

# Automating Expertise - The ACE Project

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## The Adaptive Constraint Engine - ACE

- Experts are usually needed to identify methods to solve constraint satisfaction problems (CSPs) - this creates a bottle neck in the solving process. ACE learns the best approach for a class of problems, thus enabling a user with little expertise to solve CSPs.
- ACE learns heuristics to guide the search process. Heuristics are reasoning techniques that are not "100% correct" but in general work well.
- ACE aims to learn a combination of heuristics which work best for a particular class of problems and can be reused to solve similar problems in the future.

## Transatlantic Collaboration

- The ACE project is being done in conjunction with Prof. Susan Epstein in Hunter College, New York (CUNY), who is an expert in the area of cognitive science and machine learning.
- Her FORR (For the Right Reasons) architecture has been successfully used for maze solving and game playing and is now used with ACE for CSP solving.
- Prof Epstein's ACE work is funded by the NSF.
- She has four students working on the ACE project in her lab in Hunter College.

## Digression Based Weight Learning - DWL

- ACE learns from "mistakes", i.e. it learns not only the good choices during search but also learns from the bad choices, so as not to repeat them.
- ACE rewards heuristics that contributed to the choices on the solution path based on the size of the contribution they made to individual decisions and based on the quality of solution.
- ACE penalizes heuristics based on the size of the digression that came from a choice that they contributed to.

