UNI KASSEL VERSITÄT

ENDOWED CHAIR OF THE HERTIE FOUNDATION
Knowledge and Data Engineering
ELECTRICAL ENGINEERING & COMPUTER SCIENCE, UNIVERSITY OF KASSEL

Vorlesung Künstliche Intelligenz Wintersemester 2008/09

Teil IV: Wissensrepräsentation im WWW

Kap.12: Web 2.0

Web 2.0 - Begriffsklärung

Der Begriff „Web 2.0“ bezieht sich primär auf eine veränderte Nutzung und Wahrnehmung des Internets: Die Benutzer erstellen und bearbeiten Inhalte selbst.

Er bezeichnet aus technischer Sicht auch eine Anzahl von Methoden wie

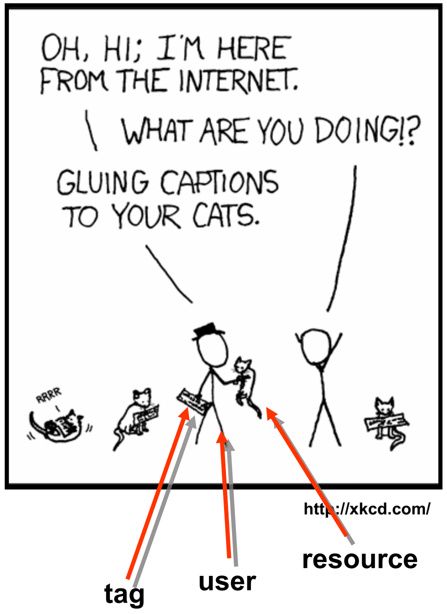
- Web-Service-APIs,
- Ajax (Asynchronous Javascript und XML)
- und Abonnement-Dienste wie RSS.

(Siehe http://de.wikipedia.org/wiki/Web_2.0)

Typen von Web 2.0- Anwendungen

- Wikis (z.B.: Wikipedia)
- Blogs (z.B.: irgendein journalistisches Blog?)
- Photo- und Videoplattformen (z.B.: Youtube, Flickr)
- Social Bookmarking (z.B.: del.icio.us, BibSonomy)
- soziale Online-Netzwerke (z.B.: Xing, Myspace, Facebook, StudiVZ)
- virtuelle Welten (z.B. Second Life, Bailamo)
- Mikroblogs (z.B.: Twitter)

Tagging / Folksonomies


OH, HI; I'M HERE FROM THE INTERNET.
WHAT ARE YOU DOING!?
GLUING CAPTIONS TO YOUR CATS.
RRRR
http://xkcd.com/
tag
user
resource

tagging is a distributed process

tagging has a small cognitive overhead

system contents can be browsed by tag

the system evolves in time: new resources, new users, new tags

there may be an underlying social network, explicitly exposed or not

the behavior of users is “selfish”

users are exposed to each other’s activity

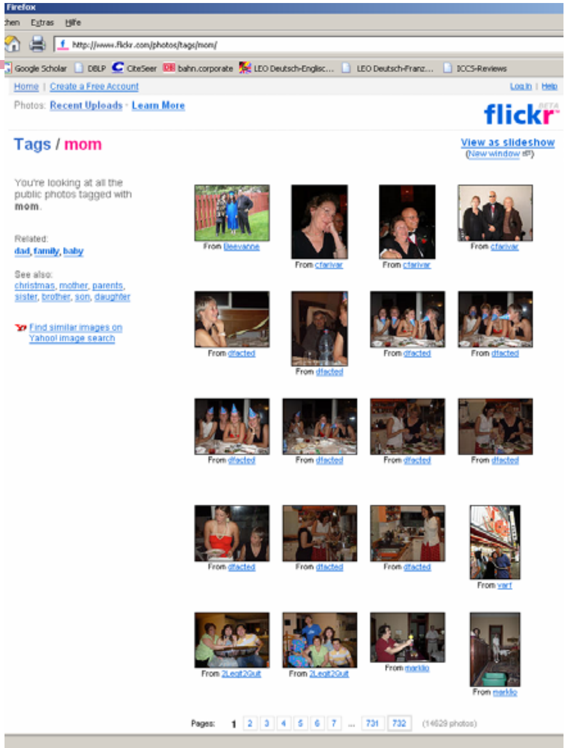
users share implicit knowledge (language, cultural background)

Social Bookmarking Systems

- Collaborative annotation of web resources
- Easy to use, open for everyone
- Joint use leads to converging vocabularies and emergent semantics.

There are many popular folksonomy systems on the web, eg:

- flickr (photos)
- YouTube (videos)
- del.icio.us (bookmarks)



http://www.flickr.com/photos/tags/mom/

flickr

Tags / mom

You're looking at all the public photos tagged with **mom**.

