Simplifying AI Models with the PEAS Representation System

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Introduction

The capability of an artificial machine to think and act rationally or like a human can be called Artificial Intelligence. Artificial intelligence is a subset of data science that gives life to a machine. Data scientists perform predictive data analysis based on algorithm-based machine learning, a subset of artificial intelligence. Machines acquire knowledge through a variety of techniques and then put that knowledge to use when making decisions or carrying out tasks. Deep learning is a new branch of machine learning that was created due to the most recent advancements in AI in the area of neural networks. With research to achieve level 5 automation for autonomous vehicles, AI is the future of self-driving cars. Based on the strength and application of AI, It can be classified broadly into three types. Weak, Strong, and Super AI.


Types of AI

- **Weak AI:** Weak AI, also referred to as narrow AI, is the intelligence of a machine applied to a specific domain or application. It is the most common and widely present AI. Contrary to its name, Weak AI is a very powerful and smart AI capable of thinking and acting rationally. When trained, It can perform one task perfectly. We can say that it has a very narrow approach to doing things. It will only achieve what it is trained or programmed to do. Examples include self-driving cars, Recommendation systems, spam filtering, fraud detection, etc.

- **Strong AI:** Strong AI(General AI) is believed to interact and operate various independent and unrelated tasks. Strong AI is said to have a human-like intelligence that can perform based on its thinking and decision-making strategies. Strong AI is still a theoretical concept as we only have weak AIs now. (yes,

even the most competent AI are weak AI) It will take a long time before we adopt the AGI, i.e., Artificial General Intelligence.

- **Super AI:** Super AI, also known as conscious AI or artificial superintelligence (ASI), can surpass human intelligence. They are believed to have human-like consciousness. It can do anything in the best way. They are capable of making decisions **rationally** rather than humanely. Super AI is purely speculative at this stage and part of science fiction. Super AI can be thought of as 'Robots taking over and enslaving humans. Super AI can be thought of as 'Chitti' from the movie Robot by the legendary Rajnikant.
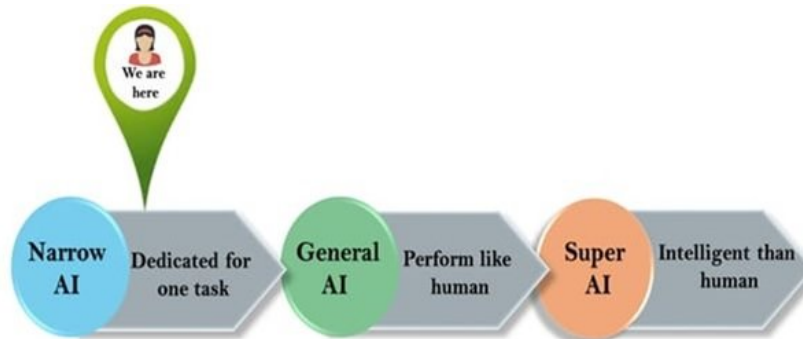
source: DeccanHerald

Composition of AI

An AI system is composed of agents and environments.

Agents: Agents are software, hardware, or a combination of both device that operates in the **environment** for achieving certain set goals. An Intelligent agent acts autonomously and persists over a longer period. It should also be able to adapt to changes in pursuit of a certain goal. Agents perceive through **Sensors** and operate on the environment through **actuators**. An environment can have a single agent or multiple agents.

Agents can be classified based on various features:

1. Simple Reflex agent
2. Simple Reflex with state agent
3. Goal-based agent
4. Utility-based agent
5. Learning-based agent

Example: Voice assistants like Alexa and Siri are Softbots or Software agents. Robotic cars are a perfect example of Hardware agents.

Rational Agent: An agent who has complete knowledge, clear preferences, models uncertainty, and behaves in a way to maximize its performance measure via all feasible actions is said to be acting rationally. A rational agent will always perform the right thing.

Autonomous Agent: An agent which can decide autonomously the actions that need to be taken in the current instance to maximize progress towards its goals.

What is PEAS?

PEAS is a representation system for AI agents which caters to measuring Performance with respect to Environment, Sensors, and actuators. To design an agent, we must know our task environment. PEAS system helps specify the task environment. PEAS is a short form for Performance, Environment, Actuators, and Sensors. Identifying PEAS can help write optimum algorithms for AI.

Sensors: Sensors help agents perceive their environment by giving them a complete set of Inputs. The action of agents depends on the past history and the current input set. Examples of sensors include cameras, GPS, odometers, various sensing tools, etc.

Actuators: Actuators help agents operate in the environment. Actuators include display boards, object-picking arms, track-changing mechanisms, etc. Actions performed by agents can bring change to the environment as well.

Environment: The surrounding of the agent at a particular instant in which the agent works is called the environment. It can be static or dynamic based on the motion of the agent. A small change in the environment will also change the required sensors and actions of the Agent.

As per Russell and Norvig, an environment can be classified on various factors:

1. Fully observable vs. Partially Observable
2. Static vs. Dynamic
3. Discrete vs. Continuous
4. Deterministic vs. Stochastic
5. Single-agent vs. Multi-agent
6. Episodic vs. sequential

Performance measure: Performance measure is the unit to define the agent's success or accuracy in achieving its set goals.

Understanding PEAS with an Example

Let's understand the PEAS system for a **ketchup-producing industry**. To produce good quality ketchup, it is important to segregate the ripe tomatoes and use them for production. Using bad quality or unripe tomatoes can lower the quality of the ketchup. Now, classifying the tomatoes can be done manually, but it would be a tedious job for humans as a factory might process thousands of tomatoes daily. Hence, we can incorporate an AI to help us. Hence, we need to know about our task environment and the agent we will use.

(source: Fine Gardening)

Agent: Tomato classification system.

Sensors: Weighing sensors, Cameras for visual input, color sensing, etc.

Actuators: Track changing mechanism for segregation, display boards, or a Y-belt for quick classification into ripe and unripe tomatoes.

Environment: Our environment can be a moving walkway through which the tomatoes are passed on for segregation. It should have a good source of light for better camera input.

Performance: It measures how successful the agent is in classifying the tomatoes. It can be a confusion matrix with true positive, true negative, false positive, and false negative numbers or the model's accuracy.

Conclusion

PEAS stands for Performance, Environment, Actuators, Sensors. They help define the task environment for an intelligent agent. Hence, PEAS is an important representation system for defining an Artificial Intelligence model.

In this article,

- we learned about the 3 types of AI.
- We understood the concept of Agents and the environment.
- We learned about the PEAS system and its importance.
- Finally, we saw an example of defining the PEAS system.

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