

# Applications of Artificial Intelligence & Associated Technologies

**Jyotsna Kadam**

ME First year  
Department of Computer Engineering  
Trinity College of Engineering and Research  
Pune University, Pune.

**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 discusses the applications of AI in the fields of heavy industries, gaming, weather forecasting, expert systems with the focus being on expert systems. The paper concludes by analysing the future potential of Artificial Intelligence.

**Keywords-** Artificial Intelligence, Robotics, Data Mining.

## I. INTRODUCTION

ARTIFICIAL intelligence (AI) is defined as intelligence exhibited by an artificial entity to solve complex problems and such a system is generally assumed to be a computer or machine. Artificial Intelligence is an integration of computer science and physiology 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 memorizing and understanding, recognizing patterns, making choices adapting to change and learn from experience. Artificial intelligence 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. Artificial intelligence can be divided into parts according to philosophy of AI.

### What is Artificial Intelligence?

Artificial Intelligence is defined as the branch of Computer Science & Engineering, which deals with creating intelligent machines that perform like humans. Artificial Intelligence helps to enable machines to sense, comprehend, act and learn human like activities. There are mainly 4 types of Artificial Intelligence: **reactive machines, limited memory, theory of mind, and self-awareness.**

### Strong AI

The principle behind Strong AI is that the machines could be made to think or in other words could represent human minds in the future. Thus Strong AI claims that in near 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 machines 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 times. More examples of Weak AI are witness expert systems, drive by wires cars and speech recognition systems

Artificial Intelligence (abbreviated as AI) is the capability of a device to perform activities, which would otherwise only be expected of the human brain. These activities include the capacity for knowledge and the ability to acquire it. It also comprises of the ability to judge, understand relationships and last but not least produce original thoughts.

**Intelligence = perceive + Analyse + React**

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

**Turing Test:** The Turing test is a test of a machine's ability to exhibit intelligent behavior. The test was introduced by Alan Turing in his 1950 paper Computing Machinery and Intelligence. The original question behind this test was "Can machines think? ". The test proceeds as follows a human judge engages in a natural language conversation with one human and one machine, each of which

tries to appear human. All participants are placed in isolated locations. If the judge cannot reliably tell the machine from the human, the machine is said to have passed the test. In order to test the machine's intelligence rather than its ability to render words into audio, the conversation is limited to a text-only channel such as a computer keyboard and screen.” Sufficiently many interrogators are unable to distinguish the computer from the human being then it is to be concluded that the computer thinks.

### Roots of AI

Artificial Intelligence has identifiable roots in a number of older disciplines, particularly

- Philosophy
- Logic/Mathematics
- Computation
- Psychology/Cognitive Science
- Biology/Neuroscience

There is inevitably much overlap Example, between philosophy and logic, or between mathematics and computation. By looking at each of these in turn, we can gain a better understanding of their role in AI, and how these underlying disciplines have developed to play that role.

## II. ADVANTAGES AND DISADVANTAGES

- One of the major advantages of artificial intelligence is that its decisions are based on facts rather than emotions. Even after our utmost efforts, it is a well-known fact that human decisions are always affected in a negative way by our emotions
- Unlike humans, machines with artificial intelligence do not need any sleep, thus overcoming the inherent disadvantage of tiredness in humans
- Easier spreading of knowledge. Once an artificial mind is trained for something, it can be very easily copied to the others reducing the time wasted in otherwise passing on knowledge to other humans through training .
- Lack of creativity in responses
- Inability to explain the logic and reasoning behind a certain decision
- Current development is at a stage where the AI cannot know when there is no solution to a particular problem
- Any malfunctioning can lead to the AI producing wrong solutions and since it cannot explain the reasoning behind its answer, blind reliance on AI can lead to problems
- Lack of common sense in reasoning can also cause major problems
- It can be used to cause mass scale destruction if given in the wrong hands

All this being said, one of the most concerning problem with the development of AI is that it will soon start substituting humans in every field thus causing a high rate of unemployment, which would lead to depression, crime and poverty. Also, there are some fields that require the human touch and there is a growing sense of belief that machines will quite possibly never be able to replace humans. The caring behavior of nurses in hospitals is one example of a job that humans feel machines will never be able to do justice to.

