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Abstract (partial)

In order for artificial intelligence to become truly useful in real- world applications and environments it is necessary to identify, document, and integrate into automated systems the human knowledge that people use to solve their real-world problems. This process has been found to be difficult, and is a critical part of what has become known as the knowledge acquisition bottleneck. The primary contribution of this dissertation is the development and application of a general methodology for modeling and representing an expert's problem-solving knowledge that supports ontology import and development, teaching-based intelligent agent development, and agent-based problem solving. The methodology provides practical guidance to subject matter experts on how to express the way they solve problems using the task reduction paradigm. It identifies the necessary concepts and features to be represented in the ontology; identifies the tasks to be represented in the agent's knowledge base; guides the rule learning and refinement processes; supports natural language generation of solutions and justifications, and is natural and easy to use. The methodology is applicable to a wide variety of domains and has been successfully used in military planning, course of action critiquing, and strategic center of gravity identification problems. This research is part of a much larger effort with the goal to develop an advanced approach to expert knowledge acquisition based on apprenticeship multi-strategy learning, in a mixed-initiative framework.