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Artificial Intelligence, its Applications and Associated Technologies

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ABSTRACT

This paper reviews the meaning of Artificial Intelligence and its various advantages and disadvantages including its applications. It also considers the current progress of this technology in the real world and discuss the applications of Artificial Intelligence in the fields of handwriting recognition, Speech recognition, Intelligent robots, Knowledge representation, Game theory and Strategic planning, Natural Language processing, aviation, Weather forecasting and Expert systems. This paper concludes by analysing the future potential of Artificial Intelligence.

Keywords: Artificial Intelligence, Turing test, Expert system, Speech recognition, Natural Language Processing

I. INTRODUCTION

Since the invention of computers or machines their capability to perform various tasks went on growing exponentially. Humans have developed the power of computer system in terms of their diverse working domains, their increasing speed and reducing size with respect to time. A branch of computer science named Artificial Intelligence pursues creating the computers or machines as intelligent as human beings.

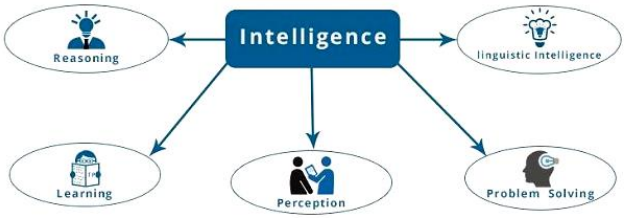


Figure 1. Overview of Intelligence

Intelligence in simple language is the computational part of the ability to achieve goals in the world. Intelligence is the ability to think, to imagine creating memorising and understanding, recognising patterns, making choices, adapting to change and learn from experience.

Artificial Intelligence is concerned with making computers behave like humans more human like fashion and in much less time, than a human takes. Hence it is called as Artificial Intelligence. According to the father of Artificial Intelligence, John McCarthy, "The science in engineering of making intelligent machine, especially intelligent computer program".

Artificial Intelligence is accomplished by studying how human brain think, and how humans learn,

decide and work while trying to solve a problem and then using the outcomes of this study as a bases of developing intelligent software and systems.

A. Philosophy of AI

While exploiting the power of the computer systems, the curiosity of human, lead him to wonder, "Can a machine think and behave like humans do?" Thus

the development of AI started with the intention of creating similar intelligence in machines that we find and regard high in humans.

AI can be divided into two parts according to Philosophy of AI

a) Strong AI
b) Weak AI

Strong AI

The principle behind strong AI is that machines could be made to think or in other words could represent human minds in the future. Thus strong AI claims that in our future we will be surrounded by such kinds of machine which can completely works like human being and machine could have human level intelligence. If that is the case those machines will have the ability to reason, think and do all functions that a human is capable of doing. Current research is nowhere, near creating strong AI, and a lively debate is ongoing as to whether this is even possible.

Weak AI

The principle behind Weak AI is simply the fact that machine can be made to act as if they are intelligent. Weak AI simply states that thinking like features can be easily added to computer to make them more useful tools and this already started to happen. For example, when a human player plays chess against a computer, the human player may feel as if the computer is actually making impressive moves. But the chess application is not thinking and planning at all. All the moves it makes are previously fed in to the computer by a human and that is how it is ensured that the software will make the right moves at the right time. More examples of Weak AI are witness expert systems and speech recognition systems.

Intelligence = perceive + Analyse + React

Also, there is a huge difference between short term memory and RAM. Short-term memory holds the pointer to the long term memory where all the information is actually stored while RAM stores data that is isomorphic to data being held on hard disk. Also RAM has a memory limit while there seems to be no capacity limit when it comes to short-term memory.

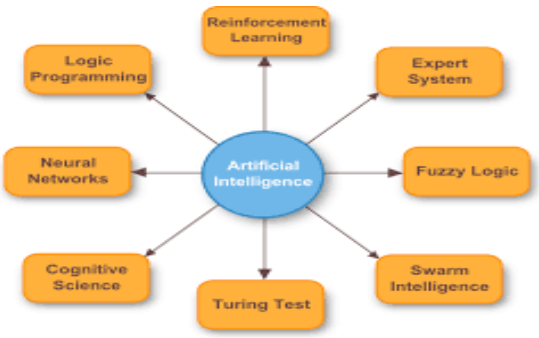


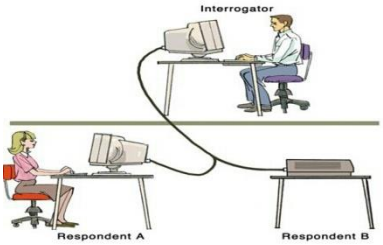
Figure 2. Overview of Artificial Intelligence

B. Turing Test

This test was introduced by Alan Turing in his 1950 paper "Computing Machinery and Intelligence". The original question behind this test was "Can machines think?"

