Artificial & Computational Intelligence/Published Online: July 2021
https://acors.org/ijacoi/VOL2_ISSUE2_5.pdf

Artificial & Computational Intelligence

Converging AI and Robotic: Techniques and Applications

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Abstract

Robotics is the study of the relationship between perception and action. Artificial Intelligence and Robotics are in high demand in society. If we want the relationship is to be intelligent, qualified intelligence is essential. Artificial intelligence is the latest medium for going well-nigh technology.Robots are made through the combination of mechanical constructive such as sensors and computers haveingenuous contribution to each component. Some of the world's leading science studies include the need of qualified Intelligence and Robotics would astound the world and how one can handle living in the big robotic world. The aim of this paper is to provide an outline of the issues and techniques of AI based robotic activities. The paper endorse a wide range of robotics functions and provide overview of how they plan, act, perceive, monitor, think about goals and integrated architectures, demonstrated with various contributions that covered AI–Robotics deliberations.

Keywords: Artificial Intelligence, Robotics, Soft Robotics, Cartesian Robot, Cylindrical Robot, SCARA Robot, 6-axis Robot

1. Introduction

Robotics is an integrative multidisciplinary domain, from mechanical and electrical engineering to theory and informatics controls, with the latest additions to physics, biotechnology and cognitive sciences. The overlap between AI and robotics is highly rich. For AI research, robot has always been a rich inspiration, which is often described in its literature, especially in the subjects mentioned above. In the early days of the AI, pioneering projects are promoting a robotic AI research programme [8]. In the 1970s, when robotics was employed for the industrial automation, the areas were clearly divided and robots were utilized in artificial intelligence to showcase the equipment. The cars equipped with an automated steering system for their movements are an example. The instruments for the car equipped are a number of lidar sensors and cameras that help recognize and make it intelligent. [3] Current technology for artificial intelligence is employed for internet advertising in aviation medicine. The notion of recognizing personal help has grabbed the imagination of scientists and of the public. Artificial intelligence and robotics are brought into being at the same era and the two disciplines are not obvious. Artificial intelligence and robotic technology are known for theirsimilar roots and a lengthy history of science and communication. [2] A robot is a computer programmable machine which can autonomously execute a complicated operation.An external control device can direct the robots or integrate the control. Robots may be man-made, but most robots are devices built to do a task without consideration to how they look. Robotics is the technical industry dealing with the design, construction, operation and use of robots as well as computer systems for their management, sensor feedback and data treatment [1]. The technologies comprise automated equipment capable of replacing or resembling people in appearance, behavior and cognitive circumstances or processes in dangerous scenarios. A number of robots nowadays are

inspired by the environment that contributes to biomedical robotics. These robots are also responsible for the development of a new field of robotics, called soft robotics [4].

2. Robotics & Artificial Intelligence:-

As of now, the industrial production system has been arranged around the machine; its environment is calibrated and limited modifications are accepted. It may now be more simply embedded into an existing environment. The autonomy of a robot may be separated into the conception, planning and implementation in an environment (manipulating, navigating, and collaborating). The basic principle of AI-Robotics convergence is an attempt to optimize the amount of independence via learning. The amount of intelligence is the ability to foresee the future, whether by planning a task or engaging (by influencing or navigating) with the world. Intelligence robots were often tried. While the creation of an intelligence-like system remains difficult, robots that can carry out certain self-sufficient activities, like driving the vehicle[5], flying in natural and man-made environments, swimming[7], carriage of boxes and materials in various fields[6], picking and releasing objects exist today. The perception task is another key use of AI in robots. With the aid of embedded sensors or computer vision, robots can detect the surrounding. In the past decade, the quality of sensing and vision has been increased by computer systems.Perception is vital not just for design, but also for artificially establishing self-consciousness in the robot. This allows for interactions with the robot in the same environment as other creatures. It is known as social robotics. This deal with two primary areas: interactions between human robot (HCI) and cognitive robotics. HCI's objective is to enhance robotic perception of people, e.g. in human comprehension [8], emotion, non-verbal communication [8], and the ability to travel with people.The cognitive robotics discipline focuses on offering robots the independent ability to learn from a high perception based on emulation and experience. Its purpose is to emulate the cognitive human system, which via experience and sensitization controls the process of learning information and understanding [9]. There are other models in cognitive robotics which embody motivation and curiosity for the quality and speed of learning in acquiring the knowledge [10]. AI has overcome many inconceivable obstacles and has beaten many records in less than 10 years. The combination of these improvements will continue to transform our robot intelligence understanding in many new fields.A few researchers from a range of professions began to consider the ability to build a stressed brain in the 1940s and 50s. In 1952-1956 there took place the lineage of strained intelligence [21].

