Title: Artificial Intelligence and Machine Learning Enhance Robot Decision-making Adaptability and Learning Capabilities Across Various Domains

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Key Ideas

This article presents the fundamentals of how AI and ML enable robots to perceive, learn, and reason in real time. Using artificial neural networks, robots can extract information from sensor data, recognize patterns, and make predictions, which allows them to function in unpredictable environments. By adapting their behavior based on data and context, robots are tuned for use in domains such as industrial automation, healthcare, space exploration, and disaster response. The article emphasizes three types of learning: supervised learning (with labeled datasets), unsupervised learning (identifying patterns in unlabeled data), and reinforcement learning (where agents learn from trial and error). It reinforces the idea that with real-time sensory data, AI- and ML-powered robots can dynamically adjust their behavior in response to environmental changes. Case studies like the Da Vinci Surgical System and Boston Dynamics' Spot robot demonstrate the potential of robots to handle complex tasks.

Contributions

The article provides a broad overview of how AI and ML enhance robotic decision-making across multiple complex domains. It shows that with learning models, AI-powered robots can respond adaptively to real-world settings such as healthcare or disaster environments. It also highlights how machine learning enables robots to learn both from pre-collected offline data and through real-time interaction with their environment.

Limitations

While informative, the article is survey-based and does not delve deeply into technical implementations. Although it briefly mentions cybersecurity concerns and trust issues, these are not central themes. The case studies presented highlight high performance but lack transparency about system failures, adversarial risks, or real-world operational limits.

Extend/Improvement

My focus will expand on the topics of security and trustworthiness in robotics using reinforcement learning (RL) to ensure reliable operation in unpredictable environments. I also plan to explore safety mechanisms against failures by examining adversarial examples and their effects on learning systems. Additionally, I aim to bridge the gap between cybersecurity and trust, an area the article does not deeply address.