A Turing test is a test performed to determine a machine's ability to exhibit intelligent behaviour. The basic concept behind the test is that if the human judge is engaged in a natural language conversation with a computer where he cannot reliably distinguish machine from human, machine passes the test. Responses from both the participants in the conversation are received in the form of a text-only channel.

The Turing test is used to measure a machines ability to think and is an important concept in the Philosophy of AI. A machine's success at thinking can be quantified by the likelihood that a human will misidentify as a human subject.



In a Turing test, the interrogator must determine which responses are from the computer and which are from the human

Figure 3. Turing Test

A computers ability to think is determined through an imitation game. In this game there are 3 players A, B and C. Player A is a man, B is a woman and C is of either sex. C cannot see A and B, and communicates with the others through written notes. Player C determines which of the others is a man and which is a woman by asking a series of questions. Player A tricks the interrogator into making wrong decisions, while B attempts to guide C towards the right path.

In the original imitation game test Turing proposes A to be a computer. The computer pretends to be a woman and tricks the interrogator into making an incorrect evaluation. The machines success is determined by comparing the outcome of the game when A is a computer against when A is a man. If the interrogator goes wrong when playing the game between man and woman, the computer is assessed to be intelligent. There are some variations on the interpretations of how a Turing test should be performed but the basic premise is whether a human judge can determine whether he is talking to a machine or another human.

C. Roots of AI

AI draws from many areas from philosophy, from mathematics, from economics, Biology and psychology, and from computer engineering, and also from linguistics.

Philosophers have analysed the nature of knowledge and have explored formal frameworks for developing conclusions. There have been mathematical formulations in logic, in computation and probability.

Economists have developed decision theory and biologists have recent about how the brain process information. Psychologists have long studied human cognition and they require knowledge about the nature of human intelligence.

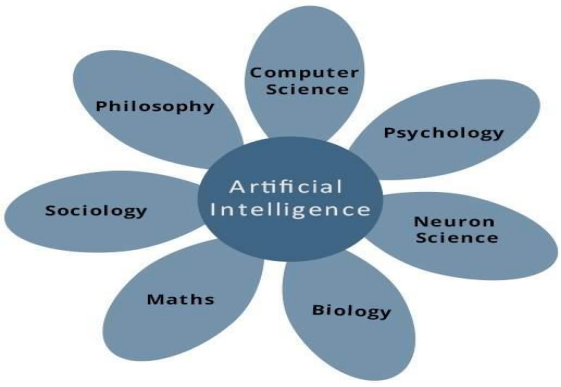


Figure 4. Roots of AI

The discussions about the importance of AI in our life have gained momentum in recent year.

Is it a boon or bane to future of human existence? , is an ongoing debate.

The very idea to create an artificial intelligence is to make the lives of human easier. Researchers of AI want to bring in the emotional quotient to the machines along with the general intelligence.

II. PROS AND CONS OF AI

Advantages

- Error reduction: AI helps us in reducing the error and chance of reaching accuracy with a greater degree of precision is a possibility. It is applied in various studies such as Exploration of space.
- Difficult exploration: AI and the science of robotics can be put to use in mining and other fuel exploration processes. Not only that, these complex machines can be used for exploring the ocean floor and hence overcoming the human limitations. Due to the programming of the robots, they can perform more laborious with greater responsibility. Moreover, they do not wear out easily.
- Daily Applications: Computed methods for automated reasoning, learning and perception have become a common phenomenon in our everyday lives. We have our lady SIRI or CORTANA to help us out. Artificial Intelligence is widely employed by financial institutions and

banking institutions to organize and manage data. Detection of fraud uses artificial intelligence in a smartcard based system.

- Digital Assistants: Highly advanced organizations use 'avatars' which are replicas or digital assistants who can actually interact with the users, thus saving the need of human resources. For artificial thinkers, emotions come in the way of rational thinking and are not a distraction at all. The complete absence of the emotional side makes the robots think logically and take the right program decisions. Emotions are associated with moods that can cloud judgment and affect human efficiency. This is completely ruled out for machine intelligence
- Repetitive jobs: These are monotonous in nature can be carried out with the help of machine intelligence. Machines think faster than humans and can be put to multi-tasking. Machine intelligence can be employed to carry out dangerous tasks. Their parameters, unlike humans, can be adjusted. Their speed and time are calculations based parameters only. We consider gaming to be the most common use of the benefits of artificial intelligence.
- Medical Applications: Medical professionals are often trained with the artificial surgery simulators. It finds a huge application in detecting and monitoring neurological disorders as it can simulate the brain functions. Robotics is used often in helping mental, health patients to come out of depression and remain active. A popular application of artificial intelligence is radio surgery. Radio surgery is used in operating tumors, this can actually help in the operation without damaging the surrounding tissues.
- No Breaks: Machines, unlike humans, don't require frequent breaks and refreshments. They are programmed for long hours and can continuously perform without getting bored or distracted or even tired.

