Arbeitsgruppe
CSW
Corporate Semantic Web

Freie Universität Berlin

# Übung Netzbasierte Informationssysteme

# Termin 6:
# Web Suche

**Prof. Dr. Adrian Paschke**

Arbeitsgruppe Corporate Semantic Web (AG-CSW)
Institut für Informatik, Freie Universität Berlin
paschke@inf.fu-berlin.de
http://www.inf.fu-berlin.de/groups/ag-csw/

# Agenda

- Feedback Übungsblatt 5

- Thema des heutigen Übungsblatts:
  - Einfache Lucene-basierte Web Suche
  - Hintergrund: Web Search
  - Hintergrund: Search Strategies
  - Hintergrund: Search Queries

- Übungsblatt 6
  - Aufgabe: Lucene
  - Aufgabe: Lucene Indexing
  - Aufgabe: Lucene Querying

# Feeback - Übungsblatt 5

- **Lernziele des 5. Übungsblattes waren:**
  - Semantic Web Programmierung
  - Ontologien
  - Regeln
  - SPARQL
- **Wie war`s?**
  - Fehlerquellen
  - Probleme?

- Abgabe verlängert bis 6.1.2009

# Web Search

When one thinks today of „Web search“, there is really just one word:


„To google“ added to the Oxford English Dictionary on June 15, 2006 and to the 11th edition of the Merriam-Webster Collegiate Dictionary in July 2006

„Googeln“ in die 23. Auflage von Duden aufgenommen

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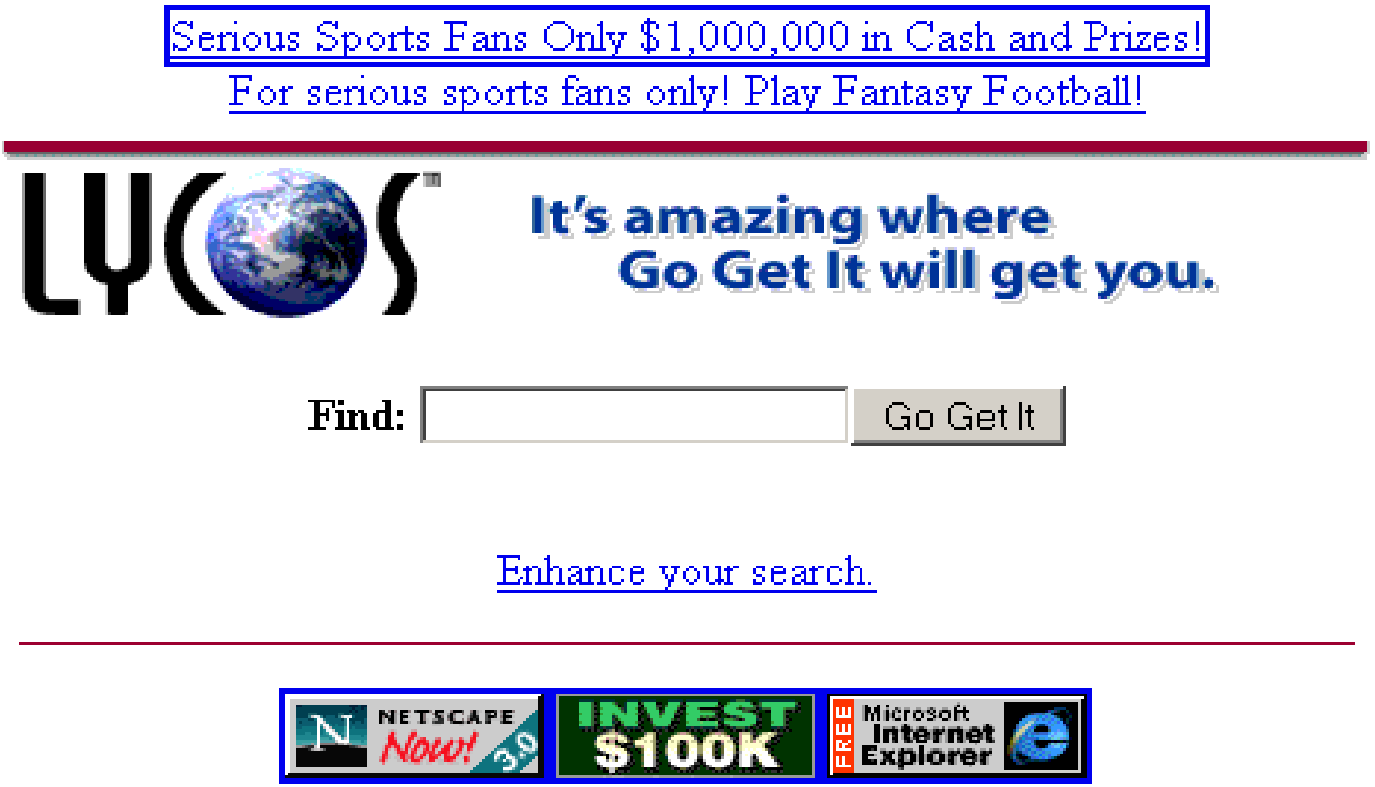
# What was there before Google?