Related: dad, family, baby

See also: christmas, mother, parents, sister, brother, son, daughter

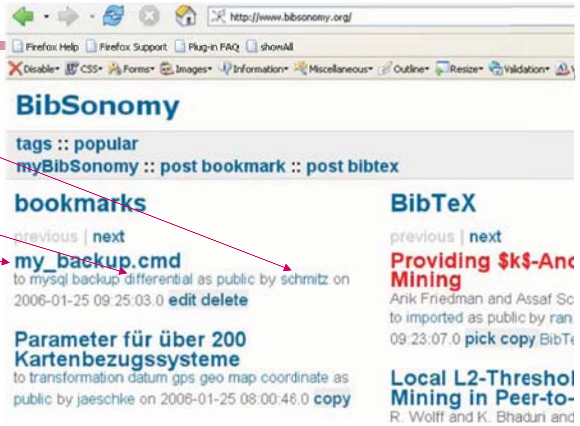
Find similar images on Yahoo! image search

Folksonomies

Folksonomies allow **users**

to assign **tags**

to **resources**.



http://www.bibsonomy.org/

BibSonomy

tags :: popular
myBibSonomy :: post bookmark :: post bibtex

bookmarks

previous | next

my_backup.cmd
to mysql backup differential as public by schmitz on 2006-01-25 09:25:03.0 edit delete

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to transformation datum gps geo map coordinate as public by jaeschke on 2006-01-25 08:00:46.0 copy

BibTeX

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Providing k-Anc Mining
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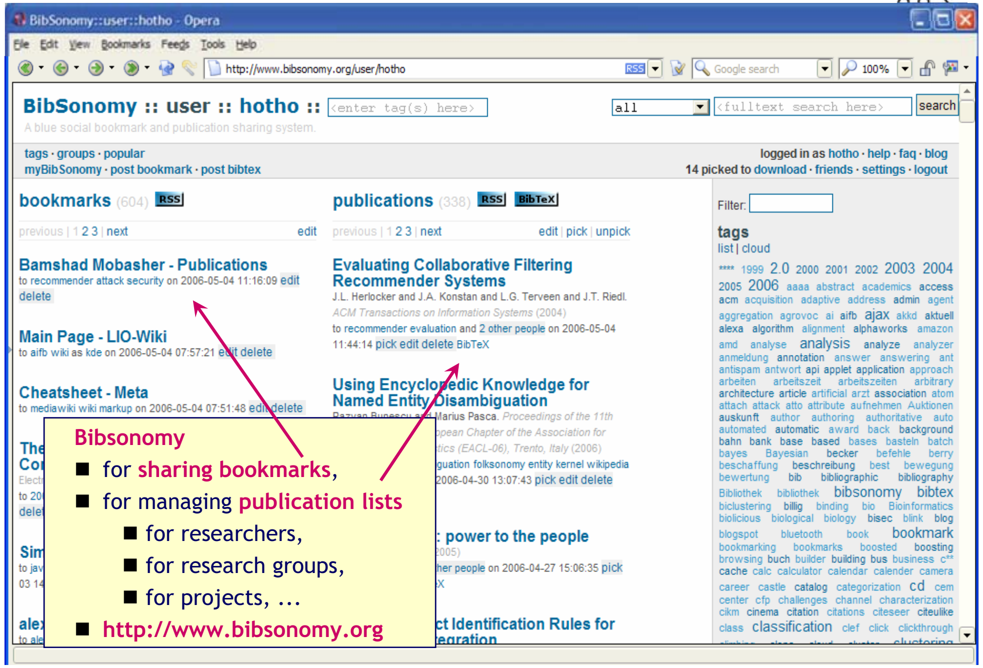
Local L2-Threshol Mining in Peer-to-
R. Wolff and K. Bhaduri and

A *folksonomy* is a tuple $\mathbf{F} := (U, T, R, Y, \prec)$ where

- U, T, and R are finite sets, whose elements are called *users*, *tags* and *resources*,
- $Y \subseteq U \times T \times R$, called set of *tag assignments*,
- $\prec \subseteq U \times T \times T$ is a user-specific sub-tag/super-tag relation.

The *personomy* $\mathbf{P}_u$ of user u is the restriction of $\mathbf{F}$ to u.

Our system: BibSonomy



BibSonomy::user::hotho - Opera

http://www.bibsonomy.org/user/hotho

BibSonomy :: user :: hotho :: <enter tag(s) here> all <fulltext search here> search

A blue social bookmark and publication sharing system.

tags · groups · popular
myBibSonomy · post bookmark · post bibtex

logged in as hotho · help · faq · blog
14 picked to download · friends · settings · logout

bookmarks (604) RSS

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Bamshad Mobasher - Publications
to recommender attack security on 2006-05-04 11:16:09 edit delete

Main Page - LIO-Wiki
to aifb wiki as kde on 2006-05-04 07:57:21 edit delete

Cheatsheet - Meta
to mediawiki wiki markup on 2006-05-04 07:51:48 edit delete

publications (338) RSS BibTeX

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Evaluating Collaborative Filtering Recommender Systems
J.L. Herlocker and J.A. Konstan and L.G. Terveen and J.T. Riedl.
ACM Transactions on Information Systems (2004)
to recommender evaluation and 2 other people on 2006-05-04 11:44:14 pick edit delete BibTeX

