

A Brief Motivation of Spectral Graph Theory

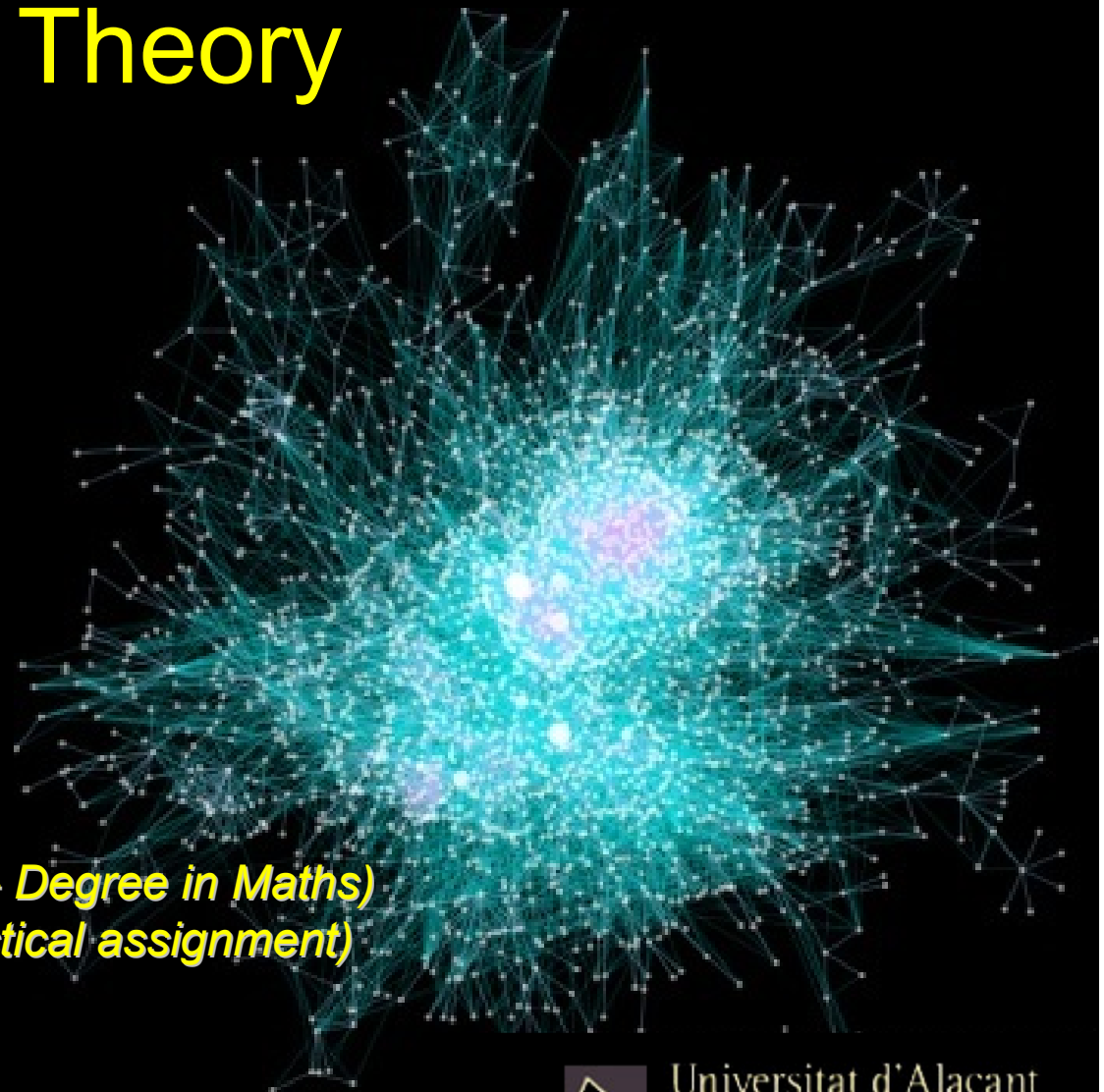
Francisco Escolano, PhD

University of Alicante (Spain)

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sco@dccia.ua.es

Matrix Computing (subject 3168 – Degree in Maths)
30 hours (theory) + 15 hours (practical assignment)



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History...

