Juliana Yurie de Heer
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Research Review

Amongst the greatest developments in the field of AI planning and search is the creation of Shakey, the world's first mobile automaton. Developed between 1966 and 1972 at Stanford Research Institute (now SRI international), Shakey introduced breakthroughs in software architecture and algorithms, earning the first IEEE milestone in the fields of robotics and AI. In terms of software architecture, Shakey was the first robot to use a layered architecture, which allowed it to develop general purpose skills. "Endowed with a limited ability to perceive and model its environment, Shakey could perform tasks that required planning, route-finding, and the rearranging of simple objects."(Nilsson 1) Shakey combined everything available in AI at the time into a single, moving, robot. In other words, Shakey combined the automation of locomotion, perception (eg computer vision), and problem solving, demonstrating the potential of AI to the world and generating an enormous amount of interest in this type of research. In addition, many of Shakey's components were in and of itself huge breakthroughs that are still useful today, such as the STRIPS language and planner, and the A* search algorithm. Shakey's direct successors contributed to the development of fuzzy logic and goal oriented behavior (Flakey), as well as to swarm robotics and the collaborative mapping of complex areas (Centibots). The influence of Shakey's contributions can be seen today in the development of natural based language interactions (eg, Siri, Alexa, Google, etc), self driving cars, Google Maps and other mapping apps that use A* search, and even in Mars exploration rovers, for which the navigation techniques were first developed for Shakey (SRI International).

Another important development was the creation of GRAPHPLAN, a general purpose automated planner that processes problems in STRIPS-like domains by constructing and analyzing a Planning Graph. The Planning Graph is a compact structure that reduces the amount of search needed by propagating constraints as the graph is iteratively being built. The graph is composed by alternating levels containing atomic facts and actions that are connected through edges representing preconditions or effects. The importance of GRAPHPLAN lies in the fact that it can be used to address a wide range of problems, including those in the NP-hard domain.

Finally, a more recent event was the development of general-purpose computing on graphics processing units (GPGPU), which, although it wasn't developed within AI search and planning specifically, has revolutionized the field by drastically expanding the limits on massively parallel computation. For instance, researchers in Tsinghua University, China, demonstrated how a "GPU-based A* algorithm can achieve a significant speedup by up to 45x on large scale search problems" (Zhou 1). In particular, the popularization of NVIDIA GPUs is associated with its success in The Google Brain project and many other breakthroughs in AI, in special within Deep Learning (there are quite a few articles about this, including "A $2 Billion Chip to Accelerate Artificial Intelligence," "The Three Breakthroughs That Have Finally Unleashed AI on the World," and "Accelerating AI with GPUs: A New Computing Model").

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