

Social Network Analysis

Introduction

Published literature in “social network analysis”

Web of Science

Scopus

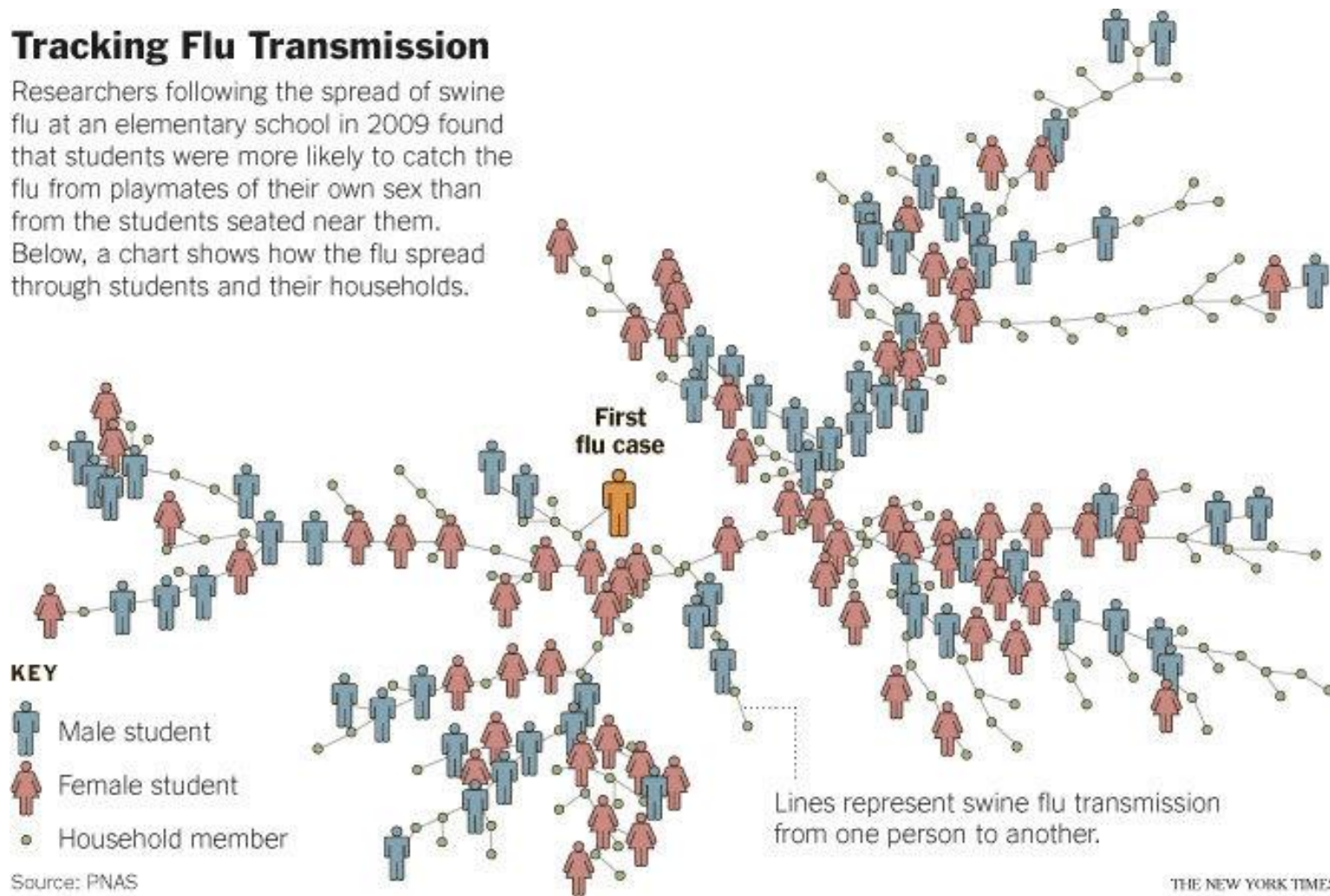
Network



A group or system of interconnected people or things

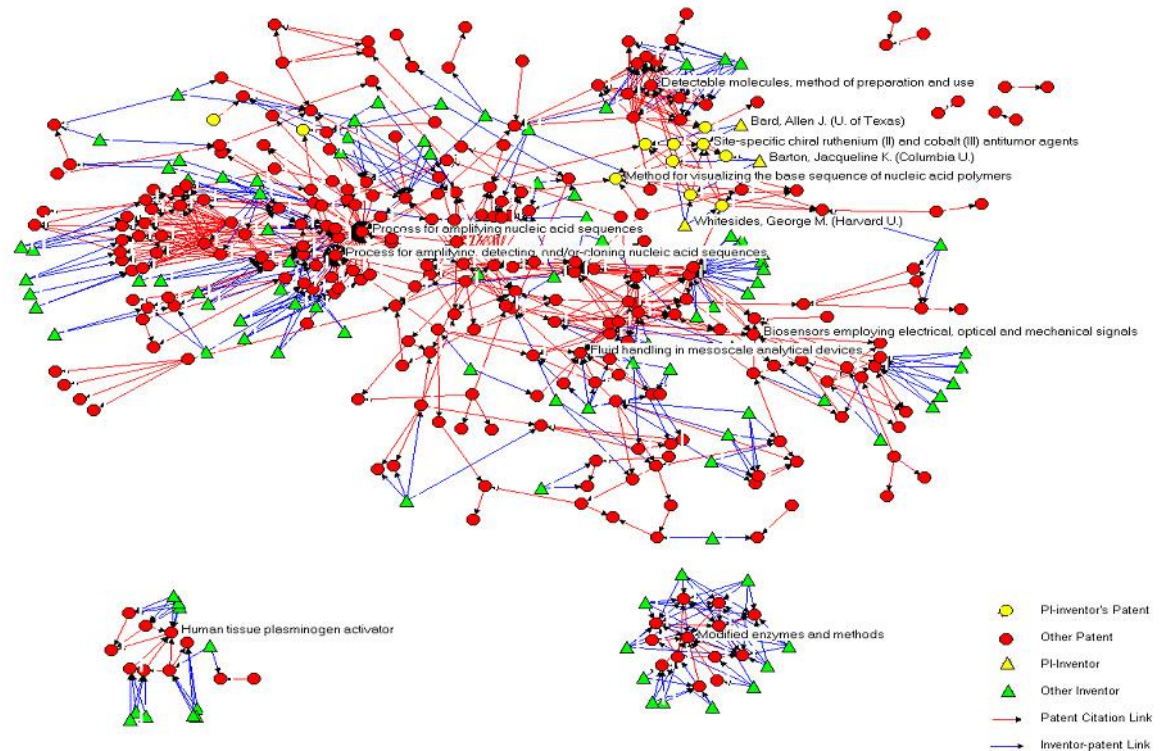
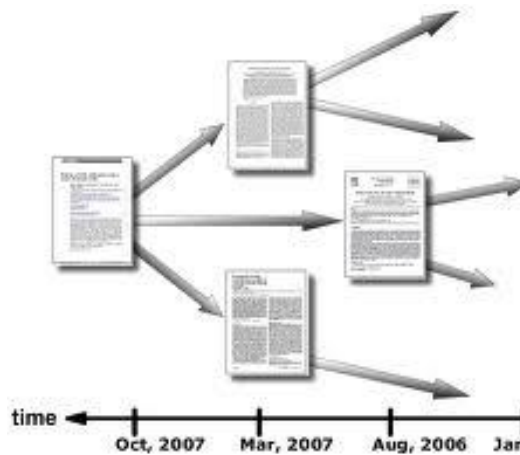
Tracking Flu Transmission

Researchers following the spread of swine flu at an elementary school in 2009 found that students were more likely to catch the flu from playmates of their own sex than from the students seated near them. Below, a chart shows how the flu spread through students and their households.

