SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF MECHANICAL ENGINEERING

19MEE403 - Industrial Digitalization

IV YEAR / VII SEM

UNIT 5 - AI /ML IN MANUFACTURING

Computer Vision

Object Recognition: AI-powered computer vision allows robots to recognize and identify objects in their environment. Computer vision helps robots understand their surroundings, create maps, and navigate through complex environments. This is essential for autonomous vehicles, drones, and robots operating in unstructured spaces.

Visual serving: AI allows robots to track and precisely manipulate objects based on visual feedback, crucial for tasks like welding, painting, or assembling delicate components.

AI algorithms process camera and sensor data to map surroundings, identify obstacles, and plan safe and efficient paths for robots to navigate.

Natural Language Processing (NLP):

Human-robot interaction: Robots can understand and respond to natural language commands, enabling more intuitive and collaborative interactions with humans.

Voice control: Robots can be controlled through voice commands, making them accessible for a wider range of users.

Sentiment analysis: AI can analyze human text and speech to understand emotions and adjust robot behavior accordingly.\

Machine Learning:

Autonomous decision-making: AI algorithms can learn from data and make decisions in real-time, enabling robots to adapt to changing environments and react to unexpected situations.

Reinforcement learning: Robots can learn motor skills and control strategies through trial and error, allowing them to perform complex tasks like walking, running, or playing games.

Predictive maintenance: AI can analyze sensor data to predict equipment failures and schedule preventive maintenance, reducing downtime and costs.

ROBOTICS IN AI-APPLICATIONS OF AI/ML

1. Weak Artificial Intelligence

This type of AI is used to create a simulation of human thought and interaction. The robots have predefined commands and responses. However, the robots do not understand the commands they do only the work of retrieving the appropriate response when the suitable command is given. The most suitable example of this is **Siri and Alexa**.

The AI in these devices only executes the tasks as demanded by the owner.

2. Strong Artificial Intelligence

This type of AI is used in those robots who perform their tasks on their own. They do not need any kind of supervision once they are programmed to do the task correctly. This type of AI is widely used nowadays as many of the things are becoming automated and one of the most interesting examples is self-driving cars and internet cars

This type of AI is also used in humanoid robots, which can sense their environment quite well and interact with their surroundings. Also, robotic surgeons are becoming popular day by day as there is no human intervention required at all.

3. Specialized Artificial Intelligence

This type of AI is used when the robot needs to perform only specified special tasks. It is restricted only to limited tasks. This includes mainly industrial robots which perform specified and repetitive tasks like painting, tightening, etc.

Benefits of AI in Robotics

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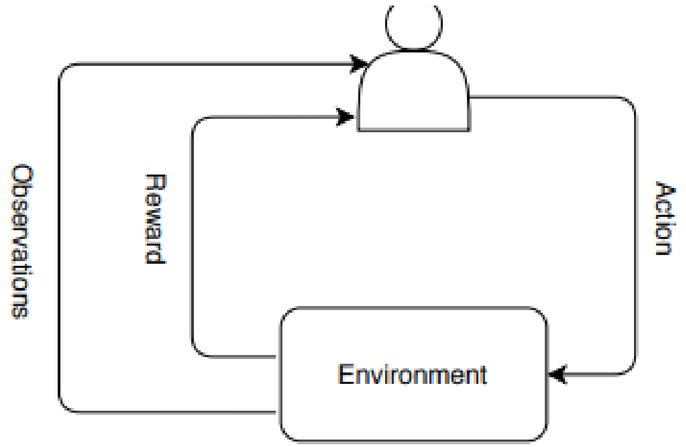
AI has already been adopted in robotics, establishing a new generation of intelligent robots that can go farther. These artificial intelligence robots provide flexibility in all sectors of industries, changing the way we interact with technology.

The main components of RL methods, some fundamental concepts and major theoretical problems are also clarified. RL is a kind of machine learning method where agents learn the optimal policy by trial and error. Unlike supervised learning, the feedback is available after each system action, it is simply a scalar value that may be delayed in time in RL framework, for example, the success or failure of the entire system is reflected after a sequence of actions. Furthermore, the supervised learning model is updated based on the loss/error of the output and there is no mechanism to get the correct value when it is wrong. This is addressed by policy gradients in RL by assigning gradients without a differentiable loss function which aims at teaching a model to try things out randomly and learn to do correct things more. Inspired by behavioral psychology, RL was proposed to address the sequential decision making problems which exist in many applications such as games, robotics, healthcare, smart grids, stock, autonomous driving, etc. Unlike supervised learning where the data is given, an artificial agent collects experiences (data) by interacting with its environment in RL framework. Such experience is then gathered to optimize the cumulative rewards/utilities

Some key aspects of RL are: (i) Address the sequential decision making; (ii) There is no supervisor, only a reward presented as scalar number; and (iii) The feedback is highly delayed. Markov Decision Process (MDP) is a framework that has commonly been used to solve most RL problems with discrete actions. DRL, which was proposed as a combination of RL and DL, has achieved rapid developments, thanks to the rich context representation of DL. Under DRL, the aforementioned value and policy can be expressed by neural networks which allow dealing with a continuous state or action that was hard for a table representation



Thank You