Implicit Feedback-based Estimation of Student's Knowledge

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Nowadays, it is more common, that the learning process is being transferred from adaptive educational systems, where students have possibilities to study available materials in different courses in addition to the possibility of elaborating a variety of exercises and questions and, inter alia, collaborative work together to solve these tasks with their classmates or teachers. It is common for such systems to store information about users (students) - create a so-called user model for the purpose of estimating their interests, knowledge of such content and their future behavior, eventually in pursuance of gathered information to include them to the group of users with similar properties [1]. The user model is created based on a feedback from the user or a group of users. There is an explicit and implicit feedback. We deal with the implicit feedback.

The goal of this work is to propose a method for the implicit feedback-based estimation of student's knowledge, therefore we monitor the student activity during the study of the learning objects. Despite the existing methods for user modelling that evaluate implicit feedback in form of various signals of user activity, which aim to explore its characteristics, there is still a room for improvement. Inaccurate information obtained by the evaluation of the implicit feedback based on the student's behavior, have an impact on the accuracy of user modeling. With the increasing possibilities of monitoring users on the Web, like signals from eye tracking camera, blood pressure, body temperature and pulse sensors, we gain the ability to evaluate implicit feedback with great accuracy, and with that, gain the related interpretation of various signals of activity not only in the domain of education mentioned before.

To determine the level of the user's knowledge related to some concept included in a learning object, we propose to take a closer look at some of the learning object characteristics, more specifically:

- understandability, the readability index (we use ARI and LIX metrics [2])
- concepts connected with the given learning object

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– the average time of all students spent working with a learning object

Various signals of user's activity play an important role in determining the value of the knowledge level. We monitor these signals when users are working with the educational system while we focus mainly on those that help us detect time of active work with the learning object, e.g.: the display time of the learning object, the reading time of the learning object, mouse clicks, scrolling and pressing different keys.

These characteristics of the learning object along with the student's actions go to the input of our method. Subsequently, the method estimates the active time spent working with the learning object, the level of the student's knowledge of the learning object and the level of the student's knowledge of the concept connected to the given learning object.

To estimate the level of a student's knowledge we have to estimate the active time of working with the learning object. We monitor various signals of the student activity while working with the educational system. Therefore it is necessary to evaluate the weight of each signal based on how these signals are related to the active time of the user. Based on these activities we estimate the whole active time of student. We measure the time of performing these activities.

Once we have estimated the active time of working with the learning object, on the basis of similarity of the learning objects in terms of readability, understandability and others metrics mentioned before, we can determine the increase of knowledge for the unread learning objects. If the student reads a given number of learning objects, we can determine, for the unread learning objects, how long will it take on average to read each of them. Our goal is to find the dependence between the time of the active work with the learning object and the student's knowledge which he acquired. We assume that the user acquires the highest value of knowledge in time close to the other times of reading the similar learning objects on the basis of the average time of reading by other students.

Based on these we estimate the level of the student knowledge to the learning object and the level of the student knowledge to the concept contained in the given learning object.

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References

[1] Brusilovsky, P., Millán, E.: User models for adaptive hypermedia and adaptive educational systems. The adaptive web, (2007), vol. 4321, pp. 3-53.

[2] Yilmaz, E., Verma, M.,Craswell, N., Radlinski, F., Bailey, P.: Relevance and Effort: An Analysis of Document Utility. In: *CIKM '14 Proceedings of the 23rd ACM International Conference on Conference on Information and Knowledge Management*, ACM, (2014), pp. 91-100