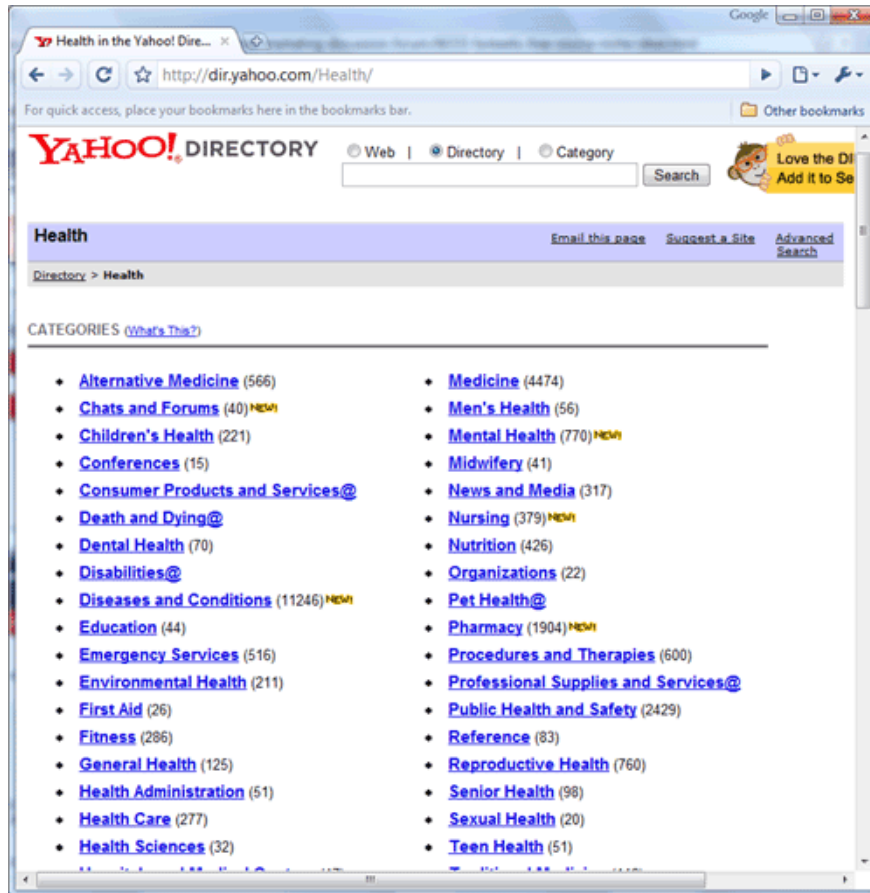


What are the variables involved in this model?

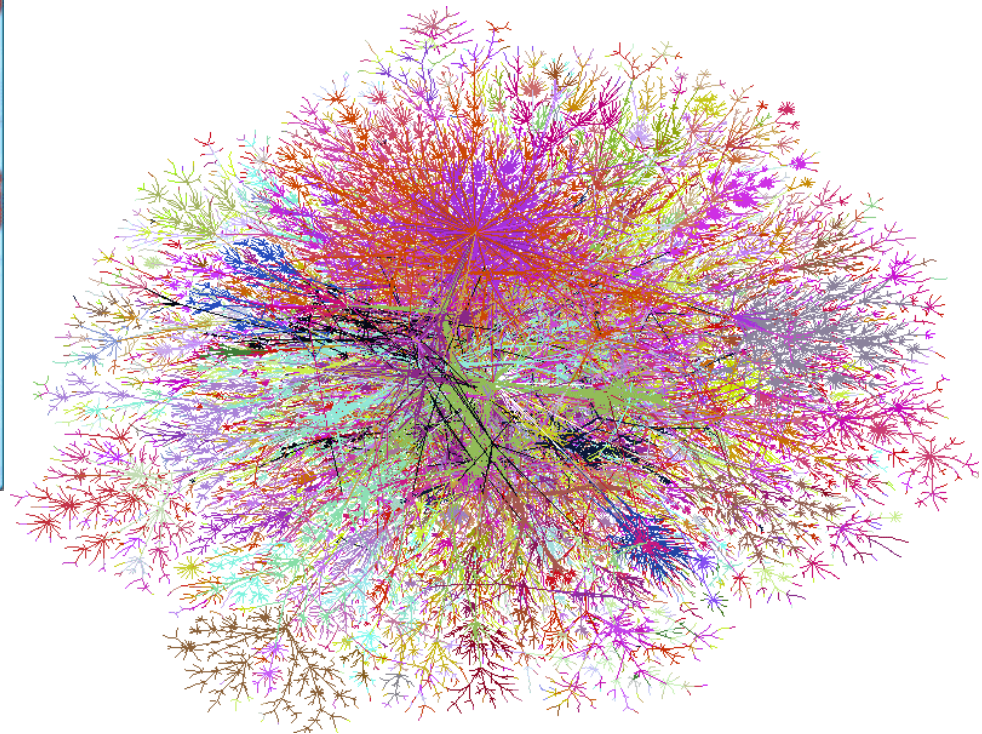
Citation network



Network as an organizational principle

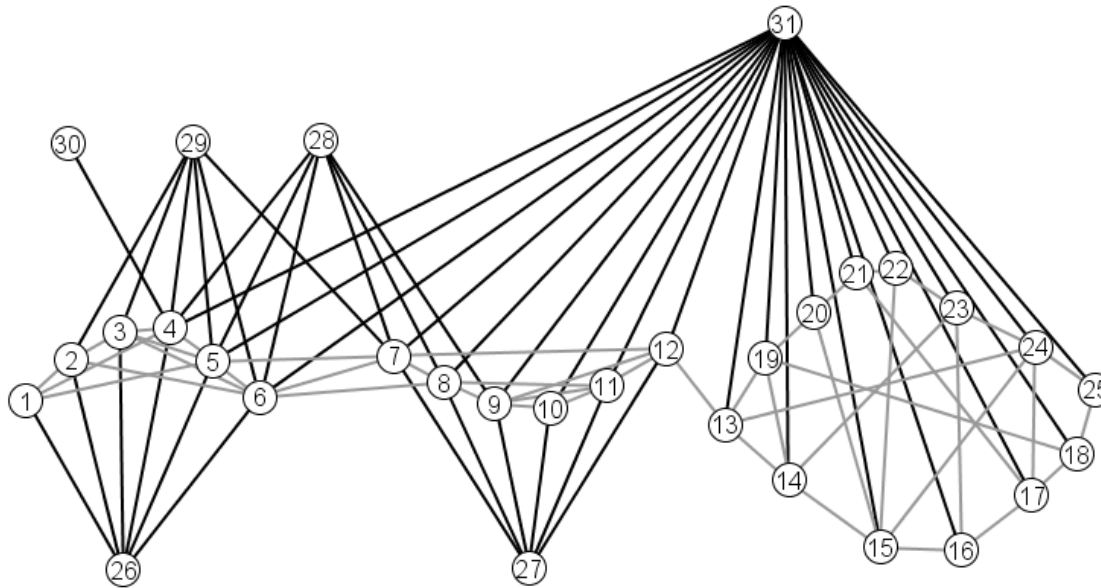


Music taste similarity



Recommendation network

Customer who bought this also bought



For #26, who would you suggest to be her Facebook friends?
If using Jaccard coefficient

Source: Bruce Hoppe “Introduction to Network Mathematics”

SNA, definition

- Social network analysis [SNA] is the mapping and measuring of *relationships* and flows between people, groups, organizations, computers or other information/knowledge processing *entities*.
- The nodes in the network are (NOT always) the people and groups while the links show relationships or flows between the nodes.
- SNA provides both a visual and a mathematical analysis of complex human systems.

Doctors based in a Northeastern U.S. community who have prescribed, or are potential customers for, an oncology drug.

Each circle represents one doctor.

- RELEVANT SPECIALISTS

Has not prescribed the drug being surveyed

Has prescribed the drug being surveyed
- OTHER DOCTORS

Has not prescribed the drug being surveyed

Has prescribed the drug being surveyed

PRESCRIBING VOLUME FOR ANY ONCOLOGY DRUG

- Low Medium High

POSITIONING

Although currently a low-volume prescriber, this doctor is in a key central position to sway others. Marketers would be likely to single him out.

CONNECTIONS

mean that doctors share more than a certain number of relevant patients in common — patients whose condition could make them potential users of the drug being surveyed.

PRIORITIZING

In a complex cluster like this one, there are many interrelated physicians, all at similar prescribing levels. A marketer may decide it would be inefficient to prioritize all of them, instead pinpointing only a few.