# Importance of Web search

- Search engines are the second most common Web activity after e-mail
- 90% of users find new sites by search
- 80% of Internet traffic to sites comes through search engines

- In August 2007, 95% of Web users performed a search
- A total of 61 billion searches were performed

# Importance of relevance

- 80% of users only look in the first two pages of search results (Google: first 20 results)
- Number of matches to typical search terms:
  - wetter :  71 000 000
  - weihnachten : 23 000 000
  - harry potter : 75 600 000

# Getting to Google‘s No 1

- Paid placement: e.g. Google AdWords
- Set up a dummy site with multiple links to our content, multiple text terms and a redirect, etc.: Google gets wise to this
- Hack Google: probably not possible
- Pay a search engine optimiser
- Or just do it yourself
  - Understand how search engines index and answer queries
  - Make use of content, markup and metadata on your site
  - Promote your site to get more links to it from other sites

# Search Strategies: Text Indexing

- Text Indexing is the basic approach of all Web search engines
  - Language-specific stemming/stripping
  - Frequency of keywords
  - Location of keywords (closer to the top = more relevant)

- Search engine optimisation
  - Choose your keywords (at least two words)
  - Use text instead of textual graphics
  - Provide static pages, beside dynamic content
  - Scripts and tables can push keywords further down the page

# Search Strategies: Markup

- Which markup is relevant to search?
- In HTML, certain elements indicate greater importance of a term
  - <TITLE>
  - <H1>
- In XML, more difficult as the search engine must know how to interpret the XML markup

# Search Strategies: Links

- The web is a hypermedia system, i.e. content has links to other content
- Links can be seen as an indicator of importance
  - the more links to some content, the more important that content must be
  - the better the linking site, the better the linked site
- XLinks would provide further information but nobody uses them and no search engine considers them
- Other ways to gain information about the link must be found
  - Standard: the text within the HTML <A> tag describes the content pointed to by that tag
- Google took this principle and built PageRank around it

# Search Strategies: Metadata

- What metadata is available in Web content?
- In HTML, one has the <META> tag
  - META name=„description“ content=„…..“
  - META name=„keywords“ content=„…..“
  - Other META tags could be used for internal search functionality e.g. author, date
  - By Oct 2002 only one search engine – Inktomi – crawled the META tag
- There are other approaches which have not yet gained widespread usage in the Web
  - Microformats
  - RDF (e.g. RDFa as RDF in HTML, GRDDL to extract RDF from microformats)