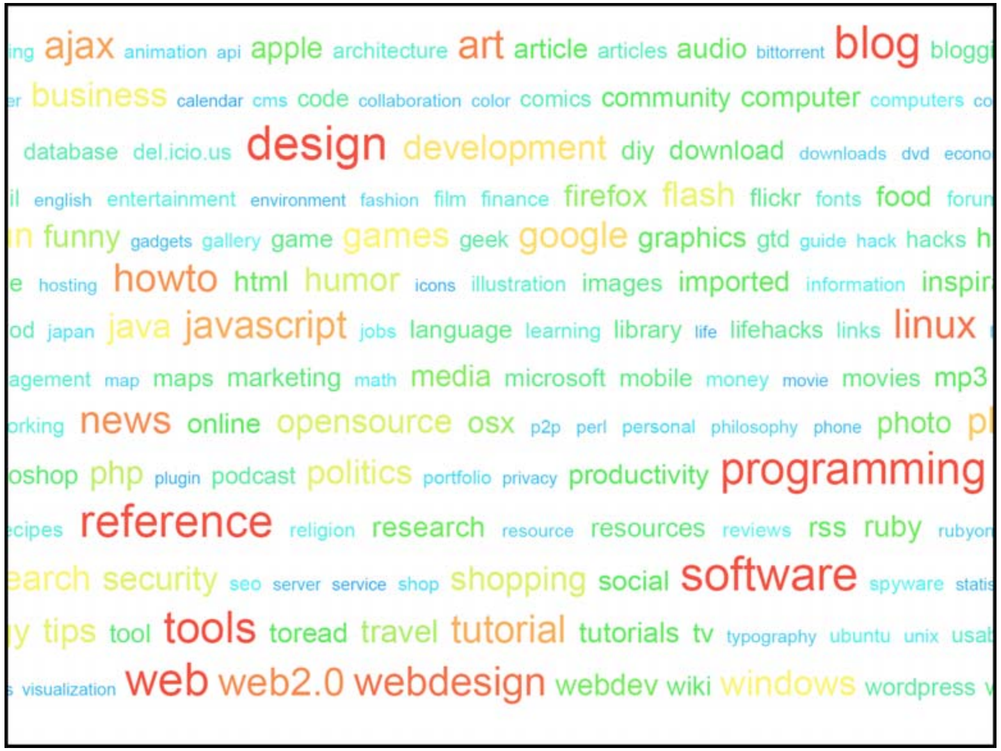
Using Encyclopedic Knowledge for Named Entity Disambiguation
Razvan Bunescu and Marius Pasca. *Proceedings of the 11th ... opean Chapter of the Association for ... tics (EACL-06), Trento, Italy* (2006)
... guation folksonomy entity kernel wikipedia
... 2006-04-30 13:07:43 pick edit delete

Filter:

tags
list | cloud

Bibsonomy

- for **sharing bookmarks**,
- for managing **publication lists**
  - for researchers,
  - for research groups,
  - for projects, …
- **http://www.bibsonomy.org**



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Types of Tags

content/topic of resource (nouns, proper nouns, ...)

category of resource

opinion about resource (adjectives)

ownership of resource (user names)

self-reference, relation between resource and user (*mystuff*, *myown*, *citingme*)

task organization (*toread*, *tobuy*)

social coordination (*for:andrea*)

[see Golder & Huberman ’06]

Probleme und Vorteile des Web2.0 (insbes.Folksonomies)

Probleme:

- keine formale Semantik
- viele Mehrdeutigkeiten, Tippfehler, etc.

Vorteile:

- Viele Beitragende tragen große Mengen an Wissen zusammen
- Hilft gegen den Wissensakquisitions-Flaschenhals

Semantic Web und Web 2.0

Ziel ist es, die Lücke zwischen dem Semantic Web und dem Web 2.0 zu schliessen. („Bridging the Gap“)

(Dies wird gelegentlich schon als „Web3.0“ bezeichnet.)

Wenn dies (semi-)automatisch gelingt, kann man das Wissen der Vielen („Wisdom of the Crowd“) in eine formale Sprache überführen und somit maschinell verarbeitbar machen.