## III. CURRENT PROGRESS

Artificial Intelligence was created with the sole aim of mimicking or even outperforming human minds. Thus it is very important we question the fact 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 humans 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 it 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 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 a lot of progress in the past few decades, it is not at 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 sidelining humans into a more supervisory role. Stock brokerage firms are now using Artificial Intelligence to analyze data, make analysis and buy or sell stocks without the interference of any human beings. Some of the applications of Artificial Intelligence are as follows



**Fig . Pattern Matching AI Applications**

### 1. Robotic Soccer

RoboCup started its activity about ten years ago by taking soccer games (football for Europeans), as a scientific testbed for the research in AI and Robotics. Italian researchers gave a significant contribution to RoboCup over the years, both at the organization level and in terms of participating teams. RoboCup 2003 was held in Padova, and it attracted more than a thousand participants from all over the world. Below we focus on the leagues, where the Italian participation has been more relevant. The *Middle-Size* league is played within a 5x9 meters field by 4 wheeled robots per team and the body of the robot must be within a cylinder of 50 cm diameter and 80 cm height. All sensing devices must be onboard the robots, in particular global vision as well as other external sensing devices are not available. The Italian participation in RoboCup was boosted by the creation of a national team, called ART (Azzurra Robot Team), formed by several universities and the Consorzio Padova Ricerche. ART obtained the 2nd place in 1999 and subsequently it was split into several local teams: Golem, Artisti Veneti and Milan RoboCup team. The *Four Legged Robot* league is played in 4x6 meters field by 4 four-legged Aibo robots. The Aibo have on board a color camera and their mechanical structure provides 18 degrees of freedom. The availability of a standard platform has significantly contributed to the scientific evaluation of the solutions proposed. The SPQR team participated in the competition since 2000 obtaining the 4th place and accessing the quarter finals several times. Recently, a *Humanoid Robot* league started to approach the ultimate goal of RoboCup to build a humanoid team to play with humans. Humanoid Robotics is currently one of the main challenges for many researchers, mostly focussing on mechanics and locomotion. Politecnico of Torino developed the humanoid robot Isaac that has participated to RoboCup Humanoid League since 2003. IASLab of University of Padova later joined the Humanoid League, with a fully autonomous humanoid robot that uses an omnidirectional visor. It is worth emphasizing that the ART national model led to scientific and technical success: ART showed the ability to realize competitive robotic football players, but foremost the ability to blend in a single national team methodologies and implementation techniques individually developed by the research groups. In this respect, the work done on the issue of coordination, leading to the definition of communication and coordination protocols used by the ART players, has been both very challenging and very successful. Finally, collaboration/competition achieved in the project has been essential to the final results, since it allowed for a project development with a tight interaction and exchange of results, compared to conventional research projects.

### 2.Space Robotics

The aim of the project *An Intelligent System for the Supervision of Autonomous Robots in Space*, funded by the Italian Space Agency (ASI) during years 1997-2000, is the application of AI techniques to the design and realization of space robotics systems for planetary exploration missions, that require an increasing autonomy. In particular, the aim of this project has been the application of AI techniques to the design and realization of an effective and flexible system for the supervision of the ASI robotic arm SPIDER. The project was coordinated by the unit at the University of Palermo. Subproject units were the Universities of Roma "La Sapienza", Torino, Genova, Parma, and the research centers ISTC-CNR Roma and IRST-ITC Trento. The scientific objective of the project is the design and development of an intelligent system able to supervise autonomous robots in space. The system is based on a multiagent architecture in which each block is a software agent interfaced with the rest of the system. This design choice is motivated by high flexibility, agent interchangeability with consequent easy improvement of the architecture, reuse of all the agents or part of them, or of the architecture itself. The architecture has been designed by keeping in mind the ASI missions; but it is fully general and the single modules and the whole architecture may be easily reconfigured. The project aimed at realizing an innovative research product, and it is complementary to ASI activities.

