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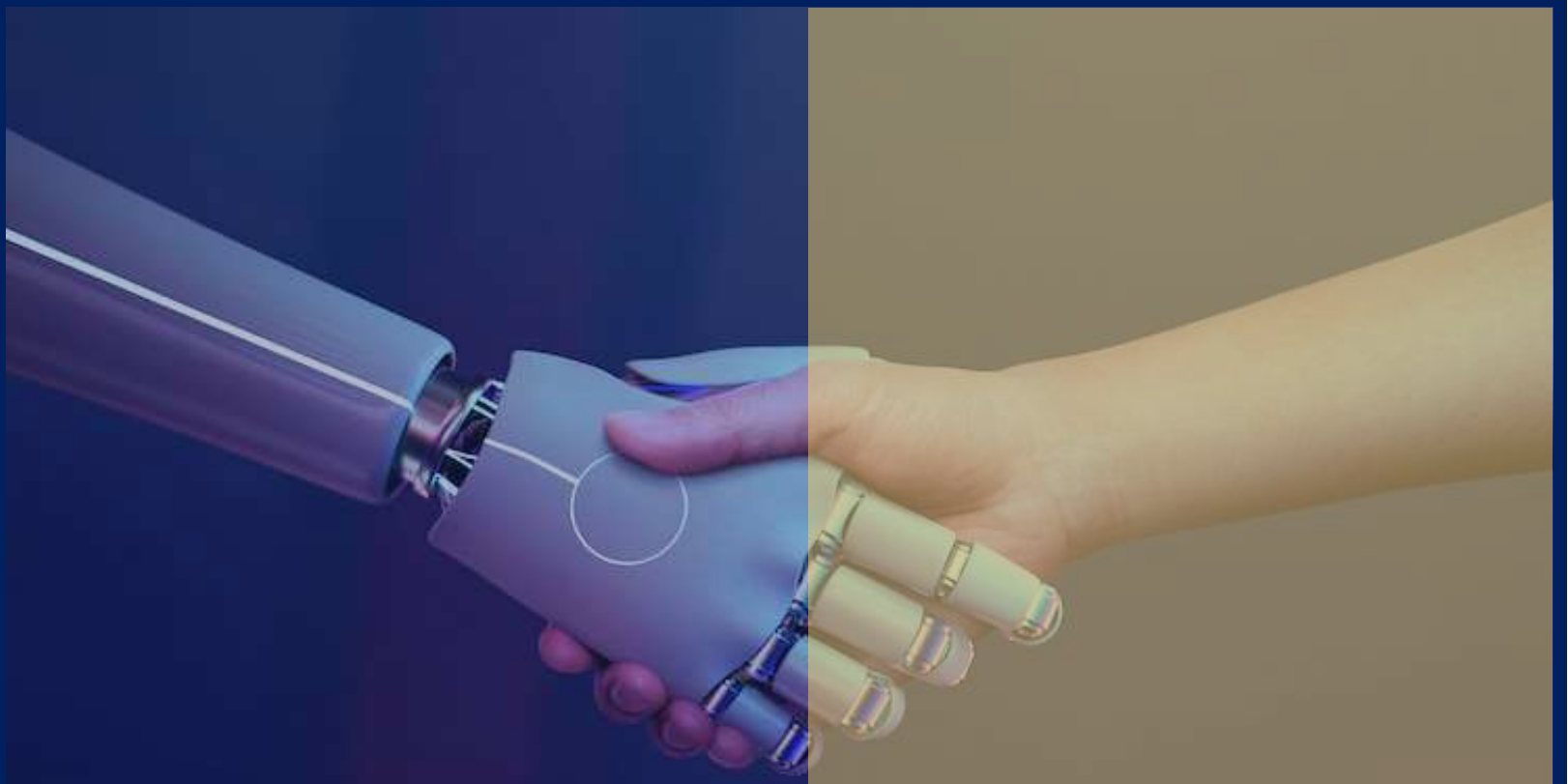

RESEARCH PAPER

ARTIFICIAL INTELLIGENCE AND ITS APPLICATION

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Artificial Intelligence

Abstract: Artificial intelligence (A.I.) is a multidisciplinary field aimed at automating tasks that currently need human intelligence. Despite its lack of general familiarity, artificial intelligence (AI) is a technology that is revolutionizing every aspect of life. This article aims to educate laypeople about AI and encourage them to utilize it as a tool in many disciplines to rethink how we combine data, analyze it, and make choices. We quickly covered what artificial intelligence (AI) is, how it works, and how it may be applied in our daily lives in this article.
Keywords: Artificial Intelligence, Machine Learning, Deep Learning, Cognitive Computing, Computer Vision.

