Abstract: Acquiring Domain-Specific Planners by Example

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Intelligent problem solving requires the ability to select actions autonomously from a specific state to reach objectives. Planning algorithms provide approaches to look ahead and select a complete sequence of actions. Given a domain description consisting of preconditions and effects of the actions the planner can take, an initial state, and a goal, a planning program returns a sequence of actions to transform the initial state into a state in which the goal is statisfied. Classical planning research has addressed this problem in a domain-independent manner—the same algorithm generates a complete plan for any domain specification. This feature comes at a cost which domain-independent planners incur either in high search efforts or in tedious hand-coded domain knowledge.

Previous approaches to efficient general-purpose planning have focused on reducing the search involved in an existing general-purpose planning algorithm. An interesting alternative is to use example plans in a particular domain to demonstrate how to solve problems in that domain and to use that information to solve new problems independently of a domain-independent planner. Others have used example plans for case-based planning, but the retrieval and adaptation mechanisms were still domain-independent and efficiency issues were still a concern.

In my thesis, I propose to introduce algorithms to extract complex, repeating processes, in the form of domain-specific planning programs, from example plans. I will investigate the application of these learned programs to modelling agent preferences and choices. I will also investigate how the programs can be used, extended, and repaired dynamically as an agent encounters new problems and acquires new experience. Finally, I will compare the template-based planning paradigm to existing general-purpose and domain-specific planning programs with a full evaluation on new and existing planning domains. I expect the core contribution of this thesis to be a new planning paradigm in which domain-specific planners are learned by example.