A Case Study Comparing Planning and Learning vs. Hand-coded Knowledge

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Building agents that perform complex, interactive tasks by hand can be extremely time consuming, requiring an iterative process of knowledge acquisition, coding, debugging and verification. As part of the development, the human encodes specific strategies and tactics. To decrease development time and possibly improve the performance of the agent, an alternative is to have the agent develop tactics from the first principles, that is, by exploring possible actions and applying an evaluation function to the resulting situations. If the results of those explorations can be saved in a general form, they can be used in place of hand-coded tactics to control behavior.

In this talk I will presents results of a case study that investigates the tradeoffs between these two approaches. I have built two agents using these approaches that play a complex, interactive competitive tank game. There are limited resources (energy and health), barriers, multiple actions that can be performed in parallel, and limited, cost-sensitive sensing. One of the agents is built by hand, while the other learns tactics by planning using first principles and a user defined evaluation function. Part of the talk will address the challenges that had to be overcome to develop the learning agent:

1. How to encode the task-knowledge so that useful tactics could be learned?
2. How to organize the planning when some actions can be issued at the same time, while others are mutually exclusive?
3. How to evaluate the outcome of planning when the obvious evaluation function (points for hitting and destroying opponents) gives little indication of the worth of most actions?

The remainder of the talk will compare the approaches and address the following questions:

1. How much knowledge is required to create each agent?
2. What is the ratio of task-dependent knowledge vs. task-independent knowledge?
3. What types of knowledge are easier to encode/learn in each agent?
4. How well do the agents play the game?