Role of AI in Space Tech

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Abstract

Artificial intelligence has been making waves in recent years, enabling us to solve problems fasterthan traditional computing could ever allow. And as much AI has helped evolving the civil (day today) services of its users, it's also promisingly evolving for space exploration (after all that's the actual birth place of an AI). India too has been generating indigenous AI technology to power its space missions. Take for example its Chandrayaan-2 mission that was launched in July 2019. AI helps analyse the huge amounts of dataemanating from space exploration and this helps advance space exploration with each passing day. Moreover, AI is making it possible for rovers currently roving the atmosphere of Mars to take decisions independent of the mission. So with the help of this Paper I'll try my best to eradicate all that unknown status of how AI and how Elon Musk and his organization SPACEX is trying accomplish the Colonization on mars and is going to change and actually is changing not just spaceexploration but our lifestyle too.

Introduction

Space Exploration has always been of interest to scientists and governments across the globe asit holds the key to the origin of mankind and many marvelous wonders of the universe including the possibility of alien lives. The visible universe represents the parts of space that we can see using telescopes. Yet, scientists and explorers do believe that the universe may be larger than that. Increasing the levels of autonomy and automation using techniques from artificial intelligence allows for a wider variety of space missions and also frees humans to focus on tasks for which they are better suited. In some cases autonomy and automation are critical to the success of the mission. For example, deep space exploration may require more autonomy in the spacecraft, as communication with ground operators is sufficiently infrequent to preclude continuous human monitoring for potentially hazardous situations.

Knowledge of Artificial Intelligence

Artificial Intelligence is an approach to make a computer, a robot, or a product to think how smart human think. AI is a study of how human brain think, learn, decide and work, when it tries to solve problems. And finally this study outputs intelligent software systems. The aim of AI is to improve computer functions which are related to human knowledge, for example, reasoning, learning, and problem-solving. The objectives of AI research are reasoning, knowledge representation, planning, learning, naturallanguage processing, realization, and ability to move and manipulate objects. There are long-termgoals in the general intelligence sector.

Major Goals

- Knowledge reasoning
- Planning
- Machine Learning
- Natural Language processing
- Computer Vision
- Robotics
- IBM

Watson

Fig.1 IBM Watson Analysis

"Watson" is an IBM supercomputer that combines Artificial Intelligence (AI) and complex inquisitive programming for ideal execution as a "question answering" machine. The supercomputer is named for IBM's founder, Thomas J. Watson. IBM Watson is at the forefront of the new era of computing. At the point when IBM Watson made, IBM communicated that "more than 100 particular techniques are used to inspect perceive sources, find and make theories, find and score affirm, and combination and rank speculations." recently, the Watson limits have been expanded and the way by which Watson works has been changed to abuse new sending models(Watson on IBM Cloud) and propelled machine learning capacities and upgraded hardware open to architects and authorities. It isn't any longer completely a request answering figuring system arranged from Q&A joins yet can now 'see', 'hear', 'read', 'talk', 'taste', 'translate', 'learn' and 'endorse'.

About Space Tech

Advanced space technologies are needed to enable many potential space activities and to reduce the cost and improve the performance of others. The National Aeronautics and Space Act of 1958, which created the National Aeronautics and Space Administration (NASA), directed the agency to conduct the nation's civil space activities to contribute materially to "the preservation of the role of the United States as a leader in aeronautical and space science and technology…" (Space Act, 1958). Subsequent national space policies have reaffirmed NASA's responsibility for the development of advanced civil space technologies (The White House, 1989,1996). If NASA is to continue its drive for more capable and cost-effective missions into the twenty- first century, it will need advanced and innovative technologies—some of which may require years to develop and mature. The commercial space industry and other government agencies could provide some of these technologies, but some critical technologies will require long lead- time NASA research and technology development (R&T) to ensure that they are available when required. NASA also will have to develop a plan and mechanism to support advanced technology development for the long term if it intends to be a source of technology for industry and other government programs in the new century.

SpaceX

Space Exploration Technologies Corp. (SpaceX) is an American aerospace manufacturer and space transportation services company headquartered in Hawthorne, California. SpaceX was founded in 2002 by Elon Musk with the goal of reducing space transportation costs to enable the colonization of Mars. SpaceX manufactures the Falcon 9 and Falcon Heavy launch vehicles, several rocket engines, Dragon cargo, crew spacecraft and Starlink communications satellites.

