Applying Cognitive Learner Models for Recommender Systems in Sparse Data Learning Environments

Simone Kopeinik
ISDS, Graz University of Technology
Inffeldgasse 13/5, Graz, Austria
simone.kopeinik@tugraz.at

Abstract

In recent years, various recommendation algorithms have been proposed to support learners in technology-enhanced learning environments. Such algorithms have proven to be quite effective in big-data learning settings (massive open online courses), yet successful applications in other informal and formal learning settings are rare. Common challenges include data sparsity, the lack of sufficiently flexible learner and domain models, and the difficulty of including pedagogical goals into recommendation strategies. Computational models of human cognition and learning are, in principle, well positioned to help meet these challenges, yet the effectiveness of cognitive models in educational recommender systems remains poorly understood to this date. This thesis contributes to this strand of research by investigating i) two cognitive learner models (CbKST and SUSTAIN) for resource recommendations that qualify for sparse user data by following theory-driven top down approaches, and ii) two tag recommendation strategies based on models of human cognition (BLL and MINERVA2) that support the creation of learning content meta-data. The results of four online and offline experiments in different learning contexts indicate that a recommendation approach based on the CbKST, a well-founded structural model of knowledge representation, can improve the users' perceived learning experience in formal learning settings. In informal settings, SUSTAIN, a human category learning model, is shown to succeed in representing dynamic, interest based learning interactions and to improve Collaborative Filtering for resource recommendations. The investigation of the two proposed tag recommender strategies underlined their ability to generate accurate suggestions (BLL) and in collaborative settings, their potential to promote the development of shared vocabulary (MINERVA2). This thesis shows that the application of computational models of human cognition holds promise for the design of recommender mechanisms and, at the same time, for gaining a deeper understanding of interaction dynamics in virtual learning systems.

Supervisor: Univ.-Prof. Dipl-Inf. Dr. Stefanie Lindstaedt

Co-Supervisor: Ass.-Prof. Dipl-Ing. Dr. Elisabeth Lex

Available at: `https://online.tugraz.at/tug_online/wbabs.showThesis?pThesisNr=63039&pOrgNr=37`