iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: IV Month of publication: April 2023

DOI: https://doi.org/10.22214/ijraset.2023.50635

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue IV Apr 2023- Available at www.ijraset.com

Artificial Intelligence in Robotics: (Review Paper)

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Abstract: This article offers an overview of the dynamic intersection of artificial intelligence, robotics, and their impact on economic and organizational dynamics. We delve into the burgeoning research streams that explore the multifaceted consequences of these cutting-edge technologies in the fields of economics and management. Drawing from the diverse approaches adopted by scholars in this field, we provide insights into the implications of artificial intelligence, robotics, and automation for organizational design and firm strategy. We call for increased attention and involvement by organizational and strategy researchers in these areas and outline promising avenues for future research endeavors.
Keywords: Artificial intelligence, Robotics, Machine learning Machine learning, Human-robot interaction, Humanoid robots, Applications of AI in robotics

I. INTRODUCTION

Artificial intelligence (AI) and robotics have emerged as revolutionary technologies with the potential to transform various aspects of society and the economy. By integrating AI into robotics, machines can now autonomously perceive, reason, and act in complex environments, leading to the development of advanced robotic systems in industries such as manufacturing, healthcare, and logistics. Moreover, the intersection of AI and robotics has opened up new possibilities in fields such as human-robot interaction, social robotics, and cognitive robotics. As a result, there has been a growing body of research investigating the latest advancements, challenges, and potential applications of AI in robotics. In this review paper, our goal is to provide an overview of the current state of AI in robotics, highlighting research trends, technical approaches, and real-world use cases, while also addressing ethical, social, and economic implications of this rapidly evolving field. Through this review, we aim to contribute to the understanding of the current landscape and future prospects of AI in robotics, shedding light on the opportunities and challenges associated with this cutting-edge technology.

II. LITERATURE REVIEW

Artificial intelligence (AI) has emerged as a significant technological advancement with the potential to revolutionize the field of robotics. In recent years, there has been a growing interest in integrating AI techniques into robotic systems, enabling them to perform tasks autonomously and adapt to changing environments. Machine learning techniques, including supervised, unsupervised, and reinforcement learning, have been extensively employed in robotics to enable robots to learn from data and make decisions based on patterns and experiences. Computer vision, a subfield of AI, has also played a crucial role in enhancing robotic perception capabilities, allowing robots to perceive and understand their surroundings through visual information. Furthermore, natural language processing (NLP) has been utilized to facilitate human-robot interaction, enabling robots to understand and generate human language for communication and collaboration. NLP techniques have been applied in various robotic applications, such as personal assistance robots, service robots, and social robots, to improve their ability to interact with humans in a more intuitive and natural manner. Deep learning, which involves training artificial neural networks with large amounts of data, has demonstrated remarkable performance in many robotics tasks, including object recognition, speech recognition, and motion planning. Reinforcement learning, a type of machine learning, has also been used to train robots to learn optimal decision-making policies through trial-and-error interactions with their environments. Apart from technical advancements, ethical considerations surrounding the use of AI in robotics have gained significant attention. Ethical issues, such as safety, transparency, accountability, and bias in decision-making, need to be addressed to ensure responsible and ethical deployment of AI-powered robots in various domains. Despite the rapid progress in AI for robotics, challenges remain, including the limitations of AI algorithms in handling uncertain and dynamic environments, as well as issues related to safety, robustness, and interpretability. Moreover, the social and economic impacts of widespread adoption of AI in robotics, including the potential impact on employment and societal norms, need to be carefully considered. Nevertheless, the potential applications of AI in robotics are vast and diverse, with the integration of AI and robotics expected to continue advancing and shaping the future of automation, creating new opportunities and challenges for researchers, engineers, policymakers, and society as a whole.

III. APPLICATIONS

A. *Health Care*

1) Furthermore, AI enhances the ability of healthcare professionals to gain a deeper understanding of the day-to-day patterns and needs of the individuals they care for. This understanding allows them to provide more personalized feedback, guidance, and support for maintaining good health. Overall, the integration of AI and IoMT in consumer health applications has the potential to revolutionize healthcare by empowering individuals and improving the care provided by healthcare professionals.
2) AI is already proving its potential in disease detection, such as cancer, with increased accuracy and early-stage identification. The American Cancer Society reports that a significant proportion of mammograms yield false results, leading to misdiagnosis of healthy women as having cancer. However, with the use of AI, mammogram review and translation can now be done up to 30 times faster with 99% accuracy, reducing the need for unnecessary biopsies. Furthermore, beyond scanning health records to identify at-risk individuals, AI can enable clinicians to take a more comprehensive approach to disease management, coordinating care plans and aiding patients in better managing and complying with long-term treatment programs.
3) In addition to AI, robotics have also been utilized in medicine for over three decades. From simple laboratory robots to highly complex surgical robots that can assist human surgeons or perform operations autonomously, these machines are used in hospitals, labs, rehabilitation, physical therapy, and in support of individuals with long-term conditions. The integration of robotics in medical settings has the potential to improve efficiency, precision, and patient outcomes, making them a valuable asset in modern healthcare.