INTRODUCTION

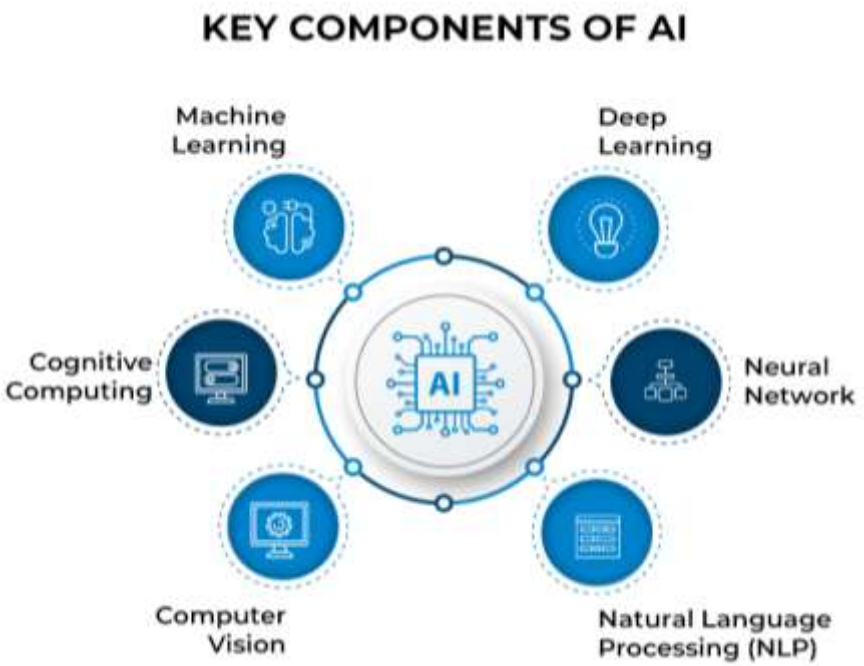
Artificial Intelligence (AI) refers to the ability of computer systems to perform complex tasks that typically require human-level intelligence, such as recognizing speech or images, playing games, or making decisions. In essence, AI involves the computational component of an entity's capacity to achieve goals in the real world. Intelligence can be defined as the ability to perceive, reason, learn, and adapt to changing circumstances. AI aims to make computers more adaptable, flexible, and capable of forming their own analyses and solution strategies by applying general knowledge to specific situations. The potential applications of AI are vast, ranging from healthcare and finance to transportation and entertainment.

OVERVIEW OF AI

Machine or software intelligence is referred to as artificial intelligence. Perceive + Analyze + React = Intelligence. Artificial intelligence (AI) is an interdisciplinary field of study that deals with the development of intelligent machines that can perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and language translation. The goal of AI is to create machines that can learn from experience, adapt to new situations, and solve complex problems in a more efficient and effective way than humans can. AI is transforming industries such as healthcare, finance, transportation, and education, and is becoming increasingly integrated into our daily lives through virtual assistants, chatbots, and recommendation systems. As AI continues to advance, it has the potential to create new opportunities and address some of the world's biggest challenges, but also raises ethical and societal concerns that must be carefully considered.

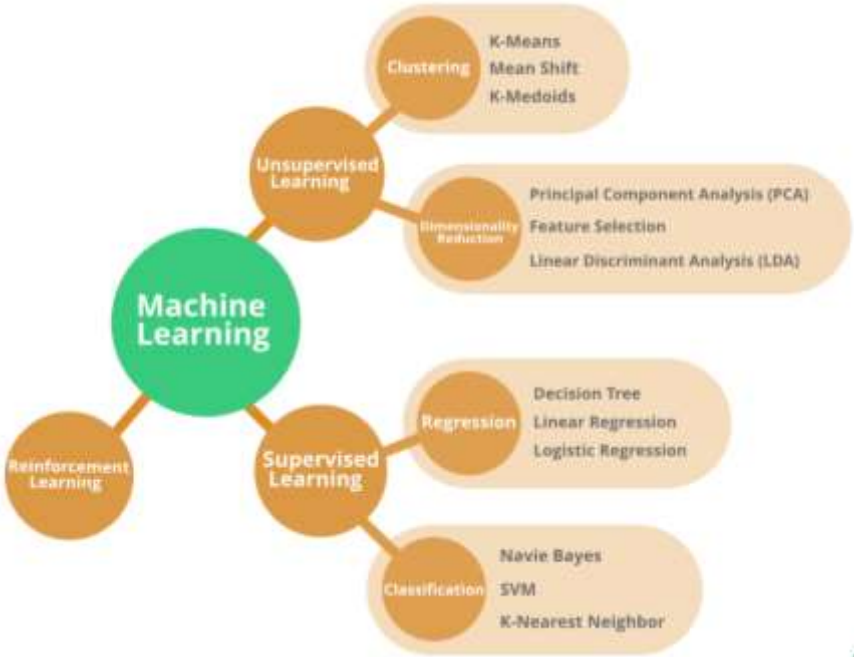
WORKING OF AI

AI is frequently misplaced on an island with robots and self-driving cars, according to popular belief. This method, however, overlooks one of artificial intelligence's most important practical applications: analysing the massive volumes of data created every day. Insight gathering and job automation may be done at a previously inconceivable velocity and scale by carefully applying AI to particular activities. AI systems execute sophisticated searches through the mountains of data generated by people, deciphering both text and pictures to detect patterns in complicated data and then acting on their findings. Computer systems that can grasp the meaning of human language, learn from experience, and make predictions, thanks to cutting-edge technologies. Following are a few subfields of AI.