Big-bang of the spectral analysis of discrete mathematical structures in the 90s!



[Cvetkovic et al, 80]



[Cheeger, 60]



[Shi & Malik, 95]



[Chun-Graham, 97]



[Smola, 03]

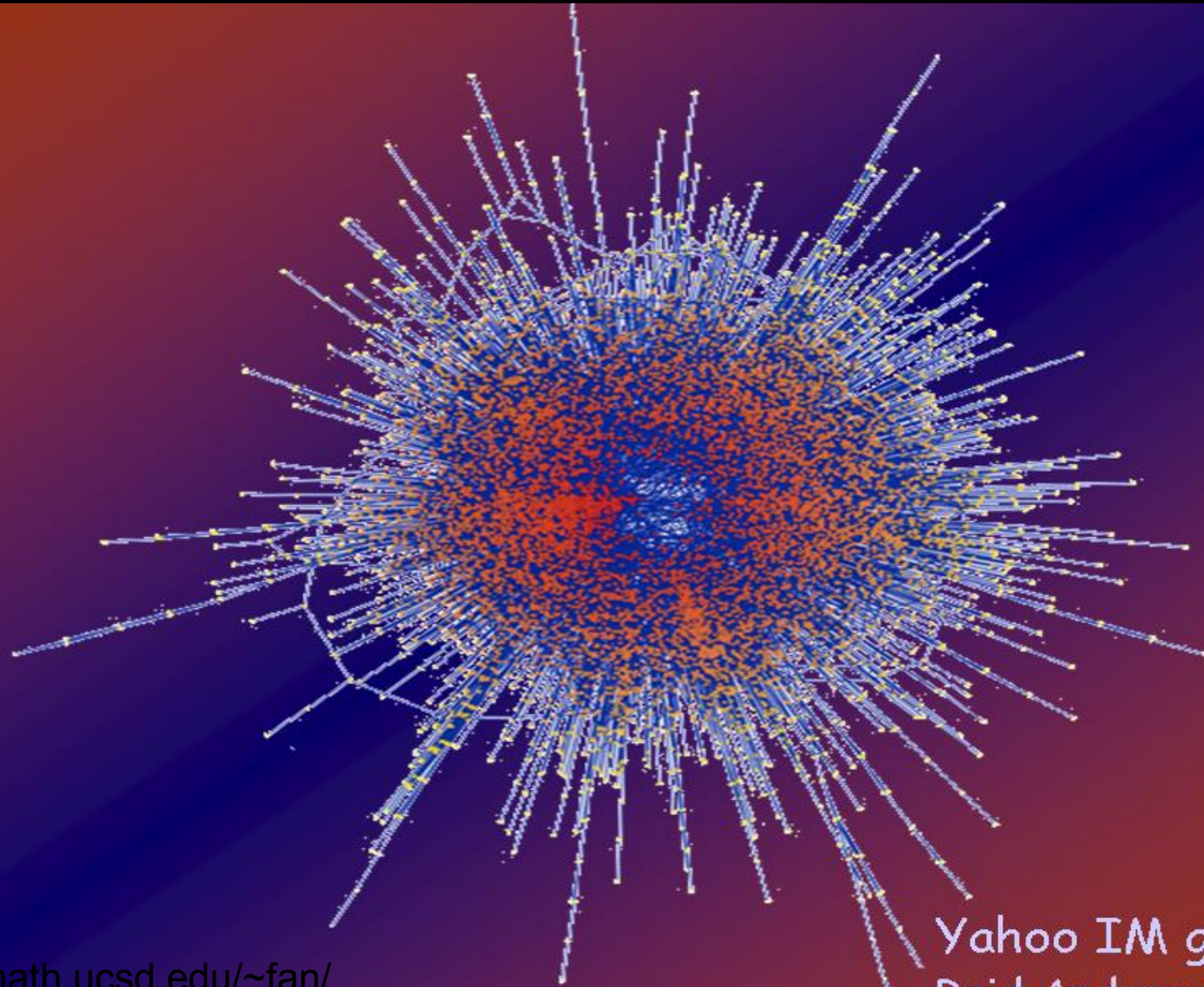
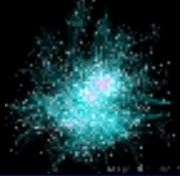
[Hancock et al, 03]