B. *Agriculture*

The integration of artificial intelligence (AI), machine learning (ML), and robotics in agriculture provides agronomists with valuable insights to enhance farm productivity. By leveraging this information, farmers can achieve high yields and low operational costs, ultimately leading to farm success. The adoption of robotics in farming aims to automate labor-intensive tasks such as irrigation, seed distribution, pest control, and harvesting, freeing up farmers' time to focus on more productive activities. One of the key advantages of robotics in agriculture is precision, which helps optimize land utilization and reduce wastage. This technology also enables monitoring of quality enhancement and environmental conservation in the green economy. As the agricultural community gradually shifts towards AI and robotics, it promises significant success in the broader context of sustainable development, aligning with the goals of the United Nations and the global focus on sustainability. The integration of AI and robotics in agriculture has the potential to drive positive change and contribute to the overall improvement of the global agricultural landscape.

C. *Storage*

Large companies with expansive storages are avaricious druggies of robotics due to their capability to reduce functional time and intermediate costs. These storages use high- tech detectors, including visual, audile, thermal, and haptic detectors, to enable independent operation of robots. The integration of AI has further enhanced safety through better perception of the girding terrain, particularly with thermal and haptic detectors. These detectors serve as the decision- making medium for robots, allowing them to operate effectively. Automated guided vehicles(AGVs) or automated guided wagons(AGCs) are generally employed for stock transportation within storages, enabling round- the- timepiece operations with harmonious costs. Upstanding drones are also being decreasingly used in storages for quick force scanning and optimization with minimum trouble. espousing robotics in storages offers several benefits, similar as minimum crimes, rigidity, and safety. Robots, designed with mortal- suchlike numbers and trained algorithms, can operate without making miscalculations. Safety is a significant advantage of robotics, as it eliminates the need for workers to perform parlous tasks, similar as pulling stocks from heights, thereby reducing the eventuality for accidents. In summary, robotics in storages give multitudinous advantages, including bettered effectiveness, rigidity, and safety, relieving workers from mundane and dangerous tasks.

D. *Motor Cars*

Robotics plays a vital part in the automotive assiduity, encompassing a wide range of operations from design and force chain operation to product conditioning and overall operations. Transportation for the machine assiduity benefits from systems similar as motorist backing, independent driving, and motorist threat backing. The integration of robotic intelligence in the automotive assiduity has been current for over 50 times, with significant advancements in AI and ML in recent times. The advantages of robotics in motorcars are multifarious, including. Accurate vision for locating and situating needed particulars, easing tasks similar as installing door panels, buffers, and other factors.

Assembly of machine bias similar as motors, screws, pumps, etc. with perfection and effectiveness. Deployment of robotic arms in oil and coating processes, icing harmonious quality and uniformity. Ability to transfer and handle segregated corridor, including lading and unloading, streamlining product processes and reducing homemade labour. In summary, robotics in the automotive assiduity offer multitudinous benefits, ranging from accurate vision for locating and situating factors to effective assembly and running of machine bias, contributing to bettered productivity and quality in the overall manufacturing process.

IV. ALGORITHMS USED FOR ROBOTICS

1) *Reinforcement Learning (RL):* Reinforcement Learning (RL) is a type of machine learning algorithm where an agent interacts with an environment and learns to make decisions based on feedback in the form of rewards or penalties. RL is particularly well-suited for robotics as it enables robots to learn from trial and error, adapt to dynamic environments, and make real-time decisions. However, RL can be computationally resource-intensive and may have slow convergence rates.
2) *Supervised Learning:* Supervised learning is an algorithm in machine learning that involves an agent learning from labelled data, where inputs are paired with their corresponding outputs. In robotics, supervised learning is often utilized for tasks such as object recognition, localization, and mapping. It is considered relatively straightforward to implement and can achieve high accuracy when trained on large labelled datasets. However, supervised learning may face challenges in generalizing to new, unseen data and can be constrained by the quality and quantity of available labelled data.
3) *Computer Vision:* Computer vision algorithms are employed in robotics to enable robots to perceive and interpret visual information from their environment. Commonly used techniques include image recognition, object detection, and semantic segmentation, which provide visual perception capabilities. However, computer vision algorithms can be computationally demanding, necessitating substantial computing power and memory resources.
4) *Simultaneous Localization and Mapping (SLAM):* SLAM (Simultaneous Localization and Mapping) is a widely utilized algorithm in robotics for navigation and mapping purposes. It allows robots to construct maps of their surroundings while concurrently tracking their own position within that environment. SLAM is crucial for tasks like autonomous navigation and exploration. However, it can be computationally demanding and may necessitate sophisticated sensor setups for accurate mapping and localization.
5) *Evolutionary Algorithms:* Evolutionary algorithms, drawing inspiration from natural selection, are employed in robotics for tasks like optimization, motion planning, and parameter tuning. They are particularly valuable in scenarios where the solution space is intricate and ill-defined. Evolutionary algorithms are known for their robustness in noisy environments and ability to handle multi-objective optimization. However, they may necessitate a significant number of evaluations to converge to a satisfactory solution.
6) *Deep Learning:* Deep learning algorithms, specifically Convolutional Neural Networks (CNNs), are widely employed in robotics for perception, control, and planning tasks. CNNs have demonstrated impressive performance in areas like image and speech recognition, making them valuable for tasks such as object detection, grasping, and manipulation. However, deep learning algorithms often necessitate substantial labelled data for training and can be computationally resource-intensive.