INFLUENCE INDEX

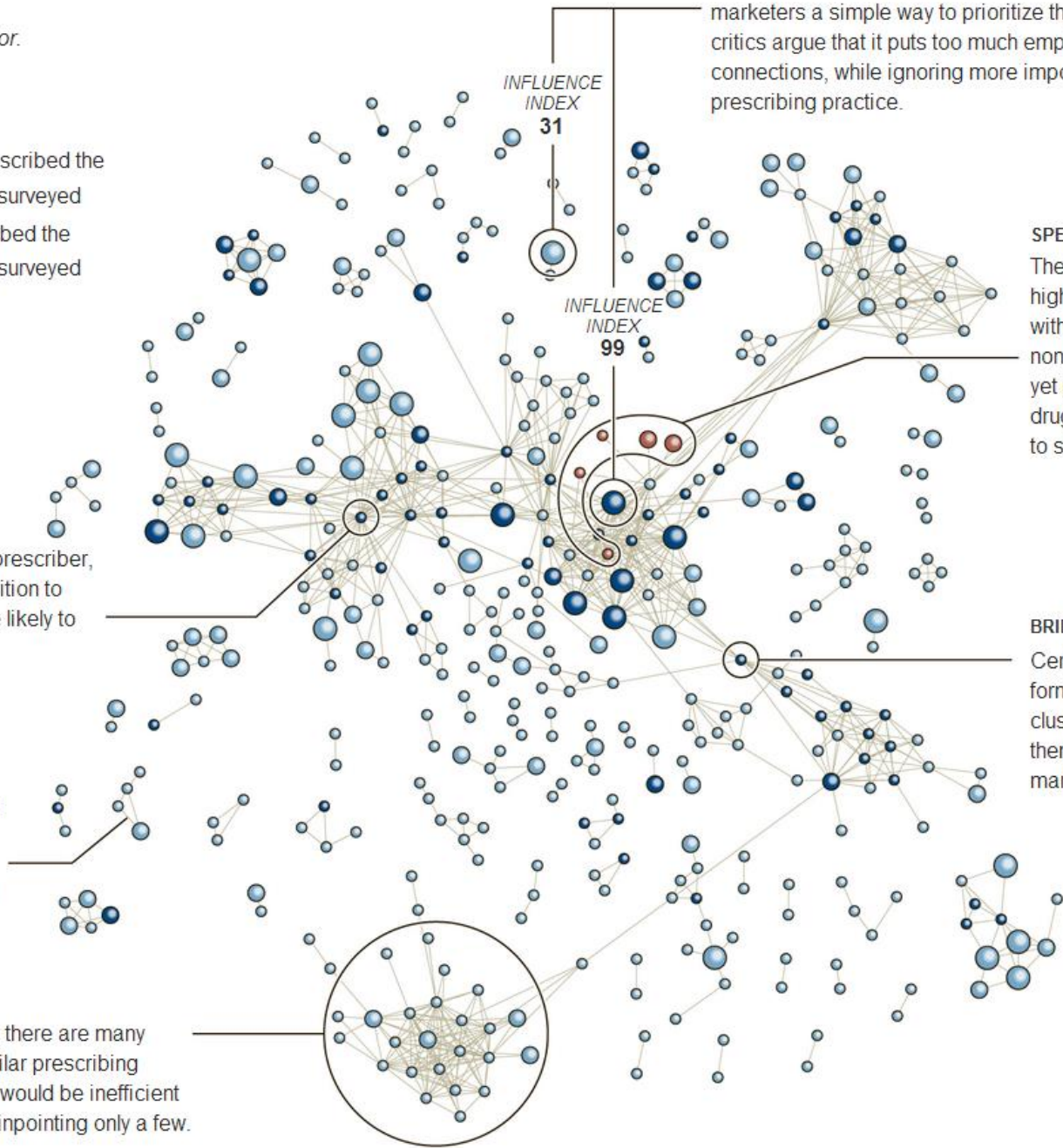
The software can assign each doctor an “influence index” based on his or her connectedness to others. This gives marketers a simple way to prioritize their potential targets, but critics argue that it puts too much emphasis on social connections, while ignoring more important values like proper prescribing practice.

SPECIALISTS

The software allows users to highlight relevant specialists with color. In this example, none of the specialists have yet prescribed the featured drug, so marketers may try to sway them.

BRIDGES

Certain physicians seem to form key links between clusters. That could make them good targets for marketers.

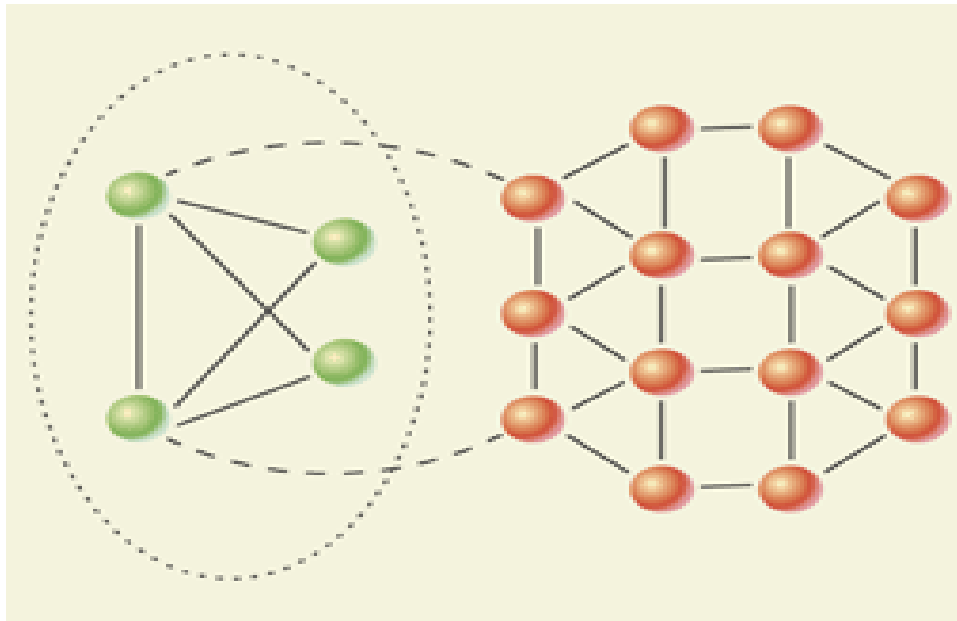


What does SNA do?

- Identify subsets of networks – Derive meaningful subgroups
 - Cohesive
 - Structural equivalent
- Identify actors who occupy strategic positions
 - Bridge and boundary spanners
- Identify dynamic – flow of information, influences, diseases etc.
- Identify structures – Display and analyze the **forest** given data on **trees**
 - E.g. Visualizing knowledge domain
 - Open or close ego network etc.
-

Identify subsets of networks : the link structure of the Web

- Within community link density



Source: Kleinberg and Lawrence (2001). The Structure of the Web. *Science*.

Mapping Science

Map Of Science based on I.S.I. Subject Categories

Aggregated journal-journal citation matrix produced from L. Leydesdorff & I. Rafols data
(see paper and information available at <http://www.leydesdorff.net>)

METRIC
Diameter: 2
Average Path length: 1.2351761105910513
Graph Density: 0.7706718344525323 (max. = 1)
Average Clustering Coefficient: 0.6256903889000650

VIZUALISATION
Directed Graph / Visualization using Iken Hu algorithm with Gephi v.0.7
(available at : <http://gephi.org/>)

