

Ways and Means of Employing AI Technology in E-Learning Systems

Dunwei Wen, Fuhua Lin

*School of Computing and Information Systems,
Athabasca University, Athabasca, AB, T9S 3A3, Canada
{dunweiw, oscarl}@athabascau.ca*

Abstract

Employing the state-of-the-art artificial intelligence (AI) technology in current e-learning systems can bring personalized, adaptive, and intelligent services to both students and educators. Although we have seen more and more successful applications of AI in e-learning, most of them have not yet been expanded to or adopted in widely used e-learning systems, especially open-source learning management systems (LMS) such as Moodle, Sakai and so on. This observation takes us to the analysis and discussion of the current work in both LMS and applied AI. The findings include that current intelligent LMS systems are still in their early stage, while AI applications need to handle some problems or to be modified before applying them into the LMS systems, and AI technology also needs to be brought to open source communities.

1. Background

In the past decades, artificial intelligence (AI) has enjoyed a grand success and provided us with a set of general technologies for real-world program solving [1]. AI has been applied in many areas, especially in business, space exploration and military systems. For examples, Deep Blue beating the world's chess champ, commercial systems capable of continuous speech recognition, and robots running around the surface of Mars are among the highlight achievements, which involve many general tools and approaches of AI, such as knowledge representation and reasoning, heuristic search, machine learning, natural language processing, intelligent agents, and ontologies, useful for modeling and solving problems in different kinds of information systems. One of the main focuses of its application has been AI in education [2], the very topic of this paper. We have seen more and more applications of AI in e-learning in recent years. For example, a novel case-based legal reasoning model forms the basis of an

intelligent learning environment [3]; text-mining has been used in an automatic knowledge building, e.g. constructing concept maps for e-learning domain [4]; knowledge modeling and reasoning have been adopted to implement adaptive assessment [5]; intelligent agents, automatic planning and ontology techniques and tools have been contributed a lot to an educational advisory system [6]; and natural language processing and question answering are supporting questions & answers services in a mobile learning environment [7], and so on. Yet more and more AI resources such as knowledge bases and software tools are becoming available, e.g. Cyc (<http://opencyc.org>) and Opennlp (<http://opennlp.sourceforge.net>). Researchers in AI in Education (AIED) community thus have conducted some prospective reviews over this issue [8-9]. Despite of these, however, the applications of AI in education are currently not yet as impressive as that in other fields such as business, space exploration, and military applications as mentioned above. This paper focuses on the technical issue regarding ways of employing AI in e-learning systems, particularly learning management systems (LMS).

2. AI in LMS systems

As standalone intelligent e-learning applications, the examples mentioned above mostly work well. When turning to current LMS, the only way of using e-learning systems for many learners and educators, however, we have found that few AI techniques have been employed in the LMS. We believe that the most convenient and effective way of applying the application of AI into e-learning is to employ AI technology in the LMS, considering the fact that the LMS are widely used in most institutions and have become the de facto standard application platforms in e-learning. To expand AI application to e-learning and benefit both learners and educators, the first thing we need to do is realizing the problems and/or reasons obstructing AI's application in LMS.

3. Problems remaining

One of the obvious reasons obstructing AI application in LMS is that e-learning itself is less mature than similar fields such as e-business and still in his early stages. This can be seen easily when compared to the current systems and services such as well-known Amazon (<http://www.amazon.com>) and CNKI (<http://www.cnki.net>), a digital library system, which provides system-wide enhancements in content processing and personalized features besides the basis functions. Some promising functions, such as adaptive assessment, student profile mining, that AI can help to implement, however, are still under discussion or schedule in LMS community. As we can imagine, AI development and programming for intelligent e-learning applications are more complicated and time consuming than other well-known tasks such as interface and database design, and does need developers with stronger technical background. For example, to effectively develop a machine learning algorithm for supporting an adaptive question answering system for LMS, a range of techniques and algorithms such as Bayesian Networks, Support Vector Machine and Expectation Maximization may need to be understood, examined, and then utilized. Some of the AI techniques need careful efforts to make them work, even if both the theoretical and practical issues are well known. Another fact is that many well written AI programs are still in Prolog or Lisp program language, which are not familiar to other IT communities and needed to be translated into common languages and platforms such as Java and C++. LMS developing teams, which are mostly open source communities, need more preparation in order to provide their LMS systems with well designed AI functions, particularly when some of the plain functions are even remain under schedule at present.

4. Possible ways of employing AI

Based on the above analysis and our previous experience in developing AI applications for e-learning, we propose several possible ways to employ AI technology to existing LMS. First of all, we need to be optimistic about AI by understanding the success of it in other information systems, and to face the need of AI in e-learning for providing adaptive, smart and convenient e-learning services. Second, as we did in AmIReady and eAdvisor systems [5-6], realizing AI algorithms by using optional ordinary computing techniques may reduce the complexity and costs in the

development. For example, we have implemented some reasoning algorithms by SQL instead of Prolog or CLIPS like languages (<http://clipsrules.sourceforge.net>) as usual. Third, we can make use of open source AI libraries and try to integrate them with LMS, instead of developing them from scratch. For examples, our systems [6-7] have been developed based on well-known AI open source projects such as Protégé (<http://protege.stanford.edu>), JADE (<http://jade.tilab.com>), Lucene (<http://lucene.apache.org>) and Opennlp. Last but not least, we need to advance AI knowledge in other IT communities. One thing that we need to keep in mind though is that AI technology is for improving our e-learning systems and assisting the users instead of replacing them.

6. References

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