

... knowledge structures from a collection of specified examples. Some of the earliest work in automated knowledge acquisition took this approach, such as Meta-Dendral [Buchanan and Mitchell, 1978] and Induce [Michalski et al., 1983]. These early efforts focused on inducing pattern-action rules for expert systems. Recent research has focused on learning more complex knowledge structures. For instance, Cluster [Stepp and Michalski, 1986] learns classifications of structured objects, and RL [Fu and Buchanan, 1985] learns intermediate concepts, probabilistic domain-level rules, and meta-level rules. There is a growing realization that deleterious interactions between induced rules can significantly reduce problem-solving performance. Two efforts have shown how performance can be improved by deletion of part of the rule set [Michalski et al., 1986, Wilkins et al., 1986].

III. Explanation-Based Learning

Explanation-based learning can be used to improve a knowledge-based system; learning is achieved during the process of constructing explanations of examples [DeJong and Mooney, 1986, Mitchell et al., 1986].

It is now widely recognized that the space of expert systems decomposes into a number of generic problem classes, such as diagnosis, design, prediction, and planning [Hayes-Roth et al., 1983]. Construction of an expert system by the use of a shell for the generic problem class has significant consequences for knowledge acquisition. The knowledge of how to do problem solving for a generic class can be manually encoded, and then only the factual domain-specific knowledge needs to be automatically learned. The Odysseus apprentice learning system provides one example of this approach. Odysseus improves an expert system that is implemented using the Heracles expert system shell [Clancey and Bock, 1986], which solves problems using the heuristic classification method. The advantage of a shell derives largely from separation of the declarative knowledge of the application domain from the strategic and procedural knowledge of how problems are to be solved using this knowledge. This procedural knowledge is concentrated in the generic shell.

