Adaptive Navigation Support for Open-Corpus Hypermedia

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Information Access: One Size Fits All?

• Unknown before variety of users
• Yet almost all information access system treat them the same way
  – Virtual stores
  – E-Learning systems
  – Search engines
• Adaptive (Personalized) Information Access systems offer an alternative. They attempt to treat differently users that are different from the system’s point view
What can be taken into account?

- Knowledge about the content and the system
- Short-term and long-term goals
- Interests
- Navigation / action history
- User category, background, profession, language, capabilities
- Platform, bandwidth, context...
Adaptive systems

Classic loop “user modeling - adaptation” in adaptive systems
Adaptive Information Access Systems

- Adaptive Hypermedia Systems
  - adaptive presentation
  - adaptive navigation support
- Adaptive Search Systems
- Adaptive Information Filtering Systems
- Recommender Systems
  - Content-based
  - Collaborative
Adaptive Hypermedia

- Hypermedia systems = Pages + Links
- Adaptive presentation
  - content adaptation
- Adaptive navigation support
  - link adaptation
Adaptive Navigation Support

- Direct guidance
- Hiding, restricting, disabling
- Generation
- Ordering
- Annotation
- Map adaptation
Adaptive Link Annotation
The Value of ANS

• Lower navigation overhead
  – Access the content at the right time
  – Find relevant information faster
• Encourages non-sequential navigation
  – Better use of *true hypertext* links
• Better learning outcomes
  – Achieve the same level of knowledge faster
  – Better results with fixed time
The Problem

- Nearly all popular and efficient adaptive hypermedia technologies were built to operate with a relatively small set of documents that were structured and enhanced by metadata annotations at design time.
Closed and Open Corpus AH

• **Definition 1 (Closed Corpus Adaptive Hypermedia System)**
  - A closed corpus adaptive hypermedia system is an adaptive hypermedia system which operates on a closed corpus of documents, where documents and relationships between the documents are known to the system at design time.

• **Definition 2 (Open Corpus Adaptive Hypermedia System)**
  - An open corpus adaptive hypermedia system is an adaptive hypermedia system which operates on an open corpus of documents, e.g., a set of documents that is not known at design time and, moreover, can constantly change and expand.
The Open Corpus Problem

- Provide adaptation within a set of documents that is not known at design time and, moreover, can constantly change and expand
The Open Corpus Problem in the Web Age
Why it is a problem?

• Adaptive E-learning
  – Adaptive Java Tutorial vs. hundreds of Java books and Web pages

• Adaptive Tourist Guide
  - Guide pages vs. information about the same city from other sources

- Adaptive News System
  - Google News vs. news from other news providers and blogs
The Anatomy of the Open Corpus Problem in AH

- Provide browsing-based access to open corpus (linking)
- Guide the user to the most appropriate content (adaptive navigation support)
- Present the open corpus content adaptively (adaptive presentation)
The Anatomy of the Open Corpus Problem in AH

- Provide browsing-based access to open corpus (linking)
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- Present the open corpus content adaptively (adaptive presentation)
How it is Done in Classic AH

• Classic AH use external models
  – Domain models, pedagogical modes, stereotype hierarchy, etc.

• Users are modeled in relation to these models
  – User is field-independent
  – User knowledge of loops is high
  – User is interested in 19th century architecture styles

• Resources are connected (indexed) with elements of these models (aka knowledge behind pages)
  – This section presents while loop and increment
  – This page is for field-independent learners
  – This church is built in 1876
An External Model
Indexing of Nodes

External (domain) model

Hyperspace

Concept 1

Concept 2

Concept 3

Concept 4

Concept n

Concept m
Indexing of Fragments

Concepts

- Concept 1
- Concept 2
- Concept 3
- Concept 4
- Concept N
- Concept 5

Node

- Fragment 1
- Fragment K
Concept-Level User Model
How to do it for the OC?