# Search Queries

- Problem: Ambiguity of Natural Language

  Term „Apache“







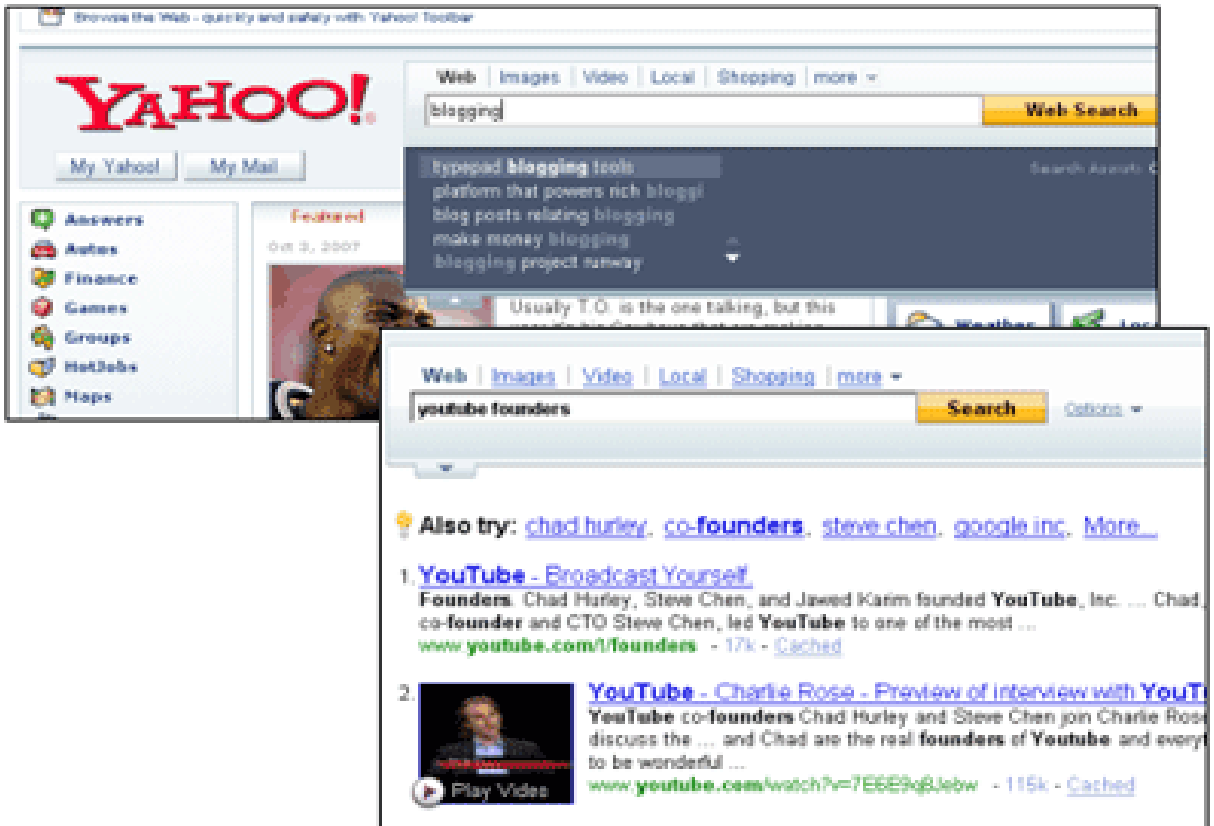


# Query Completion

- While the query is still not complete, suggest already suitable completions
- Based on most common query terms from all users

Yahoo offers „Search Assist“ since July 2007 from yahoo.com

„a 61% increase in successful task completion„ - Yahoo



# Clustering

- Gathering of results into groups around a certain theme
- Based on text analysis: which terms occur more often in combination with the query term