3. Evolutions of Robotics using AI:-

Table 1: The evolution of Robots

Name of the Robot	Year	Developed by	Distinct Feature
Alphago	2017	Google DeepMind	Alphago has beaten top players of the ancient far-eastern board game “Go”.
Nanorobots	2016	Polytechnique of Montreal	Manage medication without harming surrounding tissues and organs
Robot Exoskeleton	2014	Ekso Bionics	This robot helps the paralysed person to walk
Pepper	2014	Aldebaran Robotics	The robot has integrated an emotion engine to interact with people.
Icub	2010	RobotCub Consortium	The robot is emotionally capable and equipped to interact with the surroundings using touch sensors.
Robonaut2	2010	NASA	It is a humanoid robot that can replace human astronauts with a wide variety of sensors
Robot BigDog	2005	Bostan Dynamics	The first robot to handle equipment of 150 kg. The robot could use its four legs to cross bumpy terrains.
Roomba	2002	iRobot	Help to avoid obstacles as well as navigating within a house without using maps
Asimo	2000	Honda	The first humanoid robot to go like people, walk stairs, adjust its route and remove risks using a video camera.

Hero Robot Kit	1984	Hero	First playing robot with human interaction abilities
Denning Sentry Robot	1985	Denning	The first safety guard robot that could patrol more than 14 hours in a range of 150 foot radius and warn you of anything unexpected.
Speak and Spell	1978	Texas Instruments Inc.	This technology carries out a mathematical model of human track and produces human sonorities

4. Classification of Robots:-

A more easily and comprehensively defined robotic type may be reduced to four types: cartesian, cylindrical, SCARA, and 6-axis. There are certain components for each industrial robot type that make them the most suited to various uses. They are distinguished mainly by their speed, size and working space. Awareness of all five sorts of operations may assist machine developers select the ideal robot for their work.

a) Cartesian: -Cartesian is the most frequent robot type utilised in most industries. This sort of plant operator is frequently used since it is straightforward to operate and programme. The linear motions of the cartesian components provide the robot with a working location in the shape of a cube that is best suited to picking applications and may vary from 100m to 10m. These robots are a popular choice as they can be personalised very well [11]. The stroke length, speed and accuracy of the robots may be determined by clients, since the most components arrive separately and are combined by the builders of machines. In other words, the intricacy of the assembling required is one downside of cartesian robots.

b) Cylindrical: -In their axis of motion, cylindrical robots are quite basic and similar to Cartesian. The two moveable parts, rotary and linear actuators, comprise most of the cylindrical robots. As the engineers have a circular work envelope, they might be chosen for their space economy. The robot is situated in the centre of a workstation and may operate anywhere around it due to its rotating element [12]. Simple applications include the collection, rotation and then optimization of materials for cylindrical robots.

c) SCARA: -A more complete answer is offered by SCARA robots than Cartesian or Cylindrical. These are all-in-one robots, which are to be ready for use by a SCARA robot, aside from end-of-arm tools, having x, y, z and rotating motion in one package. The work envelope is like cylindrical robots, but in a radius or arch-shaped room it exhibits greater motion [13]. Cylinder and cartesian robots also have comparable applications, although SCARA robots can move faster than the other two ones. Because of their limited work area, they are typically found in biomedical applications. Because of the ease integration of SCARAs, they seem to be the ideal answer for most applications.

d) Axis: -The 6-Axis is another all-in-one robot. While 6-axis robots can occasionally be nearly a toy, they are usually extremely big and are employed for big assembly tasks, for example, by placing seats on a mounting line in a car. These robots work like human arms and can collect and transport things from one aircraft to another [14]. An example would be to take a section off a table top and place it in a closet – something that cannot easily be done by other sorts of robots. The 6-Axis robots can move rapidly and are supplied with comprehensive solutions, such as SCARAs.

5. Limitations of AI Faced by Robotics Systems:-

Robots generally face many limitations which include the following:

i) Due to the poor fastening, the flexibility necessary for manufacturing parts following parts in the absence of adequate control might fluctuate.

ii) Currently, there is limited use of artificial intelligence and machine learning in enhancing the capacity of industrial robotic systems. Robot technology and machine learning are not yet complete, but contemporary applications are promising [20].

i) Training an operator of the robot would be one of the problems. This is a reasonably basic robotic system to operate and it shouldn't be difficult to locate someone

who can learn it. This device needs to be further tested for implementation [15].

ii) The influence on present employees is one argument. This is a prevalent problem in the automation of a process. Robotic welding is more effective than a human approach and requires fewer people. This implies that solders may lose their employment and damage them and their families.

iii) The time and effort needed to programme a robot to weld a new part in small to medium production or maintenance operations is relatively high [16].

iv) There are more constraints on the robotic welding system to qualified personnel with required training and competence.

v) Less use of robots because they cannot respond to ambiguity.

