Web 2.0: User Generated Metadata

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Agenda

- Introduction
- Examples for User Generated Metadata
- What is User Generated Metadata?
- Folksonomies
- Emergent Semantics
- Summary

Introduction

- Why should we care about metadata?
  - Why don't just analyze the data?
- Why should we care about users generating something?
  - Isn't it always error prone?
  - Isn't it always unreliable?

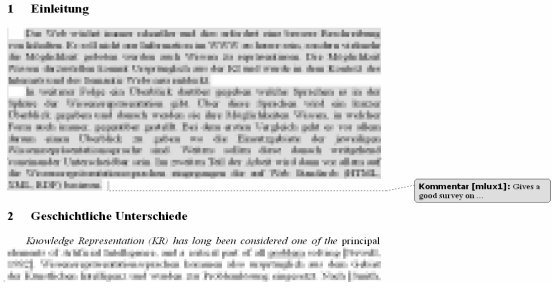
Why metadata?

- Understanding of data is a key issue
- Interpretation often not possible
  - e.g. Abstract Semantics in Images like „Friendship"
  - Cannot „infere" metadata

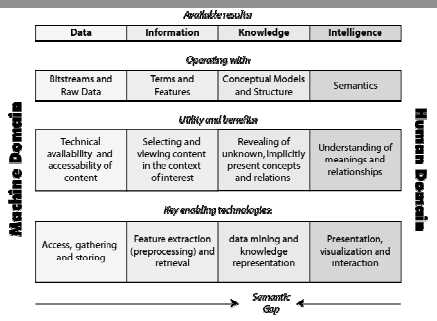
Why metadata?

- Compare to Information Search & Retrieval:
  - e.g. User need: some „good survey or state of the art"
  - Often available in „related work" sections of „related" articles
  - Might be possible with metadata.

Example for Annotations



Semantic Gap



Why should we care about users generating something?

- Users are the driving force
  - Consumers/Sellers in e-business
  - Reader & Ad-Clickers on Content Portals
- So we've got to give them „something"
  - Give them what they need (see Google Mail)
  - Give them what they like (see YouTube)
- And take a added value for us
  - e.g. money (in case of ads) or generated content (in case of mails)

Isn't it always error-prone?

- We are not talking about
  - Life Support Systems
  - Ontological Knowledge
- We have to „live" with errors, e.g. in
  - Information Retrieval: Incomplete sources and queries
  - Emails: Spams and Phishing Mails

Isn't it unreliable?

- In many cases UGM (and UGC) is unreliable.
- But there can be ways to create added value with a **certain** quality level
  - Compare to Internet Search Engines
  - Compare to Data Mining issues (Outliers, Data Cleaning, etc.)

So what can UGM do for us?

- Provide additional data & structure
- Add abstract (not obvious) annotations
- At certain quality levels
  - Depending on domain and application

Examples for UGM

In Web 2.0 lots of examples exist ...

- Social Bookmarking
- Collaborative Annotations
- Social Media Sharing
- Collaborative Content Creation
- Blogging

Obvious and Hidden

http://www.uni-klu.ac.at

- Some approaches are very obvious

Obvious and Hidden

http://www.uni-klu.ac.at

- Some are more subtle
  - Plug-Ins with client-server communication

Examples: Social Bookmarking

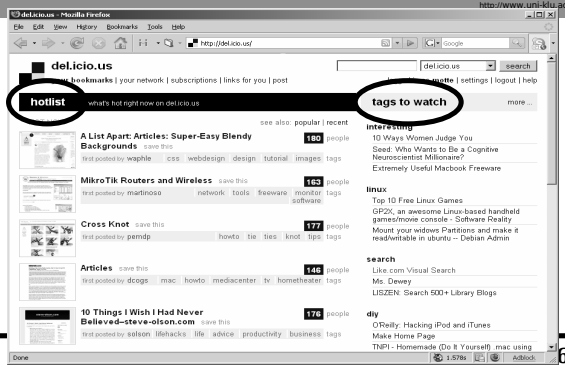
http://www.uni-klu.ac.at

Social Bookmarking defined:

- Bookmarking Resources
- Providing a „stream of bookmarks“
- Eventually additional support for
  - Tagging (keywords)
  - Caching (Saving the state of the bookmark)
  - Organization & Collaboration (Groups)

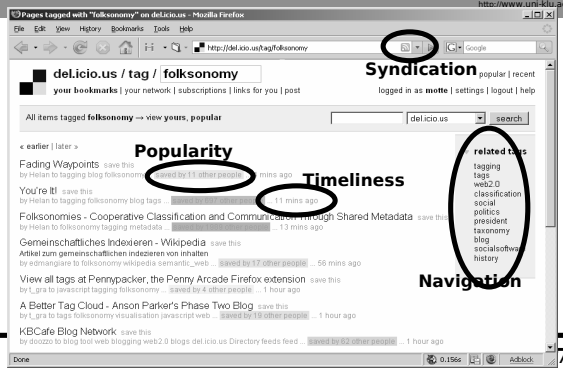
Example: del.icio.us

http://www.uni-klu.ac.at



Example: del.icio.us

http://www.uni-klu.ac.at



Example: del.icio.us

http://www.uni-klu.ac.at

- User Interface
  - Clean and easy2use
  - Powerful tools (bookmarklets & plugins)
- Additional Features
  - Thumbnails
  - Social Networking

del.icio.us

- User intentions are unclear:
  - Self-organization or group organization
  - Participation / Being part of it
- Explicitly Generated Metadata
  - Bookmarking & Tagging
  - Tag Bundles
- Implicitly Generated Metadata
  - Time, Interestingness, The „Seen Web“
  - User Profile, Social Network

Example: Web Clippings & Sticky Notes

- Several Applications exist:
  - Google Notebook
  - Clipmarks.com
  - etc.
- Our example:
  - Annotate a part of a web page ...
  - Done using Diigo

Demo: Diigo

- Video or
- Live Demo ...

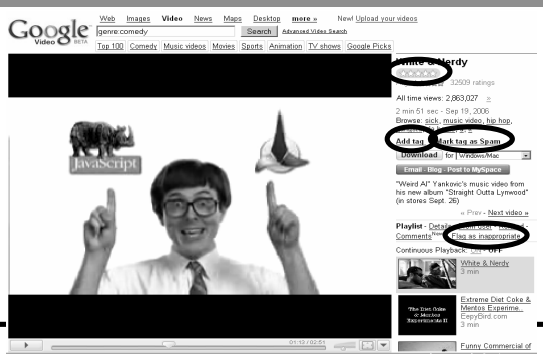
Example: Diigo

- User intentions are unclear:
  - For himself (later reading / work)
  - For a group of people / coworkers
- Explicitly Generated Metadata
  - Highlighting & bookmarking
  - Tagging & Description, Sticky Note
- Implicitly Generated Metadata
  - Time, Interestingness, The „Seen Web“
  - User Profile

Examples: Social Media Sharing

- Flickr.com, Bubbleshare.com, Zooomr.com, ...
  - Sharing images & annotations
- YouTube.com, Google Video, VideoEgg.com. ...
  - Sharing videos & annotations
- Pandora, Last.fm
  - Sharing music & flavors

Example: Google Video



Google Video

- Explicitly Generated Metadata
  - Ratings, Flags, Tags, Spam Filtering
- Implicitly Generated Metadata
  - Interestingness (Charts, etc.)
  - Usage (Client reports events like start, pause, stop, ...)
  - From the HTTP-Request: GET http://video.google....&reportevent=pause...

Example: Wikipedia

Wikipedia is

- A user driven encyclopedia
- Self-organizing & self-directed

General issues:

- Reliability and truth
- Completeness (e.g. Computer Science)

Example: Wikipedia: Heinrich Rudolf Hertz

article | discussion | edit this page | history | Sign in / create account

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Heinrich Rudolf Hertz

From Wikipedia, the free encyclopedia

Heinrich Rudolf Hertz (February 22, 1857 - January 1, 1894) was the German physicist and mechanician for whom the hertz, an SI unit, is named. In 1888, he was the first to demonstrate the existence of electromagnetic radiation by building an apparatus to produce UHF radio waves.

