Bornholm Cases in Web Mining

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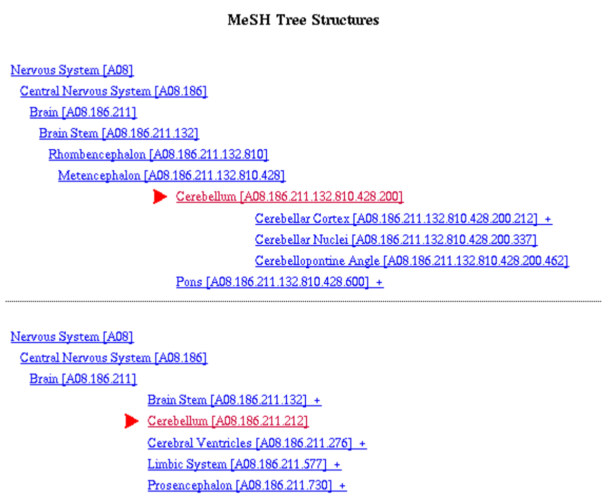
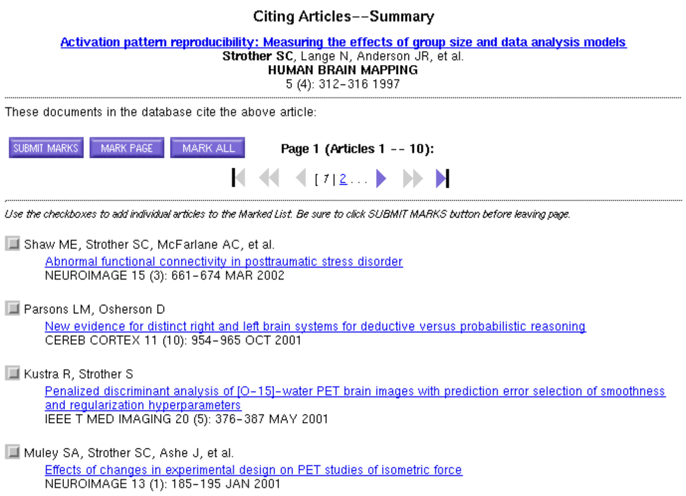
OVERVIEW

- PubMed & ISI
- ResearchIndex. Web-site with scientific computer science papers
  - Persistence of URLs.
- Inquirus, meta-search engine.
- DEADLINER. Special topic search engine.
- Webgames.
- Modeling the growth of the web.
- Gene mapping

PUBMED AND ISI



(a) PubMed



(b) ISI Web of Sience

- PubMed, http://www.ncbi.nlm.nih.gov/entrez/
  - Web-based index with bibliographic information, links to full-text. No citations.
  - Keywords in MeSH hierarchy.
  - Typed queries possible, e.g., `"Hum Brain Mapp"[Jour] AND "1997"[dp] AND "5"[vol]`.
  - "Related articles" service (Wilbur and Yang, 1996).
- ISI Web of Science, http://wos.isiglobalnet.com/
  - Web-based citation index.
  - Widely used in citation studies.