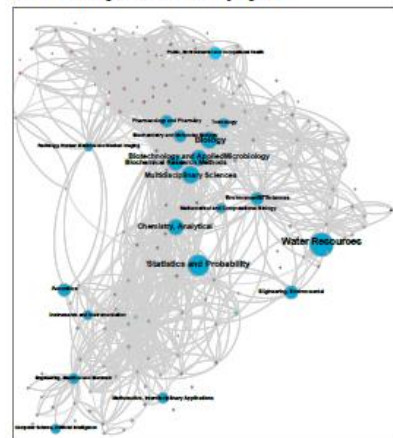
Map of Science

172 Subject Categories

8,614 Journals in Journals Citation Report

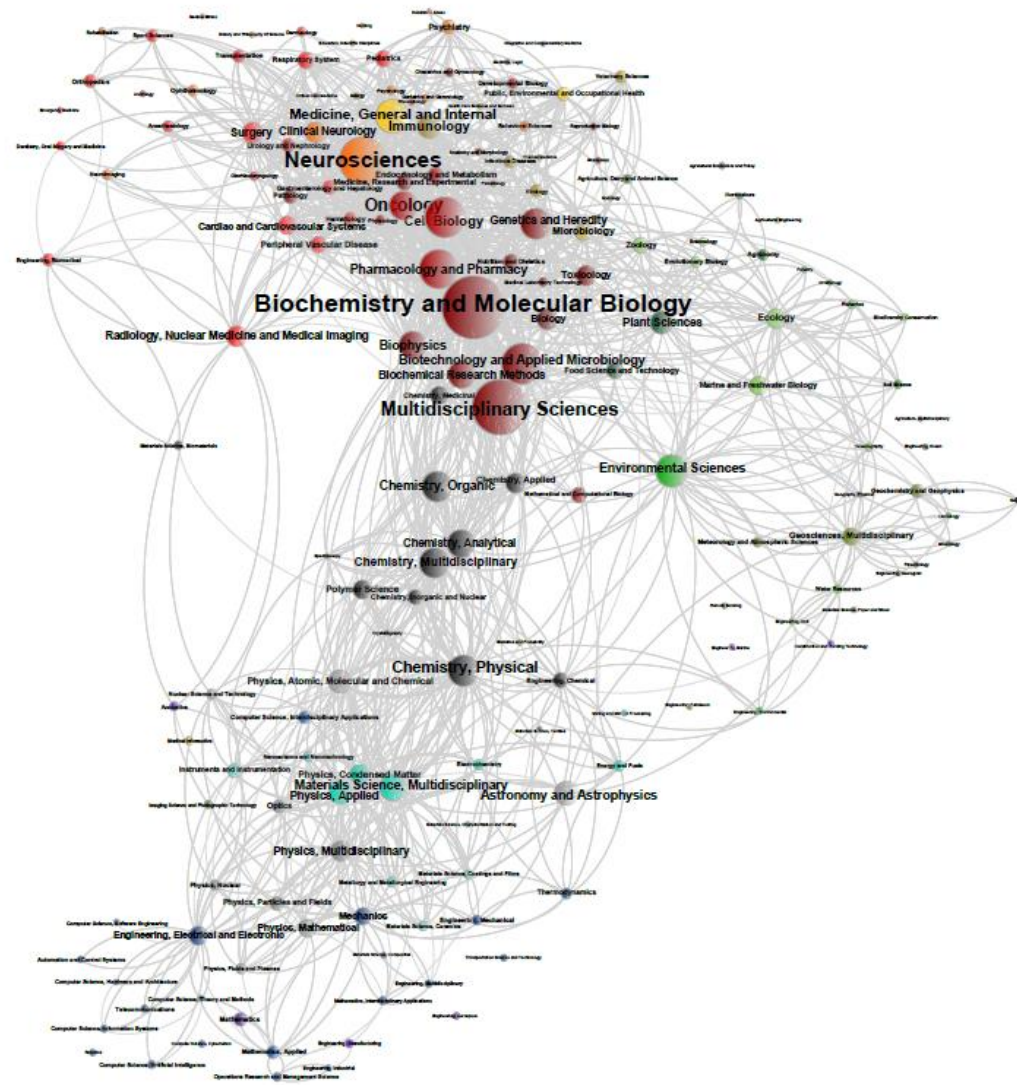
8,888,388 papers

Visualisation using Betweenness Centrality Algorithm



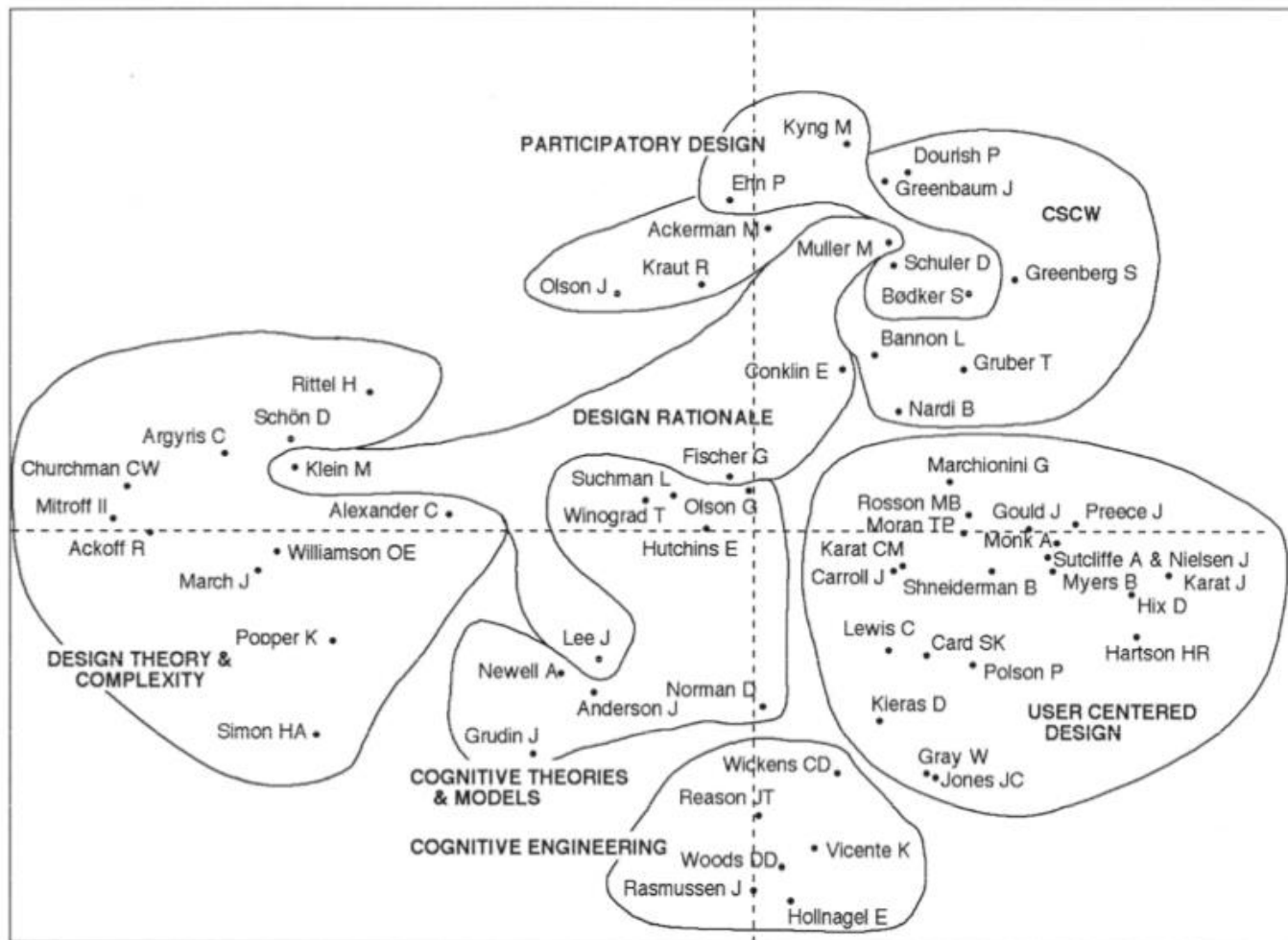
Top 20 ISI Subject Categories using:

Degree Ranking	Betweenness Centrality
Robotics and Computer Science	Visual Perception
Planning and Planning	Statistics and Probability
Neuroscience	Mathematical Sciences
Multiagent Systems	Environmental Science
Cell Biology	Biology
Energy	Technologies and Applied Working
Physical	Engineering, Information Systems and Architecture
Computer	Chemical Engineering
Medical, General and Internal	Engineering, Electrical and Electronics
Neuroscience	Chemical Research Methods
Chemistry, Multidisciplinary	Public Health and Occupational Health
	Analytics
Medical Sciences, Multidisciplinary	Planning and Planning
Healthcare and Health	Engineering, Information Systems and Architecture
Environmental Science	Environmental Science
Cell Biology	Statistics and Probability
Robotics and Applied Working	Mathematical and Computational Biology
Physics, Applied	Physics, Applied
Statistics, Research and Experimental	Statistics, Social Sciences
Psychology	Health Sciences and Medical Imaging

