

ABSTRACT

SHARED EXPERTISE MODEL

FOR BUILDING INTERACTIVE LEARNING AGENTS

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The research goal of this dissertation is to define, implement and apply the Shared Expertise Model for building interactive learning agents in complex real-world domains. An interactive learning agent is a specialized knowledge-based system that can be taught by a user to assist him, or other users, in various ways.

The theoretical foundation for the Shared Expertise Model is an integration of apprenticeship and multistrategy learning methods, within the Plausible Version Space paradigm. The model allows an expert to teach the agent in much the same way in which the expert would teach a human apprentice – by giving the agent specific examples of tasks and solutions, providing explanations of these solutions, and supervising the agent as it performs new tasks. During such interactions, the expert shares his expertise with the agent, which is continuously extending and improving its knowledge and performance abilities. These kinds of agent capabilities are achieved by a synergistic integration of several learning and knowledge acquisition methods: systematic elicitation of knowledge, empirical inductive learning from examples, learning from explanations, and learning by analogy and experimentation.

To validate the Shared Expertise Model, a software toolkit called DISCIPLINE and a methodology for using it to build learning agents for various domains have been developed. The toolkit and the methodology have been experimentally verified and validated by developing a knowledge base for a personal assistant of a computer workstation configuration specialist, and an assessment agent for users of the Multimedia and Thinking Skills system.

The main contributions of this thesis are: the development of the Shared Expertise Model, the toolkit implementation of the model, and the development of experimental agents for several complex domains. Specific technical contributions are: the

development of a modular architecture of the toolkit, the Knowledge Query Language, the Knowledge Elicitation Tools, and the Learning Tools.

The main claim made by this thesis is that the knowledge acquisition bottleneck can be overcome by teaching the agent, rather than manually encoding its knowledge. This is mainly achieved by the Shared Expertise Model of interaction between the instructor and the agent, and by use of the Plausible Version Space learning paradigm.