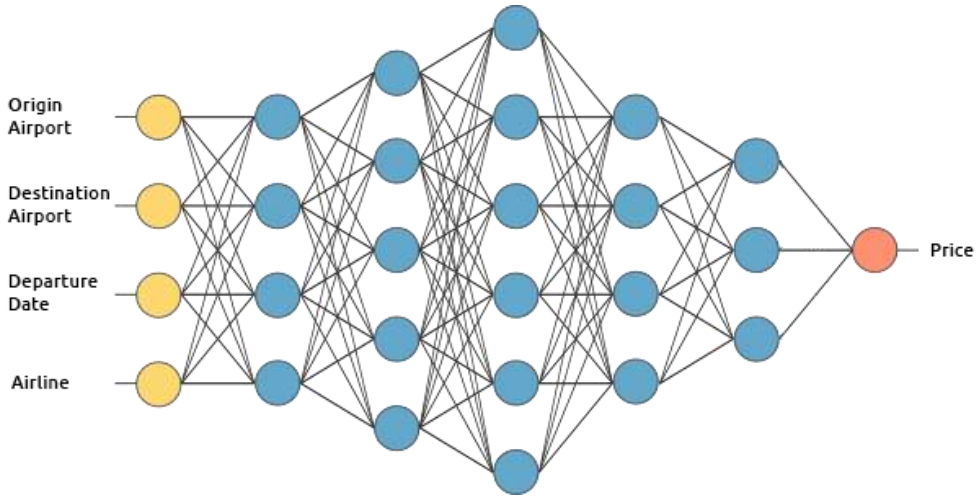
1. Machine Learning | Learning from experience

Machine learning, or ML, is an AI application that allows computers to automatically learn and grow from their experiences without having to be explicitly programmed. The goal of machine learning is to create algorithms that can analyze data and generate predictions. Machine learning is being utilized in the healthcare, pharma, and life sciences sectors to improve illness detection, medical picture interpretation, and medication acceleration, in addition to predicting what Netflix movies you would like.



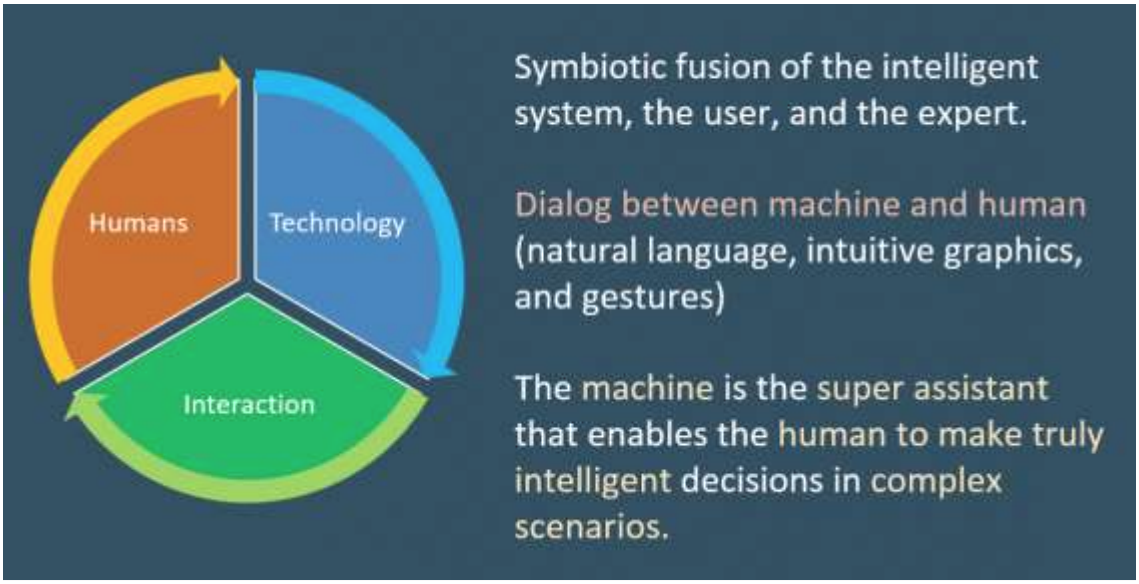
2. Deep Learning | Self-educating machines

Deep learning is a type of machine learning that utilizes artificial neural networks to learn from data and make predictions or decisions. The neural network is composed of layers of interconnected nodes or neurons that process and transform the data. By stacking multiple layers, the network can learn to recognize increasingly complex patterns in the data, leading to better performance on the task at hand. Deep learning has been applied to a wide range of fields, including computer vision, natural language processing, speech recognition, and robotics, and has achieved state-of-the-art performance on many tasks.



3. Cognitive Computing | Making inferences from context

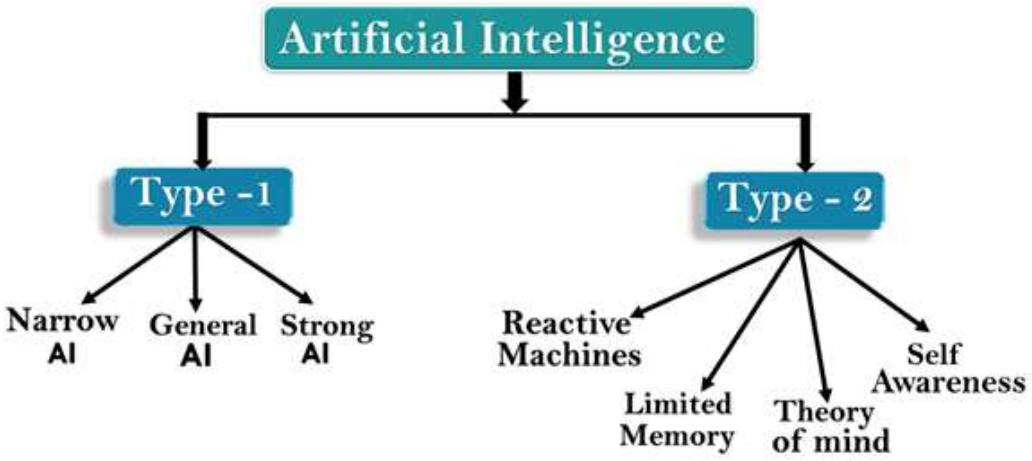
Cognitive computing is a field of computer science that aims to create intelligent machines that can perform tasks that typically require human-like understanding and reasoning. This includes tasks such as natural language processing, speech recognition, image and video analysis, and decision making. Together, cognitive computing and artificial intelligence strive to endow machines with human-like behaviour and information processing abilities. Another form of deep learning is speech recognition, which enables the voice assistant in phones to understand questions like, "Hey Siri, how does artificial intelligence work?"