- How to build hyperspace?
- Where we can get external models?
- How we can index the hypertext nodes to accumulate “knowledge behind pages”?
- How we can build and maintain user models?
• Adaptive IR systems (IR, from 1980)
  – Use word-level profile of interests and remedial feedback to adapt search and result presentation

• Adaptive hypermedia (HT, ITS, from 1990)
  – Use explicit domain models and manual indexing to deliver a range of adaptation effects to different aspects of user models

• Web recommenders (AI, ML, from 1995)
  – Use explicit and implicit interest indicators, apply clickstream analysis/log mining to recommend best resources for detected use interests
  – Content-based recommenders
  – Collaborative recommenders
Personalized Information Access 2000

Adaptive Hypermedia
- Concept-level domain models
- Concept-level user model
- Manual indexing at design time
- Use many adaptation techniques
- Adapt to many user factors
- Expressive, reliable adaptation

Adaptive IR
- No domain model
- Keyword-level user model
- No manual indexing
- Adapt to user interests
- Use ranked list of links/docs

Web Recommenders

HCI / HT

AI / IR
A Look under the Hood

Types of information access

Navigation

Adaptive Hypermedia

Search

Adaptive IR

Recommendation

Web Recommenders

Metadata-based mechanism

Keyword-based mechanism

Community-based mechanism

Adaptation Mechanisms
Building Open Corpus
Adaptive Hypermedia with:

- Classic metadata-based (concept-based) mechanisms
  - Why not? If indexing can done after the system design time

- Community-based mechanisms
  - Indexing done by users

- Keyword-based mechanisms
  - Classic IR text processing and indexing approaches
Metadata-based OCAH

- Full-blown concept-level manual indexing
  - KBS-Hyperbook, SIGUE
- Simplified concept-level manual indexing: categorization
  - Topic-based adaptation in Quiz-GUIDE
- Automatic concept-level indexing
  - ELDIT, NavEx, concept-based Quiz-GUIDE
- Using metadata-enriched content
  - Standard metadata: Proactive
  - Semantic Web: Personal Reader
KBS-HyperBook: Expandable AH

Integrating new resources by indexing
QuizGuide: Topic-Based AH

Indexing by categorization

Quiz Guide

Question 1

main()
{
    int i = 0;
    if (7 % 2)
        i += 2;
    else
        i++;
}

What is the final value of i

i = ______

Submit
NavEx: Automatic Indexing

Classic “traffic light” prerequisite-based mechanism based on automatic indexing
See more in Sergey Sosnovsky’s Talk

**Question:**

Show all the information contained in table "store".

Enter your answer here.

Table Name: Schema & Sample Data (click +/− to show/hide sample data)

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<thead>
<tr>
<th>actor</th>
<th>actor_id</th>
<th>first_name</th>
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<th>last_update</th>
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<tbody>
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<td>2006-02-15 04:34:33.0</td>
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**Address:**

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<th>address</th>
<th>address2</th>
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<th>city_id</th>
<th>postal_code</th>
<th>phone</th>
<th>last_update</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

**Category:**

<table>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
Proactive: Metadata for ANS

Recommendation and navigation support based on available metadata indexing
Community-based OCAH

- Footprint-based social navigation
  - Footprints, CoWeb, Knowledge Sea II, ASSIST

- Action-based social navigation (annotation, scheduling...)
  - Knowledge Sea II, Conference Navigator

- Direct feedback for navigation support
  - CourseAgent, PittCult

- Tag-based social navigation
  - Any example???
Welcome to the Front Page or our tryout Swiki.

Feel free to experiment here to get a feel for what a Swiki is about. Essentially it's a collaborative space where you can see where other people are going, what's new etc. So it typically feels much more alive than just Web pages. Adding stuff is very easy -- click the Modify button on the top, modify the page (you can use HTML but don't have to) and click Save. That's it!

It's also very simple to create links and new pages. Have a look at the Formatting Rules to find out how.

Please sign our Guestbook

How to get papers accepted

Playground (a good place for experiments...)