# Advanced Search

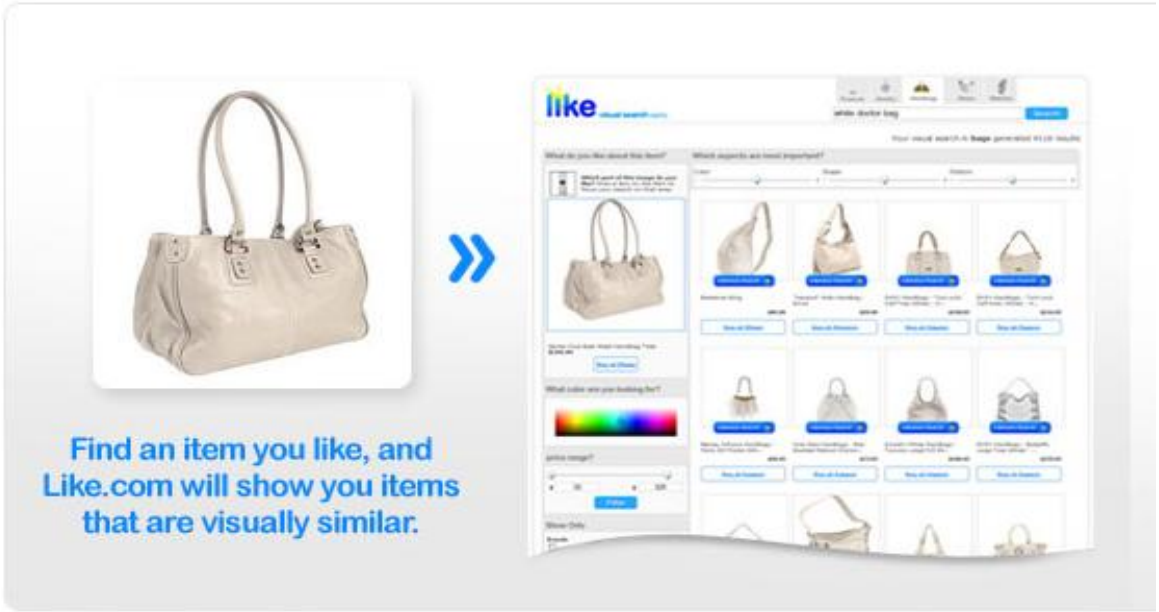
- Already many advanced searches possible but only if one knows the syntax, for example in Google:

- **Fuzzy Search** - Search for ~music player, and google searches for music player, mp3 player, audio player, and other words that have similar meanings to music.
- **Number Ranges** - Searches for a range of numbers, for example mp3 player **20..60** GB will match 20, 40, and 60GB mp3 players (and any other number inbetween).
- **Wildcard** - When you place a * in your query, google will match any word in between. For example: apple * player matches apple ipod player, apple mp3 player, etc.
- **Search Page Title only** - Use the allintitle: operator to search only page titles. For example: allintitle:ipod Searches for any page with ipod in the title.

courtesy http://www.petefreitag.com/item/473.cfm

# Media Search

- Search could be based on feature similarity (like.com)



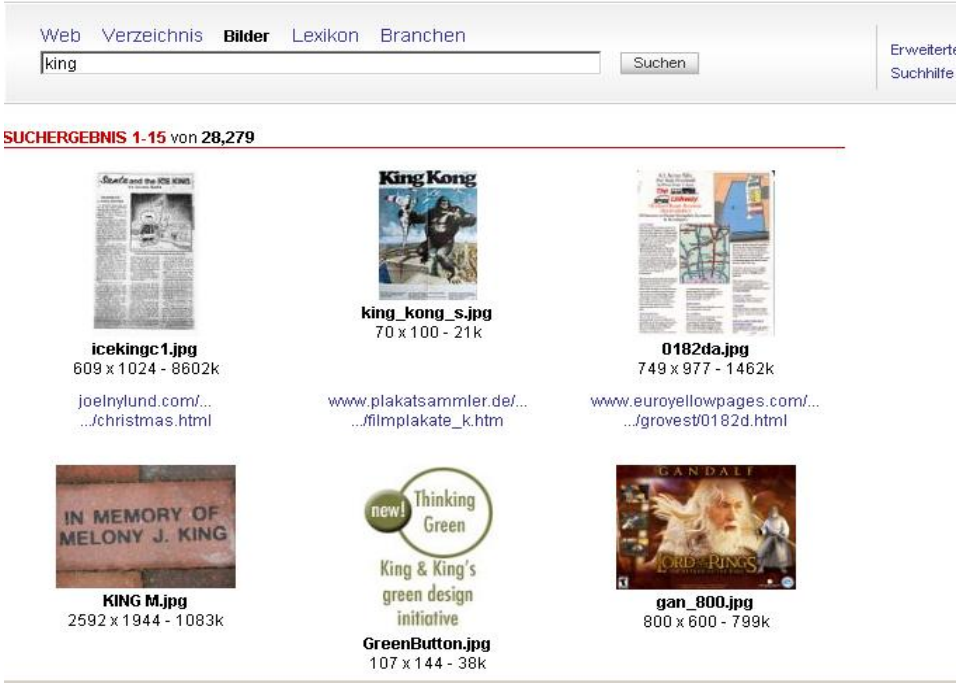

- However, classical search is still text based
- How to index non-text media for text-based search?