4. Computer Vision | Understanding images

Computer vision is a method of interpreting image material, such as graphs, tables, and photographs within PDF documents, as well as other text and video, using deep learning and pattern recognition. Computer vision is a branch of artificial intelligence that allows computers to recognize, analyse, and interpret visual input. This technology's applications have already begun to transform areas such as research and development and healthcare. Computer Vision and machine learning are being used to analyse patients' x-ray images in order to diagnose patients faster.

TYPES OF AI



AI Type-1: Based on Capabilities

1. Artificial Narrow Intelligence (ANI) - also known as Weak AI - refers to AI systems that are designed to perform a specific task or a set of tasks within a limited domain. ANI systems are not capable of general intelligence, and they can only operate within their specified domain. Examples of ANI include voice assistants like Siri or Alexa, image recognition software, and recommendation engines.
2. Artificial General Intelligence (AGI) - also known as Strong AI - refers to AI systems that can perform any intellectual task that a human can. AGI is currently a hypothetical concept, and no such system has been

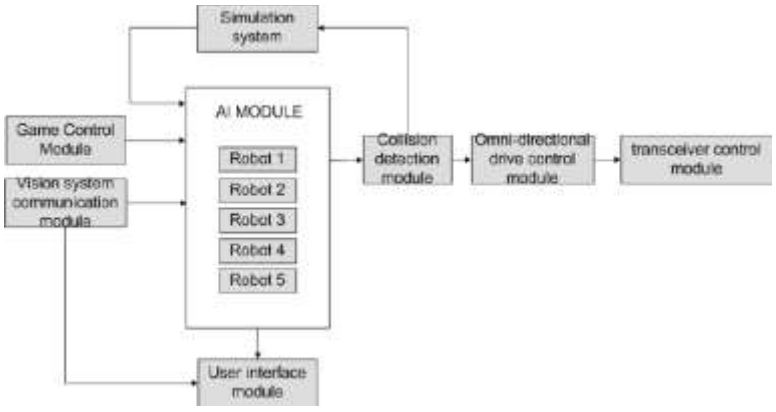
developed yet. An example of an AGI system would be a robot that can navigate complex environments, learn from its surroundings, and engage in a range of tasks.

3. Artificial Superintelligence (ASI) - refers to AI systems that surpass human intelligence in all aspects, including creativity, problem-solving, and social skills. ASI is also a hypothetical concept, and it is not clear if such a system can be developed or if it would be safe. An example of ASI would be a system that could solve problems that humans are unable to solve, such as finding a cure for cancer or understanding the mysteries of the universe.

AI Type-2: Based on Functionality

1. Reactive Machines - AI systems that can react to a situation based on pre-defined rules without any memory or learning. Reactive machines are not capable of learning or adapting to new situations. Examples of reactive machines include chess-playing computers, voice assistants that respond to specific commands, and automated trading systems.
2. Limited Memory - AI systems that can use past experiences to make decisions. Limited memory systems are capable of learning from their experiences, but they do not have a complete understanding of the world around them. Examples of limited memory AI include self-driving cars that learn from past driving experiences, personalized recommendation systems that learn from user behavior, and fraud detection systems that use historical data to identify potential fraud.
3. Theory of Mind - AI systems that can understand human emotions, beliefs, and intentions. Theory of mind AI is still in the early stages of development, but it has the potential to revolutionize human-AI interactions in fields such as healthcare, education, and customer service. An example of a system that utilizes this concept is the virtual assistant Replika, which is designed to understand and respond to human emotions and thoughts.
4. Self-Aware - AI systems that can understand their own existence and consciousness. Self-aware AI is currently a hypothetical concept, and it is not clear if it can be developed or what the implications would be. There are currently no examples of self-aware AI.

I. AI SYSTEM ARCHITECTURE



A main thread runs through the artificial intelligence system, looping and calling each of the several modules. To determine the position and orientation of robots, the main system thread first connects with the visual system. Aside from the ball's location. The system then checks the referee's control of the game state. After that, the system invokes the AI module function, which provides the required robot movement position as well as extra actions to take. Following the specification of motions, the system calculates collision avoidance trajectories to prevent colliding with other robots. The algorithm

then estimates the speed of each of the robots' four wheels. Finally, the system broadcasts communication packets corresponding to orders to take action via the transceiver. The following is a full description of each of the modules depicted in the above diagram:

1. Vision System Communication Module

This module offers vision system commands for the game scenario, which correlate to robot and ball coordinates, as well as robot angles, through packets.

2. Game Control Module

Through a serial interface, this module takes referee orders and returns the game's current status.

