Heuristics in AI

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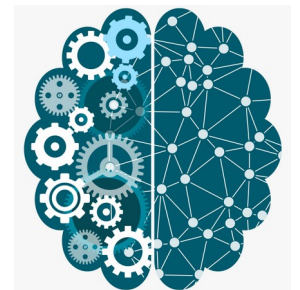http://tusharkute.com

What is Heuristic?

- A heuristic is a technique that is used to solve a problem faster than the classic methods.

- These techniques are used to find the approximate solution of a problem when classical methods do not.

- Heuristics are said to be the problem-solving techniques that result in practical and quick solutions.

What is Heuristic?

- Heuristics are strategies that are derived from past experience with similar problems.

- Heuristics use practical methods and shortcuts used to produce the solutions that may or may not be optimal, but those solutions are sufficient in a given limited timeframe.

History

- Psychologists Daniel Kahneman and Amos Tversky have developed the study of Heuristics in human decision-making in the 1970s and 1980s.

- However, this concept was first introduced by the Nobel Laureate Herbert A. Simon, whose primary object of research was problem-solving.

Why do we need heuristics?

- Heuristics are used in situations in which there is the requirement of a short-term solution.

- On facing complex situations with limited resources and time, Heuristics can help the companies to make quick decisions by shortcuts and approximated calculations.

- Most of the heuristic methods involve mental shortcuts to make decisions on past experiences.

Why do we need heuristics?

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- The heuristic method might not always provide us the finest solution, but it is assured that it helps us find a good solution in a reasonable time.

- Based on context, there can be different heuristic methods that correlate with the problem's scope. The most common heuristic methods are - trial and error, guesswork, the process of elimination, historical data analysis.

- These methods involve simply available information that is not particular to the problem but is most appropriate. They can include representative, affect, and availability heuristics.

Heuristic Search Methods

Heuristic Search in Artificial Intelligence

- Hill Climbing
- Constraint Satisfaction Problems
- Simulated Annealing
- Best-First Search (BFS)

Categories

- We can perform the Heuristic techniques into two categories:

    – Direct Heuristic Search techniques in AI

    – Weak Heuristic Search techniques in AI

Direct Heuristic Search techniques in AI
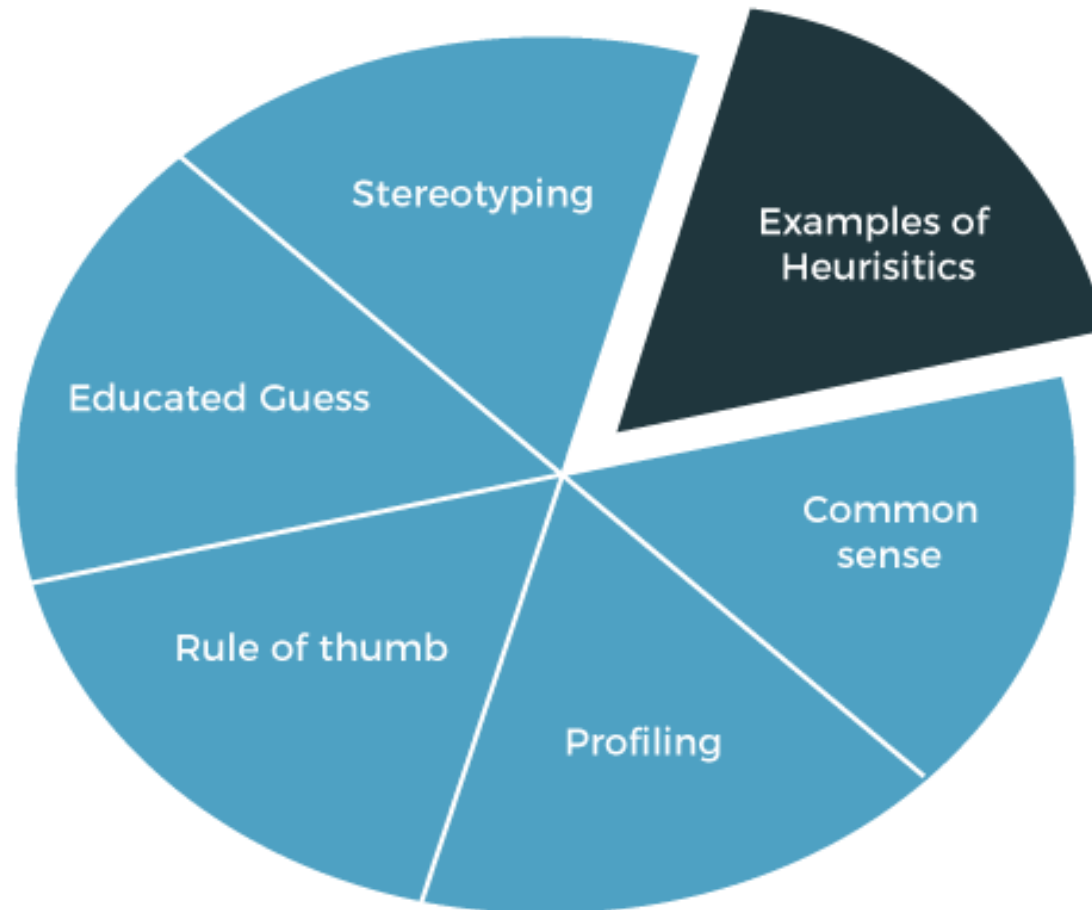
- It includes Blind Search, Uninformed Search, and Blind control strategy.