# Use text

- Strategy of the major search engines, e.g. Google

  *„Google analyzes the text on the page adjacent to the image, the image caption and dozens of other factors to determine the image content „ (Google FAQ)*

- Identify text **within** the image



# Use markup

- IMG SRC attribute: use file name as approximate descriptor of the image
- IMG ALT attribute: provides short description of the image which may be indexed

# Use metadata

- Popular approach but metadata is lacking
  - Often only low level and creation information e.g. audio recording at which KHz, photo taken with which camera
- Audio „signatures“ can identify licensed music
  - Obviously not valid for other types of audio
- Extraction of media metadata ongoing research problem
  - Speech recognition
  - Visual feature extraction
- Other problems
  - Agreeing on a metadata standard for media
  - Agreeing on schemas for the metadata concepts
  - Agreeing on how one binds a media object to its metadata

# Metadata: tagging

von davidanthonyporter

Fotostream von davidanthonyporter

452 Fotos

durchsuche

Tags

- The Apache Trail
- apache lake
- phoenix
- scottsdale
- arizona

Dieses Foto gehört

The Apache Tr

durchsuche

Teil von: Arizona

Tags

- The Apache Trail
- apache lake
- phoenix
- scottsdale
- arizona

# Metadata: geotagging

- Idea: standardized provision of location metadata
  - Geotagging defines two tags

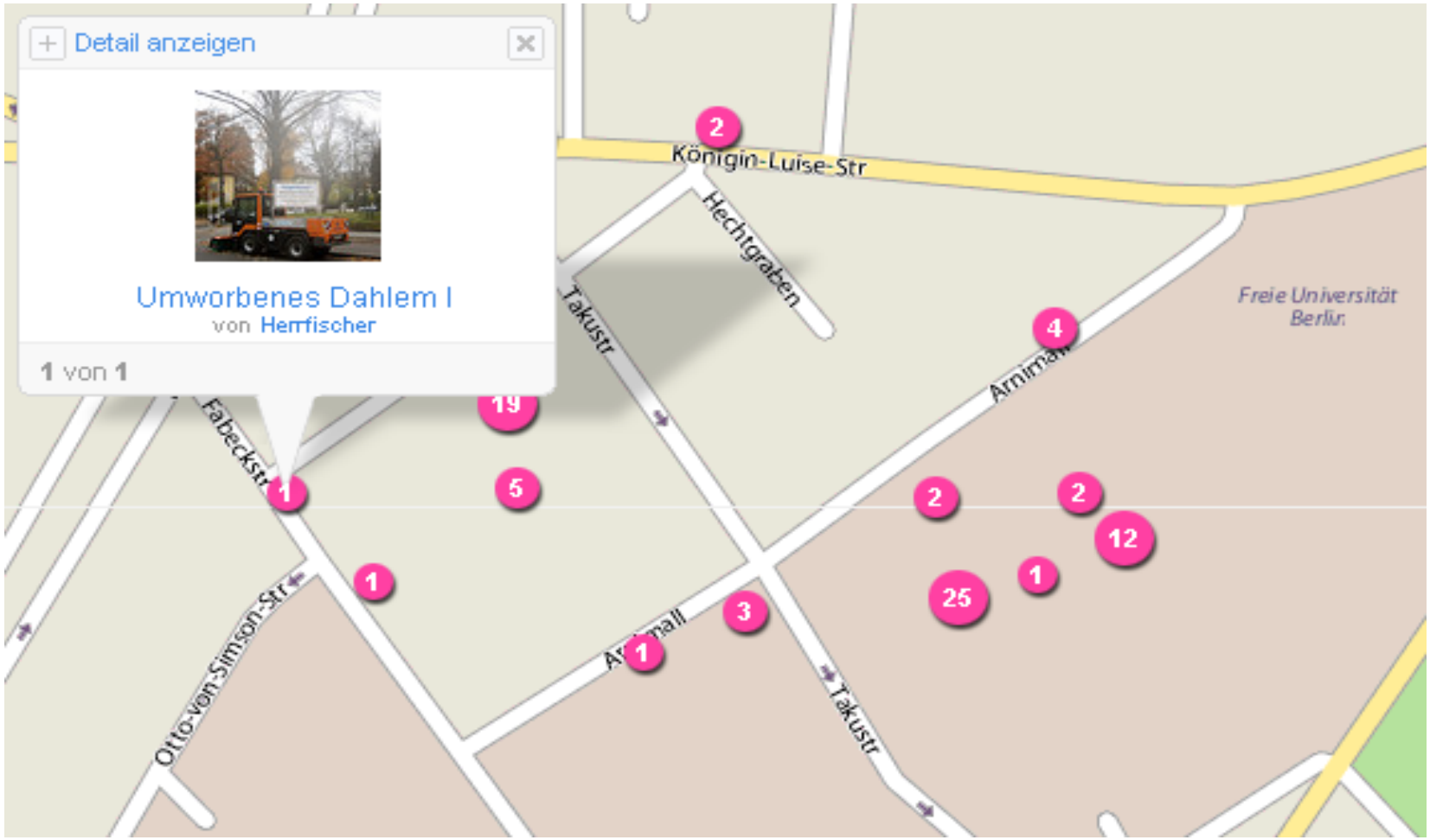
    geo:lat=x  where x is a real numeral specifying latitude

