Development of a Methodology and Software Shell for the Automatic Generation of Intelligent Tutoring Systems from Existing Generic Task-based Expert Systems

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There is a growing demand for a wide array of principled and useful instructional software applications, in both academic and industrial settings. The need for effective tutoring and training is increasingly important in industry and engineering fields, which demand the learning of complex tasks with the use of large knowledge stores. In the last two decades, intelligent tutoring systems (ITSs) were proven to be highly effective as learning aides (Shute and Psotka, 1996), and numerous ITS research and development efforts were initiated. However, few tutoring systems have made the transition to the commercial market thus far. The main reasons for this failure to deliver are that the development of ITSs is difficult, time-consuming, and costly (Murray, 1998). Thus, there is a need for easier, more cost-effective means of developing tutoring systems.

My doctoral research proposes a novel approach to developing an intelligent tutoring system shell that will generate tutoring systems for a wide range of domains. The goal is to develop an ITS authoring environment that interacts with any generic task-based (GT) expert system (Chandrasekaran, 1986), and to produce a tutoring system for the domain knowledge represented in that system. The focus is on the issue of reusability. The knowledge-rich structure of generic tasks can be reused for instructional purposes, allowing the tutoring of domain knowledge embedded within the expert system and of problem solving skills utilized by the expert system. By integrating this reusable knowledge with other reusable ITS components, a powerful authoring environment is created for the generation of tutoring systems for various domains. In effect, such an authoring environment can be linked to any generic task-based expert system, allowing the same tutoring components to be coupled with different knowledge bases.

The proposed solution adopts a task-specific approach to ITS generation, allowing the development of ITSs for a specific class of tasks. There are several benefits to such an approach. First, a task-specific ITS shell is more reusable than domain-specific or individual component approaches, yet is easier to use and more useful than general-purpose approaches. Moreover, the shell can be grounded in a task-specific model of learning. Overall, a task-specific approach offers flexibility and power as an ITS authoring methodology. The AI objectives of my doctoral research include the generation of tutoring systems from GT components, knowledge representation and reuse, reuse of tutoring components, support for rapid prototyping of tutoring systems, and development of an ontology for task-specific tutoring. The education objectives include grounding the ITS shell in a model of learning and using it as an evaluation tool for various learning scenarios.

References

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