3. AI Module

This module gets the locations of the robots and the ball, as well as the orientations of the robots, the game state, the roles of the robots, the firing direction, and the field setup. The system uses all of this data to calculate each robot's future position and actions. The chosen approach is determined by the configuration of a tree containing all feasible actions. The activities are categorized based on their significance. One or more evaluations are utilized for each node in the tree. Each evaluation has a set of possible outcomes linked to a certain score. The tree is assessed during the program's loop. The path to travel from root to leaf (final action) is determined by the highest score of each level's assessment result using the Best First Search technique. The robot movement vector, its linear and rotational velocity, and the employment of the kicker and dribbler devices are determined after the system has achieved a final action such as passing, shooting, or blocking. The robots also include a roll motion to help them coordinate joint operations. Different roles are used to coordinate the robots: goalkeeper, defence, first, second, and third forward. The goalie's job is to keep the ball out of the net. When the ball is far away, it takes a block path; when the ball is close, it kicks it. The region around the goal is the only place where you may move. The defence is responsible for assisting the goalkeeper in defending the goal from long-range shots, as well as developing collaborative plans with the three strikers. When near to their own area, defenders clear the ball out and follow opposite robots to prevent a pass and goal. The three forwards have a shared goal, but their priorities differ. They travel over the entire field, coordinating various forms of passing and shooting. When necessary, they may migrate in groups.

4. User Interface Module

Positions, orientations, motor speeds, intended positions, ids, actions, game status, and referee instructions are all shown in real time for each robot in this module. Robot positions, orientations, desired locations, and actions are visually shown in an OpenGL-based GUI.

5. Simulation System

This module simulates the functioning of an artificial intelligence system without requiring the use of a real vision system or robotics. The artificial intelligence module may be used to debug and test activities. The construction of things that think using decision logic is referred to as intelligent object-based simulation. Simio, for example, selects jobs or resources using intelligent objects packed with decision logic. As a result, the item has intelligent behaviour that can predict future performances. The usage of intelligent objects in the context of AI in simulation emphasizes the integration of rule-based AI into simulation models. Manually developing complicated rule-based reasoning is a time-consuming operation, and the rule's performance is also determined by the creator's expertise level. AI, with a focus on the use of neural networks,

eliminates the need for manual construction. Manually developing complicated rule-based reasoning is a time-consuming operation, and the rule's performance is also determined by the creator's expertise level.

6. Collision Detection Module

This module simulates the functioning of an artificial intelligence system without requiring the use of a real vision system or robotics. The artificial intelligence module may be used to debug and test activities. An infrared obstacle avoidance sensor with customizable detection distance is created for wheeled robot obstacle avoidance. One infrared transmitter and one detector make up the module. When an obstacle is in front of the sensor, the emitter's infrared light is reflected back to the receiver. A comparator squares the signal to generate a digital signal. The production is high when there are no obstacles. The output is low when an obstruction is within range. A potentiometer knob can be used to change the sensitivity.

7. Transceiver Communication Module

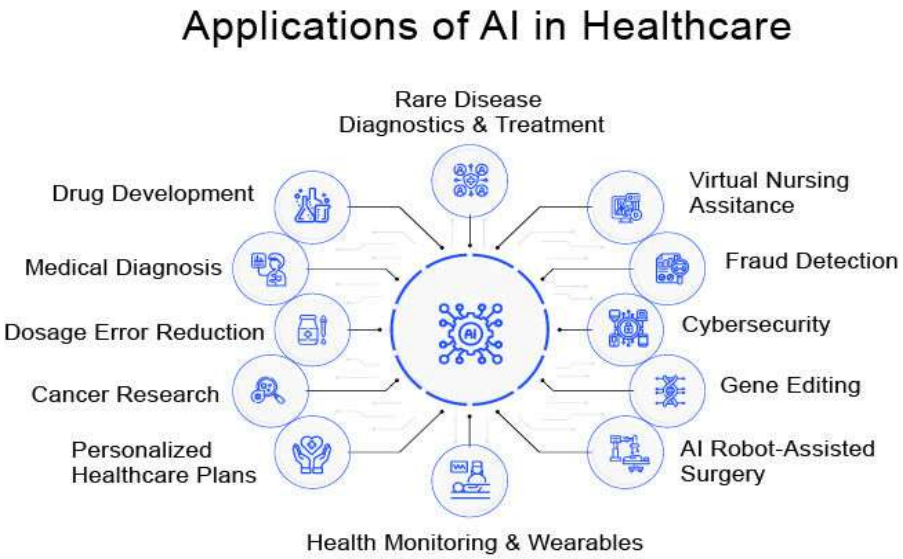
This module gets the speed of each robot motor as well as the activities to be performed. This module creates the packets that our transceiver sends out. It also ensures that communication is always active.

