جامـــــعة المـــــستـقبـل
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المحاضرة الأولى

المادة: Heuristic Search
المرحلة: الثانية
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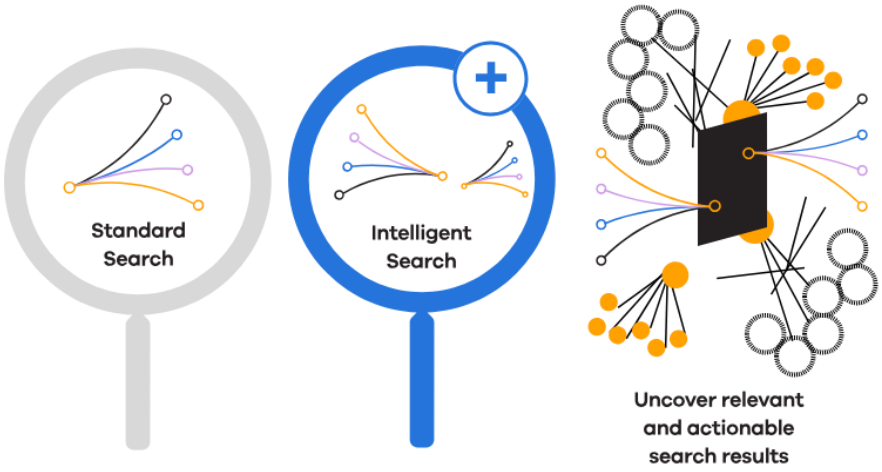
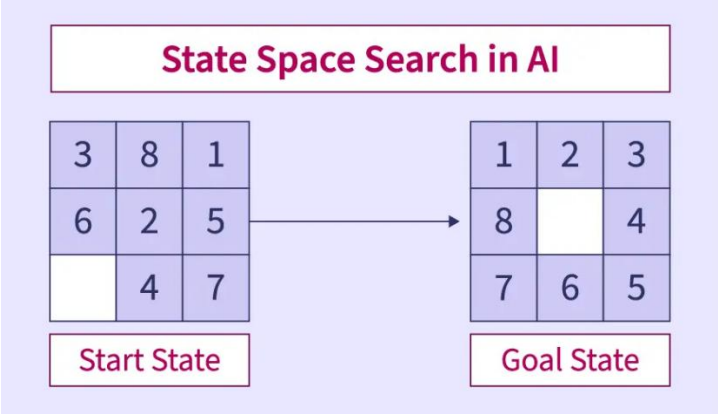
1- Intelligent Search Methods and Strategies

Search is inherent to the problem and methods of artificial intelligence (AI). This is because AI problems are intrinsically complex. Efforts to solve problems with computers which human can routinely innate cognitive abilities, pattern recognition, perception and experience, invariably must turn to considerations of search. All search methods essentially fall into one of two categories, exhaustive (blind) methods and heuristic or informed methods.



2 - State Space Search

Concept Overview: The state space search is a collection of several states with appropriate connections (links) between them. Any problem can be represented as such space search to be solved by applying some rules with technical strategy according to suitable intelligent search algorithm.



Formal Problem Description Requirements

What we have just said, in order to provide a formal description of a problem, we must do the following:

1- Defining the State Space

Define a state space that contains all the possible configurations of the relevant objects (and perhaps some impossible ones). It is, of course, possible to define this space without explicitly enumerating all of the states it contains.

2- Identifying Initial States

Specify one or more states within that space that describe possible situations from which the problem-solving process may start. These states are called the initial states.

3- Identifying Goal States

Specify one or more states that would be acceptable as solutions to the problem. These states are called goal states.

4- Defining Rules and Operators

Specify a set of rules that describe the available actions (operators).

This requires careful consideration of the following issues:

• What unstated assumptions exist in the informal problem description?

• How general should the rules be?

• How much of the problem-solving work should be precomputed and represented in the rules?

Problem Solving Through Search

The problem can then be solved by using rules, in combination with an appropriate control strategy, to move through the problem space until a path from an initial state to a goal state is found. Thus, the process of search is fundamental to the problem-solving process.

Role of Search Versus Direct Methods

The fact that search provides the basis for the process of problem solving does not, however, mean that other, more direct approaches cannot also be exploited. Whenever possible, they can be included as steps in the search by encoding them rules.

Search as a General Mechanism

Of course, for complex problems, more sophisticated computations will be needed. Search is a general mechanism that can be used when no more direct methods is known. At the same time, it provides the framework into which more direct methods for solving subparts of a problem can be embedded.

Analyzing Search Algorithm Behavior

To design and implement effective search algorithms, the programmer must be able to analyze and predict their behavior. Key questions include:

• Is the problem solver guaranteed to find a solution?

• Will the algorithm always terminate, or can it enter an infinite loop?

• If a solution is found, is it guaranteed to be optimal?

• What is the time complexity of the search process?

• What is the memory (space) usage?

• How can search complexity be reduced effectively?

• How can an interpreter best utilize a representation language?

Structuring Search to Answer Key Questions

To address these questions effectively, search can be structured into three main parts.

Foundations of Search and Induction

A first part presents a set of definitions and concepts that lay the foundations for the search procedure into which induction is mapped.

Alternative Approaches to Induction as Search

The second part presents an alternative approaches that have been taken to induction as a search procedure and finally the third part present the version space as a general methodology to implement induction as a search procedure.

Guaranteeing Optimal Solutions

If the search procedure contains the principles of the above three requirement parts, then the search algorithm can give a guarantee to get an optimal solution for the current problem.