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Robotics And Artificial Intelligence: A Short Review

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Abstract

Robotics and artificial intelligence (AI) are interconnected, with robotics being a branch of AI focused on developing intelligent machines or robots. Although Robotics and AI initially shared a strong synergy, the two fields have diverged significantly over the subsequent decades. This material highlights the integration of mechanical engineering, electrical engineering, and computer science within the field of robotics. Robots are capable of mimicking human actions and engaging with their surroundings using sensors and actuators. This paper aims to contribute to this resurgence by offering an overview of the challenges and methodologies related to autonomous deliberate action in robotics. It promotes a comprehensive understanding of deliberation functions and provides a synthesized view of planning, acting, perceiving, monitoring, and goal reasoning, along with their integrative architectures. This perspective is illustrated through various contributions that have addressed deliberation from the AIRobotics perspective.

Keywords: Artificial intelligence, Robotics, Machine learning Machine learning, Human-robot interaction, Humanoid robots.

Introduction

Robotics is a specialized area within Artificial Intelligence that facilitates the development of smart machines or robots. Although robotics and artificial intelligence are distinct fields, many people consider robotics to be a part of AI. Robotics involves the integration of mechanical and electrical components, which are controlled through programming languages. This makes it a blend of mechanical engineering, electrical engineering, and computer science. Robots resemble humans in appearance and mimic human actions and behaviours. They use sensors to detect their surroundings and actuators to interact with the environment, typically utilizing artificial intelligence. These robotic machines are commonly referred to as robots. (Thakur et al., 2023). Artificial intelligence (AI) and robotics have emerged as ground breaking technologies capable of reshaping numerous facets of society and the economy. By incorporating AI into robotics, machines are now able to autonomously perceive, reason, and operate in intricate environments, resulting in the creation of sophisticated robotic systems across industries like manufacturing, healthcare, and logistics. (Chopra, 2023).In this exploration of Robotics in AI, humans embark on a journey to uncover the core of this synergy, investigate its possibilities and limitations, and thoughtfully assess its ethical and societal impacts. Central to this convergence is the capability of robots to engage with their surroundings and, more importantly, with people. AI-driven robots are transforming our work, lifestyle, and leisure across various sectors, from industrial automation to healthcare, transportation to entertainment, and even within our homes. (Mahajan, Kaur, 2024).

HISTORY OF ROBOTICS & AI:

The development of robots as we recognize them today started in the mid-20th century. In 1954, George Devol invented the first industrial robot, known as the Unimate. This robot was mainly utilized in manufacturing, significantly boosting productivity in the automotive sector. The term "robot" was introduced by science fiction writer Isaac Asimov, who also extensively explored the idea of robotic ethics and formulated the Three Laws of Robotics. Asimov's Three Laws of Robotics are a set of principles designed to ensure that robots do not harm humans. These laws dictate that robots must prioritize human safety above everything else, follow human instructions unless they contradict the first law, and safeguard their own existence unless it conflicts with the first or second law. The initial AI program was created in 1951 by Christopher Strachey, who developed a checkers-playing program for a Ferranti Mark I computer. However, it was not until the 1960s and 1970s that AI research truly advanced, with the emergence of new algorithms and technologies like machine learning. The Dartmouth Conference in 1956 marked a significant moment for AI, as it brought together researchers to explore AI's potential and ways to advance the field. This event is often regarded as the inception of AI as an academic discipline. Throughout the 1960s, 70s, and 80s, AI research progressed with innovations like expert systems and the creation of Lisp, a programming language frequently used in AI studies. However, the field also faced challenges, such as the AI winter of the 1980s, when funding dwindled due to insufficient progress. In the 1990s, AI and automation software began to find more practical uses, including customer service Chatbots and speech recognition technology. The advent of the internet also spurred the development of search engines and recommendation systems, which heavily relied on AI algorithms.

