
Assignment -06

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1 Agents and Environments

An agent is anything that can be viewed as perceiving its environment through sensors and Sensors acting upon that environment through actuators. Just like human has eyes and ears to see, a robot might have cameras to see and motors to move. In the same way a computer program acts by displaying information or generating sounds. What an agent senses is percepts and the complete history of everything that is sensed till now is called percept sequence. Agent function gives us an idea about what it has sensed till now. The idea of an agent is illustrated by an example. The vacuum cleaner robot analyses in which square it is, whether there is any dirt in it and then either moves to the next square or sucks all the dirt. However, we should not take every object as an agent like a calculator which displays 4 when given $3+1$. AI agents are the end of the spectrum where the task involves nontrivial decision making.

2 Good Behavior: The Concept of Rationality

AI model behavior is assessed by the sequence of actions it follows in a given situation (consequentialism). If the set of actions is desired then the agent has performed well or its performance measure is high. For us rationality is based on outcomes that we desire, so a machine's desire is set as per their user. But this performance measure may be hard to design, for example, the vacuum cleaner robot may dump dirt and then clean it again to maximize the score. Therefore the question of a perfect specification to set in a machine to achieve overall efficiency still remains unanswered. It's difficult to predict everyone's preferences, especially when designing software for different users.

The perfect rationality depends on four factors performance maximization, prior knowledge, available actions and percept sequence. For example, a vacuum cleaner is rational if based on the knowledge about clean floor it stops after it's done cleaning and not moving unnecessarily after all squares are clean. Rational agents that adapt themselves based on rules, performance measures, and environmental factors achieve the best possible outcome.

It's important to understand the difference between rationality and perfection. An omniscient agent knows the actual outcome of its actions and can act accordingly. Rationality maximizes expected performance, while perfection maximizes actual performance. Rational agents must gather information. Like looking both ways in the road before crossing the road. Agents should learn from their experiences. In contrast to animals like beetles or wasps which show a lack of adaptability, a good AI agent should be autonomous, becoming less dependent on what it was initially programmed to know.

3 The Nature of Environments

Designing any AI agent involves PEAS framework. Like the automated taxi driver system should drop the person accurately and also should use fuel effectively with no traffic law violations. Next, we consider the environment in which the taxi will operate. Different types of roads, pedestrians, animals, etc. The weather will also affect its performance. Moving to actuators, allow the taxi to move and respond like how a human driver would respond. Finally, we have the Sensors, which help the taxi understand its surroundings. It will be equipped with cameras and ultrasound sensors to detect other cars and obstacles nearby. It needs sensors to monitor speed and GPS for navigation. Tasks in environments can be classified in several dimensions which help us in designing better

AI agents. Firstly, we can classify as fully observable, in which agent had complete access to all information at that given time. In contrast partially observable environment has limited knowledge. A vacuum cleaner robot that can only detect dirt directly beneath it is in a partially observable environment. Environments can be classified as single agent or multi agent. In single agent, agent operates alone. In multi agent it interacts with other agents like in a chess game. Next is the deterministic vs. nondeterministic distinction. In deterministic, outcome can be predicted and depends only on the agent's action. However in non-deterministic uncertainty is present. Stochastic processes characterize deterministic situations. In episodic environments each task is independent of the other. But sequential decisions depend on past events. Discrete environments have a limited number of distinct states and actions where as continuous environments involve smooth and ongoing changes. A known environment means the agent or its designer understands how the environment works. By understanding all these dimensions, AI researchers can design agents that can perform well across all possible environments. This boosts the overall performance of the model.