[Kondor & Lafferty, 03]



Graphs everywhere: Internet

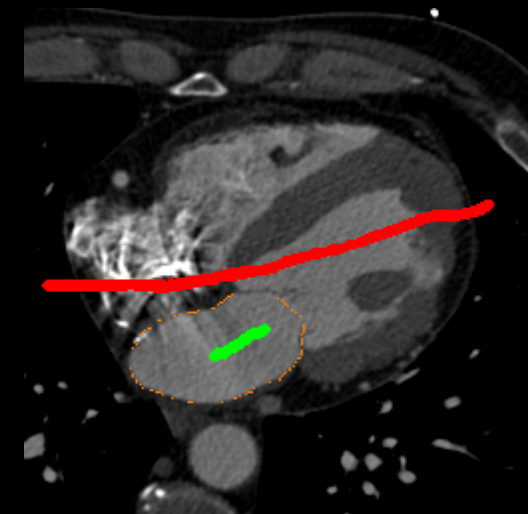
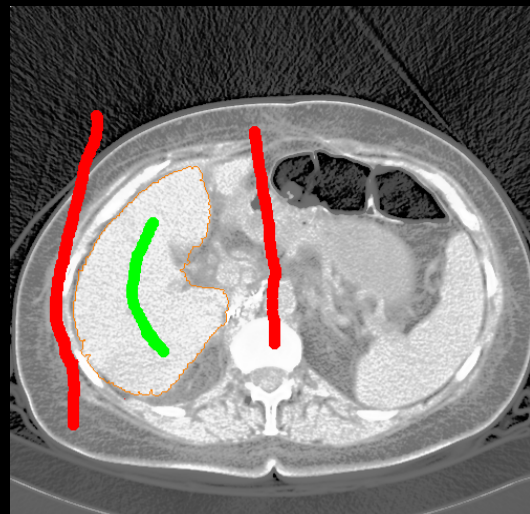
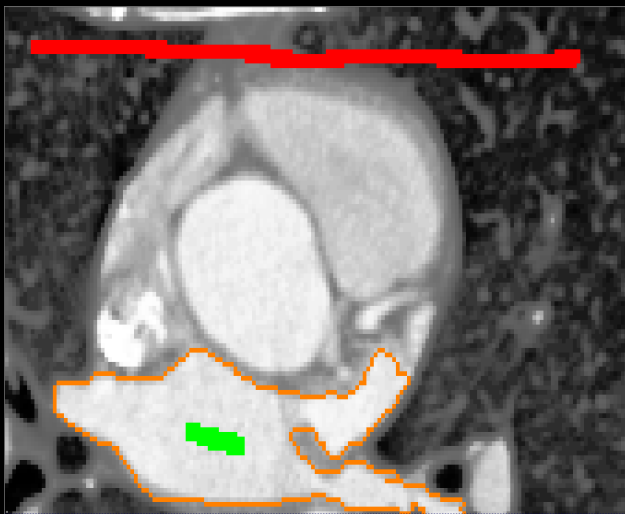
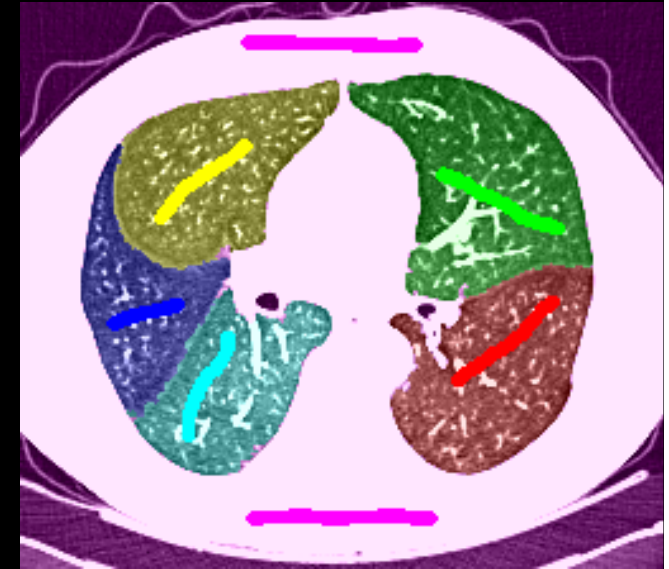
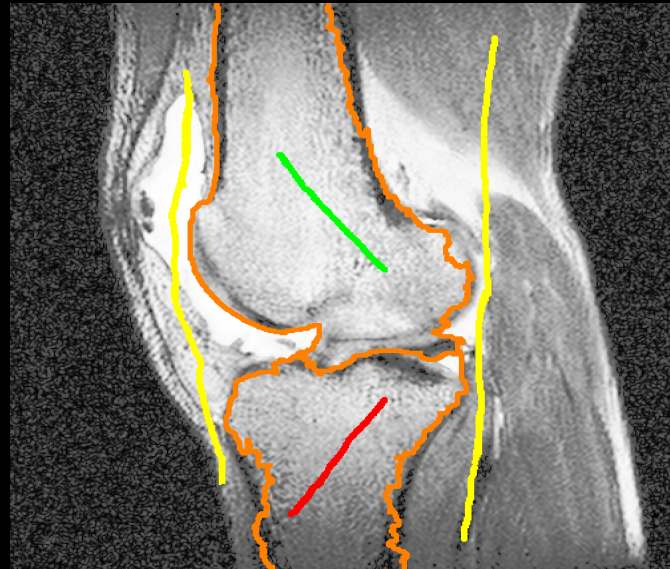


