

Experience-based Recommendation for a Personalised E-learning System

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1 Introduction

A large amount of learning resources is available to learners on the Web. Users of these resources are often discouraged by the time spent in finding and assembling relevant resources to support their learning goals, and these users often face the information overload problem [4]. Personalisation within e-learning would allow the learning abilities and preferences of individual learners to be taken into account, thus enabling such systems to offer relevant resources to learners [7].

The interaction of previous learners with resources and the resulting outcome can be viewed as a learning experience. An experience-based recommendation approach would allow the experiences of similar users to be reused for making recommendations to new users. Currently, some recommender systems in e-commerce can capture the experience of users with items and reuse these to enhance recommendation [2]. However, little work has been done to reuse experiences in the e-learning domain [1, 3]. There is potential to improve the recommendations made within e-learning [5], drawing from the impact that the reuse of user experiences has made within e-commerce. Although recommendation in the e-learning domain is challenging given that the learning resources have to be carefully combined unlike individual products in e-commerce.

A key contribution of this research will be the development of innovative approaches to incorporate the learning experiences of previous learners captured in outcomes such as reviews and ratings, in the recommendations made to new learners. This research will harness the wide range of available e-learning resources in order to cater for learners with different preferences. The knowledge contained in the learning resources will be employed for refining learners' goals and indexing new learning resources. This work will improve the current state of e-learning systems by reusing the experiences of previous learners when recommending relevant learning resources to new learners.

2 Research Questions

This research aims to capture and reuse the learning experiences of previous learners to enhance recommendations made to new learners within a personalised e-learning system? This research seeks to address the following questions:

- How can learners' goals be refined to improve the recommendation of learning resources?
- How can learners' preferences and abilities be captured to enhance personalised recommendations?
- How can learning resources be represented to support effective retrieval?
- How can outcomes such as learners' reviews and ratings, be captured and reused to enhance e-learning recommendation?

3 Research Plan

This research will involve the development of novel approaches for reusing the experiences of previous learners to enhance e-learning recommendation. Techniques to capture learners' preferences and abilities will be developed. Existing learner models will be adapted for this task with the aim of capturing the preferences and the abilities of learners. This information would be used for making relevant recommendations to new learners.

Existing knowledge sources will be organised into a coherent background knowledge structure. Potential knowledge sources such as Microsoft Academic Search, the ACM Computing Classification System, and Wikipedia have already been identified. The plan is to employ these in the development of a background knowledge structure which can be employed for refining learners' goals and for indexing learning resources. This structure will be useful for identifying the links between resources and for recommending relevant resources.

Methods for representing and refining learners' goals will be developed. This is necessary in e-learning because learners often have insufficient knowledge of the domain to formulate suitable goals. The plan is to map the goals to a resource representation developed using shared background knowledge, this will entail reasoning with the text in the goals and the learning resources.

Representations that capture learners' outcomes will be created. Learners' test scores, reviews and ratings can be viewed as outcomes in an e-learning domain. Currently, learners' test scores are the major form of feedback used in e-learning. However, this does not capture learners' opinions which can be effectively employed to inform other learners. The plan is to incorporate user-opinions with user-performance to enhance the recommendation process.

4 Current Progress

The research methodology has been substantially developed. Various approaches for representing learning resources have been investigated, these range from

knowledge-light to knowledge-rich approaches. Some methods of refining learners' goals have also been examined.

Different types of learning resources have been identified to use as data for this work. These include e-books, online teaching slides and video lectures. They have been chosen because they contain structure and metadata that will help with the research, and because of the variety of media types contained.

Preliminary experiments have been carried out to develop a background knowledge structure to use for the refinement of learners' goals and the representation of new learning resources. A collection of 217 e-book chapters from the machine learning domain were collected for the experiments. Terms and phrases were extracted from the Tables-of-contents (TOCs) of the e-books using some NLP techniques and phrase identification methods.

E-books are used as the primary data source in this work because of the structure they contain and because they are designed to be effective for teaching and learning. Furthermore, issues of trust and provenance [6] are catered for because the nature of books means an author and affiliation exists. Wikipedia is used as a complementary data source, because it is a knowledge-rich source put together by many contributors.

Terms and phrases were extracted from the TOCs of e-books and compared with phrases from the Machine Learning category in Wikipedia to generate a set of suitable phrases to use for developing the background knowledge structure. The result was 90 phrases consisting of 17 unigrams, 58 bigrams and 15 trigrams.

Initial output shows the potential to harness the knowledge in e-Books and Wikipedia for developing a background knowledge structure that will enable the refinement of learners' goals and indexing of new learning resources. Further work will involve evaluation of this method, and the development of a system that employs the background structure to recommend relevant learning resources.

References

1. Bobadilla, J., Hernando, A., Arroyo, A.: E-learning experience using recommender systems. In: Proceedings of the 42nd ACM Technical Symposium on Computer Science Education, pp. 477–482. ACM (2011)
2. Dong, R., Schaal, M., O'Mahony, M.P., McCarthy, K., Smyth, B.: Opinionated product recommendation. In: S.J. Delany, S. Ontañón (eds.) Case-Based Reasoning Research and Development, *LNCS*, vol. 7969, pp. 44–58. Springer, Heidelberg (2013)
3. Ghauth, K.I.B., Abdullah, N.A.: Building an e-learning recommender system using vector space model and good learners average rating. In: Ninth IEEE International Conference on Advanced Learning Technologies, pp. 194–196. IEEE (2009)
4. Kantor, P.B., Rokach, L., Ricci, F., Shapira, B.: Recommender systems handbook. Springer (2011)
5. Kolodner, J.L., Cox, M.T., González-Calero, P.A.: Case-based reasoning-inspired approaches to education. *The Knowledge Engineering Review* **20**(3), 299–303 (2005)
6. Leake, D., Whitehead, M.: Case provenance: The value of remembering case sources. In: Case-Based Reasoning Research and Development, pp. 194–208. Springer (2007)
7. Peter, S.E.: The use of tagging to support the authoring of personalisable learning content. Ph.D. thesis, University of Greenwich (2012)