V. ETHICAL CHALLENGES AND COUNTERMEASURES OF DEVELOPING ADVANCED ARTIFICIAL INTELLIGENCE AND ROBOTS

1) The ethical considerations girding AI and robotics in society can be addressed in two crucial ways. First, masterminds developing these systems need to be apprehensive of implicit ethical challenges and take way to avoid abuse, while allowing for mortal examination of algorithms and systems. Second, as independent systems come more advanced, they should be able of ethical decision- making to minimize the threat of undesirable geste.
2) The adding use of independent systems working together can amplify the impact of incorrect opinions made without mortal intervention, pressing the need for robust control mechanisms and relations between decision systems.
3) One academic script outlined in the book" Moral Machines" by Wallach and Allen illustrates the implicit consequences of unethical robotic trading systems contributing to an instinctively high oil painting price. This leads to automated systems switching to more contaminating coal power shops, performing in power outages, chaos at airfields, and other negative consequences. This highlights the significance of incorporating morality- grounded decision- making into AI systems, which can estimate the ethical counteraccusations of their conduct, including compliance with laws and consideration of ethical dilemmas arising from different artistic or philosophical perspectives. •

4) The challenge of automating moral opinions, similar as the trade- off between guarding passengers in an independent vehicle versus girding climbers, is a significant concern. masterminds must strive to develop systems that don't pose pitfalls of severe adverse events and gain nonsupervisory blessing to insure social adequacy. still, this can be complex and requires careful consideration of implicit changeable actions that may arise in real- world scripts. similar ethical challenges have braked the relinquishment of independent vehicles.
5) To address these ethical challenges, countermeasures can be taken, including incorporating machine ethics and enforcing developer preventives. This involves designing AI and robotic systems with erected- in mechanisms to automatically limit geste inform drivers of conditions that bear mortal review, and consider different ethical perspectives. Overall, a visionary approach towards addressing ethical challenges associated with AI and robotics is pivotal to insure responsible and socially respectable deployment of these technologies in our society.

VI. DISTRIBUTIONAL GOODS OF ARTIFICIAL INTELLIGENCE AND ROBOTICS

1) Former exploration on artificial intelligence(AI) and robotics has aimed to identify the winners and disasters of these technologies and understand their distributional goods. Some studies have examined the impacts across different diligence. For case, Autor and Salomon's(2018) demonstrated that when assiduity-specific productivity increases due to AI, it frequently leads to dropped employment within that assiduity. still, positive spill over goods in other sectors neutralize the negative impact on the affected assiduity. also, Mandel(2017) studied the goods off-commerce on slipup- and- mortar retail stores and set up that although department stores educated job losses, the new jobs created at fulfilment and call centres further than compensated for these losses.
2) Other exploration examines how the composition of chops can impact the reciprocal or negotiation goods of new technologies like AI. A recent working paper by Choudhury etal(2018) investigates the performance goods of AI technology on workers with different training backgrounds. The study finds that productivity with AI is significantly told by an existent's moxie in computer wisdom and engineering. Those with applicable chops in these fields are more suitable to achieve superior performance using AI technologies compared to those without similar chops. also, Felten etal.(2018) borrow an capacities-grounded approach to dissect the link between recent advancements in AI and employment and pay envelope growth. They discover that occupations that bear a fairly high proportion of software chops witness employment growth when impacted by AI, while other occupations don't parade a meaningful relationship between AI impact and employment growth.

VII. CONCLUSION

Artificial Intelligence (AI) and robotics have the potential to transform society, but they also present ethical challenges. These include concerns about misuse, autonomy, biases, transparency, and impact on employment and human interaction.