    geo:long=y  where y is a real numeral specifying longitude
  - These two tags should be attached to media with location property, e.g. photos (Flickr) and videos (YouTube)
  - Enable machines to identify media close to a given location

    Flickr, give me photos taken close to Times Square, New York

- Supported by geocoding services
  - Map an address to a latitude/longitude pair

# Metadata: geotagging (2)

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# Website Search

- Search restricted to a certain web site
- Search box generally found on the same web site
- Enables a visitor to a web site quicker location of the information desired

# Website Search: How To

- Create an index of the website
  - Index the text
  - Use markup
  - Use links
  - Use metadata

- Provide search functionality
  - A HTML search box is just the front end
  - The back end searches for the query string in the index
  - Results are collected and returned
    - The website in which the match was found
    - The snippet of the website which is the match
    - Possibly other relevant (meta)data about the result

# Lucene

- A Java-based indexing and search technology developed by the Apache Foundation … http://lucene.apache.org/

- Getting Started
- How Lucene works
  - Text Indexing
  - Querying a Lucene index
- Lucene as web application
- Tasks
  - Customization for the index
  - Customization for the queries

# Getting Started

- Lucene 2.4.0 available from http://www.apache.org/dyn/closer.cgi/lucene/java/
- Requires Java 1.4, Ant 1.6.5 or up
- Set both JAR files on your CLASSPATH

- Test the installation
  - `java org.apache.lucene.demo.IndexFiles {full-path-to-lucene}/src`
  - `java org.apache.lucene.demo.SearchFiles`

# How Lucene works

- Check src/demo for sample code to index and search files


- `IndexFiles` is the main class responsible to create indices.
- `FileDocument` is the indexed object, representing its content as well as creation time and location.
- `SearchFiles` is the main class responsible to search the index and return query results.

# Index the data

- Create a new Lucene index using an `IndexWriter`
- Create a Lucene `Document`
- Add the document to the index
- Optimize and close the `IndexWriter`

- `StandardAnalyzer` is little more than a Java Tokenizer, converting all strings to lowercase and filtering out useless words and characters (e.g. the, s)

  See the *Analyzer.java sources under svn: contrib/analyzers/src/java/org/apache/lucene/analysis

# Querying a Lucene index

- Open a Lucene `IndexSearcher`
- Construct a Lucene query. An analyzer is used to interpret the query text in the same way the documents are interpreted.
- Perform the search
- Display the top Lucene hits

