Preliminary Study of Various Applications of Artificial Intelligence: A literature review

Dr. Bharat C. Patel

Smt. Tanuben & Dr. Manubhai Trivedi College of Information Science, Affiliated to Veer Narmad South Gujarat University, Surat, Gujarat, India

ABSTRACT

Journey of artificial intelligence begins in the ancient Egypt. The statues of god animated are prepared by engineer with the help of priest. Hundred years ago, the philosophers have illustrated the process of human thinking in the form of symbols using the logic and tools; and established the foundation for the concept of artificial intelligence such as general knowledge intelligence. This paper explores the fundamentals of artificial intelligence, types of artificial intelligence, various trends in artificial intelligence (AI) and challenges of AI in various sectors. The aim of this paper is to provide basic information about artificial intelligence and progresses made in this particular field.

Keywords: Artificial intelligence, artificial narrow intelligence, artificial general intelligence, artificial super intelligence, virtual assistance, application area of AI.

1. INTRODUCTION

Artificial intelligence is very fast growing branch of computer science in the end of 20th century which is focused on making machines capable of thinking and learning. Artificial intelligence is term first used by John McCarthy at the conference held at Dartmouth, USA in 1956 [1]. The foundation of AI is made in the ancient Egypt where engineers built statues of gods animated by priests. During the 13th century philosophers used the tools and logic to describe human thought processes as symbols. In the last few decades an AI made incredible growth in the field of computer science. Artificial intelligence is a process of making a machine intelligence that means a machine is capable to think and behave like human being. There are many progresses were done in the AI. Basically, AI is the very large area of the computer science which involves technologies like Machine learning (ML) and Deep Learning (DL). So, we can visualize the relationship according to one group of researchers that AI is the superset of ML and DL [2] as shown in the figure 1. But, there are some controversies among other group of researchers that AI is not the superset of ML and DL.
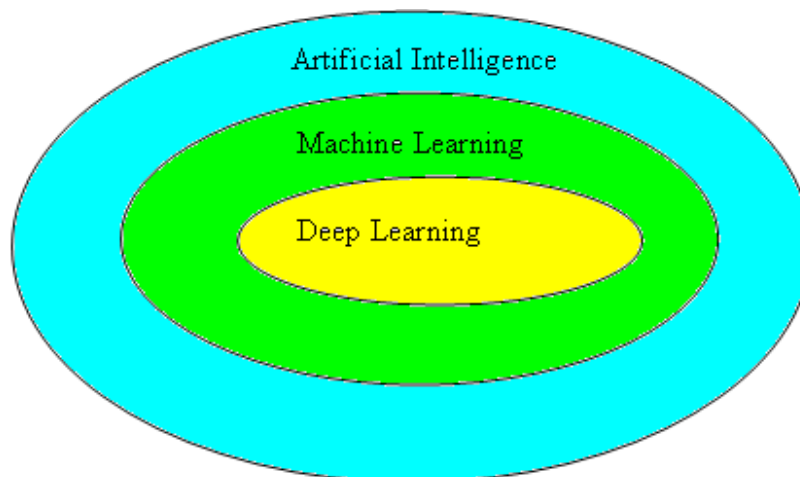
[**Figure 1: Relationship between AI, ML and DP**]

AI could be a technology in which a machine, especially a computer system, has been trained in order to acquire the intelligence of the human process. Machine learning is nothing but a set of algorithms having a capability to get train and carry out tasks such as prediction and classification more efficiently using data. Learning is accomplished using

additional data and/or additional models. An algorithm is called a learning algorithm when it improves on a task, for example, the accuracy of classification such as fraud, customer churn and so on.

Deep Learning is a subset of machine learning that emulate the functioning of the human brain to unravel problems. Deep learning is understood as a way to enhance results and optimize processing times in several computing processes. The Deep Learning concept appeared for the first time in 2006 as a brand new field of research within machine learning. It absolutely was first called hierarchical learning at the [3] and it usually involved many research fields related to pattern recognition.

2. TYPES OF ARTIFICIAL INTELLIGENCE

Artificial intelligence is the science of making machine that acquire the intelligence or skill of humans and perform a task similar to them. Many of the fields like pattern recognition, computer vision, expert system, object detection, robotics etc are involved in AI. AI can be categories into Artificial Narrow Intelligence (ANI), Artificial General Intelligence (AGI) and Artificial Super Intelligence (ASI) [4].

A. Artificial Narrow Intelligence:
In this particular type, the machine has narrow range of capability so sometime it is also known as weak AI. The term weak or narrow means the machine is designed to fulfill the task in specific domain. For example, face verification on iPhone, autopilot features in Tesla, virtual assistance like Siri, Cortana and Alexa are designed to perform a specific task.

B. Artificial General Intelligence:
AGI is one step ahead of ANI where ANI is designed to do specific task whereas AGI is designed to learn anything. That means the machine has the capability to learn and take an appropriate decision in different situations. Therefore, AGI is sometimes known as strong AI. It has the capability to think conceptually, make strategies and carry out knowledgeable decision with a creative outcome. For example, a Philips screwdriver could be converted into a saw, or a paint brush, or a tape measure depending upon the problem at hand and choose the right tool to solve the problem.