6. Major Organization Investing in AI Based Applications:-

Table 2: Organization Investing in AI Based Applications

	Name of the Organizations	Technology used	AI-Applications designed	Open Source used
1	Google Deep mind	Search engine, Maps, Ads, Gmail, Android, Chrome, and YouTube	Self-driving cars: Technology that allows a car to navigate in normal traffic without any human control	Tensor Flow: Construction of Deep Neural Networks
2	Open AI	Non-profit organisation Evolutionary Algorithms Deep Neural Networks	Evolutionary Algorithms tuned to work with Deep Neural Networks Testbeds for AI: Benchmarking tools and performance measures for AI algorithms.	Gym: Toolkit for developing and comparing reinforcement learning algorithms. Universe: Measure an AI's general Intelligence
3	IBM	Manufacturer of computer hardware and software Hosting and consulting services Cognitive Computing	Deep Blue: First computer program to defit world champion chess player Watson: Won top players on Jeopardy!', a popular quiz show	Apache System ML: Distribution of largescale machine learning computations on Apache Hadoop and Spark. Apache UIMA: Unstructured Information Management
4	Facebook	Social Networking Service	Applied Machine Learning: Spot suicidal users. Human Computer Interaction: Image Descriptions for Blind Users	CommAI-env: A communication-based platform for training and evaluating AI systems. fbcunn: Deep learning modules for GPUs
5	Apple In	Computer hardware and software Consumer electronics Online services	Siri: AI Virtual Assistant Self-driving car: AI technology that could drive at car without human interaction.	
6	Amazon	Cloud Computing Online Retail services Electronics	Alexa: AI virtual assistant Amazon AI platform: Cloud software and hardware AI tools	DSSTNE: Deep Scalable Sparse Tensor Network Engine
7	Microsoft	Developing, manufacturing and licensing computer hardware and software Consumer electronic	Microsoft Azure: Cloud services Cortana: AI virtual assistant	CNTK: Cognitive Toolkit Microsoft Azure: Cloud computing platform offered as a service.

7. Applications of Artificial Intelligence in Robotics:-

There are a lot of applications of robots in future some of them are discussed below-

7.1-Transportation:-

In future robots may be used as a suburbanite of the car although it could take some time to make them increasingly perfect voluntary car will one day ferry us from place to place [19].

7.2-Education:-

With the help of strained intelligence a lot of books are digitized.

7.33-Robotics will boost our standard of living:-

Robots will make our life easier through better accuracy which reduces the amount of time and materials wasted;they can also work fast as compared to humans [23].

7.4-Robotics in public security:-

In future robots can be used for the public security considering once it is programmed and designed there is less chances of mistakes [22].

7.5-Robots at home:-

Robots can be used in homes for domestic works in next coming years considering it has worthiness to do work smoothly. A robot can work regularly 24*7 without taking any breaks as compared to human [7].

7.6-Robots as worker and co-workers:-

Enhanced robot workplaces have the potential to reduce employee injuries caused by programming mistakes, mechanical breakdowns and the absence of human surveillance. By keeping robots secure and adopting latter precautions, the workers may reduce risk [12].

7.7-Robotics for entertainment:-

In future robots can be used for the entertainment purposes such as it can make music for us read our mood etc [5].

7.8-Robotics in healthcare:-

Robots can be used in healthcare for the variegated purposes such as medical device packaging, labautomaton, cutting bones, neurosurgery etc.[6]

8. Conclusion:-

Artificial Intelligence and Robotics unchangeably interest and surprises us with new ideas, topics, Innovations and products, etc. The efficient use of Artificial Intelligence and robotics and deployment of artificial intelligence shows that we are going to unzip the largest and powerful world. It has provided mankind a powerful tool. In the coming next 5 to 10 years they may wilt so wide it is the possibility that they can replace humans and this is a threat to mankind.Thus, artificial intelligence, because of all its capabilities, can provide enormous discoveries and breakthroughs for humankind. The majority of artificial intelligence systems are able to learn and increase performance over time. The adoption of AI is in the early or experimental stage outside the technology industry. The research implies that AI can provide our lives actual value. AI relies on acquiring enormous amounts of data, processing it, evaluating it and performing activities to resolve particular problems based on its operational algorithms. Due to the new computer cloud designs, it is more inexpensive for any company. Computer programmes have already been written with aspects of intelligent behavior such as problem solving, inferences learning and language understanding; AIprogrammes outperform human specialists. AI programmes. AI research has been pushed down major new avenues in perception and planning to provide effective solutions in the real world. Further progress in the field of beliefs modification and learning will be necessary for AI to succeed. Having robots therefore enables business owners to remain competitive, as robots can do better and quicker work than people.