Tagora

2005 2006 academic acquisition activism ai ajax analysis api architecture art article berlin bibliography
Bibliothekare bibtex biology blog Blog blogs book bookmarking bookmarks books Books boomerang Cadre
calendar Canada China classification clustering cognition collaboration collaborative comics community
computer css CSS739 culture data database dblp de del.icio.us delicious
design development dictionary directory download editor education elearning emacs email en engine
engineering firefox flash folksonomies folksonomy Francisco free fun funny future
games Germany google Google graph graphics hacktivism hardware history howto html humor ijtme2006
images imported information internet ir java javascript journal kassel knowledge Knowledge
lang:de language latex learning lecture Library library linux list literature lklprogrammingcourse logic mac
macosx map maps math mathematics mathgamespatterns metadata mining ml mozilla mp3 music
myown network networks news News online ontology open opensource osx owl p2p patterns perl
philosophy photography php politics portal programming ProjectoMazagão publication radio rdf read
review Rita RSS rss ruby safari_export science search search-
engine security semantic semantic_web semanticweb seminar seminar2006 service sicherheit
tagging tags Tavim technology text theory tips tool

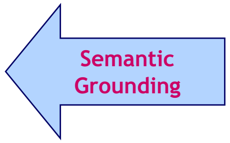
- Semantic Grounding of Measures for Tag Relatedness
- Ontology Learning

EU Project: TAGora – Emergent Semantics in Social Online Communities

C. Cattuto, D. Benz, A. Hotho, G. Stumme: ISWC 2008

Motivation

- Final Goal: Understand “**tag semantics**” in a folksonomy, i.e.,
  - Which tags describe the same / a more specific / a more general concept?
- Two basic approaches:



Look up tags in **external thesaurus:**

+ semantically grounded metrics

- “folksonomy jargon” (misspellings, neologisms etc.) not present

Apply measures **directly to folksonomy structure** (e.g. cooccurrence statistics, …)

+ inclusion of complete vocabulary

- semantic interpretation of measures is not clear

→ **Understand characteristics** of (distributional) measures

→ assess their applicability for **tag recommendation, ontology learning**, …

Dataset

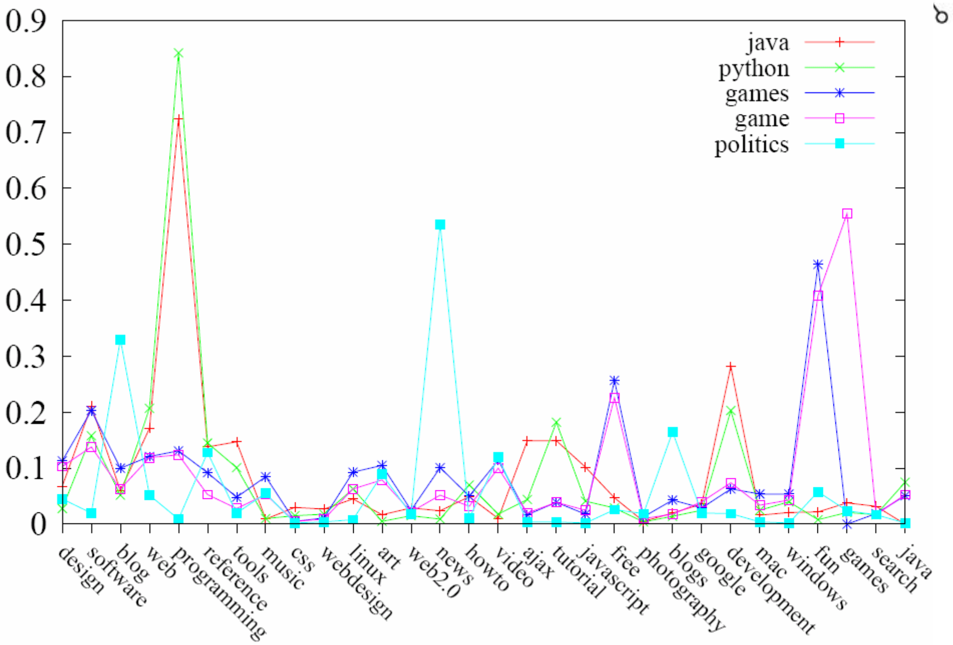
- Del.icio.us crawl 2006
  - $|U| = 667{,}128$ $|T| = 2{,}454{,}546$ $|R| = 18{,}782{,}132$
  - $|Y| = 140{,}333{,}714$
- Excerpt: 10,000 most popular tags
  - $|U| = 476{,}378$ $|T| = 10{,}000$ $|R| = 12{,}660{,}470$
  - $|Y| = 101{,}491{,}722$
- In the following: **tag rank** = position in most-popular list:
  - 1: design
  - 2: software
  - 3: blog
  - 4: web
  - …

Relatedness Measures

- Take **Co-occurrence frequency** as similarity measure (freq).
- Use **FolkRank** to find related tags (folkrank).
- Describe each tag as a **vector**, whereby each dimension of the vector space corresponds to another tag. Compute similar tags by **cosine similarity** (cosine).

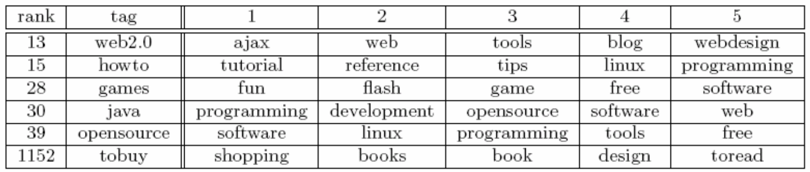
  (The same can be done in the user space or the resource space and with TF-IDF.)