RESEARCHINDEX/CITESEER

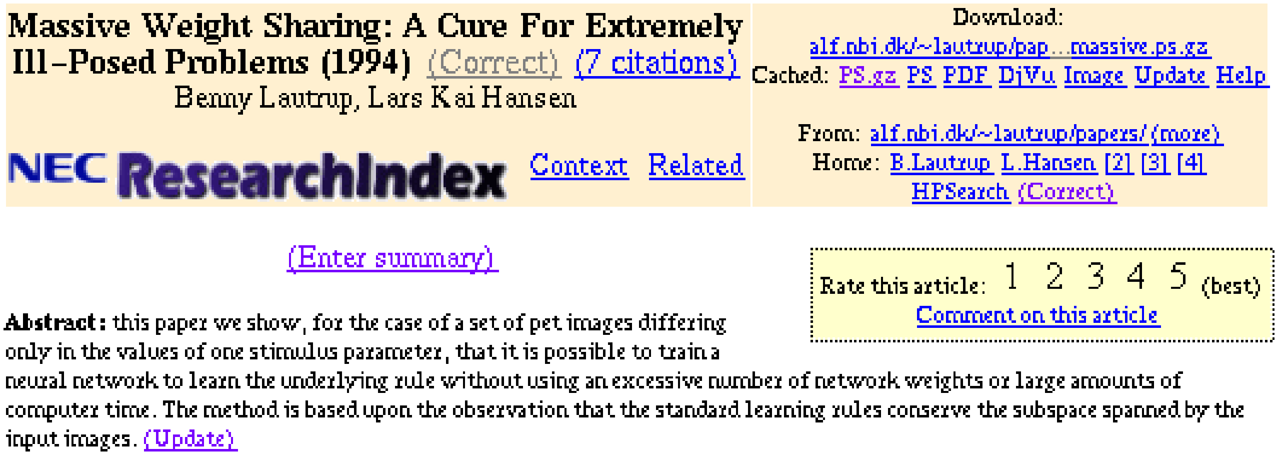


Figure 1: Screen shot from ResearchIndex.

- ResearchIndex, Citeseer. (Lawrence et al., 1999; Giles et al., 1998; Bollacker et al., 1998) http://researchindex.com.
- Collection of scientific computer science papers in PostScript/PDF files downloaded from the Internet: 270,000 articles with 100,000 internally cited.
- Conversion of PDF and PostScript files to text (and other formats)
- Identification of words and citations.
- Ad hoc text search.
- Collaborative correction (if the machine translation fails) and annotation.

RESEARCHINDEX

Cited by: More
Comparison Of Pca And Ica Based Clutter Reduction.. - Karlsen, Larsen.. (Correct)
Antenna Characteristics and Air-Ground Interface.. - Karlsen, Larsen.. (2000) (Correct)
On Independent Component Analysis for Multimedia Signals - Hansen, Larsen, Kolenda (2000) (Correct)

Similar documents (at the sentence level):
19.4%: Extremely Ill-posed Learning - Hansen, Lautrup, Law, Mørch, Thomsen (1994) (Correct)

Active bibliography (related documents): More All
0.3: Generalizable Patterns in Neuroimaging: How Many.. - Hansen, Larsen.. (1999) (Correct)
0.3: Unsupervised Learning and Generalization - Hansen, Larsen (1996) (Correct)
0.3: Nonlinear Autoregressive Moving Average Signal Modeling using the .. - Fischer (Correct)

Users who viewed this document also viewed: More All
0.0: Fast Planning Through Planning Graph Analysis - Blum, Furst (1995) (Correct)
0.0: Handwritten Digit Recognition with a Back-Propagation Network - Le Cun (1990) (Correct)
0.0: Uniform Design Based On Latin Squares - Kai-Tai Fang (Correct)

Similar documents based on text: More All
0.3: Nonlinear versus Linear Models in Functional.. - Mørch, Hansen.. (1997) (Correct)
0.3: Visualization of Neural Networks Using Saliency Maps - Mørch, Kjems, Hansen.. (1995) (Correct)
0.3: Neural Networks for Signal Processing - Svarer (Correct)

Related documents from co-citation: More All
2: Automatic Mine Detection based on Ground Penetratinig Radar (context) - Yu, Witten - 1999
2: A multivariate analysis of PET activation studies (context) - Friston, Poline et al. - 1996
2: Design and Evaluation of Neural Classifiers - Application to Skin Lesion Classif.. (context) - Hintz-Madsen, Hansen et al. - 1995

Figure 2: Screen shot from ResearchIndex.

- Sorted citation and reference list.
- Sentence hash: Identification of copied documents.
- Similar documents:
  - Text: “Similar documents based on text”.
  - Citation structure
  - Usage analysis “Users who viewed this document also viewed”.
- Similar effort
  - Cora, (McCallum et al., 2000).
  - (Bergmark, 2000): Discusses conversion to text, extraction of references and anchors, parsing of reference lists.