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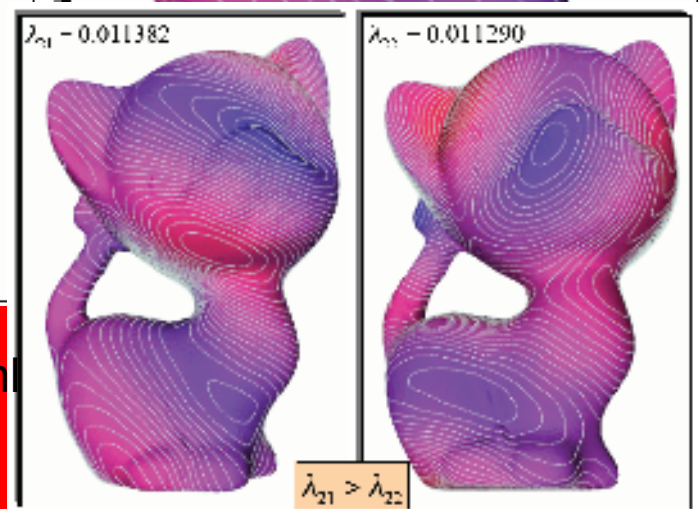
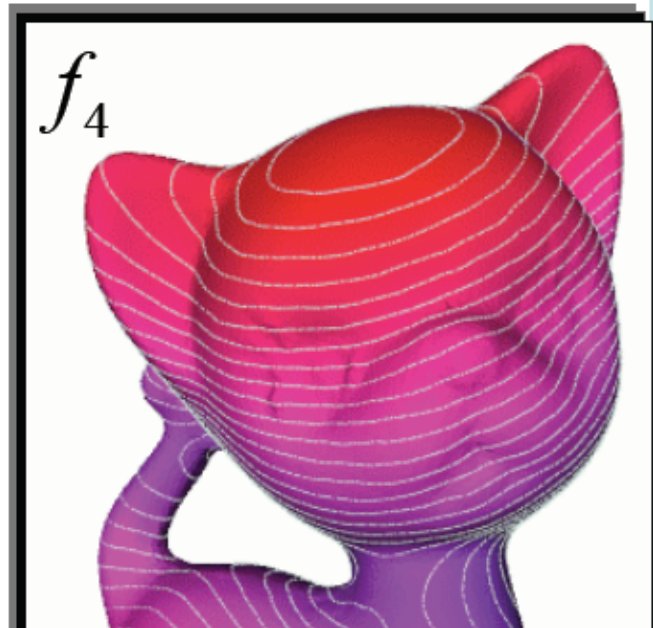
Yahoo IM graph
Reid Andersen 2005