8. Omni-Directional Drive Control Module

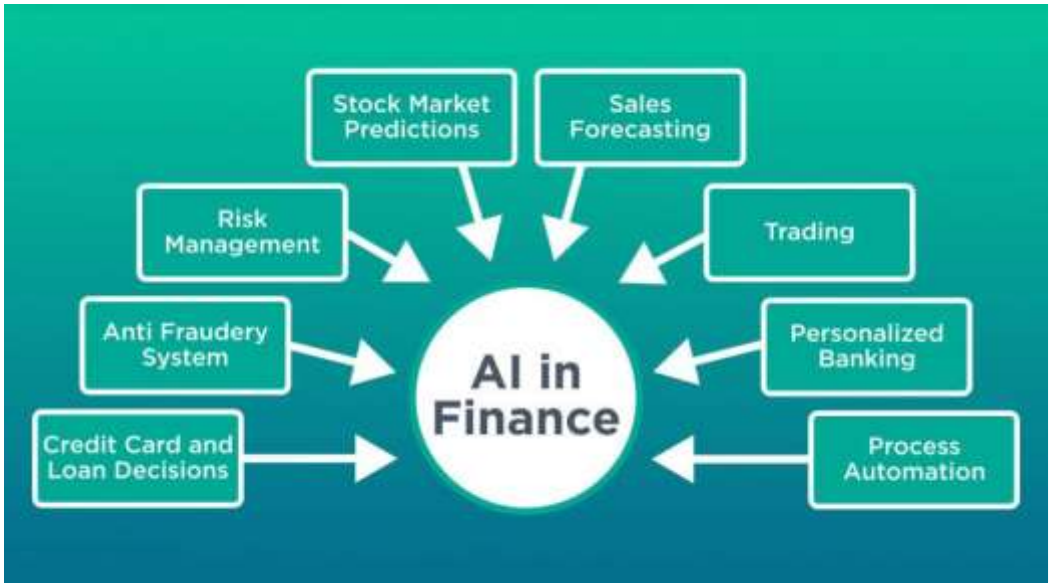
This module takes the movement vector, which includes linear and angular velocities, and calculates the speed of each of the four robot motors. This module calculates the speed of each motor for the robot's four omnidirectional wheels in order to travel in the correct direction.

II. APPLICATIONS OF AI

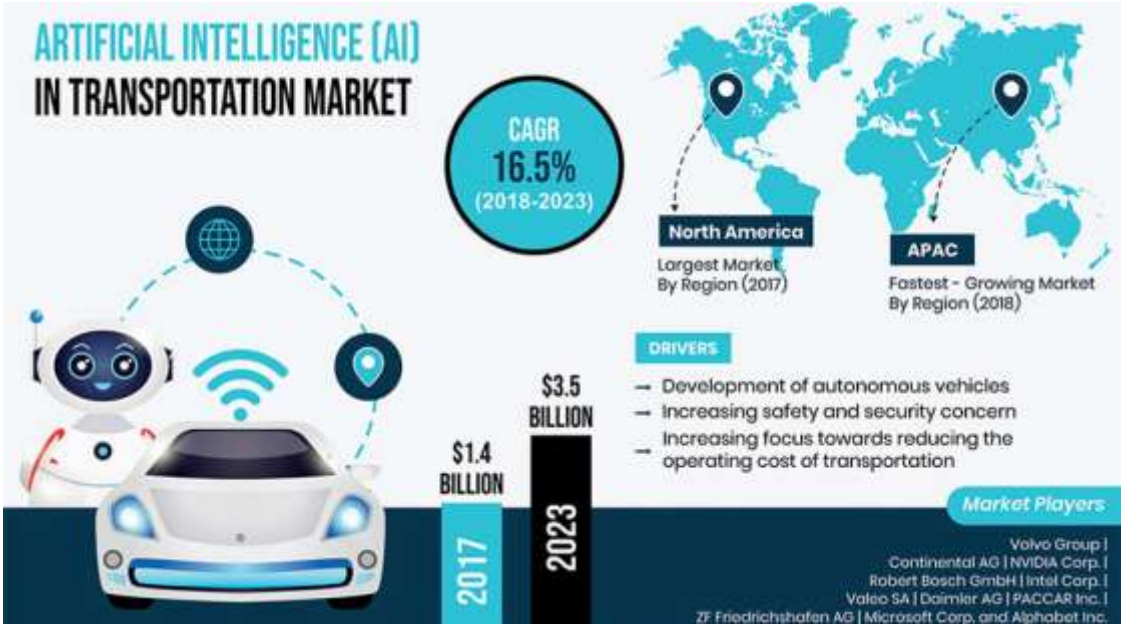
Healthcare: AI is being used to develop personalized treatment plans for patients, for example, IBM Watson Health's Oncology Expert Advisor, which provides clinicians with personalized treatment recommendations for cancer patients based on their medical history and genetic data. AI is also being used to identify disease patterns, such as Google's DeepMind Health, which uses AI to detect eye diseases, and to improve drug discovery, such as BenevolentAI, which uses AI to identify potential drug candidates for clinical trials.



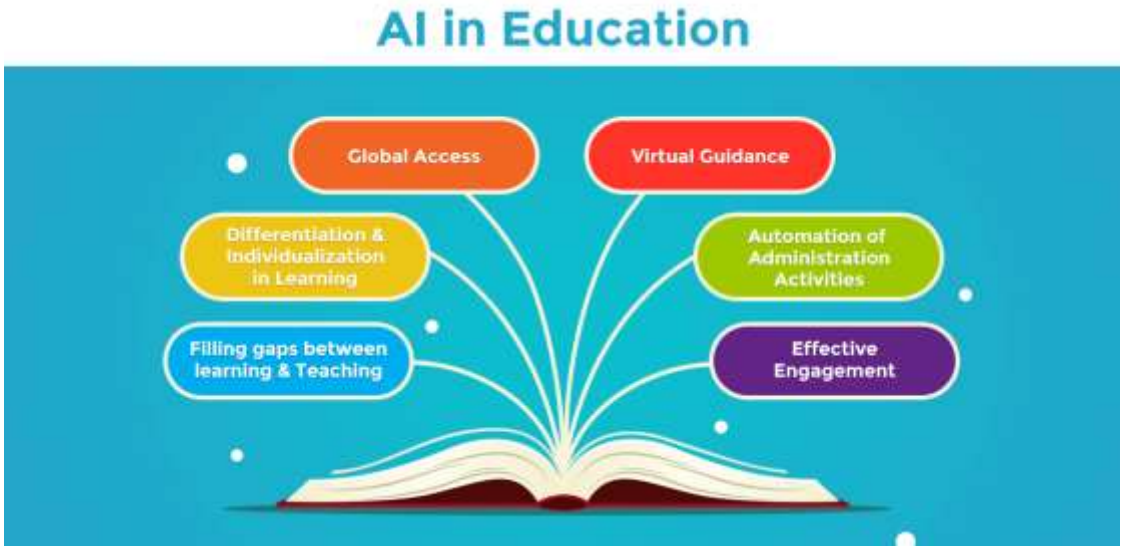
Finance: AI is being used to detect fraud, for example, Mastercard's AI-powered fraud detection system which analyzes millions of transactions in real-time to identify fraudulent activity. AI is also being used to assess credit risk, such as ZestFinance, which uses AI to predict creditworthiness based on non-traditional data points. AI is also being used to optimize investments, such as BlackRock's Aladdin platform, which uses AI to help asset managers make better investment decisions.