SpaceX's achievements include the first privately funded liquid-propellant rocket to reach orbit (Falcon 1 in 2008), the first private company to successfully launch, orbit, and recover a spacecraft(Dragon in 2010), the first private company to send a spacecraft to the International Space Station (Dragon in 2012), the first vertical take- off and vertical propulsive landing for an orbital rocket (Falcon 9 in 2015), the first reuse of an orbital rocket (Falcon 9 in 2017), and the first private company to send astronauts to orbit and to the International Space Station (SpaceX Crew Dragon Demo-2 in 2020). SpaceX has flown and reflown the Falcon 9 series of rockets overone hundred times.

SpaceX is developing a satellite megaconstellation named Starlink to provide commercial internet service. In January 2020 the Starlink constellation became the largest satellite constellation in the world. SpaceX is also developing Starship, a privately funded, fully reusable, super heavy-lift launch system for interplanetary spaceflight. Starship is intended to become the primary SpaceX orbital vehicle once operational, supplanting the existing Falcon 9, Falcon Heavy and Dragon fleet. Starship will be fully reusable and will have the highest payload capacity of any orbital rocket ever on its debut, scheduled for the early 2020s.

AI assisting Commercializing Space

Even before modern computers became a reality, science fiction gave us a plethora of examples of artificial intelligence and smart robots in the context of outer space. From Hal in 2001: A Space Odyssey and the computer on Star Trek to C3PO and R2D2 in Star Wars and even the fantastic machines in Hitchhiker's Guide to the Galaxy, it seems that AI and space go together. While those examples are fiction, we are indeed starting to see examples in the real world where we are using artificial intelligence to help commercialize space.

AI Assisting in the Manufacturing of Satellites and Spacecraft

Satellites and spacecraft are complex and expensive pieces of equipment to put together. Within the spacecraft manufacturing operations, there are repetitive and complex tasks that need to be done with exacting measures of precision and often must be done in clean rooms with little exposure to potential contamination. AI- enabled systems and robotics are being used to help the manufacturing process and take away some of the tasks that humans currently do so that humans can focus on the parts that computers can't assemble.

When working to assemble satellites, not only can AI help to physically speed up the process but it can analyze the process itself to see if there are ways the process can be improved. In addition, the AI is also able to look at the work that has been performed and ensure that everything is done properly. Furthermore, the use of collaborative robots ("cobots") as part of the manufacturing process are helping to reduce the need for human workers in clean rooms, and make more reliable manufacturing steps that can be error-prone.

The Importance of Artificial Intelligence in Space Technology

Artificial intelligence has transformed many areas of our daily lives. From healthcare to transport, tasks usually carried out by humans are now being performed by computers or robots, more quickly and efficiently. What's more – AI is adapting. It's now bringing us closer and closer to the stars, with numerous benefits.

Here's a closer look at the importance of artificial intelligence in space technology.

Fig.2 Earth captured from outer space rim

The need of AI

Artificial intelligence allows computer systems to work with the intellectual processes of humans. However, these machines can carry out tasks more dexterously and efficiently than people. They can also enter hazardous environments, such as areas that require deep sea diving, making certain processes much safer.

In short-AI is improving the way we work. It's not about replacing humans, rather, changing our workplaces for the better.

How AI Powers Space Missions Like Those of SpaceX's– A Study

On May 30, 2020 a SpaceX Falcon 9 rocket carrying Crew Dragon was launched at 3:22 p.m. US Eastern Time from the Kennedy Space Center, this being the first time a space mission was launched by NASA since it decommissioned its ageing and unsafe Space Shuttle fleet in 2011. The rocket was successful in deploying the vehicle into orbit and safely returning to Earth. 5.1

The mission

Aboard the Crew Dragon are astronauts Bob Behnken and Doug Hurley who are tobe launched into the International Space Station. The mission marks the first time a private company has pulled off a crewed mission into low Earth orbit, a report said. The Crew Dragon and its self- landing, reusable Falcon 9 rocket is owned by SpaceX, who's founder and CEO is Elon Musk. NASA just rents the spacecraft and the rocket at a cost of around $55 million per passenger, said another report.

AI in SpaceX's mission

Little did you know this historic mission is powered by the cuttingedge technology of artificial intelligence, Yes! A sophisticated AI autopilot steers the cone-shaped Crew Dragon that is on its way to the ISS. Once the Crew Dragon reaches within 60feet of the space station, the astronauts will maneuver the vehicle to the ISS and remain in space for weeks on end, depending on when they are called back. In 2018too, a SpaceX rocket flew into space with the first robot powered by artificial intelligence.

Fig3. Image Source: businessinsider.in

How AI powers space exploration

AI helps analyze the huge amounts of data emanating from space exploration and this helps advance space exploration with each passing day. Moreover, AI is making it possible for rovers currently roving the atmosphere of Mars to take decisions independent of the mission. Data received from space is mainly in the form of images that are studied through machine learning techniques at the NASA Frontier Development Lab that has roped is the services of tech giants like IBM and Microsoft.