Graphs everywhere: Image Analysis

http://videolectures.net/gbr07_grady_gpsa/

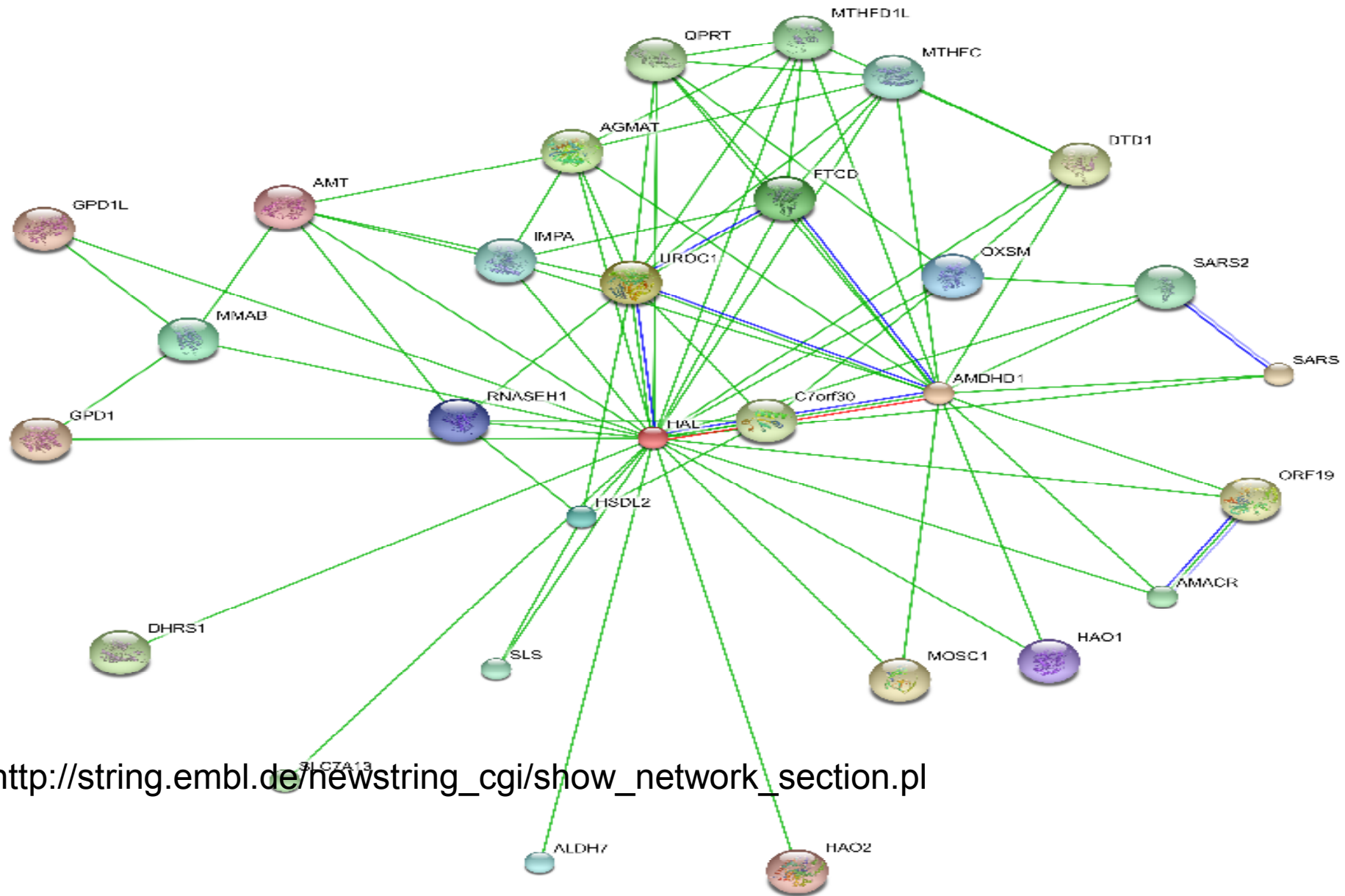


Graphs everywhere: 3D objects



<http://www.ge.imati.cnr.it/ima/smg/web-page/eg2007.html>

Graphs everywhere: Bioinformatics



http://string.embl.de/newstring.cgi/show_network_section.pl

Focus on graph spectra!