# Lucene query types

- Field query (based on Document field)
  - Title:“This is my website“
- Wildcard query (? – single; * - multiple char wildcard)
  - Test*
- Fuzzy query
  - Roam~
- Proximity query
  - „jakarta apache“~10
- Range query
  - Title:[Aardvark TO Deer]
- Boolean query (AND, NOT, OR, +, -)
  - Apache AND (Jakarta OR Tomcat)
- See docs/queryparsersyntax.html for full information

# Lucene result ranking

- hits = searcher.search(query);
  - org.apache.lucene.search.Hits class, it is a collection which can be iterated over
- hits.score(i);
  - Each hit has a score, it is a value between 0 and 1
- searcher.explain(query,i);
  - Low level explanation of how a document scored for a query e.g.

0.29372874 = (MATCH)
fieldWeight(contents:seoul in 0), product of:
1.7320508 = tf(termFreq(contents:seoul)=3)
1.3566749 = idf(docFreq=6)
0.125 = fieldNorm(field=contents, doc=0)

  - It can be seen that tf/idf measure is used

# Lucene as Web application

- Copy `luceneweb.war` to your Tomcat `webapps` directory
- Create an index from your web site‘s `webapps` subdirectory

```
java org.apache.lucene.demo.IndexHTML -create -
index {index-dir} ..
```

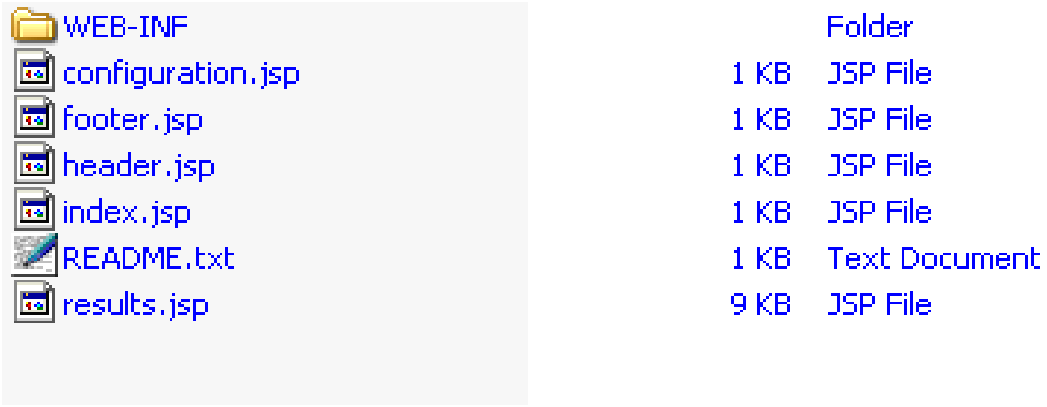
- Edit `configuration.jsp` in `webapps/luceneweb`

```
String indexLocation = "/opt/lucene/index";
```

- You may also wish to update the war file by typing `jar -uf luceneweb.war configuration.jsp` from the `luceneweb` subdirectory.