In today's world, automation and AI have become integral to our everyday experiences, influencing everything from the algorithms behind our search engines and social media platforms to the robots that collaborate with us in manufacturing and storage facilities. Looking ahead, automation is expected to become even more intertwined with AI, leading to the creation of sophisticated robotics, self-driving vehicles, and intelligent systems capable of independent learning and adaptation. Although the advantages of automation are evident, there are also worries about its effects on employment and the economy. Therefore, it is crucial for society to thoughtfully evaluate how to leverage this technology for maximum benefit.

APPLICATION OF ROBOTICS AND AI:

1. **Healthcare:-**

Moreover, AI enhances healthcare professionals' capacity to gain a more profound insight into the daily habits and requirements of the individuals they care for. This insight enables them to offer more tailored feedback, guidance, and support for maintaining optimal health. In general, the integration of AI and IoMT in consumer health applications holds the potential to transform healthcare by empowering individuals and enhancing the care provided by healthcare professionals. For more than thirty years, robotics, alongside AI, have been employed in the medical field. These machines range from basic laboratory robots to advanced surgical robots capable of assisting surgeons or independently conducting surgeries. They are utilized in hospitals, laboratories, rehabilitation, physical therapy, and to aid individuals with chronic conditions. The incorporation of robotics in healthcare settings can enhance efficiency, accuracy, and patient outcomes, making them an invaluable component of contemporary medical practice. (Chopra, 2023)

Surgical Robots: Precision robots assist surgeons in minimally invasive procedures (e.g., Da Vinci Surgical System).

Diagnostics: AI analyzes medical images (X-rays, MRIs) to assist in disease detection.

Rehabilitation Robots: Assist patients with mobility impairments.

Robot Caregivers: Assist elderly or disabled individuals with daily tasks.

2. **Agriculture:**

The incorporation of artificial intelligence (AI), machine learning (ML), and robotics into agriculture offers agronomists crucial insights to boost farm productivity. Utilizing this data, farmers can attain high yields while minimizing operational expenses, leading to successful farming operations. The implementation of robotics in agriculture seeks to automate labor-intensive tasks like irrigation, seed distribution, pest management, and harvesting, allowing farmers to concentrate on more productive endeavors. A major benefit of using robotics in agriculture is its precision, which aids in optimizing land use and minimizing waste. This technology also facilitates the monitoring of quality improvements and environmental conservation within the green economy. As the agricultural sector gradually embraces AI and robotics, it holds the promise of substantial success in the broader context of sustainable development, aligning with the United Nations' goals and the global emphasis on sustainability. The integration of AI and robotics in agriculture has the potential to drive positive transformation and contribute to the overall enhancement of the global agricultural landscape. (Chopra, 2023)

3. **Gaming:**

AI controls non-player characters (NPCs) to make them behave realistically and adaptively. AI generates game content like levels, maps, quests, and items dynamically. This keeps games fresh with endless variations and surprises. AI bots playtest games to find bugs and balance issues faster than humans.AI adapts difficulty levels, story paths, or in-game events based on player behavior. AI assists developers by automating repetitive tasks (e.g., animation, asset creation).AI-driven tools can even help design levels or suggest gameplay mechanics. Sophisticated AI opponents challenge players with human-like strategies. AI powers dynamic conversation systems with realistic dialogue. Enables more immersive storytelling and player interaction. AI detects cheating patterns and enforces fair gameplay in online multiplayer games. (Julian Togelius et al.)

4. **E-Commerce:**

AI analyzes customer behavior, preferences, and purchase history to suggest products. AI-powered Chatbots handle customer queries 24/7, helping with product info, order tracking, and returns. Improves customer service efficiency and user experience. AI enables customers to upload images and find similar products. AI adjusts prices in real-time based on demand, competition, and inventory levels to maximize sales and profits. AI analyses transactions to detect unusual patterns and prevent fraudulent activities. AI predicts demand trends to optimize stock levels, reducing overstock and stockouts. AI powers voice-activated shopping assistants (like Alexa or Google Assistant) for hands-free shopping experiences. AI reviews customer feedback, reviews, and social media to gauge product sentiment and brand reputation.