Example for cosine measure



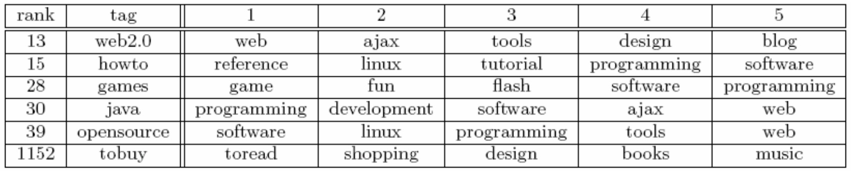
Examples of most related tags

Freq



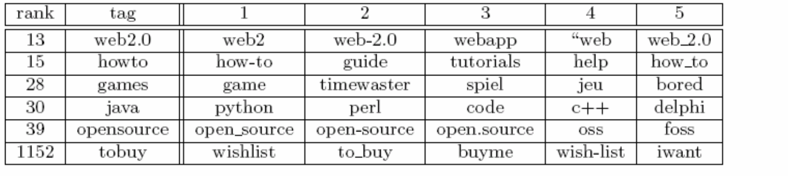
rank	tag	1	2	3	4	5
13	web2.0	ajax	web	tools	blog	webdesign
15	howto	tutorial	reference	tips	linux	programming
28	games	fun	flash	game	free	software
30	java	programming	development	opensource	software	web
39	opensource	software	linux	programming	tools	free
1152	tobuy	shopping	books	book	design	toread

FolkRank



rank	tag	1	2	3	4	5
13	web2.0	web	ajax	tools	design	blog
15	howto	reference	linux	tutorial	programming	software
28	games	game	fun	flash	software	programming
30	java	programming	development	software	ajax	web
39	opensource	software	linux	programming	tools	web
1152	tobuy	toread	shopping	design	books	music

Cosine



rank	tag	1	2	3	4	5
13	web2.0	web2	web-2.0	webapp	“web	web_2.0
15	howto	how-to	guide	tutorials	help	how_to
28	games	game	timewaster	spiel	jeu	bored
30	java	python	perl	code	c++	delphi
39	opensource	open_source	open-source	open.source	oss	foss
1152	tobuy	wishlist	to_buy	buyme	wish-list	iwant

First insights

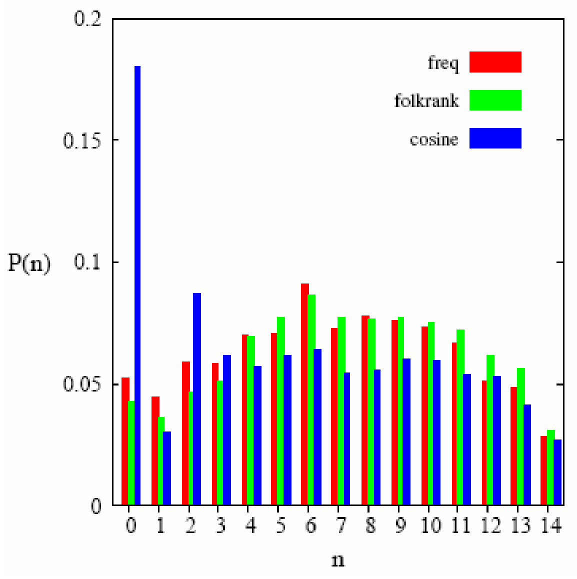
- Freq / FolkRank show bias to high-frequency tags, i.e., to **hyperonyms**.
- Cosine seems to yield more **synomyms** and **“siblings”**.

→ Now: **grounding** of these observations in WordNet.

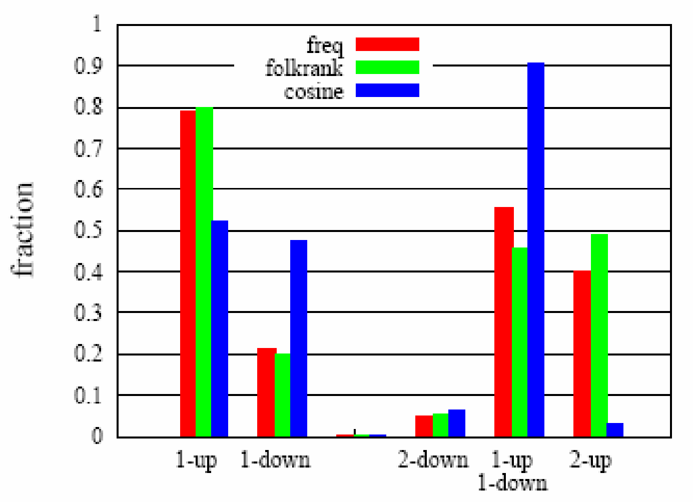
Semantic Grounding in WordNet

- WordNet is a large lexical database for English.
- Words with same meaning are grouped in *synsets*, which are ordered by an *is-a* relation.
- Introduction of single **artificial root node** enables application of graph-based similarity metrics between pairs of nouns / pairs of verbs.
- Inclusion of top *n* del.icio.us tags in WordNet:
  - 100: 82%
  - 1,000: 79%
  - 5,000: 69%
  - 10,000: 61%