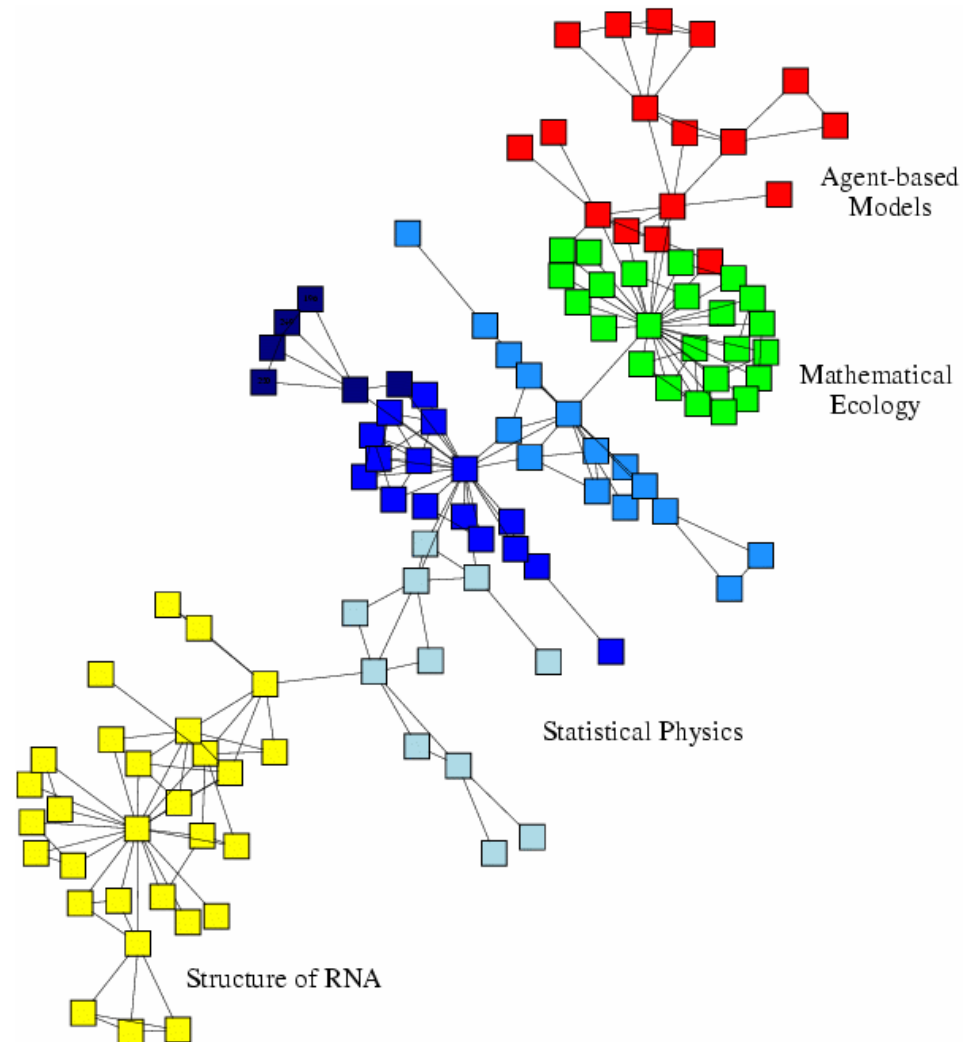


Term co-occurrence network

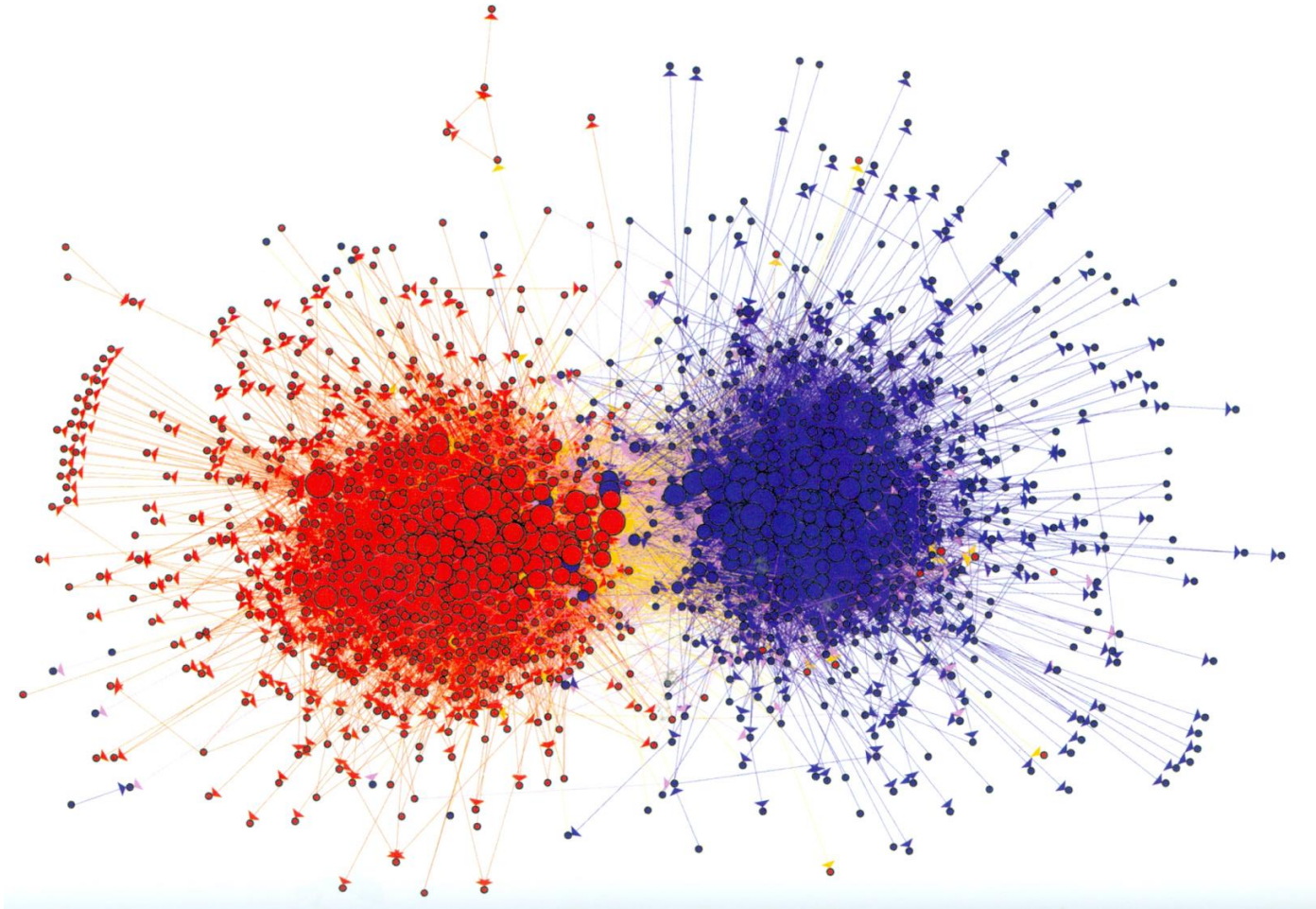
Author co-citation network: visualizing literature in HCI



