



Collaborative Open Environment for Project-Centred Learning

European Commission Sixth Framework Project (IST-027073)

Deliverable 3.2 Prototype of knowledge-sharing and recommendation services v1

Based on the requirements analysis in D5.1 and the technical survey in D3.1, we developed the first prototype of knowledge-sharing and recommendation services for the project-centred learning environments. The prototype is composed of 5 main functions packaged in web-services. They include keywords based search, search personalization, object rank, collaborative recommendation and LSA based question answering. In this report, we give an overview of these functions and the access point to an online demonstration.

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<i>Work Package</i>	<i>3</i>
<i>Status</i>	<i>Final</i>
<i>Date</i>	<i>2006-10-31</i>

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Document Control

Title: *Prototype of knowledge-sharing and recommendation services v1*

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Amendment History

Version	Date	Author/Editor	Description/Comments
1.0	31.10.2006	Xuan Zhou, et al.	

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1 Executive Summary

In Deliverable D5.1, we have discovered that the information needs in a virtual project team should be met by providing users an efficient way to locate relevant projects, documents and user profiles. In Deliverable D3.1, we have reviewed the state of the art of knowledge sharing, recommender system and latent semantic analysis. During the last 5 months, we concentrated on devising and developing a set of search and recommendation functions, to provide COOPER users a fast and convenient way to obtain useful knowledge.

This deliverable presents five services of search and recommendation we developed to satisfy the knowledge sharing requirements in COOPER. They include a keyword based search service, a personalized search service, an object ranking service, a collaborative recommendation service and an LSA based question answering services. In Section 2, we summarize the functionalities of these services. In Section 3, we present an online demonstration building upon these services.

2 The Services

This section enumerates the various knowledge sharing and recommendation services and their functionalities. All the functions have been implemented in web-services which are online accessible.

2.1 *Keyword based search*

Input: user query as a number of keywords

Output: relevant documents, projects and user profiles

Different from a web search engine or a desktop search engine, this search function treats projects and user profiles as search targets too. The keywords representing a project are extracted from the project descriptions and deliverables by using IR techniques. The keywords representing a user are extracted from the user's resume and the documents he has created. Moreover, a user is allowed to schema information in his queries. For example, a user can issue "Tereza project:cooper" to search for items relevant to Tereza and project cooper.

2.2 *Recommendation*

Input: user profile

Output: documents, projects and user profiles that could be interested by the user

The recommendation service utilizes the collaborative filtering methods we have reviewed in D3.1. Different from the traditional methods, it extends the user-item relation to user-keyword, document-keyword and project-keyword relations. In this way, it partially overcomes the sparsity problem faced by many recommender systems. Details of the proposed technique can be found in [1].

2.3 *Object Rank*

Input: none

Output: rank the objects in the COOPER repository according to their importance

The object rank algorithm utilizes the link structures within the data to obtain the importance of various data items. We adapted the algorithm to the COOPER directory, so it utilizes the ratings and access frequencies of the knowledge items and the relationships among projects, documents and user profiles to computes the ranking value of each item. These ranking values

can then be incorporated into the search and recommendation services to improve their outcomes.

2.4 Personalized Search

Input: user profile, user query as a number of keywords

Output: relevant documents, projects and user profiles that are most interesting to the user

While the previous search service can find knowledge items that are relevant to a user query, it does not consider the interests of the users. This personalization service complements the search function by shifting the query results to match the user profile. In particular, when a user issue a query, the service will extract relevant keywords from the user's profile and expand the original query with these keywords. In the end, the query becomes less ambiguous and closer to the user's interests. The details of this technique can be found in [2].

2.5 Question Answering using LSA

Input: user question in natural language

Output: A ranked list of documents as answers to user's question

The function of question answering can be summarized to finding the documents or human experts that are highly correlated to the user's question. This is accomplished by latent semantic analysis. We train the LSA machine on the COOPER repository to obtain the main the most important characteristics of the documents, and using these characteristics the machine can later be used to match user's question to the. The detailed LSA methods have been reported in D3.2. In the future, this question answering scheme will be extended to match user profiles too.

3 The Demonstration

We have deployed the knowledge sharing and recommendation services on the knowledge repository of L3S Research Center, which is created by using WebRatio. A demo is available at <http://server3.l3s.uni-hannover.de:9090/L3SIR> . One can follow the subsequent steps to have an overview of all the services.

3.1 Keyword based search

- Click the **search** link on the top right of the login page.
- Type in keywords, e.g. "cooper".
- Choose whether you want to integrate object ranks into the results.
- Select what type of objects you are searching for by press the correct button (user/document/project/all).
- The service will return a ranked list of users/documents/projects or all of them.

3.2 Recommendations

- Go back to the login page.
- Log in as "DanielOlmedilla" with passwords "Olmedilla".
- After logging in, you will see three lists of recommendations of documents, projects and users given based on the user profile of Daniel.

3.3 Personalized Search

- Go to the search interface again.
- After logging in, one can perform personalized search. You can choose “personalized” and follow the previous steps to perform search. For example, if you type in “ontology”, the service will return a lot of documents related to “policy”, which is exactly the personal interest of Daniel.

3.4 Question Answering

- Click the link **LSA** on the top right of the homepage.
- Type in a question, e.g. “I want to know something about semantic web.”
- The QA service will return a ranked list of documents.

4 References

[1] J. Diederich and T. Iofciu, Finding Communities of Practice from User Profiles Based On Folksonomies, in *Proceedings of the 1st International Workshop on Building Technology Enhanced Learning solutions for Communities of Practice (TEL-CoPs'06)*, co-located with the First European Conference on Technology-Enhanced Learning, Crete, Greece, October 2006.

[2] Paul – Alexandru Chirita, Claudiu Firan, Wolfgang Nejdl, Summarizing Local Context to Personalize Global Web Search. In *Proceedings of the 15th ACM International CIKM Conference on Information and Knowledge Management*, Arlington, United States