Towards Ranking in Folksonomies for Personalized Recommender Systems in E-Learning

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Abstract. Recommender systems offer the opportunity for users to no longer have to search for resources but rather have these resources offered to them considering their personal needs and contexts. Additional semantics found in a folksonomy can be exploited to enhance the ranking of resources. These semantics have been analyzed in an e-learning scenario: CROKODIL. CROKODIL is a platform which supports the collaborative acquisition and management of learning resources. This paper proposes a conceptual architecture describing how these semantics can be integrated in a personalized recommender system for learning purposes.

1 Introduction

Recent research on personalized recommender systems has shown that the exploitation of semantic information found in folksonomy systems have led to improved recommendations [1]. Recommender systems have been applied to e-learning scenarios to help provide personalized support to learners by suggesting relevant items for learning purposes [6]. This raises the challenge of identifying relevant resources which match the current personal context and needs of the learners. Recommender systems in learning scenarios pose new requirements such as exploring and identifying which attributes represent relevance in a learning context [6]. It is therefore an ongoing challenge to meet the requirements of recommender systems in an e-learning scenario such as CROKODIL[1]. CROKODIL is based on a pedagogical concept which focuses on activities as the central structure to organize learning resources. The platform offers collaborative semantic tagging (thereby creating a folksonomy) as well as social network functionality to support the learning community [3].

Section 3 gives a brief analysis of the semantic information which could be exploited for the context-specific ranking of learning resources in the CROKODIL e-learning scenario. Section 4 describes a preliminary conceptual architecture of a personalized recommender system considering context-specific ranking. This concept will be implemented and evaluated in future work.

[1] http://www.crokodil.de, http://demo.crokodil.de (online as of 12.09.2011)

2 Related Work

A survey of the state-of-the-art on social tagging systems and how they extend the capabilities of recommender systems is given in [7]. Abel [1] shows that it is worth exploiting additional context information which are found in folksonomies to improve ranking strategies. Approaches are introduced which extend FolkRank to a context-sensitive ranking algorithm exploiting the additional semantics relating to groups of resources in GroupMe! [1]. In e-learning, recommender systems exist using context variables such as user attributes and domain specific information to provide personalized recommendations [6]. The concept in this paper proposes to use contextual information in folksonomies to rank learning resources in a personalized recommender system for e-learning.

3 Context Feature Analysis in an E-Learning Scenario

Contextual information in folksonomies can be categorized into four dimensions [1]: the *user context*, the *tag context*, the *resource context* and the *tag assignment context* (when a user attaches a tag to a resource). Considering the e-learning scenario CROKODIL, the available contextual information can be categorized as shown in Table 1. The user context comprises of: *learner groups* working together on a common task or activity, *user roles* such as the tutor role and *friendships* existing between individual learners. In future work, additional social information could be inferred from the learner's social network. When tagging resources in CROKODIL, *tag types* such as genre, topic, location, person and event can be assigned to the tags (a tag without a type is also possible). For example, the tag "Beer" of type "Location" refers to the town in Devon, England and not to the alcoholic beverage "beer", thus providing contextual information to the individual tags as well as to the tag assignments. *Activities* provide contextual information to a resource. In CROKODIL, activities structure which tasks need to be performed to achieve a defined goal. For example, in order to get ready to hold a presentation on German Culture, a learner creates an activity called "Prepare a talk about the Oktoberfest in Germany" having a sub-activity "Describe popular brands of beer in Bavaria". The required knowledge for this presentation

Table 1. Context Dimensions Applied to the CROKODIL Scenario

User Context	Tag Context	Resource Context	Tag Assignment Context
learner groups, user roles, friendships	tag types	activities	tag types, activities

is sought mostly via resources on the Web, such as on blogs or in Wikipedia. The appropriate resources are then attached to the activity. This activity thus provides contextual information to the resources. The tag assignment context comprises of *tag types* and *activities* as these both give additional contextual meaning when tagging.

4 Conceptual Architecture of a Personalized Recommender System for E-Learning

Fig.1 shows the design of a conceptual architecture of a personalized recommender system considering the CROKODIL e-learning scenario. This concept incorporates the ranking of learning resources considering the context features discussed in Section 3. Resources from friends, group members or the tutor could be given a higher weight than other resources. The tag types will have different weights according to the popularity of the tag type [2]. For example, a topic tag "Oktoberfest" is weighted higher than a genre tag "blog". Considering the activity the learner is presently working on, for example, "Prepare a talk about the Oktoberfest in Germany", resources belonging to activities nearer in the hierarchy will be weighted higher than resources belonging to an activity further away [2]. Therefore, resources belonging to its direct sub-activity "Describe popular brands of beer in Bavaria" are weighted higher than resources belonging to other activities further down the hierarchy. The results from the

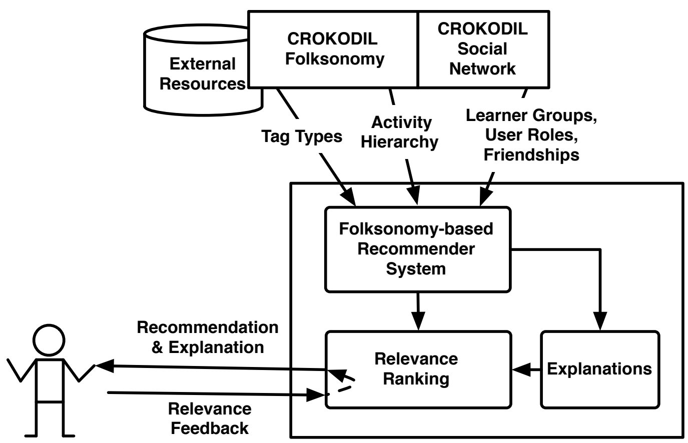

Fig. 1. Conceptual Architecture of a Personalized Recommender System

folksonomy-based recommnender system will be offered to the learner in the form of a ranked list. The learner is given the opportunity to give explicit feedback regarding these recommendations via a simple like/ dislike binary rating. This feedback is integrated into the ranking algorithm by applying Rochio's relevance feedback approach [5]. The feedback is thus used to further adapt and fit the recommendations to the learner's present learning context. In addition, explanations will be made about the recommended item, giving reasons why this item was recommended [4]. This will help to give a better understanding and stimulate the learner to reflect about the recommended learning resources. The learner is then able to give qualified feedback about whether this recommendation is appropriate to the current learning needs or not. Finally, in order to enrich the variety of resources suggested by the recommender system, external learning resources from existing learning repositories such as ARIADNE [8] or the Open University's OpenLearn [2] will be considered.

5 Conclusion

In this paper, a conceptual design of a personalized recommender system for e-learning is described applying context-specific ranking of resources. An approach for a graph-based recommender system using semantic tag types has already been proposed in [2]. Next steps will be to implement these concepts and integrate them in CROKODIL. The impact of the various semantic information sources will be evaluated by considering several variants of the ranking algorithm, thereby showing which context features or combinations thereof are suitable to the CROKODIL learning scenario. Furthermore, investigations will need to be made on how explanations can be generated. In addition, the acceptance of these explanations, relevance feedback and recommendations of external learning resources will be evaluated with learners in a usability study.

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[2] http://openlearn.open.ac.uk (online as of 12.09.2011)