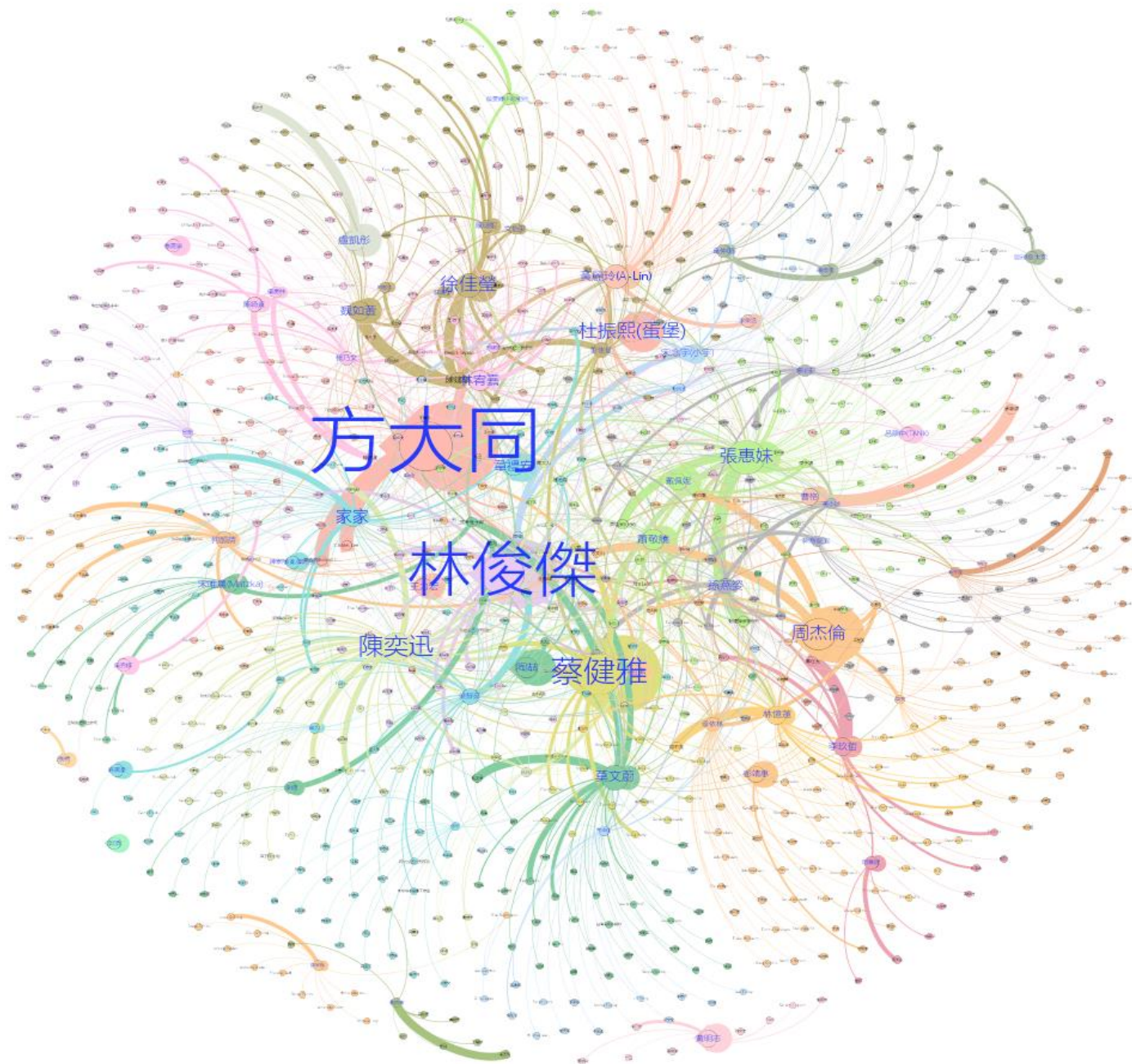
Scientific collaboration network



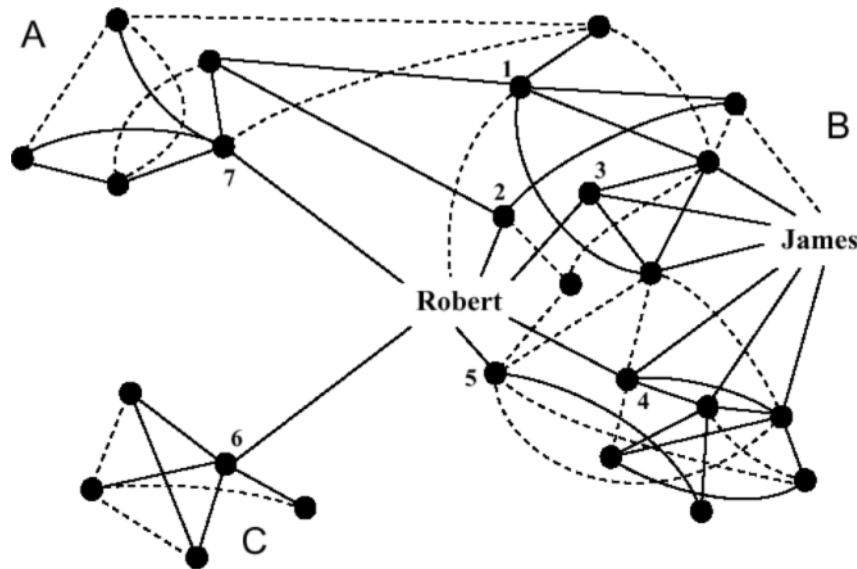
Analysis of Web documents



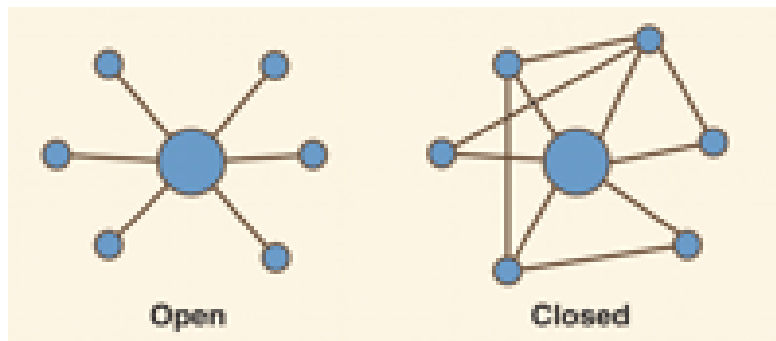
Music collaboration network Centrality and collaborative patterns



Identify actors who occupy strategic positions



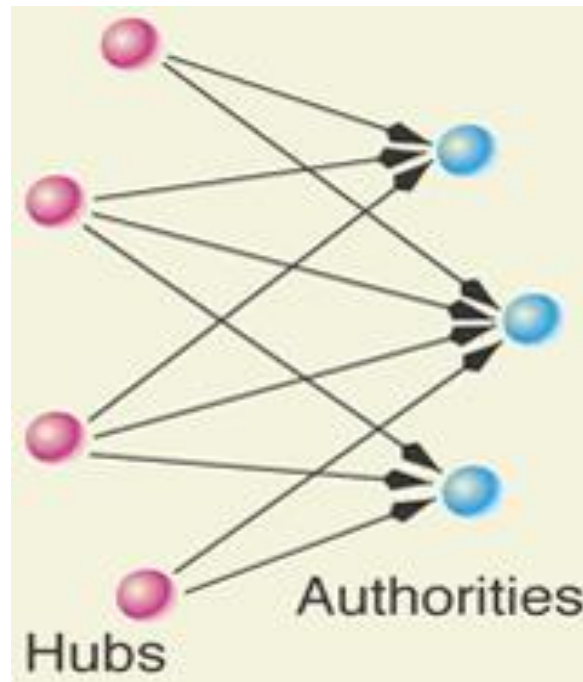
Source: Burt (2000)



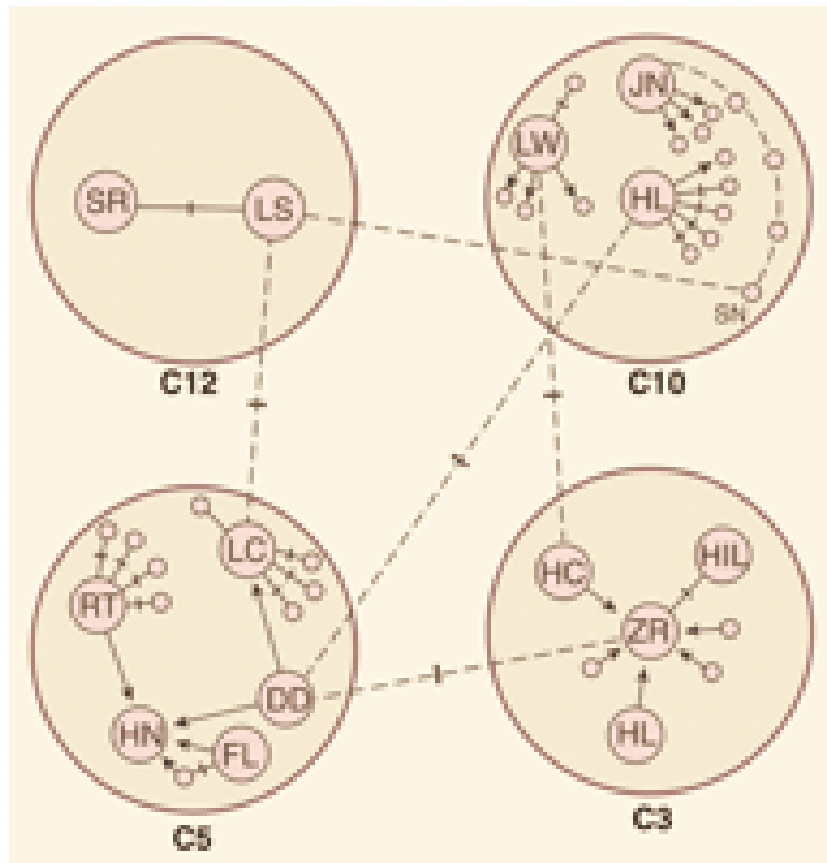
Social capital and social network

Identify actors who occupy strategic positions: the link structure of the Web

- Hubs and authorities



Trace social influence



Moreno's Network of runaways

Nondirected lines between a pair of individual represent feelings of mutual attraction.

Direct lines represent one-way feelings of attraction.

Resources in the network

Who introduced the couple?

	Close relationships		More-distant relationships					
Type of relationship	Family member	Friend	Coworker	Classmate	Neighbor	Self-introduction	Other introduction	Number of subjects
Marriages	15%	35%	6%	6%	1%	32%	2%	1,287
Cohabitations	12%	40%	4%	1%	1%	36%	3%	319
Partnerships	8%	36%	6%	4%	1%	42%	1%	920
Short-term partnerships	3%	37%	3%	4%	2%	47%	2%	251

Note: Numbers do not add to 100 percent because of rounding.

