Abstract

General problem-solving in the real world requires high level of adaptability across multiple problem environments such that a problem solver should be able to solve problems in varied environments. A problem is usually solved by searching through a solution space. The search space should be of manageable size relative to the search speed and storage capacity in order to find a solution in a realistic time. However, for a majority of the real-world problems, the situation is barely the expected one. A brute force search would easily get lost in the combinatorial explosion of the search space. Thus, some sort of intelligence is required to dampen the search space and perform a focused search. Humans are good at adapting across different problem environments and consequently are effective general problem solvers. This is not quite true for artificial agents. Most of the research on artificial intelligent agents is mostly focused on domain-specific problems and achieving adaptability across environments is still a challenging task. Few pieces of research focused on designing general problem-solving agents based on strong theoretical groundings. Yet, creating a practically feasible agent which can sense and act optimally in varied environments under resource constraints of time and space is still far from trivial. Thus, we focused on designing a practically feasible general problem-solving agent. We took an integrative approach where multiple components can be integrated synergistically to build a problem solver. The solutions are represented as programs in a proposed programming model. The problem-solving agent searches through program space using generate and test approach to find solutions in varied problem environments. Solution programs can integrate multiple disparate components including sensors and actuators to interact optimally in a heterogenous problem environment. The search space is dampened using policy gradient-based incremental learning, equivalent program pruning, and genetic programming. We experimented with our designed agent in multiple problem environments and the results reinforced our claims. Comparison with the current state-of-the-art methods revealed the excellent performance of our developed agent. Last but not least we proposed a formal structure of a seed AI that has the capability to evolve into a general AI system.