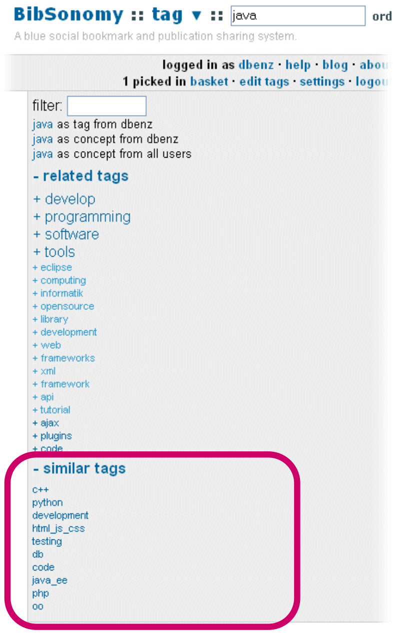
Shortest paths between original tag and most closely related one



Edge composition of shortest paths (for lengths 1 and 2)



Similar tags live on www.bibsonomy.org



BibSonomy :: tag ▾ :: java order by (date | folkrank)

A blue social bookmark and publication sharing system.

logged in as dbenz · help · blog · abou
1 picked in basket · edit tags · settings · logou

filter:

java as tag from dbenz
java as concept from dbenz
java as concept from all users

- related tags

+ develop
+ programming
+ software
+ tools
+ eclipse
+ computing
+ informatik
+ opensource
+ library
+ development
+ web
+ frameworks
+ xml
+ framework
+ api
+ tutorial
+ ajax
+ plugins
+ code

- similar tags

c++
python
development
html_js_css
testing
db
code
java_ee
php
oo

Learning Ontologies from Folksonomies

Idea:

- automatically induce a concept hierarchy
- semantics of the relations resembles closely the one of taxonomic relations

Data:

- The tag-tag co-occurrence network of the delicious dataset forms the basis of the experiments (UTC = user-based tag-tag-co-occurrence, RTC = resource based tag-tag-co-occurrence)

Possible approaches:

- Social network analysis
- Set theoretic approaches (association rules, TRIAS)
- Statistical approaches (clustering, similarity measure)

Main steps of an Ontology Learning Algorithm

Filter the tags by an occurrence threshold

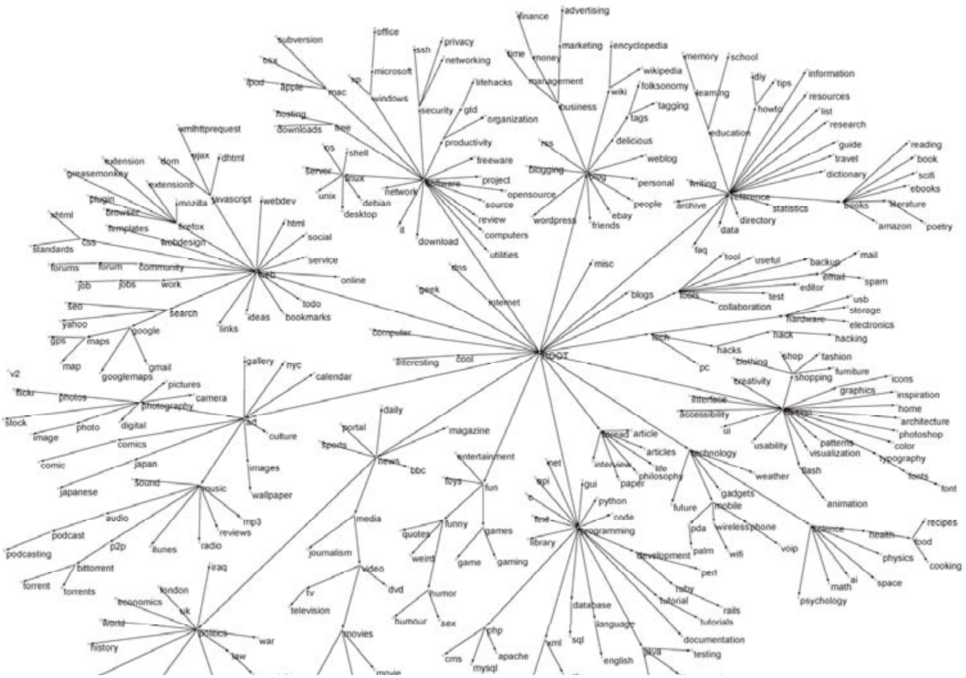
Order the tags in descending order by generality
(measured by degree centrality in the UTC network)

Starting from the most general tag, add all tags subsequently to an evolving tree structure:

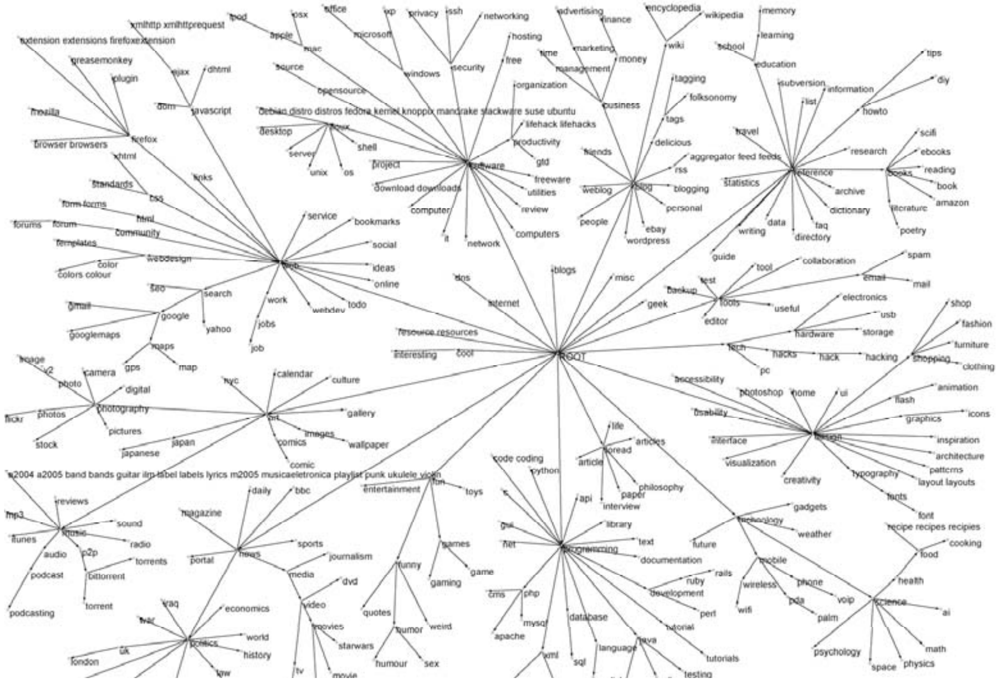
- identify the most similar existing tag
- (decide whether the tags are synonyms or form a compound expression and expand the tree accordingly)

We follow: P. Heymann, H. Garcia-Molina: Collaborative Creation of Communal Hierarchical Taxonomies in Social Tagging Systems. 2006.

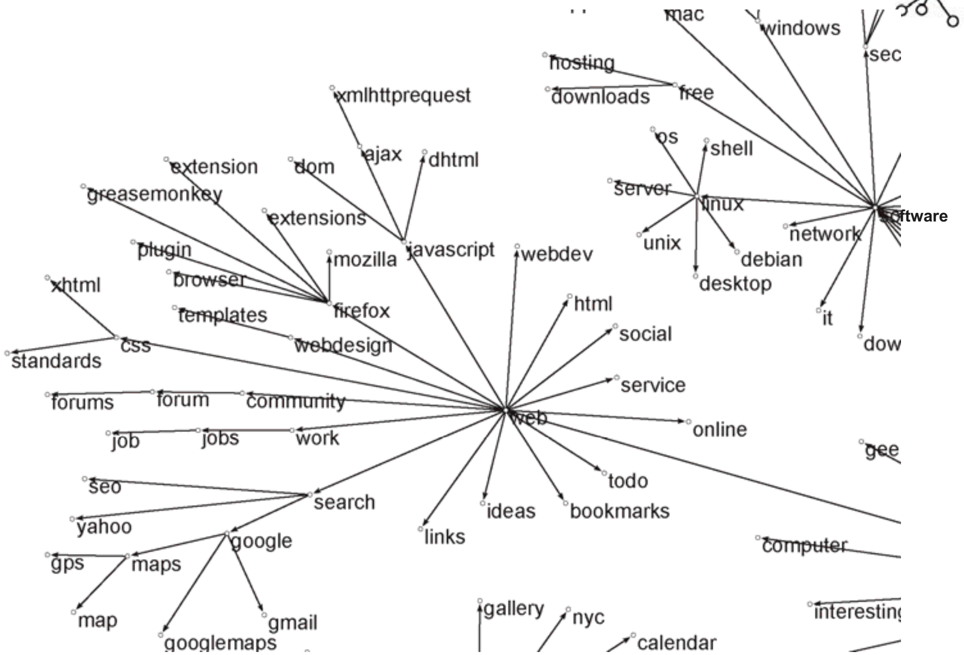
Results for delicious (dataset 2005, 320 tags, used by > 2000 users)