To address these challenges, ethical considerations should be integrated into the design process, including identifying and mitigating biases, ensuring transparency and human oversight, and promoting machine ethics aligned with human values. Education and awareness programs, along with regulations and policies, should be established to govern the ethical use of AI and robots, with close collaboration between policymakers, technologists, and ethicists.

By prioritizing ethical decision-making and responsible practices, we can harness the benefits of AI and robotics for the betterment of society.

In conclusion, various algorithms employed in AI for robotics come with their own strengths and limitations. Reinforcement learning excels in adaptive decision-making, supervised learning is beneficial for labelled data tasks, computer vision provides visual perception capabilities, SLAM is critical for navigation and mapping, evolutionary algorithms are effective in optimization, and deep learning is powerful for perception and control.

The selection of the appropriate algorithm depends on the task requirements, data availability, computational resources, and desired autonomy level for the robot.

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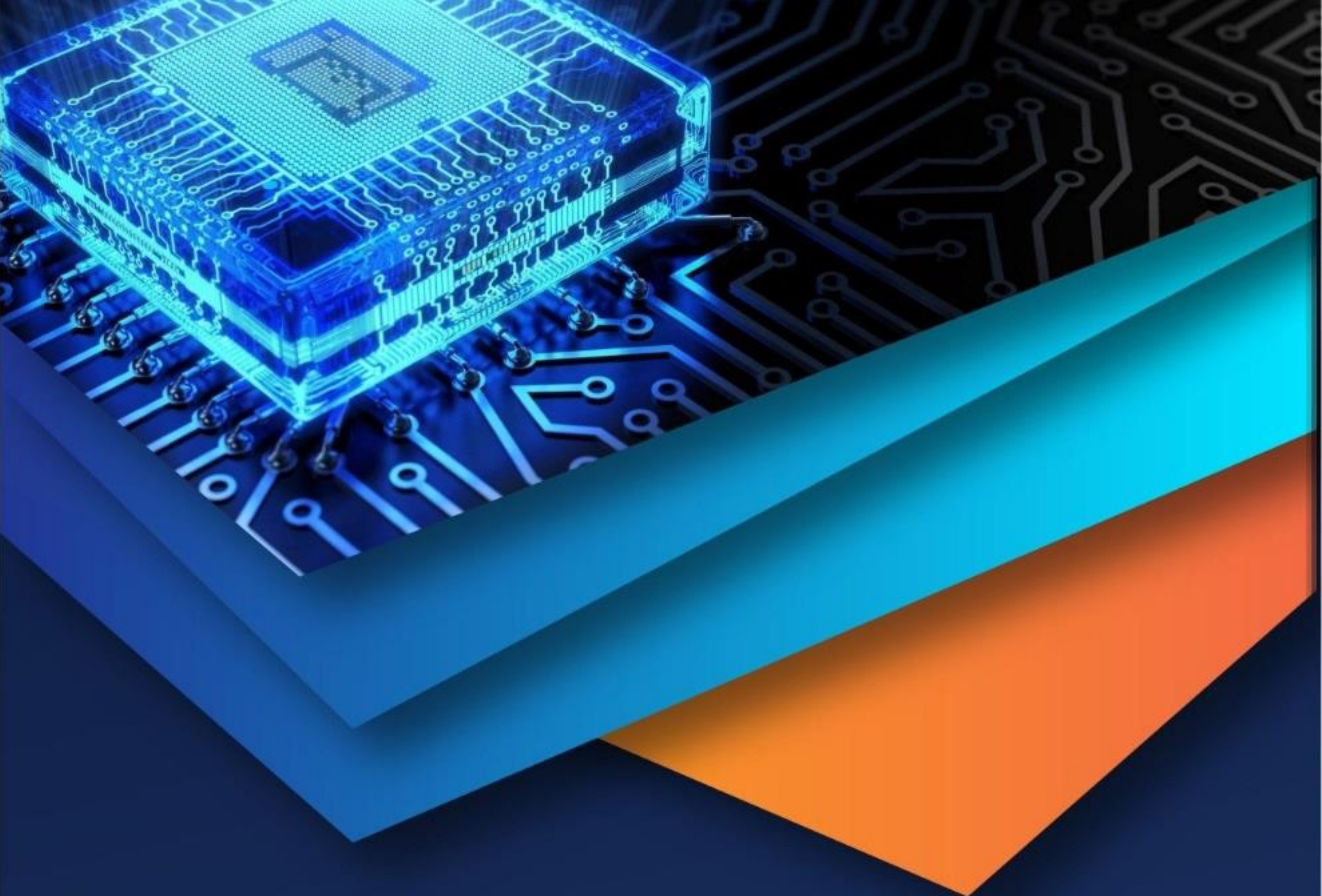

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