# Research Review on AI Planning & Search

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## Introduction

The field of Artificial Intelligence (AI) has a long history back in 1956 at Dartmouth Summer Research Project on Artificial Intelligence. Search and Planning is always one of the key areas in AI which deals with goal-directed behavior to win or accomplish specific goals.

## Non-directional Search – BFS, DFS, etc

Early age search were focusing on non-directional search which the context doesn't matter towards the algorithm. For example, BFS is checking out layer by layer while DFS prioritize to check out the depth in one path. The domain knowledge won't help much on speeding up the search efficiency. The most breakthrough algorithm for non-directional search is iterative deepening depth-first search which restricts algorithm to get the best move out from limited time

## Heuristic Search – directional based on scoring

With heuristic search, we can build efficient approach for finding solutions in large, combinatorial spaces. However, it highly depends on the heuristic function (which is also called as expert systems). The disadvantage is requiring tailored knowledge for specialized domains and it won't be transferrable across different problems. A* search is one of the most classic algorithm which is widely used to solve problems like Sokoban [2]

## Deep Learning on heuristic function

To cope with the disadvantage of heuristic function, researchers tries to merge the machine learning technique into the heuristic. One of the example is AlphaGo by Google[3]. Basically it is using search also but the difficulties is on the enormous search space (branching factor≈250, depth≈150) which makes exhaustic search infeasible so need to restrict the effective search space to a great extent. However, simply heuristic won't help given the value of each move is really subjective towards everyone while it cannot win over the best player if it relies on human expertise only. So it uses supervised learning to enhance the value function with deep convolution network to aid non-linear combination of input features

1. *Korf, Richard (1985). "Depth-first Iterative-Deepening: An Optimal Admissible Tree Search". Artificial Intelligence. 27: 97–109.* doi:10.1016/0004-3702(85)90084-0.
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