68 % introduced by others, 32 self-introduction

Network topologies

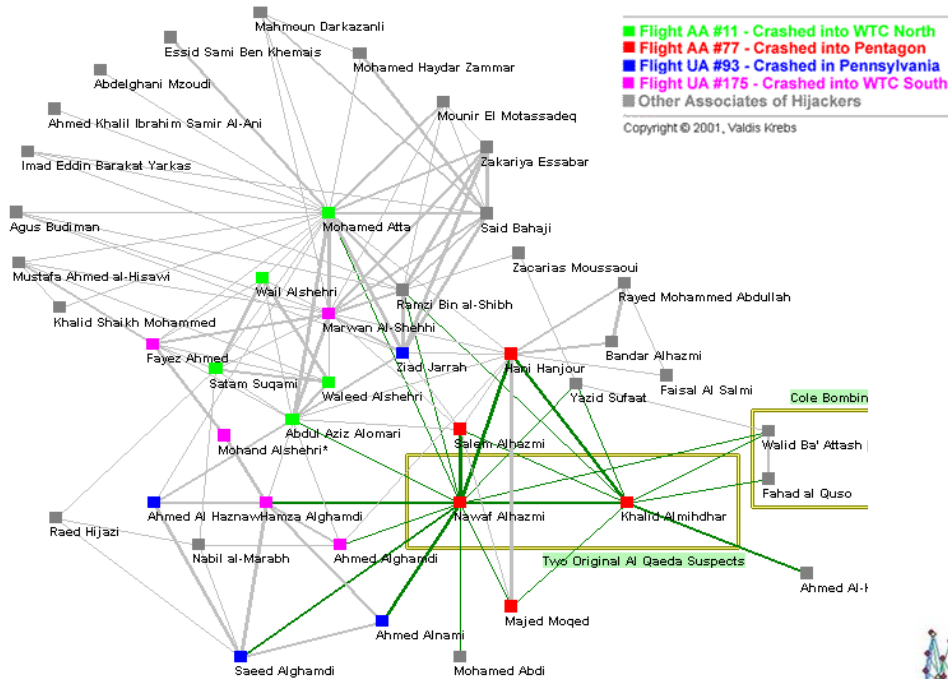
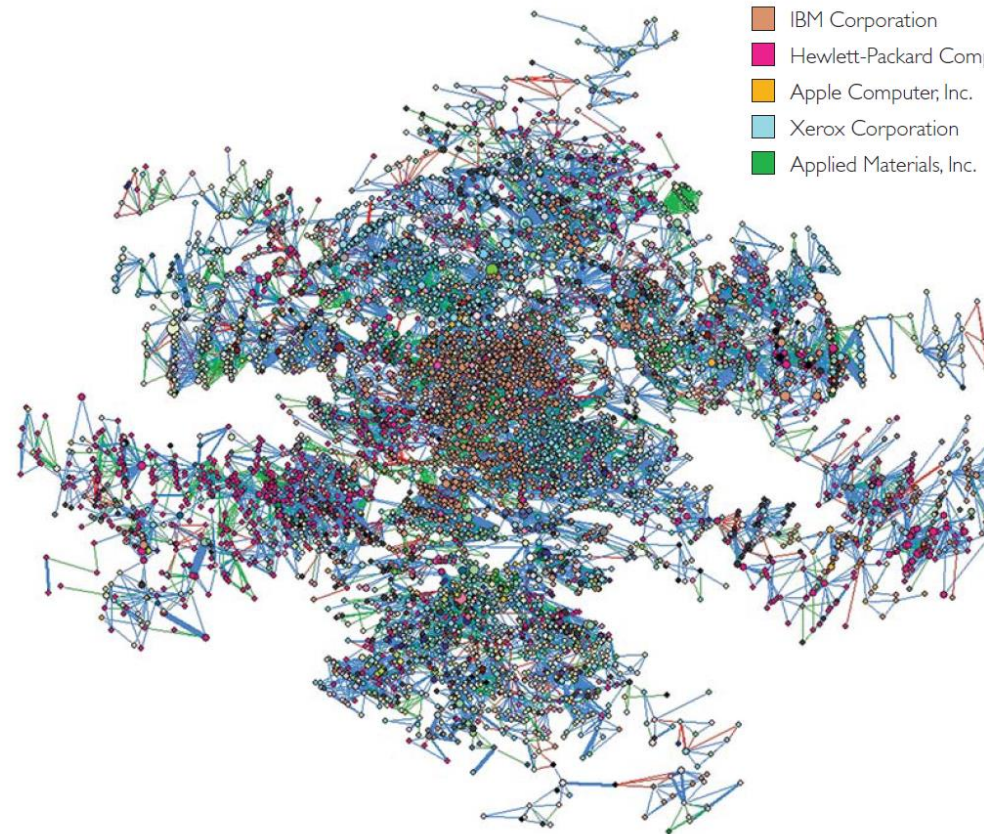
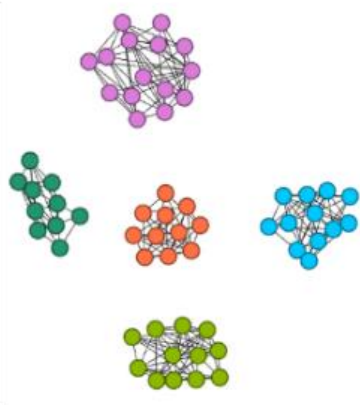