# Lucene web app structure

- Check src/jsp for the code for the web app

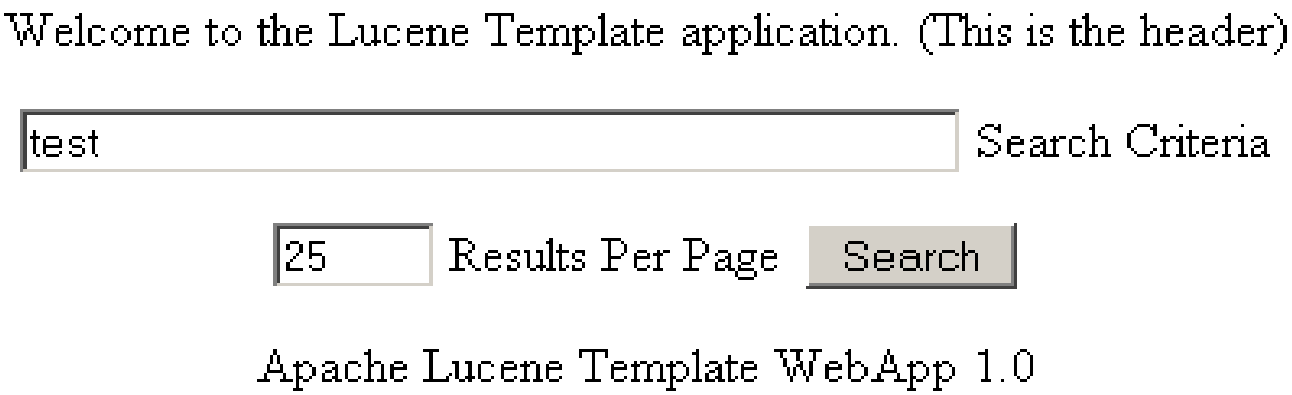



Most of the functionality is in results.jsp

- It constructs an `IndexSearcher` with the indexLocation that was specified in configuration.jsp
- It constructs a query parser only for the document contents
- Results are returned in the collection called `hits`
- An iterator constructs the results table with „known“ fields of the documents such as URL and title

# Lucene website search

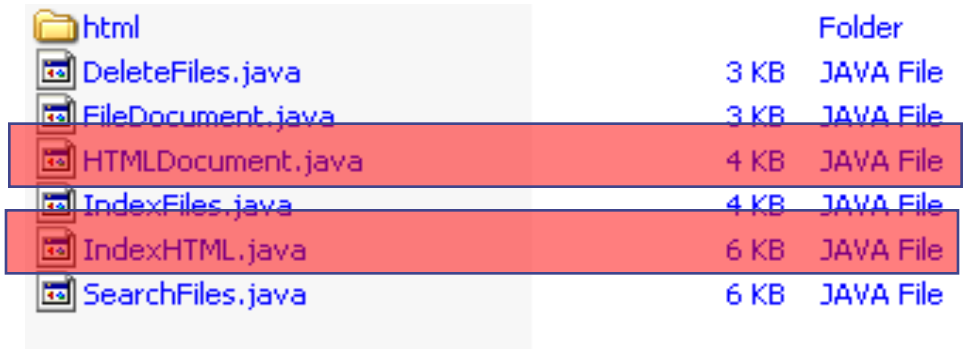
- Browse to the url `http://localhost:8080/luceneweb`




- Try searching for some term in your website!
- Error opening the index? Check `configuration.jsp`

# Customization

- We are going to customize the web application so that we can perform better indexing and search over our web sites.
- For example, compare IndexHTML and IndexFiles, and HTMLDocument and FileDocument
- HTMLDocument contents are delivered by HTMLParser




# Customizing Lucene

- Typically you will adapt some code
  - IndexMyWebsite JAVA file
  - MyWebsiteDocument JAVA file
  - SearchMyWebsite JAVA file

- Adapting Lucene to other document types:
  - XML
  - Images

- Extending Lucene for existing document types (HTML):
  - Use the markup
  - Use metadata

# Adapting to other document types

- As with HTML, you will probably need to code an IndexMyType Java file and a MyTypeDocument Java file
- With XML, you can use an existing XML Parser. As your XML is very small, it doesn‘t really matter if it is DOM or SAX.
- Basic idea:
  - Parser „listens“ for your XML content‘s root element
  - When found, create a Document object with appropriate fields and contents (e.g. the address as one text string, or separate fields for separate values)
  - Add Document to the index

- With Images, you could parse HTML for IMG tags and generate Documents for the index with SRC and ALT values

# Extending Lucene for a document type

- HTML results ranking could make use of the markup and/or metadata
- e.g. give more weight to a match in TITLE than in the document body
- How to do this?
  - No need to change the `IndexSearcher` class
  - Easier to „alter“ the rankings after the results have been fetched
- One possibility: seperate indexes and merge the results
- Another possibility: use a single index, place markup or metadata that weights the result into a Document field, check for text matches and „boost“ the score accordingly

# Übungsblatt 6

- **Lernziele**

  Einfache Lucene-basierte Web Suche

- **Termine**
  - Ausgabe: 16.12.2008 Abgabe bis: 6.1.2009, 16:00 Uhr
  - 2-wöchiges Übungsblatt
  - 2er-Teams

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# Viel Spaß und Erfolg !