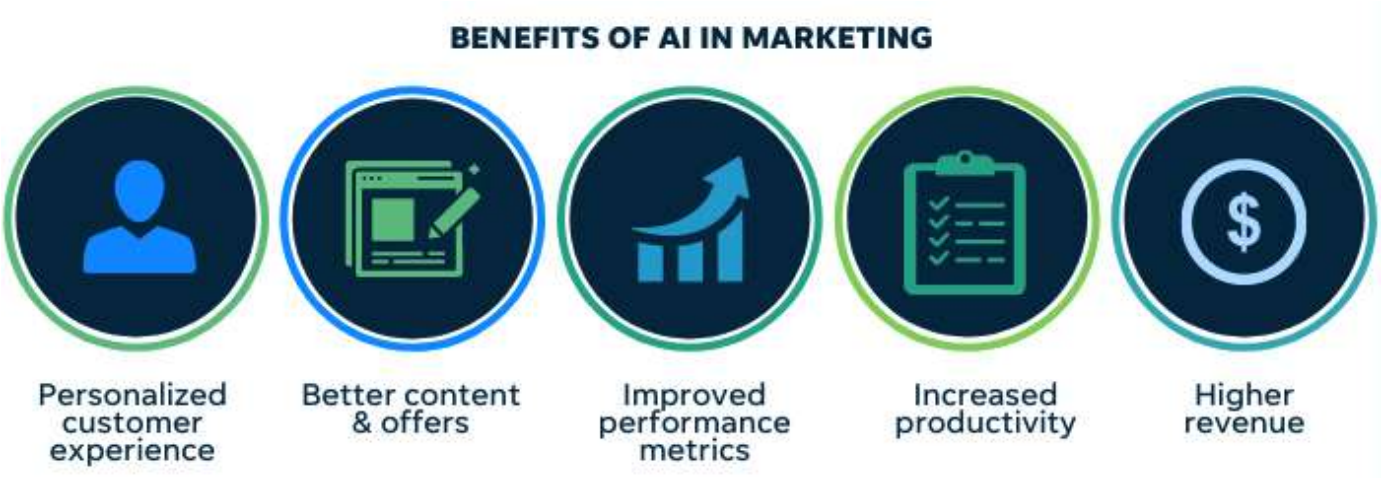
Transportation: AI is being used to develop self-driving cars, for example, Tesla's Autopilot system which uses AI to analyze sensor data and make driving decisions. AI is also being used to optimize logistics and supply chain management, such as UPS's ORION system which uses AI to optimize package delivery routes. AI is also being used to improve public transportation systems, such as London's "Smart Bus" project which uses AI to optimize bus routes and schedules.



Education: AI is being used to personalize learning, for example, Knewton's adaptive learning platform which uses AI to create personalized learning paths for students. AI is also being used to develop intelligent tutoring systems, such as Carnegie Learning's MATHia platform which uses AI to provide personalized math instruction. AI is also being used to assess student performance, such as the EdTech company Dream box which uses AI to analyse student performance data and provide feedback to teachers.



Marketing and advertising: AI is being used to develop personalized marketing campaigns, for example, Amazon's product recommendation system which uses AI to suggest products to customers based on their browsing and purchase history. AI is also being used to optimize customer experiences, such as chatbots and virtual assistants which use AI to provide customer support. AI is also being used to improve product recommendations, such as Netflix's recommendation engine which uses AI to suggest content to viewers based on their viewing history.



Agriculture: AI is being used to optimize crop yield, for example, John Deere's Intelligent Solutions Group which uses AI to help farmers optimize planting, irrigation, and fertilization. AI is also being used to develop precision agriculture

techniques, such as precision irrigation and precision pest management. AI is also being used to monitor livestock health, for example, Ceres Imaging which uses AI-powered aerial imagery to detect crop stress and other issues.

Manufacturing: AI is being used to optimize production processes, for example, GE's Brilliant Factory which uses AI to improve efficiency and reduce downtime. AI is also being used to improve quality control, such as the AI-powered vision system used by Foxconn to detect defects in smartphone screens. AI is also being used to develop predictive maintenance strategies, such as SKF's Rotating Equipment Performance platform which uses AI to predict equipment failures and reduce downtime.

There are many ways in which the average technology consumer interacts with artificial intelligence technologies in their daily lives, but most people don't realize what technologies actually use AI. Here are a few examples of artificial intelligence technologies that many people encounter in their lives.