In the Beginning (the true story about Windows)

Social Navigation workshop

This Swiki runs at SICS, the Swedish Institute for Computer Science.
Knowledge Sea II
Conference Navigator

Considers user visits, scheduling, annotation
http://strelka.exp.sis.pitt.edu/cn20beta/
CourseAgent

Schedule of spring 2006

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<th>CRN</th>
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<th>Day</th>
<th>Time</th>
<th>Location</th>
<th>Instructor</th>
<th>Workload</th>
<th>Relevance</th>
<th>Action</th>
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<td>8:00-9:45 AM</td>
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<td>10:00-11:50 AM</td>
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<td>Plan It</td>
</tr>
</tbody>
</table>

Difficulty level of the course:
- Low
- Medium
- High

Planned to take (can be registered)
Already taken (can be evaluated)
Degree of relevance to students’ career goal:
- Marginally relevant
- Relevant
- Very Relevant
PittCult
Social networks for contextual recommendation

Most Recent Events

[CINEMA IN THE PARKS] The Spiderwick Chronicles
Date: 2008-07-30 20:00  |  Venue: Schenley Park [map]  |  Kind: Film/Video Arts
Grab a blanket and head out for an unforgettable evening of cinema under the stars. The 2008 "Cinemas in the Park" schedule will include Spider-Man 3, Ocean's T ...

Last Days Cafe Monthly Creative Resource Meet and Chat for Pittsburgh's Creatives
Join us for a monthly gathering of artists and creative professionals, known as "Last Days Cafe This FREE happy hour, casual "salon" is held the last day of every month ( ...}

Annie Get Your Gun
Date: 2008-07-30 20:00  |  Venue: Benedum Center [map]  |  Kind: Opera/Musical
Music and Lyrics by Irving Berlin
Book by Herbert & Dorothy Fields
As revised by Peter Stone
Keyword-based OCAH

• Siskill and Webert
  – Link ordering and annotation
• ML-Tutor
  – Link ordering and generation
• ScentTrails
  – Link annotation
• YourNews/TaskSieve
  – Link ordering and generation
# ScentTrails: Keyword-based Adaptive Link Annotation

## Departmental and Production Copiers

(60 & up Copies per Minute; Volume above 75,000 Copies per Month)

### 5665 Copier:
60 copies/min. Space efficient design, highlight color, versatile and feature rich with extensive sorter finishing options.

### 5065 Copier:
62 copies/min. Zoom R/E, up to 171"x22" originals & 11"x17" copies, feeder, duplex, other high end features.

### 5365 Copier:
62 copies/min. 100 sheet feeder, zoom R/E, up to 171"x22" originals & 11"x17" copies, duplex, other high end features.

### Document Centre 265 Digital Copier:
65 copies/min. Scans your originals only once, and then prints as many copies as you need. Duplex, zoom reduce/enlarge.

### 5385 Copier:
80 copies/min. Up to 171"x22" originals & copies, 100 sheet feeder, highlight color, image editing, many features & options.

### 5680 Copier:
80 copies/min. Space efficient design, 100 sheet feeder, auto insertion of covers & transparency sleeves, collating, stapling.

### 5388 Copier:
92 pages/min. Updated and enhanced design of the popular 1080 copier. Wide range of capabilities and capacities.

### 5892 Copier:
92 pages/min. Compact size, photo mode, background suppression, and 100-sheet universal document feeder. Easy-to-use control panel with message display and color graphics.
YourNews: Open Keyword-Level User Models

Keyword-level user model is visible and editable.
Personalized Information
Access 2008

Adaptation Mechanisms

- Adaptive Hypermedia
- Adaptive IR
- Web Recommenders

- Metadata-based mechanism
- Keyword-based mechanism
- Community-based mechanism

Navigation
Search
Recommendation
Personalized Information Access 200X

- With and without domain models
- Keyword- and concept-based UM
- Use of any AI techniques that fit

- Use many forms of information access
- Use a range of adaptation techniques
- Adapt to more than just interests
ASSIST-ACM

Re-ranking result-list based on search and browsing history information

Augmenting the links based on search and browsing history information

See more in Jill Freyne’s Talk
Adaptive visualization with keyword-level user model and keyword-level adaptation mechanism
Navigation support is separate from the host AH system and provided by external services, which can use any mechanism.
More Information

• Read

• Explore
  – Try our systems at PAWS Community portal: http://www.sis.pitt.edu/~paws
  – Try Conference Navigator 2: http://strelka.exp.sis.pitt.edu/cn20beta/

• Contribute
  – New Review of Hypermedia and Multimedia
  – Special issue on Adaptive Hypermedia
  – Guest editors: Peter Brusilovsky & Paul De Bra