Open-Corpus Adaptive Hypermedia

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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

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)
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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

External (domain) model

Indexing of Nodes

Hyperspace
Indexing of Fragments

Concepts: Concept 1, Concept 2, Concept 3, Concept 4, Concept N

Node: Fragment 1, Fragment K

Concept-Level User Model

Concepts: Concept 1, Concept 2, Concept 3, Concept 4, Concept N

Node: Concept 1, Concept 2, Concept 3, Concept 4, Concept N, Concept 5
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?

Personalized Information Access 2000

• 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

- 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

A Look under the Hood

Types of information access

- 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 be 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
- Community-driven indexing
- 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
NavEx: Automatic Indexing
Classic “traffic light” prerequisite-based mechanism based on automatic indexing

Example 3.3
Click on a green bullet to see the annotation.

Concept-Based QuizGuide

Question:
Based on the tables below, write the required SQL expression.

Task:
Show all the information contained in table "store".
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
CoWeb: Footprint Social NS

Knowledge Sea II
Conference Navigator

Conferences consider user visits, scheduling, annotation.

CourseAgent

CourseAgent is an adaptive online course recommendation system. It helps students choose courses based on their career goals, difficulty levels, and degree of relevance to students’ career goals.
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

ML Tutor: Keyword-based link ordering and generation
ScentTrails: Keyword-based Adaptive Link Annotation

YourNews: Open Keyword-Level User Models
Keyword-level user model is visible and editable
Personalized Information Access 2011

Adaptation Mechanisms

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

Navigation
Adaptive Hypermedia

Search
Adaptive IR

Recommendation
Web Recommenders

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

More Information

• Read

• Explore
  – Try our systems at PAWS Community portal: http://www.sis.pitt.edu/~paws