5. **Social Media:**

AI algorithms analyze user behavior to suggest posts, videos, and ads tailored to individual preferences. AI tools generate posts, captions, images, or even videos. Some AI can help create memes, info graphics, or even entire articles. AI Chatbots interact with users, answer questions, and manage customer service directly within social platforms. AI scans social posts to detect public sentiment, trending topics, and emerging conversations. Helps brands and marketers adjust strategies in real time. AI identifies objects, people, or scenes in photos and videos, enabling automatic tagging and content moderation. AI generates realistic fake images or videos (both a creative tool and a challenge for misinformation). AI detects bots, fake accounts, and spam content to keep platforms safer and cleaner. AI optimizes ad placements and targeting for better engagement and ROI.

RISKS AND FEARS OF ROBOTICS AND AI:

1. **Job Displacement:-**
   Risk: Automation has the potential to substitute human labor in sectors such as manufacturing, transportation, retail, and even in professional roles like accounting and legal work.
   Fear: The result could be widespread unemployment, greater inequality, and a loss of purpose for individuals who find their jobs taken over by machines.

2. **Bias and Discrimination Risk:**
   AI systems can adopt and even intensify biases found in their training data, such as those related to race or gender.
   Concern: Discriminatory outcomes in vital sectors like employment, law enforcement, loan processing, and medical care.

3. **Privacy Concerns Risk:**
   AI-driven surveillance technologies can monitor individuals without their permission.
   Fear: A "Big Brother" scenario where all actions are observed — from facial recognition to online behavior.

4. **Autonomous Weapons Risk:**
   The deployment of AI in military drones, robots, and other technologies can result in fatal outcomes if not monitored by humans.
   Fear: An AI arms race could lead to a loss of control over decisions involving lethal force.

5. **Loss of Human Control Risk:**
   A super Intelligent AI could establish objectives that clash with human values or behave in ways that are hard to predict.
   Fear: A scenario where AI becomes uncontrollable, making decisions that humans are unable to reverse.

6. **Risk of Misinformation and Manipulation:**
   AI has the capability to create false news, deep fakes, and compelling content aimed at swaying public opinion.
   Concern: This could weaken democracy, erode trust in the media, and heighten social divisions.

7. **Security Threats Risk:**
   AI systems are susceptible to hacking or malicious use, such as in cyber-attacks, fraud, or identity theft.
   Fear: Increased vulnerability of essential infrastructure, including power grids, healthcare, and financial systems.

8. **Ethical Dilemmas Risk:**
   Complex decisions in AI programming, like self-driving cars determining whom to protect in an accident.
   Fear: Absence of clear moral guidelines and accountability when errors occur.

9. **Dependence on Technology Risk:**
   Excessive reliance on machines may diminish human skills, memory, and autonomy.
   Fear: Individuals becoming less capable or critical in their thinking, resulting in "digital dementia."

10. **Existential Risk:**
    If AGI (Artificial General Intelligence) exceeds human intelligence and acts contrary to human interests, it could threaten humanity's existence.
    Fear: AI becoming uncontrollable or indifferent to human survival.

Conclusion

Conclusion to conclude, the fields of robotics and artificial intelligence are intricately linked and work together in the creation of smart machines. Artificial Intelligence (AI) and Robotics are swiftly changing our lifestyles, work environments, and interactions with the world. AI enables machines to acquire knowledge, reason, and make choices, while robotics applies these abilities to the physical world through smart machines. Together, they facilitate automation, boost efficiency, and create new opportunities in sectors like healthcare, manufacturing, transportation, and space exploration. Nevertheless, as their impact expands, ethical issues, data privacy, job displacement, and safety become significant challenges that need to be tackled. Responsible innovation, steered by human values and transparent governance, is crucial to ensure AI and robotics benefit society positively. In summary, AI and robotics are not merely future tools — they are dynamic forces reshaping the present. With careful development and ethical implementation, they have the potential to address complex issues and enhance the quality of life worldwide. This article examines the role and applications of robotics within the fields of AI and machine learning. It reviews 23 research and review papers sourced from various journals and conferences. Future research will concentrate on robotic surgery and the use of robotics in computer vision.

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