

भारतीय ज्ञान धरोहर

विमर्श और परंपरा

सम्पादक

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Artificial Intelligence in Robotics

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Introduction

Artificial Intelligence (AI) in robotics is one of the most ground-breaking technological advancements, revolutionizing how robots perform tasks. What was once a futuristic concept from space operas, the idea of "artificial intelligence robots" is now a reality, shaping industries globally. Unlike early robots, today's AI-powered robots can retrieve data, learn from experiences, reason, and make decisions. These capabilities significantly enhance their effectiveness and versatility in sectors like manufacturing, healthcare, transportation, and domestic services.

AI in robotics is driving innovation, optimizing processes, and paving the way for future advancements. This article explores the potential of AI in robotics, its current applications, and how it is reshaping industries for a more efficient and automated future.

What is Robotics?

Robotics is a field that deals with the creation and designing of these mechanical humans. And robotics these days is not only restricted to the mechanical and electronics domain. Nowadays, the artificial intelligence robot is becoming 'smarter' and more efficient with the help of computer science.

Role of Robotics in Artificial Intelligence

Artificial Intelligence has played a very major role not only in increasing the comforts of humans but also by increasing industrial productivity, which includes quantitative as well as qualitative production and cost-efficiency. An artificial intelligence robot can significantly enhance these benefits by integrating advanced algorithms and machine learning capabilities.

Robotics and artificial intelligence (AI) are closely related

fields, and when combined, they give rise to a discipline known as robotic artificial intelligence or simply "robotics in artificial intelligence."

- * Robotics in AI involves integrating AI technologies into robotic systems to enhance their capabilities and enable them to perform more complex tasks.

- * AI in robotics allows robots to learn from experience, adapt to new situations, and make decisions based on data from sensors. This can involve machine learning, computer vision, natural language processing, and other AI techniques.

- * Robots can use machine learning algorithms to analyze data, recognize patterns, and improve their performance over time. This is particularly useful for tasks where the environment is dynamic or unpredictable.

- * AI-powered vision systems enable robots to interpret and understand visual information from the surroundings. This is crucial for tasks like object recognition, navigation, and manipulation.

The combination of robotics and AI opens up a wide range of applications, including autonomous vehicles, drones, industrial automation, healthcare robots, and more. The synergy between these fields continues to advance, leading to increasingly sophisticated and capable robotic systems.

How AI is used in Robotics?

AI plays a crucial role in modern robotics, bringing intelligence and adaptability to these fascinating machines. An Artificial Intelligence Robot is a perfect example of how AI enhances the capabilities of robots, enabling them to perform a wide range of tasks with increased autonomy and adaptability. There are several ways in which an Artificial Intelligence Robot utilizes AI in robotics:

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 analyse human text and speech to understand emotions and adjust robot behaviour 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.

How do Robots and Artificial Intelligence work together?

The answer is simple. An artificial intelligence robot, or AI robot, gives robots a computer vision to navigate, sense, and calculate their reactions accordingly. Artificial intelligence robots learn to perform their tasks from humans through machine learning, which is a part of computer programming and AI.

Since the time self-driving cars coined the term Artificial Intelligence in 1956, it has created a lot of sensation. This is because an artificial intelligence robot has the power to give life to robots and empower them to take their decisions on their own. Depending on the use and the tasks that the robot has to perform, different types of AI are used. They are as follows:

- (1) **Weak AI :-** Weak AI, also known as Narrow AI is a 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 :- Strong Artificial Intelligence is a 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 :- Specialized artificial intelligence 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



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.

1. Enhanced Capabilities

* **Complex Task Execution:** AI algorithms help robots perform highly detailed tasks that could not have been executed directly through their coding. This may involve perception, manipulation, and decision-making abilities in environments that are complex and constantly changing. For instance, robots are now able to do operations, make intricate part jointery, and traverse unknown territory.