Fan Chung Graham's Homepage - Mozilla Firefox

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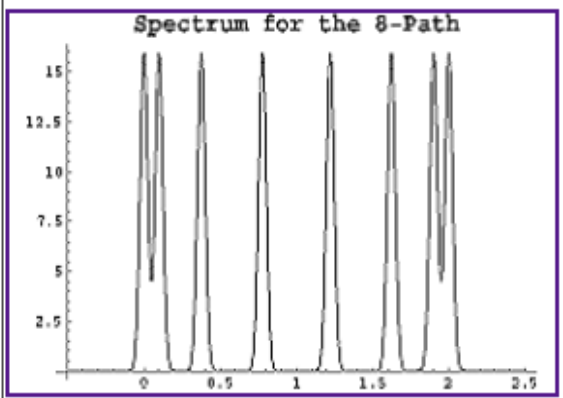
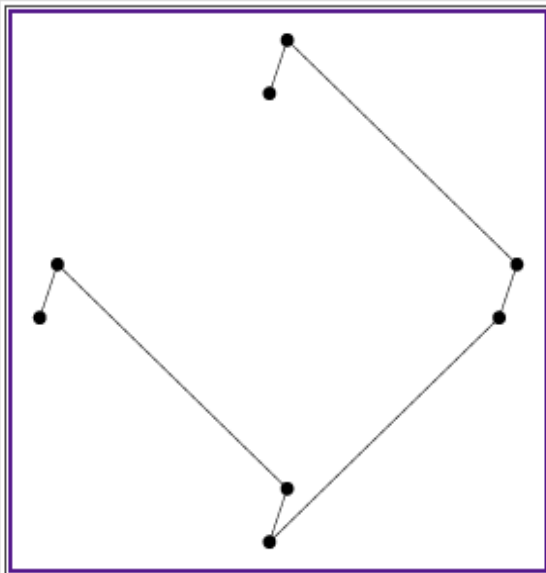
Fan Chung Graham Professor of Mathematics
金芳蓉 Professor of Computer Science and Engineering

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Can you hear the shape of a graph?

Designed by Rob Ellis



[Play eigenvalue scale](#)
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Webseminar: Random walks

INI : SCH : Hancock, 2008-03-18 : Analysis of graphs using diffusion processes and random walks (a random walk through spectral graph theory) : index - Mozilla Firefox

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18 Mar 2008

Analysis of graphs using diffusion processes and random walks (a random walk through spectral graph theory)

E. Hancock (York)

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Terminado

Una descarga activa (14 minutos restante(s))

ES < > 13:21

Syllabus



1. Motivation
2. Spectra of Adjacency Matrices and Laplacians
3. Spectral Characterization of Graphs
4. Graph Cuts and Normalized Cuts
5. Spectral Clustering
6. Heat Diffusion, Graph Kernels & Random Walks
7. The Random Walker
8. Generalized Graph Kernels
9. Spectral Smoothing
10. Spectral Semi-Supervised Learning
11. Green Function and Commute Times
12. Spectral Embeddings
13. Spectral Complexity, PageRanking and Network Analysis
14. Open questions

Course (Fall 2009)



Theoretical lessons.

Wednesday 11:30-13:30 Classroom: A1/1-61P

Development of Spectral Graph Theory elements emphasizing most important theoretical results and applications

Practical lessons (Matlab)

Friday 12:30-13:30 Classroom: CI/INF6

Each weekly session will be devoted to give practical examples of the methods and principles presented in the corresponding theoretical lesson

Teacher

Francisco Escolano

Email: sco@dccia.ua.es

Student attention: 10-13h Monday & Tuesday