DISADVANTAGES

- High cost: Creation of artificial intelligence requires huge costs as they are very complex machines. Their repair and maintenance require huge costs. They have software programs which need frequent up gradation to cater to the needs of the changing environment and the need for the machines to be smarter by the day. In the case of severe breakdowns, procedure to recover lost codes and re-instating the system might require huge time and cost.
- No replicating humans: Intelligence is believed to be a gift of nature. An ethical argument continues, whether human intelligence is to be replicated or not. Machines do not have any emotions and moral values. They perform what is programmed and cannot make the judgment of right or wrong. Even cannot take decisions if they encounter a situation unfamiliar to them. They either perform incorrectly or breakdown in such situations.
- No improvement with experience: Machines are unable to alter their responses to changing environments. We are constantly bombarded by the question whether it is really exciting to replace humans with machines. In the world of artificial intelligence there is nothing like working with a whole heart or passionately. Care or concerns are not present in the machine intelligence dictionary. They fail to distinguish between a hardworking individual and an inefficient individual.
- No original creativity*:* They are not the forte of artificial intelligence. While they can help you design and create, they are no match for the power of thinking that the human brain has or even the originality of a creative mind. Human beings are highly sensitive and emotional intellectuals. They see, hear, think and feel. Their thoughts are guided by the feelings which completely lacks in machines. The inherent intuitive abilities of the human brain cannot be replicated.

- Unemployment: Replacement of humans with machines can lead to large scale unemployment. Unemployment is a socially undesirable phenomenon. People with nothing to do can lead to the destructive use of their creative minds. They will lose their creative power and will become lazy. Also, if human starts thinking in a destructive way, they can create havoc with these machines.

III. CURRENT PROGRESS

Artificial Intelligence has created with the sole aim of mimicking or even outperforming human minds. Thus it is very important we question the fact that whether it has actually been able to do so.

It cannot be ignored that the fact of AI is being used all around us especially in the fields of medicine, robotics, law, stock trading etc. It is being used in homes and big establishments such as military bases and the NASA space station. NASA has sent out artificially intelligent robots to planets so as to learn more about their habitat and atmosphere, with the intention of investigating if there is a possibility of human living on these planets.

Expert systems have been used by Mercedes Benz and other auto manufacturers in the design of vehicle components, subway systems in Washington, D.C. use expert system software controllers to cause subway trains to stop within 3 inches of the right spot on the platform. These trains have motormen primarily to reassure passengers. AI has filtered into general applications in these fields and has become so common that is not referred to as Artificial Intelligence anymore. Blind supporters of AI would point to the time when AI Deep Blue II defeated chess master Garry Kasparov to prove that Artificial Intelligence can in fact be smarter than humans. Though there is no doubt that the AI Deep Blue II won that game, it is still probably one of the dumbest software alive. The operators were programming the AI in every round depending on the opposition's last move. Also, the Deep Blue II had studied all of Kasparov's previous games while the latter wasn't given the same benefit. One can safely say that even though the Deep Blue II AI defeated Kasparov, it was a never a fair fight to begin with.

Latest technologies like Xbox 360's Kinect and iPhone' s Siri use algorithms based on Artificial Intelligence, but it is a well known fact that these technologies are a long way from being perfect. Thus we can safely conclude that though Artificial Intelligence has made lot of progress in the past few decades, it is not a level where in one can confidently state that it is now ready to completely replace the human mind. That being said, large-scale research is now being conducted into the field of proper simulation of the human brain. Cortex is a project by Artificial Development Inc. and Swiss government's IBM sponsored Blue Brain Project, are two main ventures, whose goal is to simulate the human brain.

IV. APPLICATIONS

Artificial Intelligence in the form of neural networks and expert systems has applications in almost all human activities. The combination of high precision and low computation time makes AI a cutting edge technology. Robot ES' s are already taking over workshop level jobs in large industries, thus side lining humans into a more supervisory role. Stock brokerage firms are now using Artificial Intelligence to analyse data, make analysis and buy or sell stocks without the interference of any human beings beings.