III. ADVANTAGES OF AI

1. Reduction in Human Error

Because people make mistakes from time to time, the term "human error" was coined. Computers, on the other hand, do not make these errors if they are correctly programmed. Artificial intelligence makes choices based on previously obtained data and a set of algorithms. As a result, mistakes are decreased, and the prospect of achieving better precision and accuracy is increased.

For Example: AI has removed the bulk of human mistake in weather forecasting.

2. Takes risks instead of Humans

One of the most significant advantages of artificial intelligence is this. By constructing an AI Robot that can do the dangerous tasks for us, we can transcend many of humanity's risky limits. It can be utilized efficiently in every type of natural or man-made disaster, whether it is travelling to Mars, defusing a bomb, exploring the deepest regions of the oceans, mining for coal and oil.

For Example: Have you heard about the explosion at the Chernobyl nuclear power facility in Ukraine? There were no AIpowered robots available at the time to assist us in minimizing the effects of radiation by controlling the fire early on, since any human who came near to the core died in minutes. They ultimately used helicopters to drop sand and boron from a safe distance. AI Robots can be utilized in circumstances when human interaction is risky.

3. Available 24x7

Without breaks, an average human will labor for 4–6 hours every day. Humans are created in such a manner that they can take time off to replenish themselves and prepare for a new day at work, and they even have weekly off days to keep their professional and home lives separate. But, unlike humans, we can use AI to make robots work 24 hours a day, seven days a week with no breaks, and they don't grow bored.

For Example: Educational institutions and helpline centres get a large number of requests and difficulties that AI can successfully address.

4. Digital Assistance

Digital assistants are used by some of the most modern enterprises to engage with people, reducing the requirement for human personnel. Many websites now utilize digital assistants to supply items that consumers seek. We can discuss what we're searching for with them. Some chatbots are created in such a manner that it's difficult to tell whether we're conversing with a machine or a person.

For Example: We all know that businesses have a customer service staff that is responsible for answering customers' questions and concerns. Organizations may use AI to create a voice bot or a chatbot that can assist consumers with all of their questions. Many firms have already begun to use them on their websites and mobile applications.

IV. DISADVANTAGES OF AI

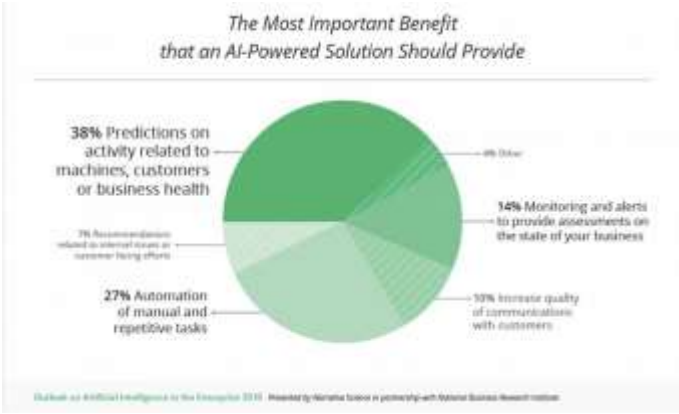
1. High Cost of Implementation

Setting up AI-based machines, computers, etc. entails huge costs given the complexity of engineering that goes into building one. Further, the astronomical expense doesn’t stop there as repair and maintenance also run into thousands of dollars.

2. Doesn't Improve With Experience

One of the most amazing characteristics of human cognitive power is its ability to develop with age and experience. However, the same can't be said about

AIs as they are machines that can't improve with experience, rather it starts to wear and tear with time.

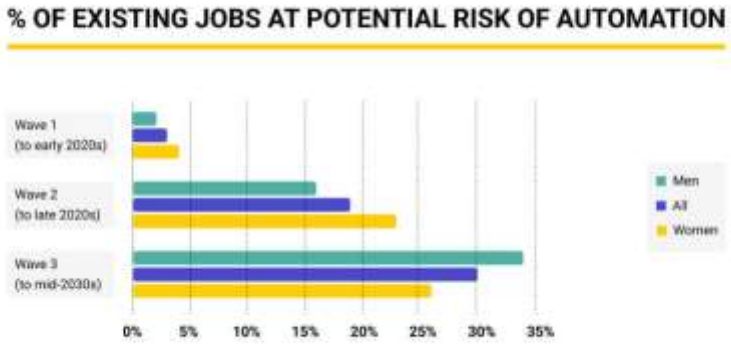


3. Lacks Creativity

As already mentioned above – AIs are not built for creative pieces of work. So, it should be crystal clear by now that creativity or imagination is not the forte of the AIs. Although they can help you in designing and creating something special, they still can't compete with the human brain. Their creativity is limited to the creative ability of the person who programs and commands them.

4. Risk Of Unemployment

With rapid development being made in the field of AI, the question that plagues our intuitive brain is that – will AI replace humans? Honestly, I am not sure whether AIs will lead to higher unemployment or not. But AIs are likely to take over the majority of the repetitive tasks, which are largely binary in nature and involve minimum subjectivity.



V. CONCLUSION

While concluding, it can be analyzed that AI has benefited computer science because it is the artificial psychology that made the machines to focus on the philosophical arguments. AI performs tasks faster than human beings and the major goal of artificial intelligence is to create the technology in an intelligent manner. It is proved that artificial intelligence is the computer knowledge that has human traits, however, these computers and robots help the environment to grow, and they respond rationally to help human beings. AI has already impacted lives of people in various fields and will surely continue to do more in the future.

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