* **Improved Learning and Adaptation:** Machine learning enables robots to learn autonomously from data and improves their knowledge in the process. It help them to cope with new conditions, to increase speed and efficiency of their work, and use their knowledge of possible difficulties in advance. Consider an autonomous vehicle which operates in a warehouse and figures out the best path through the facility based on the dynamic information it gets.

2. Increased Efficiency and Productivity

* **Automation of Repetitive Tasks:** AI, for instance, can use robots to manage many activities that are boring and time consuming to relieve workers' burden. This automation results in higher efficiency and better time usage across numerous industries, including production and supply chain processes.

* **Reduced Errors and Improved Accuracy:** It proactively reduces chances of errors associated with fatigue or perhaps inherent human limitations when compared to similarly programmed Artificial Intelligence algorithms that are capable of shallow data analysis and precise calculations. This definitively increases general process productivity and product quality.

3. Improved Safety

* **Operation in Hazardous Environments:** Because robots that use artificial intelligence can be used in risky areas such as power plant or a scene of disaster. It can also do important work without costing human lives; these robots can.

* **Enhanced Human-Robot Collaboration:** AI can bring

working synergistically alongside with humans as well as robots is safe and efficient. Some examples of robotic applications include repetitive, time-consuming, or physically demanding operations where human fatigue might be an issue; operations that humans do better, because of their flexibility, creativity, and ability to make decisions.

Applications of AI in Robotics

AI in robotics is transforming industries by enabling robots to autonomously perform tasks that were once reliant on human intervention. Below are some key applications of AI in robotics, with real-life examples of how this technology is being utilized.

- * **Autonomous Navigation:** AI-powered robots can autonomously navigate through complex environments, making decisions in real-time using data from sensors. This is especially useful in industries like logistics and manufacturing.

- * **Machine Learning for Predictive Maintenance:** Machine learning algorithms in AI-powered robots can analyse sensor data to predict equipment failures before they occur. This reduces downtime and ensures that industrial processes run smoothly.

- * **Surgical Robotics with AI Assistance:** AI is revolutionizing healthcare, particularly in surgical robotics. AI-powered robots assist surgeons in performing complex procedures with greater precision, using real-time data analysis to enhance decision-making.

- * **AI-Powered Inspection and Quality Control:** In manufacturing, AI-powered robots equipped with computer vision technology can inspect products for defects and ensure high-quality standards.

- * **AI for Search and Rescue Operations:** AI-powered robots are crucial in disaster response efforts, capable of navigating through dangerous or hard-to-reach areas to find survivors and assess damage.

- * **Human-Robot Collaboration:** AI has enabled robots to collaborate with human workers, taking over monotonous tasks and allowing humans to focus on higher-level problem-solving. This enhances productivity and safety in various industries.

- * **Personalization and Customer Service:** AI-powered robots are also being used to enhance customer service by providing personalized experiences and interacting with customers in real-time.

Real-Life Applications of AI-Powered Robots

* **Voice Assistants:** AI-powered voice assistants like Siri, Alexa, and Google Assistant use natural language processing (NLP) to understand voice commands, control smart devices, and provide real-time answers to user queries.

* **Streaming Services:** AI algorithms in platforms like Netflix and Spotify recommend movies, shows, and music based on users' viewing and listening habits, creating a personalized experience.

* **Social Media Algorithms:** AI curates news feeds, suggests connections, and detects harmful content, ensuring a tailored and safe user experience on platforms like Facebook and Instagram.

* **Email Providers:** AI in email systems filters out spam and unwanted messages, ensuring that only relevant communications reach your inbox.

* **Fraud Detection in Finance:** Banks and credit card companies use AI to monitor transactions and identify suspicious activities, helping prevent fraud and protecting customers.

Conclusion

In the intricate dance of AI and robotics, our world is witnessing transformative advancements. From manufacturing to healthcare, the marriage of artificial intelligence and robotic systems is reshaping industries, ushering in an era of unprecedented efficiency, adaptability, and autonomous capabilities. The synergy between these fields continues to redefine possibilities and elevate technological landscapes, with the artificial intelligence robot at the forefront of this evolution.