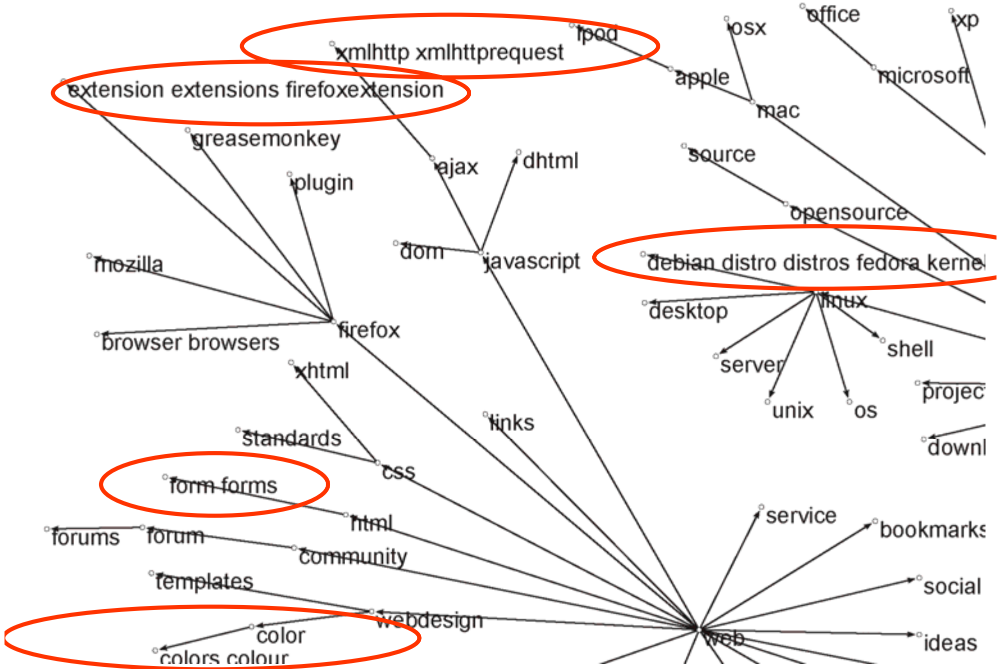
Results for delicious together with similarity pruning



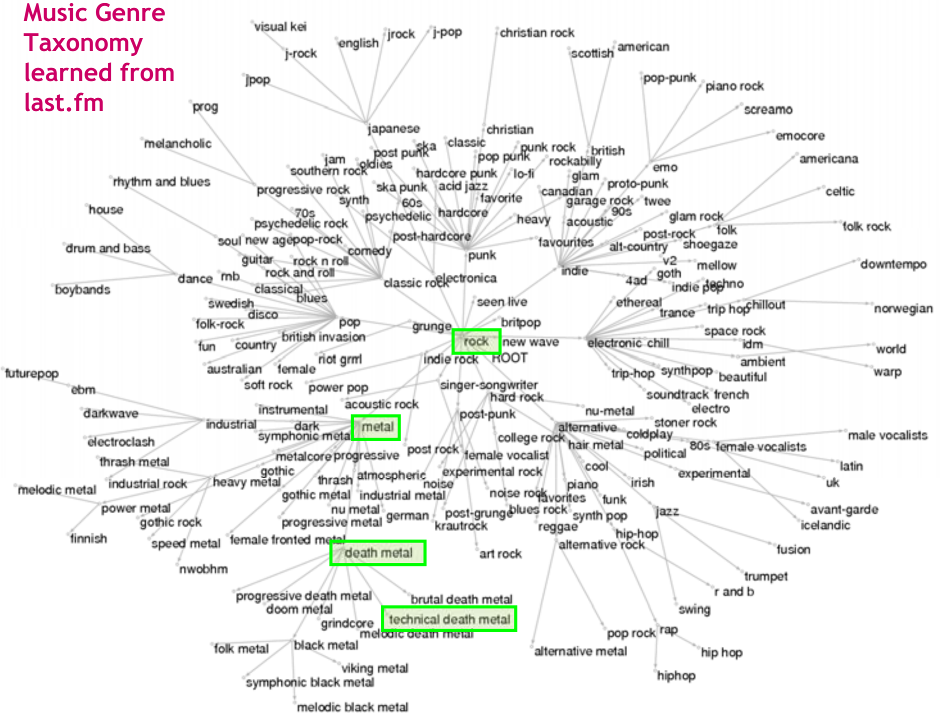
Results for delicious (dataset 2005, 320 tags, used by > 2000 users)



Results for delicious together with similarity pruning

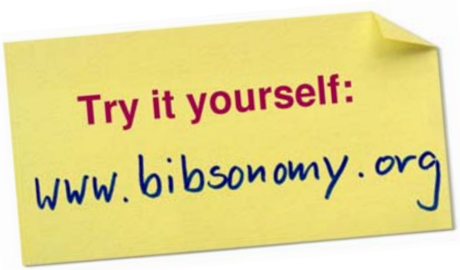


Music Genre Taxonomy learned from last.fm



Conclusion

- Folksonomies overcome the knowledge acquisition bottleneck
  - due to ease of use
  - and therefore of fastly increasing amounts of users.
- Cosine measure seems most suitable to discover synonyms and siblings.
- Similarity measures can be used for Ontology Learning.


Try it yourself:

www.bibsonomy.org