

## Artificial Intelligence

AI- seeks to understand intelligence, but also strives to build intelligence.

There are four approaches that are divided into thought processes/reasoning vs. Behavior and human vs rational performance/behavior- 1. Human-like thought processes 2. Human like behavior 3. Rational thought processes 4. Rational behavior.

The Turing test is a test which provides an operational definition of artificial intelligence. If a person interacts with a computer and the person cannot tell that it's a computer and not another person, then the computer passes the test. Contact between interrogator and computer is not necessary because physical stimulation is not necessary to have intelligence.

For a computer to have certain qualities to pass the test-

1. Natural Language Processing- being able to clearly understand and communicate in a human language. Natural/human language is not always precise and can have many variations and ambiguity.
2. Knowledge Representation- Ability to keep/store information provided during/before the conversation. Also knowing how this information/knowledge can be represented in words?\*Does this include organizing information?
3. Automated reasoning- using the information that is gathered to make conclusions and ask questions- knowing
4. Machine learning- ability to detect patterns/ use info to make predictions and adapt to different situations.

A more complete version of the Turing Test also tests the computers ability to perceive and its physical ability. To pass this part of the test a computer needs,

1. Computer vision- acquiring, processing, and understanding images/objects
2. Robotics- physical control/movement

### Different approaches-

Cognitive Modeling Approach- (human/thinking)explores cognitive science/human cognition for theories on how the human mind works. Once there is a theory that is precise enough it is possible to express that theory through a computer program. In turn, if this program acts in a way that matches human behavior, it supports the theory that those mechanisms (or at least part of them) are present in humans. This approach is concerned with solving things/behaving like a human being would, even if it means not doing things in the most effective/fast/correct manner.

The Laws of Thought Approach- (rational thinking)- this approach uses formal logic to find solutions to problems. Emphasis is made on making correct inferences using a logical approach. This approach faces some problems because knowledge/information

is not always formal and without detailed instruction/guidance too much information can exhaust the computer's resources.

The Rational Agent Approach (acting rationally)- to act rationally means to act in a way to achieve goals, given one's beliefs. This approach uses aspects of the laws of thought because making logical inferences sometimes is part of acting rationally. However, there is some types of behavior/thinking that do not involve logical thought. This approach includes the ability to take in knowledge and represent it and use that knowledge to make decisions in different situations.

An agent is something that perceives through sensors and acts upon the environment through effectors. For example, a human being senses the environment through the eyes/ears/etc (sensors) and interacts with the environment through hands, legs, fingers, etc (effectors).

A rational agent is an agent that does the "right thing". The book defines the right thing as choosing the action that will lead the agent to be the most successful. To know whether an agent is successful, we use criteria called performance measure. Observers establish an objective standard of what it means to be successful and use it to measure the performance of agents. When to measure performance is also important. If you measure only at a certain time, some agents might receive higher scores than others even if they weren't the best in the long run. For this reason it is important to measure performance many times over a period of time.

There is a difference between being rational and being omniscience. Rationality is about acting according to expectations given by what has been perceived. An omniscience agent would always know the actual income of its actions. We cannot blame an agent for not knowing something that it is incapable of knowing. What is considered the rational thing to do depends on 1. The performance level that is defined as success 2. What the agent has perceived so far- perceptual history is called percept sequence 3. What the agent already knows about the environment 4. What the agent is able to physically do.

An ideal rational agent will do whatever action is expected/necessary to maximize success based on its perceptual history and whatever build in knowledge the agent already has.

We can describe an agent by making a table of the actions it takes in response to every possible sequence. -- this type of list is called mapping from percept sequences to actions. Ideal mappings describe ideal agents.

Another important aspect of rational agents is autonomy. Autonomy is the ability to not only use built in knowledge, but use perceived/learned knowledge to make decisions. Initial knowledge/built in knowledge provides a base from which the agent can develop/adapt to new info.

A type of goal-based agent called problem-solving agent can formulate appropriate responses to problems by finding sequences. Agents might have many different goals, but a problem-solving agent must know which goal to prioritize according to each situation and timing- this is called goal formulation. After goal formulation, an agent must decide what types of actions/responses to consider- this is called problem formulation. When an agent has information in its memory, it can use that information to plot out/ consider different possible sequences and choose the most successful one. Search algorithms takes problems as inputs and returns solutions in the form of action sequences. After a solution is found, the execution phase begins, in which the actions recommended can be carried out. The process can be summarized as "formulate-search-execute"