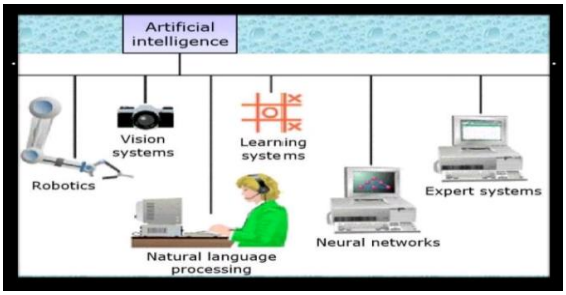


Figure 5. Applications

Artificial Intelligence has been dominant in various fields such as-

- Gaming- AI plays crucial role in strategic game such as chess, poker, tik- tak- toe etc, where machine can think of large number of possible positions based on heuristic knowledge.
- Natural Language Processing- It is possible to interact with the computer that understands natural language spoken by humans.
- Expert Systems- There are some applications which integrate machine software and special information to impart reasoning and advising. They provide explanation and advice to the users.
- Knowledge representation- Data mining seeks to discover interesting patterns from large volumes of Data. These patterns can take various forms, such as associated rules, classification rules, and decision trees, and therefore, knowledge representation becomes an issue of interest in data mining.
- Vision Systems- These systems understand, interpret, and comprehend visual input on the computer. For example a) Spying aeroplane takes photographs, which are used to figure out spatial information or map of the areas. b) Doctors use clinical expert systems to diagnose the patient. c) Police use computer software that can recognize the face of criminal with the stored portrait made by forensic artist.
- Speech Recognition- Some intelligent systems are capable of hearing and comprehending the language in terms of sentences and their meanings while a human talks to it. It can handle different accents, slang words, noise in the background, change in human's noise due to cold, etc.
- Handwriting Recognition- The handwriting recognition software reads the text written on paper by a pen or on screen by a stylus. It can recognise the shape of the letters and convert it into editable text.
- Intelligent Robots- Robots are able to perform the tasks given by a human. They have sensors to detect physical data from the real world such as light, heat, temperature, movement, sound, bump and pressure. They have efficient processors, multiple sensors and huge memory, to exhibit Intelligence. In addition, they are capable of learning from their mistakes and they can adapt to the new environment.
- Weather forecasting- Neural networks are nowadays being used for predicting weather conditions. Past data is provided to the neural network, which then analyses the data for patterns and predicts the future weather conditions.

V. FUTURE SCOPE

Artificial Intelligence is used by one another after the company for its benefits. Also, it's fact that Artificial Intelligence is reached in our day-to-day life, moreover with a breakneck speed.

On the basis of this information, arises a new question:
Is it possible that artificial intelligence outperforms human performance?
If yes, then is it happens and how much does it takes?
Only when artificial intelligence is able to do a job better than humans.

According to the survey results:

- machines are predicted to be better than humans in translating languages;
- running a truck;
- working in the retail sector, and can completely outperform humans by 2060

As a result, MI researchers believed that AI will become better than humans in the next 40year time frame

- To build AI smarter, companies have already acquired around 34 AI start-ups. It was acquired in the first quarter of 2017. These companies are reinforcing their leads in the world of Artificial Intelligence.
- In every sphere of life, AI is present. We use AI to organize big data into different patterns and

structures. Also patterns help in neural network, machine learning, and data analytics.

From 80's to now, Artificial Intelligence is now part of our everyday lives, it's very hard to believe. Moreover it is becoming more intelligent and accepted every day.

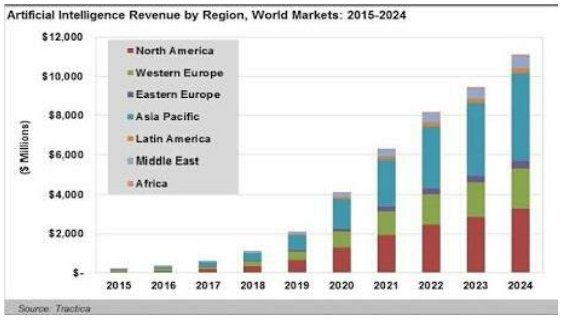


Figure 6. Artificial Intelligence revenue by Region

VII. CONCLUSION

AI is at the centre of new enterprise to build computational models of Intelligence. The main assumption is that Intelligence (human or other ways) can be represented in terms of symbol structures and symbolic operations which can be programmed in a digital computer. There is much debate as to whether such an appropriately programmed computer would be a mind, or would merely simulate one, but AI researchers need not wait for the conclusion to that debate, such as identifying diseases, nor for the hypothetical computer that could model all of human intelligence. Aspects of intelligent behaviour, such as solving problems, making inferences, learning, and understanding language, have already been coded as computer programs, and within very limited domains of soybean plants, AI programs can outperform human experts. Now the great challenge of AI is to find ways of representing the commonsense knowledge and experience that enable people to carry out everyday activities such as holding a wide-ranging conversation, or finding their way along a busy street. Conventional digital computers may be capable of running such programs, or we may need to develop new machines that can support the complexity of human thought.

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