Reference

[1] AginG.J(1980),"Computer vision system for industrial inspection and assembly "computer 13-11-20, H.-H. Nagel.Steps toward a Cognitive Vision System. AI Magazine, 25(2):31–50, 2004.

[2] Ambler Ap,R .J Popplestone, {19-15}"“Imferring , the position of bodies from specified spatial relationship.", Artificial: Intelligence ,6, 2,157-174.

[3] L. Iocchi, D. Nardi, M. Piaggio, and A. Sgorbissa.Distributed coordination in heterogeneous multi-robot systems.Autonomous Robots, 15:155– 168, 2003.

[3] R.C Arkin,Just what is a robot architecture anytray? Turning equivalency very versus organizing principle.In AAAI spring symposium on persons search from implemsized software Architectures for Physical Agents, 1995.

[4] A binchi and G.Tonietti Fast and soft arm tactics :Dealing with safety performance trade-off in robot arms design and control. IEEE robotics and automation magazine 11(2),2004.

[5] A.chella M Frixione, and Gaglio. Understanding dynamic scenes.ArtificialIntelligence ,123:89-132,2000.

[6] E.GiumchigliaGN.kartha, and V,lifschitz,Representing action: Indeterminacy and ramifications, Artificial Intelligence, 95(2); 409-438,1997.

[7] S.J Russell and P.Norvig. Artificial Intelligence: A Modern Approach, Pearson Education,2003.

[8] L. Sciaviuo and B.Sicilicino. Modelling and control of Robot Manipulators,2nd& 3rd ,Springer- Verlag-Berlin Heidelberg 2000

[9] S. Nolfi and D. Floreano.Evolutionary Robotics.MIT Press, Cambridge, MA, 2000.

[10] P. I. Corke. Visual Control of Robots: HighPerformance Visual Servoing. Wiley, New York,1998 .

[10] H. Kitano et al. Robocup-rescue: Search and rescue for large scale disasters as a domain for multiagent research. In Proceedings of IEEE Conference on Man, Systems, and Cybernetics(SMC-99), 1999.

[11] J. Frank and A. J´onsson. Constraint-based attribute and interval planning. Constraints, 8(4):339–364, 2003.

[12] G. Fraser, G. Steinbauer, and F. Wotawa. Plan execution in dynamic environments. In Innovations in Applied Artificial Intelligence, volume 3533 of LNCS, pages 208–217. Springer, 2005.

[13] S. Fratini, A. Cesta, R. De Benedictis, A. Orlandini, and R. Rasconi.Apsi-based deliberation in goal oriented autonomous controllers. In 11th Symposium on Advanced Space Technologies in Robotics and Automation (ASTRA), 2011.

[14] Lambèr Royakkers et al. "A Literature Review on New Robotics: Automation from Love to War" International Journal of Social Robotics, 2015.

[15] Jahanzaib Shabbir "Artificial Intelligence and its Role in Near Future" journal of l atex class files, vol. 14, no. 8, august 2015.

[16] Srishty Choudhary et al. "An Innovative Study on Artificial Intelligence and Robotics" International Journal of Innovative Research in Computer and Communication Engineering, Vol. 4, Issue 3, March 2016.

[17] Chetan Sakharam Tirgul, Mangesh Raghunath Naik "Artificial Intelligence and Robotics" International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 5, Issue 6, June 2016.

[18] A.Gnanavelbabu et al. "Implementation of Robotic Welding for the Improvement of Production Systems" International Journal of Engineering Trends and Technology (IJETT) – Volume 49 Number 5 July 2017.

[19] C. Labeshkumar et al. "Optimization of Mig Welding Process Parameters for Improving Welding Strength of Steel" International Journal of Engineering Trends and Technology (IJETT) – Volume 50 Number 1 August 2017.

[20] Tanveer Majeed, Mohd Atif Wahid et al. "Applications of Robotics in Welding" International Journal of Emerging Research in Management &Technology ISSN: 2278-9359 (Volume-7, Issue-3), March 2018.

[21] Emmanuel Afrane Gyasi "On adaptive intelligent welding: technique feasibility in weld quality assurance for advanced steels" Acta UniversitatisLappeenrantaensis, August, 2018.

[22] Baskaransa et al. "Applications and future scope of robotics-A review" International Journal of Robotics and Autonomous Systems Volume 3 Issue 1, 2018.

[23] "Robot and the workplace of the future" A positioning paper by the International Federation of Robotics, Frankfurt Germany, March 2018