Contents [hide]

1 Biography
1.1 Early years
1.2 Meteorology
1.3 Electromagnetic research
1.4 Death and afterwards
2 See also
3 Further reading
4 References, external links, and other articles

Biography [edit]

Early years [edit]

Hertz was born in Hamburg, Germany, to Gustav Ferdinand Hertz, whose father converted from Judaism to Lutheranism and married into a Lutheran family, and Anna Elisabeth Pfefferkorn, herself a

Heinrich Rudolf Hertz

"I do not think that the wireless waves I have discovered will have any practical application."

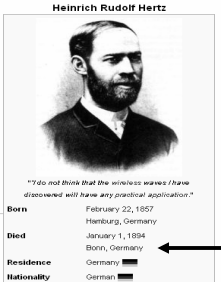
Born	February 22, 1857 Hamburg, Germany
Died	January 1, 1894 Bonn, Germany
Residence	Germany
Nationality	German

Example: Wikipedia: Heinrich Rudolf Hertz

A „standard“ Wikipedia article having:

- A wiki name: Heinrich_Rudolf_Hertz
- Lots of Wiki-Code
  - Several Outlinks
  - Several Inlinks
  - And the InfoBox ...

Example: Wikipedia: Heinrich Rudolf Hertz



Heinrich Rudolf Hertz

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{{Infobox_Scientist
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|image = Heinrich Rudolf Hertz.jpg
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   [[wireless]] waves I have discovered
   will have any [[radio|practical
   application]].'"</div>
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|birth_place = [[Hamburg, Germany]]
|residence = [[Germany]]
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   [[Image:Flag_of_Germany.svg|20px|]]
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|death_place = [[Bonn, Germany]]
...
```


Example: Wikipedia: Heinrich Rudolf Hertz

- Explicitly Generated Metadata
  - Embedded in the data
  - Based on key = concept (identified by Wiki word)
- Implicitly Generated Metadata
  - Popularity (length of the article, browsing behavior)
  - Structure & Links (partially through bots)
  - Introduction of disambiguated concepts (Wiki names)

Wikipedia: Disambiguation

- Disambiguation through Wiki Words
  - Hertz, Hertz_(crater), Heinrich_Rudolf_Hertz, Arne_Hertz

Example: Blogs

- Most prominent concept of Web 2.0
- Explicitly Generated Metadata
  - Strong typing of structure (order, header, categories, body text, etc.)
- Implicitly Generated Metadata
  - Structure & Links (Trackbacks, bidirectional)
  - Introduction of categories (tags)

What is User Generated Metadata in Web 2.0?

- Bottom up
  - In contrast to controlled vocabularies
  - In contrast to quality ensured content creation processes
- Superimposed structure
  - Instead of using predefined hierarchies
  - Through heavy use of linking
- Huge and fuzzy
  - Unimaginable mass of links & tags
  - Lots of redundant information
- Spammed
  - Just starting ...

Summary: User Generated Metadata

- We have seen examples on UGM
- We have found some characteristics of UGM

Next:

- Getting more specific on folksonomies

Folksonomies

Network of Tags, Users and URLs

- Users describe resources
- By using (multiple) tags

Examples:

- Social bookmarking, media sharing, etc.

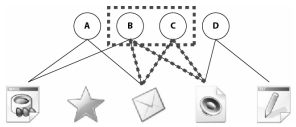
Folksonomies: The Structure

User *tags* resource (URL)

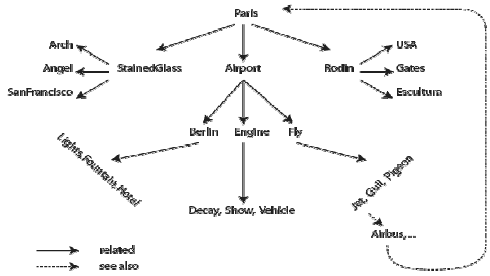
- 1+ words or phrases (bonn, „mathias lux“)
- No controlled vocabulary, taxonomy
- No quality control
- No constraints (language, length, number)

Folksonomies: Structure

- Tag to URL is a n:m relation
- Superimposed structure through bidirectional links
- Structure is called „folksonomy“

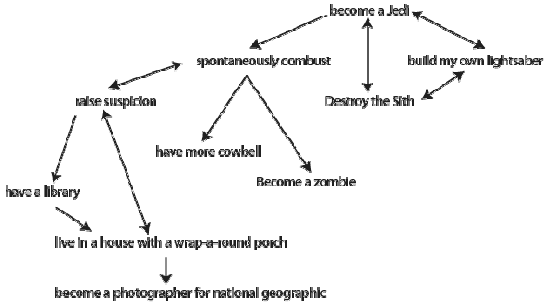


Folksonomy Example: Flickr



Folksonomy Example: Technorati

Folksonomy Example: 43things



Why do tagging systems work?

This was topic of a panel at CHI 2006, following conclusions were drawn:

- Tagging has a benefit for the user
  - Similar to bookmarking, integrated apps
  - Benefit of accessibility from everywhere in the internet
- Tagging allows social interaction
  - Connecting a user to a community trough tags
  - People can subscribe your stream

Why do tagging systems work? (2)

- Tags are useful for retrieval
  - Synonyms and typos vanish in the mass of tags
  - Communities can retrieve “their” stuff (e.g. by special tag)
- Tagging systems have a low participation barrier
  - Apps are easy to use, intuitive, responsive
  - Free text is used to do the tagging
  - Requires no previous considerations & training

Summary: Folksonomies

- We have defined folksonomies
- We have talked about why they work.

Next:

- Emergent Semantics

Emergent Computation

Stephanie Forrester defines it in 1990:

- In context of parallel computing
- Global behavior emerges from local interactions
  - Mostly in systems without central authority
- It is called emergent computation if
  - the local interactions are computations
  - the global behavior is a computation

Emergent Semantics *(Steffen Staab)*

Emergent computation describes

- Creation of complex systems / organisms
- Without explicit purpose of creation

Emergent Semantics

- Arise from user interactions
- Without explicitly aiming at semantics

Emergent Semantics *(Steffen Staab)*

Semantics emerge through user interaction allow ...

- ... to cope with the problem of knowledge acquisition
- ... aggregation of semantics without additional efforts of the users
- ... the creation of a new basis for understanding (bottom up)

Emergent Semantics *(Simone Santini)*

Simone Santini – Visual Image Retrieval

- What is the meaning of an image?
  - Derived from interactions and relations
    - Behavior, queries, browsing, ...
  - Semantics of features should be formalized
    - Meaning of low level features like color, file size, ...
  - Relative to the social context of the user
    - Different people see different things in images

Emergent Semantics *(Simone Santini)*

Simone Santini – Visual Image Retrieval

- Semantics should be specified by the user
  - Selection through appropriate interfaces
    - Telling what is similar
    - Giving examples
    - Specifying constraints
  - Adaptation to user needs
    - relevance feedback
    - retrieval of metrics

Emergent Semantics *(Luc Steel)*

What are the ways to create semantics?

- Inductive
  - Starting from a reference set, “good example”
  - Learning from this reference set
  - Applying learned things by classifying, clustering ...
- Selective
  - Start with randomly generated data
  - Select the appropriate ()

Emergent Semantics *(Luc Steel)*

- Constructive
  - Example: Moving in a new home, organizing shoes ...
    - Inductive is not possible
    - Selective would be “a mess”
  - Includes cooperation & communication
- Emergent Semantics
  - Include cooperation & communication
  - Oppose the methods of induction & selection

A Unified Model for Emergent Semantics

Mika P. (2004) *“Ontologies are us: A unified model of social networks and semantics”*

- Ontologies contain instances *I* and concepts *C*
- Ontologies are formal specifications
  - Which are stripped from their original social context of creation
  - Which are static and may get outdated

Where do semantics emerge from?

A third set besides *C* and *I* is needed

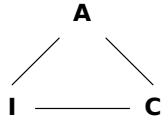
- Agents *A* are those who specify
- Agent defines
  - which Concept *C* is
  - assigned to Instance *I*

⇒ A **tripartite model** can be identified

A tripartite model

- 3 partitions: *A*, *C* & *I*