### 3. Rescue Robotics

Besides soccer, RoboCup promotes other leagues, aiming at the transfer of the research results into socially and industrially relevant contexts. Specifically, RoboCup Rescue [7] aims at the design of systems to search and rescue for large scale disasters. Here we focus on the *rescue robot* league, that aims at the design of robots searching victims in an unknown environment representing a disaster scenario. This kind of application brings in scientific challenges, related to the uncertainty about the environment, that are not present in the soccer leagues. The experimental set up, called *arena*, is being developed in close cooperation with USAR 2. The arenas have already been used in various experiments (including RoboCup and AAI rescue competitions) and nowadays represent a reference for experimental evaluation of the performance of rescue robots. The current aim of the competition is twofold: mobility and autonomy. As for the former, the research is focussed on the mechanical design that allows the robot to overcome the obstacles present in the environment; the latter is concerned with the design of robots that can autonomously explore the environment, possibly working in a team, build the map, find the victims and locate them in the map. Two Italian teams participate in these competitions since 2004: the first one from SIED Lab, within a collaboration between "Istituto Superiore Antincendi" and the University of Rome "La Sapienza"; the second one from the ALCOR lab of the University of Rome "La Sapienza", which developed a model-based approach to the executive control of a rescue rover, winning the third award in 2004. The RoboCup activity contributed and benefitted from the results of the research project Simulation and Robotics Systems for Operations in Emergency Scenarios (SRSOES 2003-2005), funded by Italian MIUR.

### 4. Gaming Industry

One of the most commonly known applications of AI in the gaming industry is its use in chess. Even though these machines are not as intelligent as humans, they use brute force algorithms and scan 100's of positions every second so as to determine the next move. As stated earlier, AI is also being used in Microsoft Xbox 360's Kinect for body motion detection. But it is still in its infancy and requires a lot more advancement for it to be used in day-to-day applications.

### 5. Heavy industries

Artificial Intelligence robots have become very common in heavy industries and are employed in jobs that are otherwise considered dangerous for humans. These robots also increase the efficiency, as they do not need any break while working thus overcoming the inherent disadvantage of tiredness in humans.

### 6. 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.

### 7. Expert Systems

Expert Systems are machines that are trained to have total expertise in specific areas of interest. They are developed to solve the problems in niche areas. These systems use statistical analysis and data mining to solve these problems by deducing the solutions through a logical flow of yes-no questions. An expert system is made up of 3 parts-

1. Knowledge base- It stores all the information, rules, data and relationships that are needed by the expert system to have total expertise in its area of interest ,
2. Inference engine- It seeks information from the knowledge base on being presented with a query, analyses it and responds with a solution or recommendation in the way a human expert would
3. Rule- It is a conditional statement that links the given conditions to the final solution

### 8. Data Mining or Knowledge Extraction

Data mining is a fast-growing area. Data mining is a part of a process called KDD knowledge discovery in databases. This process consists basically of steps that are performed before carrying out data mining such as data selection, data cleaning, pre-processing of data, and data transformation. "Data Mining is the use of computer algorithms to discover hidden patterns and unsuspected relationships among elements in a large data set. AI is a broader area than machine learning. AI systems are knowledge processing systems. Knowledge representation, knowledge acquisition, and inference including search and control, are three fundamental techniques

### 9. Knowledge representation

Data mining seeks to discover interesting patterns from large volumes of Data. These patterns can take various forms, such as association rules, classification rules, and decision trees, and therefore, knowledge representation becomes an issue of interest in data mining.

## V. FUTURE ASPECTS

The use of artificial intelligence will lead to production of machines and computers, which are much more advanced than what we have today. Speech recognition systems will reach much higher levels of performance and will be able to communicate with humans, using both text and voice, in unstructured English. There will be a great future some day for expert system applications in all aspects of health care, in both clinical and administrative areas, in improving patient care and in allocation of financial, social, and other resources. But when it comes to the question of Artificial Intelligence creating machines, which are more intelligent than human beings, no one seems to have the answer. Also, even if it is possible, the amount of time it will take cannot be predicted. It is also expected to have human brain features like learning from experience, cognition and perception. Whether human consciousness will

be incorporated in these machines is still not known. Robots in the future will be able to do everybody's work and will be faster and more efficient as compared to human beings in doing it. If one is ill, they can hire a robot nurse that will provide them with medicines at proper intervals. Thus it can be safely said that Artificial Intelligence is still in its embryonic stage and its future depends only and only upon the scientists solving the mystery of the human brain. Till that is done, no one can make a conclusion of whether our future will be affected positively or negatively by Artificial Intelligence.

## VI. CONCLUSION

The computing world has a lot to gain or benefits from various AI approaches. Their ability to learn by example makes them very flexible and powerful. Furthermore there is no need to devise an algorithm in order to perform a specific task i.e. there is no need to understand the internal mechanisms of that task. They are also very well suited for real time systems because of their fast response and computational times which are due to their parallel architecture. The goal of artificial intelligence is to create computers whose intelligence equals or surpasses humans. Achieving this goal is the famous "AI problem from last decade researchers are trying to close the gap between human intelligence and artificial intelligence.

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