- These search techniques are not always possible as they require much memory and time.

- These techniques search the complete space for a solution and use the arbitrary ordering of operations.

- The examples of Direct Heuristic search techniques include Breadth-First Search (BFS) and Depth First Search (DFS).

Weak Heuristic Search techniques in AI

- It includes Informed Search, Heuristic Search, and Heuristic control strategy.

- These techniques are helpful when they are applied properly to the right types of tasks.

- They usually require domain-specific information.

- The examples of Weak Heuristic search techniques include Best First Search (BFS) and A*.

Examples of heuristics in everyday life

Examples of heuristics in everyday life

- Some of the real-life examples of heuristics that people use as a way to solve a problem:

- Common sense: It is a heuristic that is used to solve a problem based on the observation of an individual.

- Rule of thumb: In heuristics, we also use a term rule of thumb. This heuristic allows an individual to make an approximation without doing an exhaustive search.

- Working backward: It lets an individual solve a problem by assuming that the problem is already being solved by them and working backward in their minds to see how much a solution has been reached.

- Availability heuristic: It allows a person to judge a situation based on the examples of similar situations that come to mind.

- Familiarity heuristic: It allows a person to approach a problem on the fact that an individual is familiar with the same situation, so one should act similarly as he/she acted in the same situation before.

- Educated guess: It allows a person to reach a conclusion without doing an exhaustive search. Using it, a person considers what they have observed in the past and applies that history to the situation where there is not any definite answer has decided yet.

Types of Heuristics

- There are various types of heuristics, including the availability heuristic, affect heuristic and representative heuristic.

- Each heuristic type plays a role in decision-making.

- Let's discuss about the Availability heuristic, affect heuristic, and Representative heuristic.

Availability heuristic

- Availability heuristic is said to be the judgment that people make regarding the likelihood of an event based on information that quickly comes into mind.

- On making decisions, people typically rely on the past knowledge or experience of an event.

- It allows a person to judge a situation based on the examples of similar situations that come to mind.

Representative heuristic

- It occurs when we evaluate an event's probability on the basis of its similarity with another event.

- Example: We can understand the representative heuristic by the example of product packaging, as consumers tend to associate the products quality with the external packaging of a product. If a company packages its products that remind you of a high quality and well-known product, then consumers will relate that product as having the same quality as the branded product.

- So, instead of evaluating the product based on its quality, customers correlate the products quality based on the similarity in packaging.

Affect heuristic

- It is based on the negative and positive feelings that are linked with a certain stimulus.

- It includes quick feelings that are based on past beliefs.

- Its theory is one's emotional response to a stimulus that can affect the decisions taken by an individual.

- When people take a little time to evaluate a situation carefully, they might base their decisions based on their emotional response.

- Along with the benefits, heuristic also has some limitations.
  - Although heuristics speed up our decision-making process and also help us to solve problems, they can also introduce errors just because something has worked accurately in the past, so it does not mean that it will work again.
  - It will hard to find alternative solutions or ideas if we always rely on the existing solutions or heuristics.

Thank you

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