- Hyperedges connect exactly one $a \in A$ with one $c \in C$ and $i \in I$
- One edge denotes that a user assigns a concept to a resource.

But tripartite graphs are rather hard to understand and to work with!



Simplifying the tripartite Model

Similar to the introduced structure of folksonomies:

- An instance is connected to a concept
  - like a tag to a resource
- The edge is labeled by the user or
- Weighted by the number of assignments

A bipartite Model ...

A graph connecting
- Instances *i* to
- Concepts *c*

We call this **IC-Graph**

The weights can be expressed in an association matrix

	c1	**c2**	**c3**	**...**
i1	1	5	0	...
i2	0	3	0	...
i3	4	2	2	...
...	...	...	...	...

The Association Matrix

- This matrix connects two different sets
- Folding allows to transform the Matrix to a one mode network
- Just like the co-occurence matrix in text retrieval: $M_c = M_{IC} \cdot M'_{IC}$
- Result is a matrix connecting concepts to concepts

Beispiel: Konzepte

	computer	pda	cellphone	wlan	network
i1	7	5	0	6	1
i2	7	1	1	1	2
i3	0	4	5	0	0
i4	8	0	0	0	6
i5	3	3	0	4	0

	computer	pda	cellphone	wlan	network
computer	111	62	20	62	60
pda	62	56	9	68	28
cellphone	20	9	41	0	12
wlan	62	68	0	100	24
network	60	28	12	24	34

The Association Matrix

- Also instance based co-occurrence can be calculated $M_I = M'_{IC} \cdot M_{IC}$
- Based on the co-occurrence clustering algorithms can be applied:
  - Instance Clustering
  - Concept Clustering

Other Association Matrices

- Based on the AC-Graph
  - Bipartite agent2concept graph
  - Instances are used as weights
- Based on the AI-Graph
  - Bipartite agent2instance Graph
  - concepts are used as weights
- Based on A[C|I]-Graph the social network between agents can be analyzed

Application to Folksonomies

- Concepts, agents and instances in Folksonomies:
  - Tags are concepts
  - Agents are users
  - Resources are instances
- Tags are error prone, but semantics can eventually emerge (see P. Mika for the example del.icio.us)

Problems of the approach

- Community based concepts & associations
- Tags have typos, synonyms
- Tags have different intentions
  - Abstract semantics (funny, sad, friendship)
  - Media description (pdf, online, word, image)
  - Rights and authors (persons names)
  - Organizational (2read, todo, marker)
  - etc.

Problems of the approach

- Computational problems
  - Big matrix multiplications are hard to compute
- Some folksonomies restrict tagging to the originating user:
  - Flickr tags can only be assigned by the uploader
  - YouTube has the same restriction

Summary: Emergent Semantics

- We have seen what emergent semantics are
- We have learned about a model for semantics & social networks
- We have learned about a method for identifying emergent semantics

What can UGM do for us?

- Bridge the Semantic Gap?
  - (Multimedia) Information Retrieval
- Provide some additional input
- Do “Human Computing”
- Give us some headache
  - User rights
  - Mass of content & links

Outlook

- User Rights, DRM
  - Discussed on content but not on metadata
- Aggregation over different service providers
  - Standard formats & processes
- Openness & Accessibility
  - Sharing, licenses, availability, ...

Privacy issues

- Data is aggregated about users
- Eventual violations of privacy

- Something to think about ...
  - Video of the American Civil Liberty Union
  - http://www.aclu.org/pizza/

CfP: Workshop Multimedia Semantics - The Role of Metadata

The Web 2.0 & The Multimedia Web

Topics include: Multimedia Semantics, [...] Emergent Semantics, [...] Web 2.0

see http://www.multimedia-metadata.info/Events/WMS07

Thank you ...

... for your Attention!

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