C. Artificial Super Intelligence:
In this type, machines will go beyond the intelligence of human beings virtually in all domains of interest. It will exceed human intelligence in all stages like from creativity, general wisdom and problem-solving. Currently, ASI is seen as hypothetical situation as detecting movies and science fiction works where a machine takes over the world. However, as per philosophers' point of view an ASI takes over the world by the year 2040. The machine would become highly capable and intelligence such that they ruled on the world. Although machine became more powerful and intelligence than humans, one group of researchers would also worry about the vulnerability and demolition caused by the machine.

3. CURRENT TRENDS IN ARTIFICIAL INTELLIGENCE

The development of machine learning and AI related technologies will have a long drive in coming years. Opportunity in AI looks brilliant and it is maintained by the reality. Well-Reputed companies like Apple, Amazon, Google, Facebook, IBM and Microsoft are giving more importance to research and believed that development of AI will definitely take consumers and AI closer. In the latest technology trend, organizations or manufacturing companies are in search of intelligent automation tools to solve complex business tasks and want to increase productivity, efficiency, and accuracy so that it is beneficial to organization. Furthermore, there are many artificial intelligence trends in 20th and next coming 21st century; few will be described as follow:

Robotic Process Automation: The future will be modernized. Heads of enterprise can imagine that their organization's automation potential using new process discovery technologies.

Facial Recognition: The demand for reliable personal identification in computerized access control has consequence in an increased interest in biometrics to replace password and identification (ID) card. Facial recognition technology is regarded as the artificial intelligence future due to its immense popularity. Nazeer et al. [5] proposed Face Recognition System using Artificial Neural Networks Approach and produces promising results for face verification and face recognition.

Automated Machine Learning (AutoML): Traditional machine learning technique is time-consuming, resource-intensive, and challenging for real world business. It requires experts in the several disciplines such as data scientists. AI enables us to develop model that automatically executes all the tasks and apply its own skills in the process as and when required like data sciences. AutoML solve more business problem faster and few days which traditional process takes weeks or months to complete the task.

Deep learning: Deep learning is a type of machine learning that uses multiple layers to extract higher level of features from raw data. Deep learning is successfully applied in various applications like Virtual Assistants, Chatbots, speech recognition, time series, Healthcare, Entertainment, text classification and many more. Kolluri et al. [6] studied literature survey on different "text classification" methods. They concluded that "semi-supervised text classification" is obtaining significance in mining the text. They also point out few vital issues are managing bulky classifications, data imbalance, document zones, feature selection and performance boosting.

As we discuss formerly that the base of the AI is established too earlier. Table 1 shows the major research done in particular duration that demonstrates the progress of AI.

Table 1: Timeline of evaluation in AI

Duration	
1950	The British mathematician Alan Turing resolve complex problems of mathematics and make a 'thinking machines' or 'intelligent machine'.
1956	John McCarthy proposed the term "artificial intelligence" first time at Dartmouth Conference
1965	Joseph Weizenbaum developed a first realistic chatbot called ELIZA.
1980	Edward Feigenbaum created an expert system which emulates decisions of human experts.
1997	IBM developed a computer program known as Deep Blue [2] that defeated Russian chess Grandmaster Garry Kasparov and becoming the first computer program to beat a world chess champion.
2002	iRobot launches a vacuum cleaner known as Roomba, which autonomously navigates and removes obstacles.
2009	Google builds the first self-driving car to handle urban conditions.
2011	IBM developed question-answering computer system known as Watson.
2011-14	Personal assistants like Siri, Google Now, cortana were developed that uses speech recognition to answer the questions and perform simple tasks.
2014	Ian Goodfellow comes up with Generative Adversarial Networks (GAN) deep learning frameworks within which two models, a generative model and a discriminative model, are trained simultaneously and generates output.
2016	The AlphaGo beats the professional board game Go player Lee Sedol and manifest a most important objective in the growth of intelligent machines.

4. APPLICATION AREAS OF AI

AI is a very vast field in computer science. It spreads its intelligence in many real life fields. Few of them are discuss below.

A. AI in Autonomous Driving Vehicle:

It is one of the key application areas of artificial intelligence. The vehicles are equipped with multiple sensors, such as cameras, radars and lidar, which help them to understand their surroundings and path planning. The sensors are generated a large amount of data. To make meaningful of the data collected from the sensors, autonomous vehicles (AVs) need supercomputer-like, nearly instant processing capabilities. Companies developing AV systems rely heavily on AI, in the form of machine learning and deep learning, to process the large amount of data proficiently and to train and validate the autonomous driving systems. Biggi et al. [7] performed Scientometric and Bibliometric analysis on self-driving car. They find evidence for a rapid and meaningful shift in the application of the technologies related to data gathering and processing for the purpose of self-driving cars. Martin et al [8] addressed the points like use of AI in autonomous vehicle decisions, challenges of AI decisions, safety regarding arguments like how autonomous driving decision benefit to society, The Ethical Challenge.