PERSISTENCE OF URLS

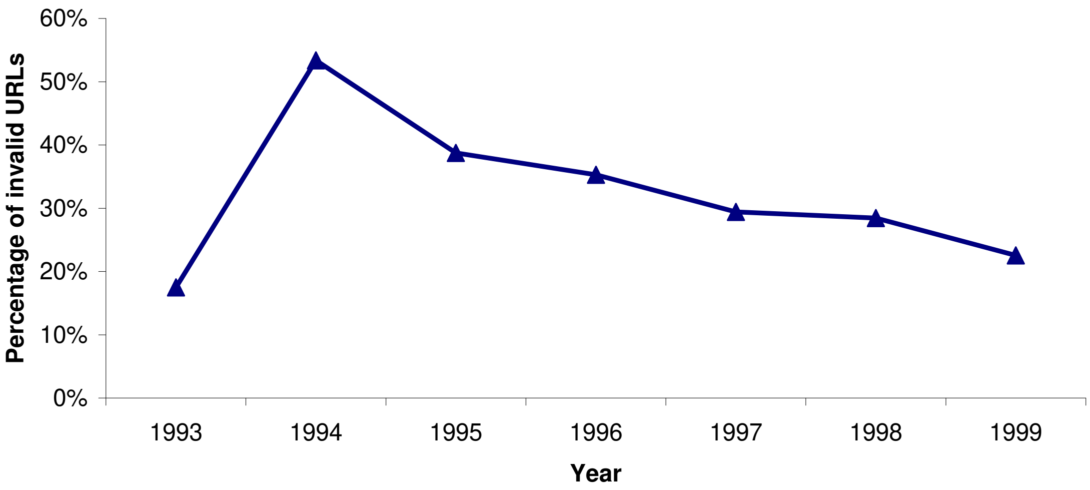


Figure 3: Percentage of invalid links (Lawrence et al., 2001, fig. 2).

- Are URLs is references in scientific documents still valid? (Lawrence et al., 2000; Lawrence et al., 2001).
- Data from ResearchIndex: 67,000 URLs extracted from 100,000 documents: Increase in average URLs from 0 in 1993 to 1.6 in 1999.
- Automatic download and if failed: Manual search for 300 randomly selected missing document by 9 people.
- Many invalid URLs (53% in 1994), personal home-page moved, servers closed.
- Often easy to relocate with search engine or guessing the URL and sometimes the URL is not important.

INQUIRUS & INQUIRUS 2

- Inquirus meta-search engine (Lawrence and Giles, 1998).
  - Aggregation of results from several search engines.
  - Identification of hubs and authorities.
- "Inquirus 2" (Glover et al., 1999; Glover et al., 2001)
  - Query modification for finding category specific web-pages, e.g., personal homepages
  - Train a classifier on a desired category (manually labeled).
  - Learn *query modificiations*, — might be different for each individual search engine
  - Personal home query modification examples: "`my "home page"`" (FAST), "`+ "my name is"`" (AltaVista), "`"s home"`" (Google).
  - A version returned results on a web-pages with Java continuously updating the ranked list.
  - An other service for query refinement (for scientific web-pages) http://www.scirus.com/

DEADLINER

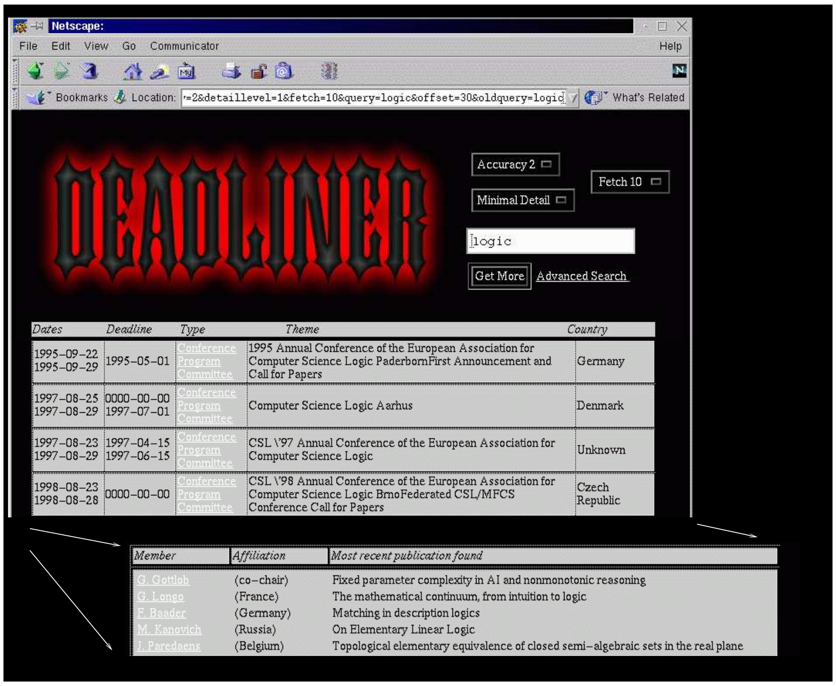


Figure 4: Screen shot from DEADLINER. From (Kruger et al., 2000, fig. 1).