Figure 3 - All Nodes within 2 steps / degrees of original suspects

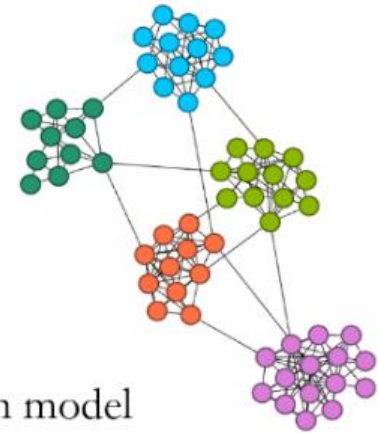


Network typology and scholarly collaboration

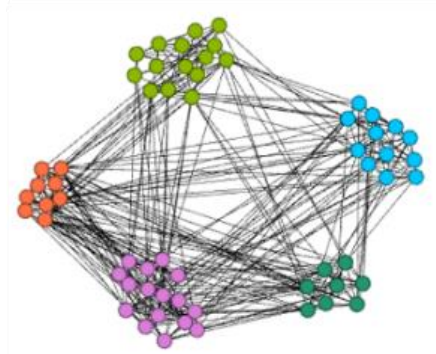
Plural-worlds



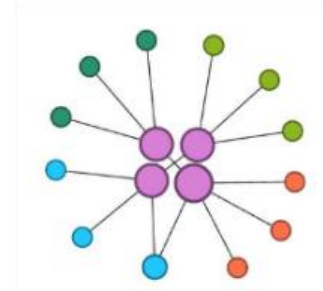
Small-world



Structural cohesion



Star production model

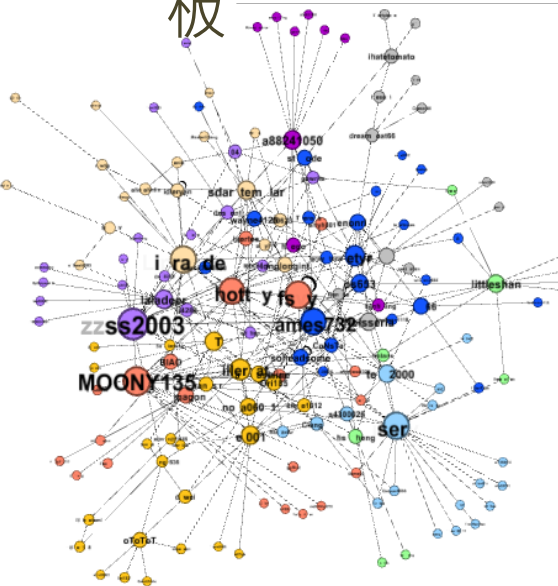


社會網絡分析指標與網絡型態

3.分群分析

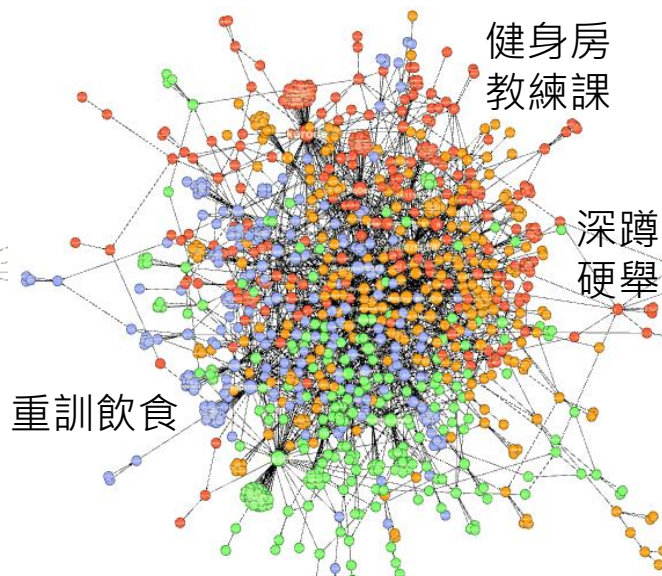
- 網絡分群能力：**狗板** > **C++板** > **健身板**

C++
板



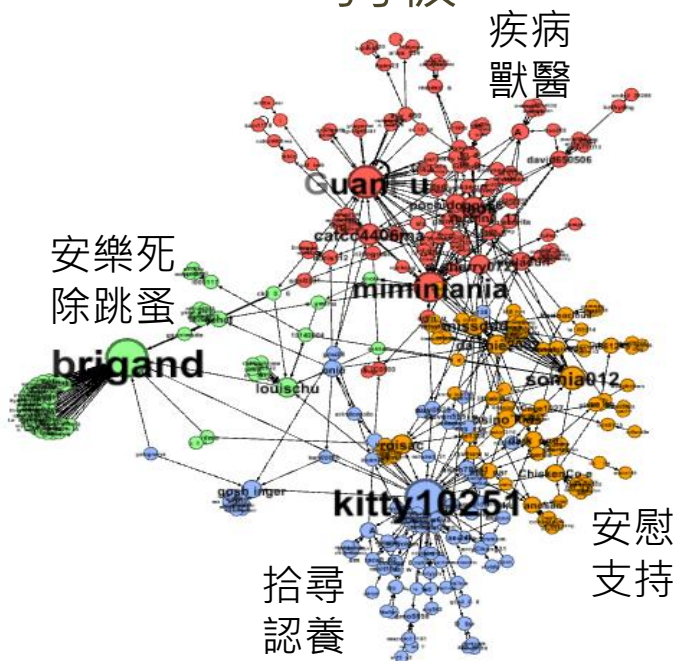
元益網絡

健身板



0.558

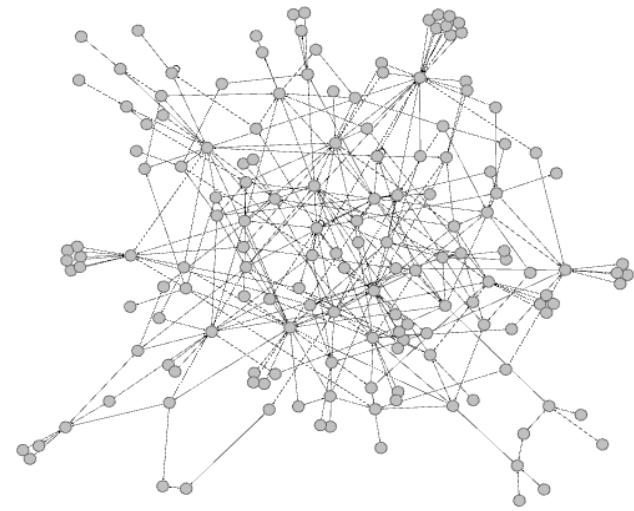
狗板



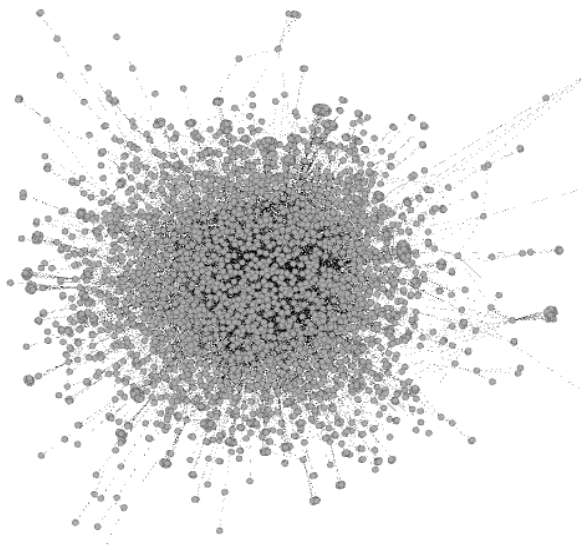
- 「健身板」網絡緊密而難以分群
- 「狗板」分群結果明顯，小團體各自有其話題，但團體之間仍有往來

網絡型態

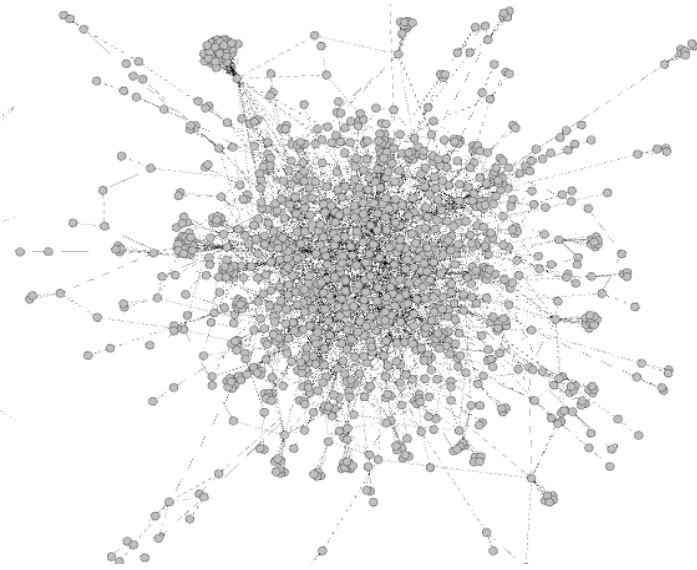
C++
+C



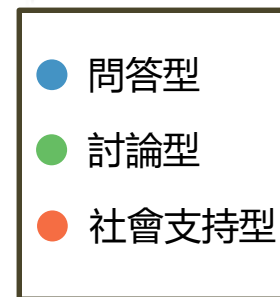
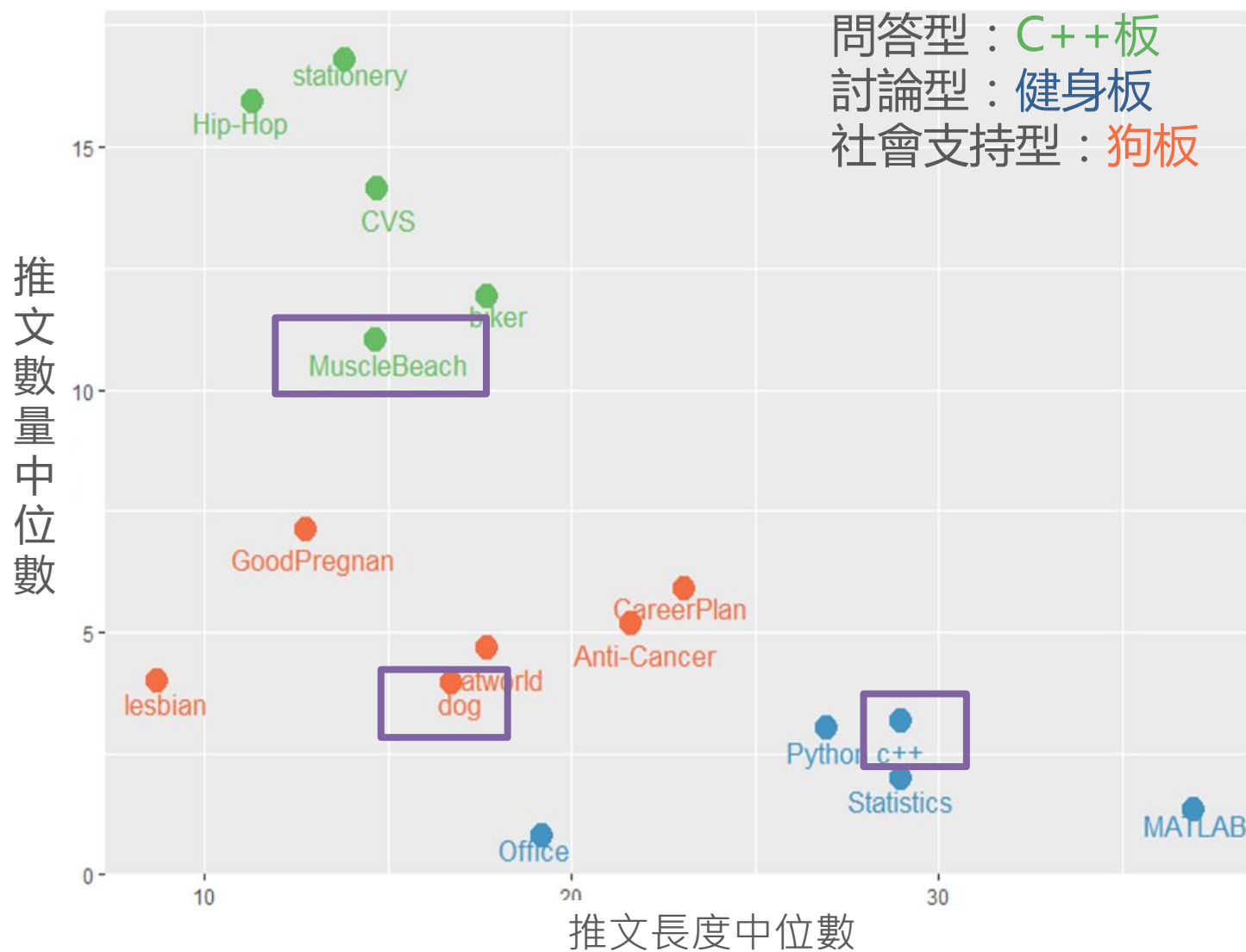
健身板



狗板



- Average path length 短
- Weighted Clustering coefficient 高
- 與「小世界」相似
- 網絡整體緊密難以分群
- 本研究提出「萍水相逢」
- 網絡型態描述此種特徵的網絡
- 網絡分群結果明顯
- 小團體內部互動密切
- 小團體之間仍有接觸
- 與「結構凝聚」相似



“Special” topics in SNA

- Scholarly communication
 - Citation network
 - Author collaboration network
- Recommender system
 - User who bought this also bought
- Social capital
 - Network view of social capital

Social network assumptions

- Relational
 - Linkage, connection, association, affiliation, membership
- Social units are interdependent
- Network structure **enable** and **constrains** action
- Structure-level relational properties are important
 - Network formulation of social constructs
 - Help us to see one step further...