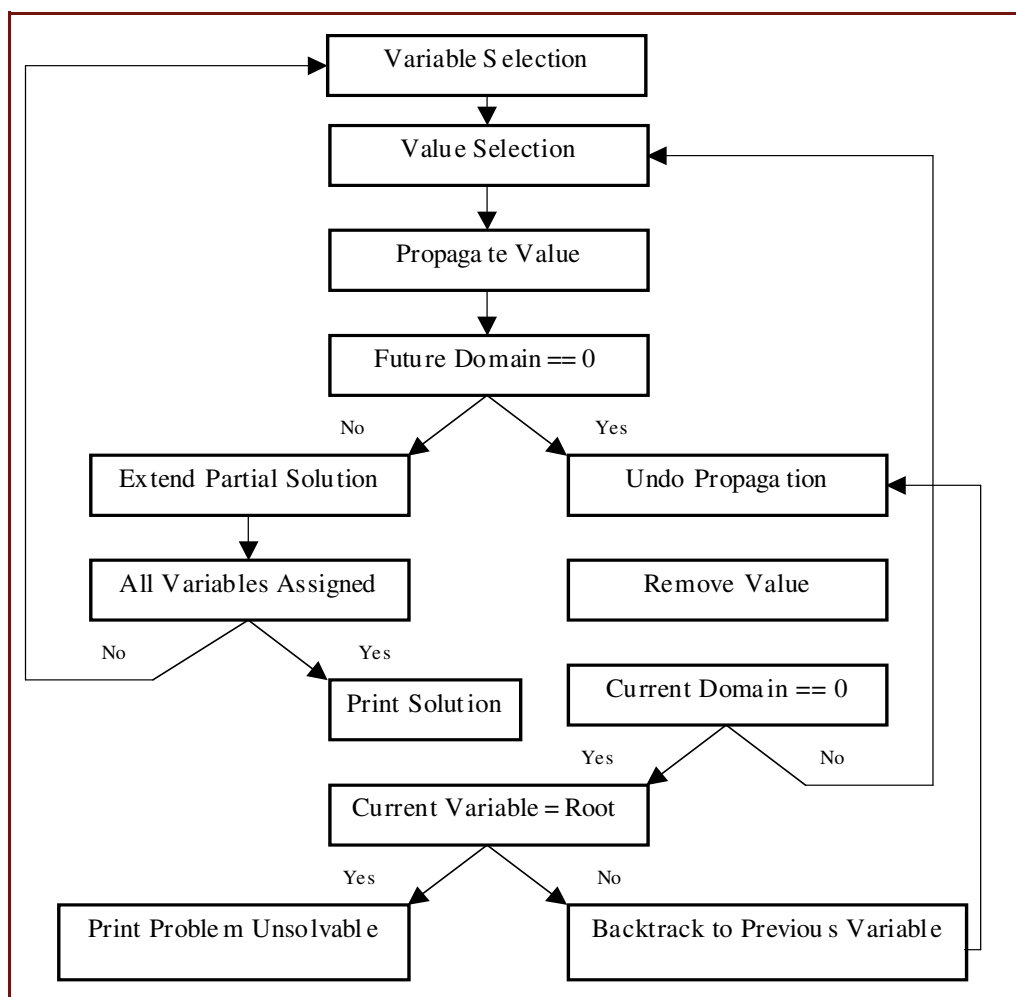


Fig. 1 The Search Process

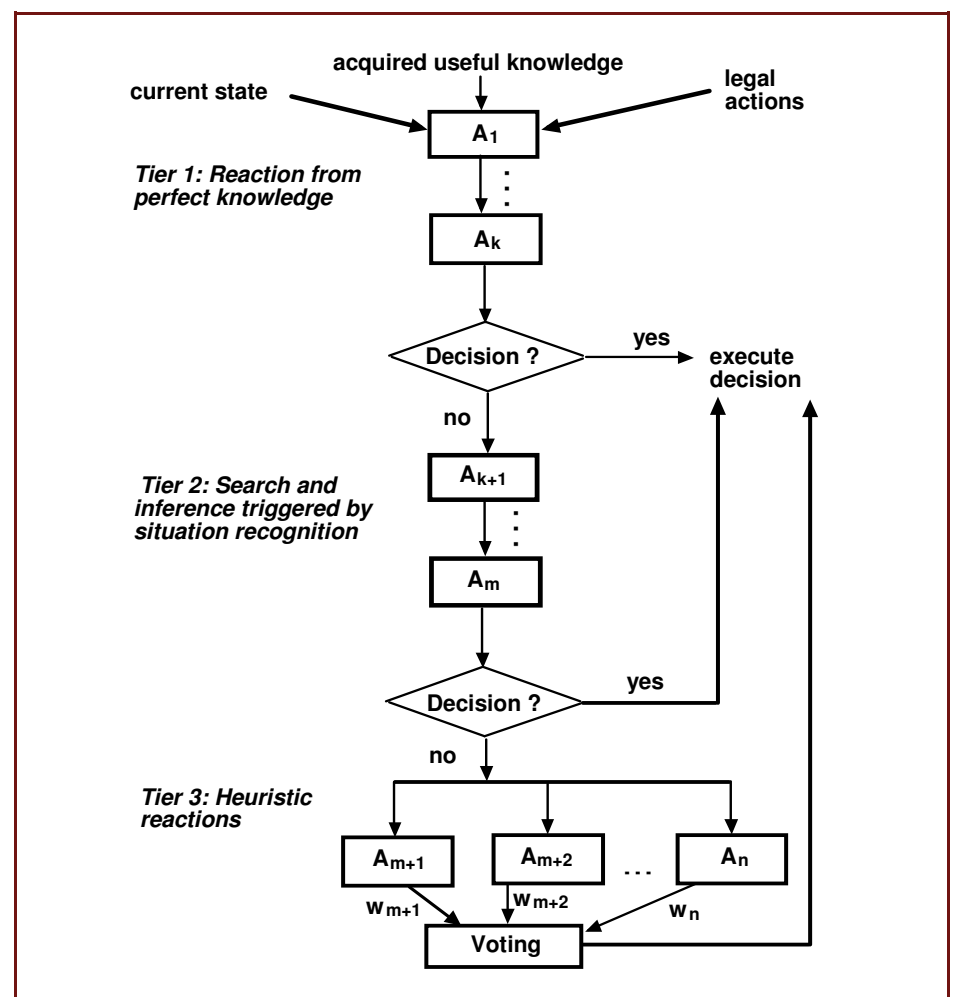


Fig. 2 Advisor Architecture

Graphs of ACE running against the best known heuristic, Min Domain/Degree (MDD), over various sets of problems.