- Search engine for conference and workshops (Kruger et al., 2000).
- Data from web (by query modified meta search and focused crawling), newsgroup and (emails).
- Preliminary screening with classifier.
- Superpattern matching on personal names with dictionary lookup, e.g., list of authors extracted from ResearchIndex.
- Information is automatically entered into a MySQL database.
- Other example: http://www.campsearch.com

WEBGAMES

- Webgames are good forecasters (Pennock et al., 2001b; Pennock et al., 2001a; Pennock et al., 2001c), http://artificialmarkets.com.
- Trading with *securities*, e.g., short selling will profit if the price goes down.
- Prices predict the odds of outcome, e.g., that a horse will win.
- Market-based belief aggregatation.
- Certain knowledge is aggregated.
- Bias: Favorites are underpriced and longshots are overpriced. Risk-seeking consensus.
- The maximum price does not garanties winner, other lower priced events should come out as winner according to the price.

EXAMPLE MARKETS: HSX

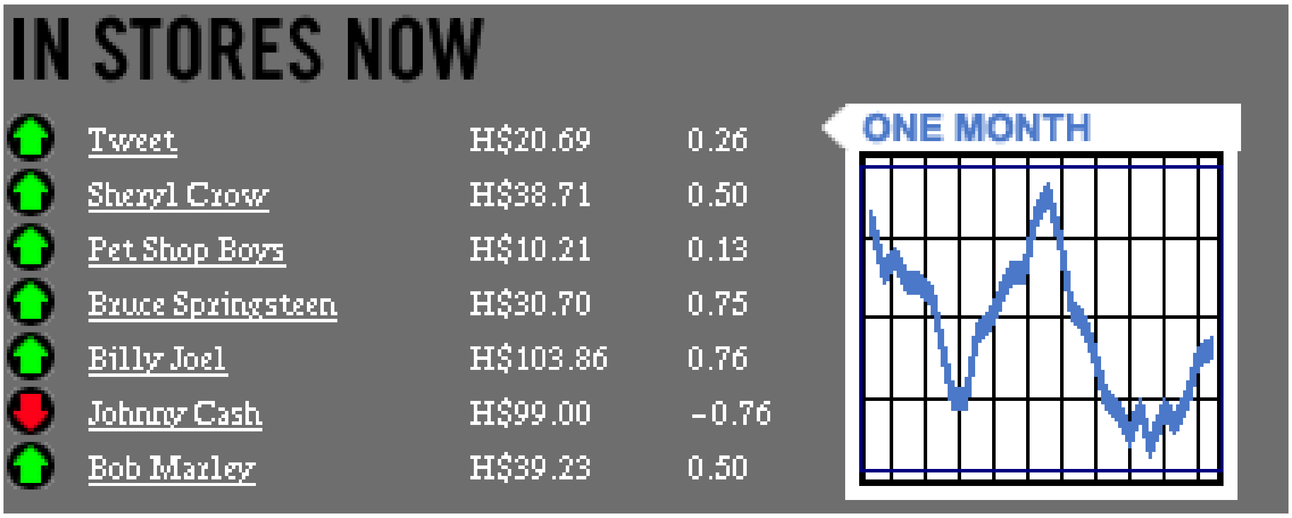


Figure 5: Screenshot from HSX with “artistocks”.

- Hollywood stock exchange (HSX) http://www.hsx.com
- Artificial money: Hollywood dollar (H$)
- Very popular with 400,000 registered accounts (in August 2000)
- Predicting box office records or award options in movies and music, e.g., MovieStock, (H$80 to $80 million in a film’s first four weeks), StarBond (Average performance of an actor or director over 5 films)
- Predictions can be more accurate than expert opinion.