Infact, machine learning is helping in solar storm damage detection, atmosphere measurement, and determining the 'space weather' of a given planet through the magnetosphere and atmosphere measurement. Reports say the same technology is used in resource discovery in space. Moreover, AI applications "can optimize planetary tracking systems, enable smart data transmission, and nullify the risk of human error (by using predictive maintenance)," said this report. it's currently being utilised by a variety of industries, including-

Healthcare

AI can mimic cognitive functions. This makes it a perfect fit within healthcare, where many issues need addressing to make treatments faster, more effective and more affordable.

One example of this is using artificial intelligence to build databases of drugs and medical conditions. This can help us find cures or treatment for rare diseases. AI is also being utilised to make healthcare more affordable around the world. The machine can mimic a doctor's brain, recognizing how humans express their ailments.

Transport

Artificial intelligence is greatly improving the efficiency of the transport sector. It can help optimise routes, finding the fastest and safest journeys for different vehicles.

Manufacturing

Adopting AI in different factories is helping to:

–Make certain processes safer by automating them

–Improve engineering efficiency

–Increase revenue

The Value of AI in Space

The space come in, Artificial intelligence has enormous promise within satellite and space technology.

Global Navigation

Data collected by Global Navigation Satellite Systems (GNSS) can support AI applications. Tracing, tracking, positioning and logistics are all areas that can be greatly improved due to precise and consistent data collection.

AI in Indian space missions

India too has been generating indigenous AI technology to power its space missions. Take for example its Chandrayaan-2 mission that was launched in July 2019. Scientists integrated AI technology with Chandryaan-2's rover – Pragyan. A report said, the Indian Space Research Organisation delivered Pragyan – a solar- powered robotic vehicle that was to explore the lunar surface on six wheels. Moreover, "the artificial intelligence algorithm could also help the rover detect traces of water and other minerals on the lunar surface."

Understanding Artificial Intelligence and Machine Learning

Artificial Intelligence or the shorter and cooler term AI refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. The term may also be applied to any machines that exhibit traits associated with a human mind such as learning and problem-solving.

Machine learning is a specialized branch in the AI domain that deals with training machines to develop intelligence that can enable them to do complex tasks by using their intelligence. Machine learning algorithms use tons of data to help machines get familiar with diverse scenarios that they can face. It enables machines to learn from their training experience and use them in real-life scenarios.

SpaceX Falcon 9 rocket carrying AI robot Cimon blasts off for ISS.

The robot named Cimon in the SpaceX will give first insights into effects on crew support by AI.

A SpaceX Dragon spacecraft loaded with about 2,600 kgs of research and supplies, including experiments investigating cellular biology, Earth science and Artificial Intelligence (AI), lifted off on a Falcon 9 rocket on 29 June from Cape Canaveral Air Force Station in Florida.

This is SpaceX's 15th cargo flight to the space station under NASA's Commercial Resupply Services contract, NASA said in a statement.

The spacecraft's occupant also included a robot named Cimon, short for Crew Interactive Mobile Companion. The pilot study with Cimon is a technology demonstration project, and an observational study, that aims to obtain the first insights into the effects on crew support by AI, in terms of efficiency and acceptance during long-term missions in space.

CONCLUSION

AI and Space: Made for Each Other

Over the last few years we have continued to see a large effort to commercialize space. Several companies are even looking to start tourist trips into space. Artificial intelligence is working to make space commercialization a possibility and to make space a safe environment in which to operate. The various benefits of AI in space all work together to enable further venturing into the unknown.

AI helps analyze the huge amounts of data emanating from space exploration and this helps advance space exploration with each passing day. Moreover, AI is making it possible for rovers currently roving the atmosphere of Mars to take decisions

independent of the mission. The NASA Curiosity rover can dodge obstacles on its route by itself and determine the best route possible. Data received from space is mainly in the form of images that are studied through machine learning techniques at the NASA Frontier Development Lab that has roped is the services of tech giants like IBM and Microsoft.

Future Scope

Machine learning is helping in solar storm damage detection, atmosphere measurement, and determining the 'space weather' of a given planet through the magnetosphere and atmosphere measurement. Reports say the same technology is used in resource discovery in space. Moreover, AI applications "can optimize planetary tracking systems, enable smart data transmission, and nullify the risk of human error (by using predictive maintenance)," said this report. There are so many other research going on implementing Artificial Intelligence in space exploration. Although, like other applications of AI, nothing can be secure and concrete. At the end of the day, we need human interventions in everything AI is capable of. With each innovation, AI is coming closer to providing newer insights and proving to be an advantage for humans in exploring the interstellar space with the innovative machine and project and researches.

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