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Expanding Task Diversity in Explanation-Based Interactive Task Learning

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ABSTRACT: The possibility of having artificial agents that can interact with humans and learn completely new tasks through instruction and demonstration is an exciting prospect. This is the goal of the emerging research area of Interactive Task Learning. One particular challenge is that the space of possible tasks is extremely large and varied. Developing approaches that cover this space is difficult, made more so by having to learn from a limited, though high-quality, number of instructor-provided examples. In this dissertation, we identify three major dimensions of task complexity and improve the task learning capabilities beyond the state of the art for each dimension. First, we extend the types of innate tasks to include those involving perceptual, communication, and mental operations. Second, we implement a novel goal-graph representation that supports both goal-based and procedural task formulations, as well as tasks that blend both types. Third, we added support for learning subtasks with various modifying clauses, such as temporal constraints, conditions, or looping structures. Crucially, we show that the agent can learn and generalize a canonical version of a task and then combine it with these various modifiers within a task hierarchy without requiring additional instruction. This is done in the context of Rosie -- an agent implemented within the Soar cognitive architecture that can learn completely new tasks in one shot through situated interactive instruction. By leveraging explanation-based generalization and domain knowledge, the agent quickly learns new hierarchical tasks, from scratch, through natural language instruction.

CHAIR: Prof. John Laird