EXAMPLE MARKETS: FORESIGHT EXCHANGE

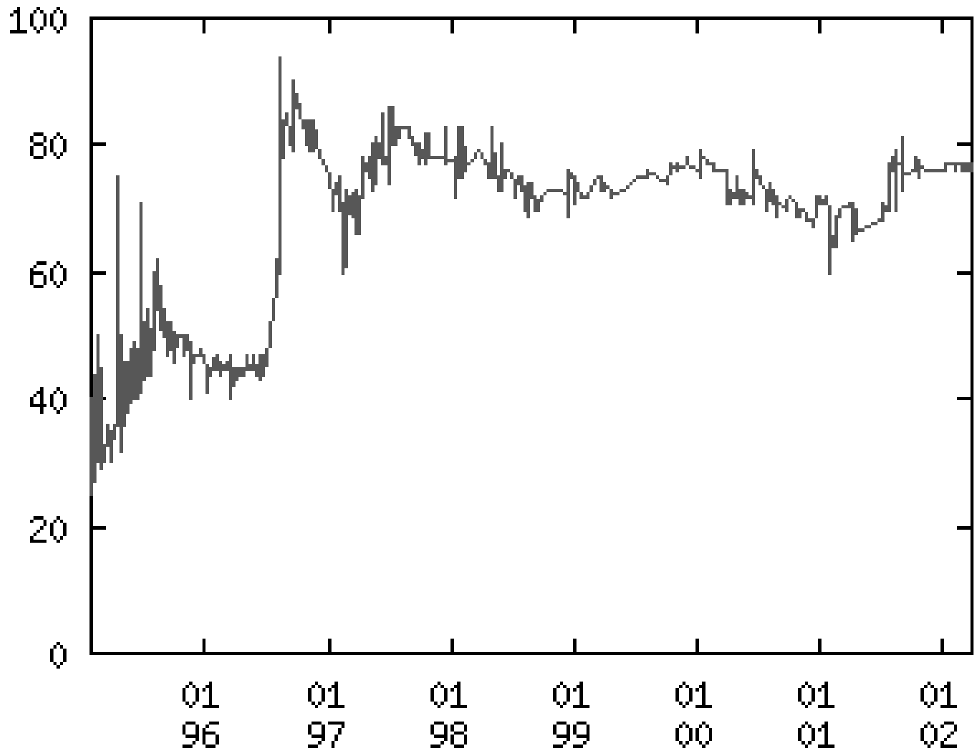


Figure 6: Price curve from Foresight Exchange for "Evidence of Extraterrestrial Life, fossils, or remains will be found by 12/31/2050". Raise in price probably caused by the "life on Mars" evidence (McKay et al., 1996).

- Foresight exchange, http://www.ideafutures.com/.
- Proposed by (Hanson, 1998; Hanson, 1995): Idea Futures market.
- Prediction in, e.g., arts, finance, news, politic, science & technology. Participants can propose.
- Examples, "Amazon crashes by 2002" (12.2%), "Human Clone before 2005" (3.6%).

EXAMPLE "MARKETS": F1P6

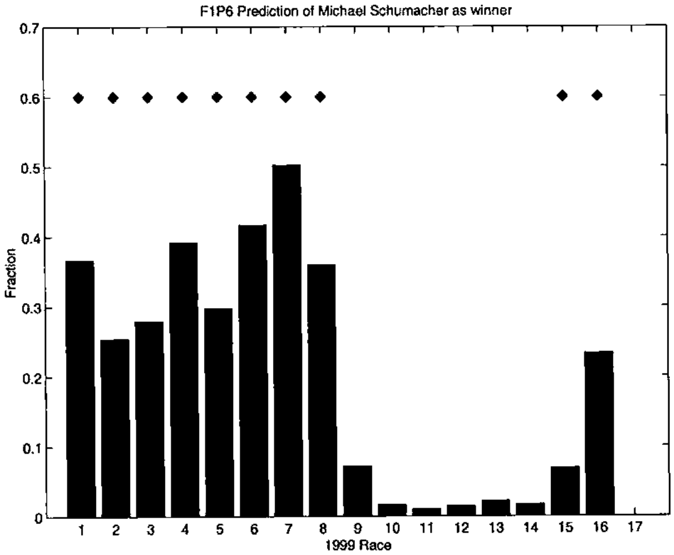


Figure 7: Not fully informed: Prediction of Michael Schumacher when he was injured and out of the game show a positive probability.