B. AI in cyber security

Nowadays, cyber threats are main problem for business. Modern businesses rely on online facilities like online payments, email newsletters and many more business activities and they are expecting more solid cyber security scheme. According to Alkhalil et al. [9] stated that phishing attacks are more common. They declared on the basis of survey that 90% of organizations have faced such attack in 2019. The figures of phishing attacks are increased from 76% in 2017 to 83% in 2018. The presence of AI in cyber security, prediction algorithms and smart technology are going to play an important role in protecting us from the various cyber attacks. AI can be used to help us in identifying misuse of sign and inform us of any fraudulent attempt. Isaac Wiafe et al. [10] presented review on existing research on the application of AI for cyber security. In conclusion, the study suggests that the application of AI in the CyberSec domain has been promising with intrusion detection and prevention systems (IDPS) showing improvement. AI has facilitated a reduction in computational complexity and reduced model training times. It was also observed that there is a considerable skewness within the domain. Moreover, researchers have focused on fewer algorithms and therefore newer algorithms are not so popular. This stands as both a challenge and also an opportunity for researchers.

C. AI in manufacturing

Manufacturing industries are going to seriously consider the implementation of the powers of AI. In the production chain, quality control is one of the hardest and most essential tasks in the whole workflow. Due to the nature of the task, traditionally quality control has mostly been a manual task. Practically speaking, automating quality control is not so simple task. Many industries such as FMCG or Automobile use AI-powered tools for automating the quality control procedure. Making AI a part of the workflow not only helps modernize the whole production line but also to augment the existing processes and address the earlier challenge.

Jorge et al. [11] addressed three matters in their paper such as how the state-of-the-art applications of AI to representative manufacturing problems, to provide a systematic view for analyzing data and process dependencies at multiple levels that AI must understand, and identify challenges and opportunities to not only further influence AI for manufacturing, but also influence the future development of AI to better meet the needs of manufacturing.

Tingting Luo et al. [12] presented article on artificial intelligence decision support systems and the complex product manufacturing industry. They present a detailed analysis of how to integrate the knowledge generated by the product life cycle in the era of big data. We calculate the influence coefficient and sensitivity index of four different industries and propose metadata architecture to improve the value of products as a whole. The findings of the research study imply that a knowledge-based collaborative platform should be designed by the enterprises and industries and a platform-based construction approach for economical, practical, and reliable production. They also present a detailed discussion about other factors such as the network cost of symmetric services, raw data and forecast data, and the number of nodes and the processing complexity.

D. AI in Healthcare

We are the witnesses about the progress of AI in healthcare sector and how it is going to change the overall workflow of the healthcare sector. The AI based techniques are useful to the patients and the healthcare professionals. AI based techniques acquire real-time data from multiple hospitals and health centers and utilize it for the benefit of both parties. Automatic initialization of equipment, automated reporting, and optimized scheduling – everything would be done to customize to an individual patient's condition. Combining AI with expert clinical and domain knowledge will result in speeding up the clinical procedure. Manne and Kantheti [13] explores the implications of AI on healthcare management, and challenges involved with using AI in healthcare along with the review of several research papers that used AI models in different sectors of healthcare like Dermatology, Radiology, Drug design etc. Practically AI tools may not replace the human physicians but can assist physicians to achieve better results and accuracy in medical field. Artificial intelligence, machine learning, deep learning can help us with proper care in assisting surgeries, diagnosing diseases like cancer at early stages etc.

E. AI in pattern recognition

Facilities like automatic facial recognition, printed or handwritten text recognition, vehicle number plate recognition etc is going to be intensified over the years. Business organizations and governments like it or not, around the world are investing millions to keep track of our identity and actions. Governments and private organizations are going to use these data for making automated agents more intelligent and powerful. The pattern recognition is an artificial intelligence based one of the most important tools in process control to identify process problems. G.Vijaya Lakshmi and N.Sharada [14] used artificial intelligence based pattern recognizer trained using the three selected statistical features and achieved better performance compared with the raw data-based recognizer. Sara and Tariq [15] demonstrated handwriting character recognition system that uses the neural network approach to identify pattern.

F. AI in medical research

The process of drug development is a costly in terms of the invested time and money. The collective efforts of hundreds of researchers can make possible to develop a single component of the drug. Researchers expect that the modern AI can be used to analyze and identify patterns in large and complex datasets faster and more precisely than the process has been

used previously. Kaur et al. [16] discussed various diseases along with corresponding techniques of AI, including Fuzzy Logic, Machine Learning and Deep Learning. They disclosed some important insights into current and previous different AI techniques in the medical used in today's medical research, particularly in heart disease prediction, brain disease, prostate, liver disease, and kidney disease.

CONCLUSION

This paper presented the basic concept of artificial intelligence. The purpose of this paper is that the beginner can know how AI is widely used in various applications like autonomous driving car, machine vision, manufacturing industries, health care, cyber security, pattern recognition and many more. There is no any area left where AI is not used. Moreover, AI makes possible to do intelligence task like human being which is sometimes difficult or even impossible by human being. There may be chances that in future AI lead the world and take their own decision without intervention of human. Literature review shows that many image processing as well as pattern recognition and other problems are solved better than conventional method.

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