their own models

Emplearemos distintas simulaciones realizadas en NetLogo en las prácticas de la asignatura