- F1P6. Formula One race car prediction game via email/web. http://www.motorsport.com (Wassermann, 1996).
- Players are to predict the position of the six first drivers, e.g., SchumacherM, SchumacherR, ...
- Players are given 10 for precise prediction, 6 if one position off, and 4 (if two off), etc. for 3, 2, 1 points. Conversion from points to odds.
- Not a real market: No price!
- Associated with real money bookmakers: F1P6 compares well with these predictions.

ASSESSING PREDICTION

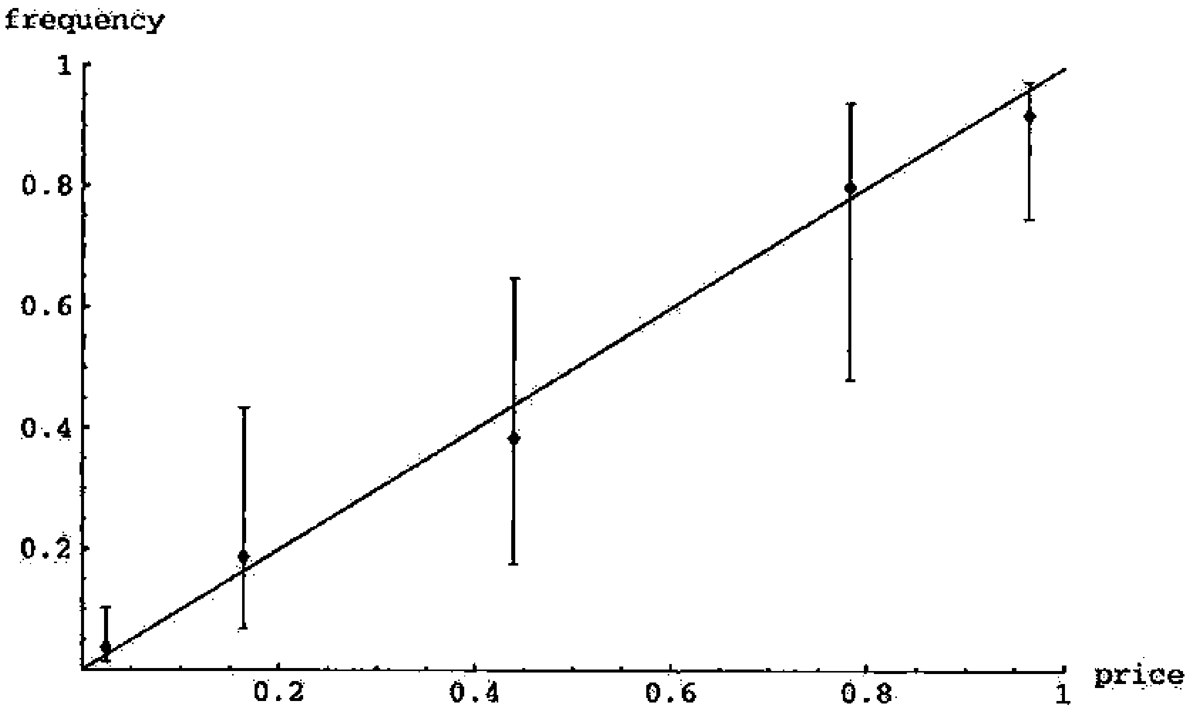


Figure 8: Accuracy of the Foresight Exchange market. Prices are 30 days before claim expiration. Points display observed frequency versus average price. The solid line corresponds to ideal accuracy. (David Pennock)

- Assessing the prediction by price with observed outcome frequency.
- Sorting by price grouping into a few number of buckets, i.e., price ranges.
- Error bars computed as regarding the outcomes as independent Bernoulli trials with a uniform prior (beta-distribution).

ASSESSING EFFICIENCY

- In an efficient market *arbitrage* should not be possible.
- Example
  - Predicting correct outcome gives 25 H$.
  - Mutually exclusive events costs 23 H$.
  - Buying stocks for all events while give certain reward.
- Unbalance in the price should by time decrease.

