SEARCH AND RETRIEVAL OF LEARNING OBJECTS

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Overview

- Introduction
- Background
- Design of Learning Object Search Engine
- Future Work

Introduction

- What is Learning Object Search Engine
  - A tool that retrieves learning objects (LOs) indexed by metadata from online LO libraries based on users' queries.

Introduction

- What is a Learning Object (LO)?
  - Provides reusable online instruction and tutorials (e.g. text, image and flash object). Some LOs contain assessment questions to evaluate users' performance.
  - Usually web-based (can be used in learning management system like Blackboard and Moodle).
  - Contains metadata to describe the structure and the characteristics of LO.

Introduction

- What is Digital Library of Learning Object?
  - Online storage of learning objects with tools for search and retrieval.
  - Or indexing of the LO from other storage with tool for search and retrieval.
Introduction

Search Tool in Moodle.org

Background

Searching LO and web page

- Common
  - Indexing, user query, scoring, ranking ...
- Difference
  - Indexing is primarily text-occurrence-based. Reviewing the result can be fast.
  - LO search involves much range retrieval and domain knowledge from education which can explain the meaning of queries. Reviewing LOs take much time and effort (may need to download the LOs and deploy them in Learning Management System).
  - Others: scale, negative educational impact of using improper LOs ...
- General search tool is not suitable for LOs.

Search Tool in the National Science Digital Library

Background

- Common
- Different

<table>
<thead>
<tr>
<th>Common</th>
<th>Different</th>
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<tbody>
<tr>
<td>Indexing</td>
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| Ranking               | Others: scale, negative educational impact of using improper LOs ...

Background

LO Metadata and Its Extension

- Metadata is an xml file with tags (e.g. tags of SCORM) that describe the structure (e.g. what page and image are contained?) and characteristics (e.g. author, difficulty level) of LO.
- New tags can be added as extensions to describe customized attributes (e.g. average score of the users who finish the assessment questions).

Background

Search Form and Metadata Extension

- Many LO search engines only provide simple interface to users. Users can not specify values for different tags in the metadata in details.
- Some LO search engines have complicated interface designed for the variety of metadata and extensions but the LOs provided by third parties do not have the preferred metadata.
Background

User Preference Modeling and Ranking
- User may prefer some LOs to other LOs in the result.
- Preference may not be completely specified in the query.
- Clicking behaviors (e.g., time of click, position of click) contains important information which can be used to model the preference.
- Preferred LOs should be ranked higher in the result.

Introduction

Background

User Preference Modeling and Ranking
- “Crucial” technology which can improve the result greatly.
- Widely used in major search engines for web page.
- Few LO search engine uses it except NSDL.

Design of Learning Object Search Engine

Two problems to be solved:
- Third party LOs may not contain desired metadata.
  - Different standard metadata
  - Same standard metadata with different extensions
- It costs much time and effort for the user to review the results. Reviewing LOs may include downloading the LOs or uploading to user’s own learning management system.

Design of Learning Object Search Engine

How to populate metadata if the metadata of the LO is not designed in the desired way?
- LO hosting
  - LOs developed by third parties can be hosted by the search engine.
  - LOs can be uploaded to the system and deployed to users for a period
  - Collect the usage data, analyze the data and add the result to metadata.
Design of Learning Object Search Engine

- Two search forms for the metadata collected from LO hosting
  - Provide a general search form if users want to handle the extensions as text-occurrence-based search.
  - Provide an advanced search form and allow users to specify the requirement for each tag in the metadata in the query.

Retrieval of LO
- Given the query, the search engine will go over the metadata of all the LOs to see whether the requirements of the query are met.
- All the LOs in the result will be graded and ranked based on the fitness and user’s implicit preference.
  - Fitness of a LO measures how well a LO matches user’s requirements in the query.
  - Grading – computing the fitness for each LO.
  - User’s implicit preference – derived from the clicking and browsing behaviors when a user is reviewing the results.
  - Ranking considers the fitness, the preference from the same user’s previous search and the preference from other similar users.

How to improve the result and reduce the negative impact of reviewing LOs?
- User Preference Modeling
  - When a user clicks and reviews a LO in the result, this interaction will be tracked for modeling the preference in the future.
  - Users are encouraged to rate the LOs as explicit feedback of the review of the result.
  - When the user comes back and searches again, the search engine will be able to predict what this user really wants besides the requirements in the query.

The entire system contains 4 major components.
- Search Form
  - General search form handles text-occurrence-based search.
  - Advanced search form handles the metadata with extensions.
- Learning Object Hosting
- Retrieval of LO
- User Preference Modeling

Future Work
- Compare different algorithms of user preference modeling.
- Design a search form that handles arbitrary metadata coming along with the LOs when they are indexed.
References


Thank you

□ Question?