GROWTH OF THE WEB

- Modeling the number in-degree to a web-page (Pennock et al., 2002).
- Generative process, m_0 initial vertices, t time step adds one vertex and m edges. Probability $\Pi(k_i)$ that an edge connects to vertex i where k_i is in-degree to i

$$\Pi(k_i) = \underbrace{\alpha \frac{k_i}{2mt}}_{\text{Preferential}} + \underbrace{(1-\alpha)\frac{1}{m_0 + t}}_{\text{Uniform}} \tag{1}$$

- Fitting the model to data from Inktomi.
- From http://modelingtheweb.com

Publications	0.99	
Entertainment	0.96	More competition /
Consumer electronics	0.94	harder to enter market
Toys & games	0.92	
Antiques & collectibles	0.86	
Sports	0.76	
Health	0.75	
Home & garden	0.72	
Jewelry	0.70	
Weddings	0.65	Less competition /
Photographers	0.38	easier to enter market

PUBGENE

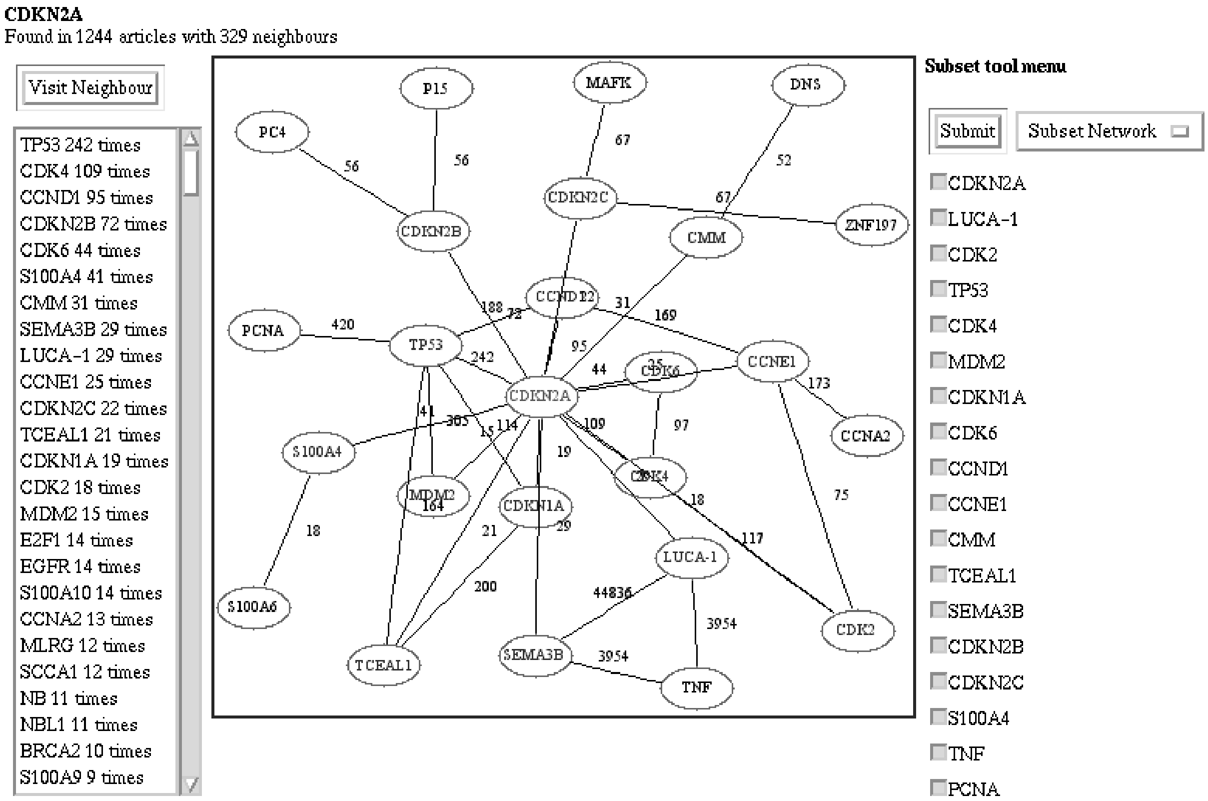


Figure 9: PubGene example for "CDK2NA".

- PubGene, http://www.pubgene.org/
- Gene cocitation analysis (Jenssen et al., 2001),
- Data from over 10 million articles from PubMed citing 13,712 human genes names obtained from HUGO, LocusLink, The Genome Database and GENATLAS.
- Network diagrams are automatically generated with the GraphViz software.

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