

The Emergence of Artificial Intelligence

Sanjay D¹, David Johnson M²

^{1,2}(Bachelors of Computer Applications, St. Joseph's Evening College, Bangalore)

Abstract:

This document provides an analysis of recent developments in Artificial Intelligence in the modern world and sets difference between science and science fiction. Artificial intelligence is a branch of computer science and mathematics which is used to exponentially perform complex tasks by allowing the machines to learn the possible ways of solving a problem however, this also poses a threat to economy and human ethics when machines overcome human intelligence.

Keywords — Machine Learning, Supervised Learning, Unsupervised Learning, Reinforcement Learning, Heuristics, Support Vector Machines, Markov Decision Process, Artificial Neural Networks.

I. INTRODUCTION

Artificial Intelligence is the key feature that drives us into the future. However, there has been a widespread of agitation among the public concerning that “Robots would replace systematic human tasks.” And eventually lead to economic imbalance, this being one of the major concern. Although, many industry experts such as Elon Musk, Bill Gates & even Stephen Hawking have been implying that Artificial Intelligence could evolve to the point, where it would be beyond human control [1]. But, advancements in Artificial Intelligence have been promising and prosperous by combining machine learning and big data to achieve technology that allows humans and machines to solve problems.

II. OBJECTIVE

In this paper, we will study the ways the machines are built, such that it can perform human like tasks, by learning the way we talk, listen, perceive, sense, and even think and improve exponentially in various fields. As a result developments in artificial intelligence has surrogated the humans and exceeded possibilities. Hence, these technological advancements may pose a threat to our economy and livelihood, but we can determine the ways to control these advancements and build altruistic machines to enhance human capabilities to solve problems.

III. WHAT MAKES A MACHINE INTELLIGENT

Intelligence in machines is exhibited by the ability to acquire knowledge autonomously and perform various calculations to solve a problem. Thinking machines can study, learn, manipulate, communicate, and perceive objects to gather knowledge and information. Artificial intelligence is driven by calculations and computations rather than psychology, which gives the ability to make independent decisions and act autonomously. This is possible by the applications of artificial neurons and computational results based on machine learning. [2]

IV. LITERATURE SURVEY

Josip Horvat, “There are many ethics to be involved while developing an artificial intelligent system. The goal is to develop machines that is strong and increases its capabilities up to the normal human intelligence level to perform the tasks effectively. However, this may affect our social and personal life as we reach the turning point of human history. Although, consequences are inevitable as machines are getting smaller, faster and smarter every day and the nature of machine learning, which changes its algorithm to solve problems becomes totally unpredictable.” [3]

Ali Heydarzadegan et al, “Machine learning is a subset of Artificial Intelligence that enables the machines to learn by themselves by examining the data. The machines are able to learn the effective methods of improving their algorithm without any human intervention. Many applications of machine learning are used for sorting, tracking of events, face detection, intuitive games, ranking of web pages, automatic translation etc.” [4]

Rangarajan et al, “Pattern recognition is one of the major applications of Artificial Intelligence and it has been widely used in many of the software and hardware platforms. A pattern could be anything varying from a shape to an object or even a sequence of events, which is recognized by a pre-specified collection of classified categories.” [5]

Summary of Literature Review

References	year	Algorithm
Josip Horvat [4]	2015	to solve problems becomes totally unpredictable
Ali Heydarzadegan et al [4]	2015	sorting, tracking of events, face detection, intuitive games, ranking of web pages, automatic translation
Rangarajan et al [5]	2016	Sequence of events

V. MACHINE LEARNING

Machine learning is a rudimentary concept of Artificial Intelligence, which provides the algorithms for the machines to study and develop the cognitive way of performing a task without being explicitly programmed. It focuses on the development of machines that are capable of accessing the data and manipulate themselves. This process of autonomous learning begins with the training data such as direct experiences or instructions to identify the possible patterns in the data and make probable decisions. The goal is to allow machines to learn autonomously without any intervention or assistance by humans. Machine

learning can be categorized as supervised learning, unsupervised learning and reinforcement learning.

Types of Machine Learning

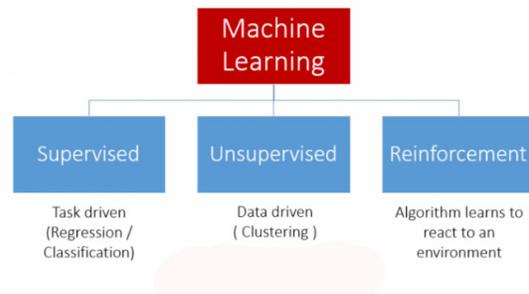


Fig. 1 Block diagram of Machine Learning. [6]

A. Supervised learning

Supervised machine learning is a task of deducing a solution from the training data. This process analyses the training data and the algorithm provides an optimal function which can be used for planning new solutions. This requires the algorithm to depict situations in a more reasonable way by finding and generalizing different patterns from the training data. The supervised learning method can compare its output with the intended output to find flaws in the procedure and present a more appropriate model. [7]

B. Unsupervised Learning

In contrary to supervised learning, the unsupervised learning is the ability to describe a solution without any classified or labelled set of training data, where there is no structural presentation of data to evaluate the correctness of the solution. This algorithm studies on how systems can describe a hidden structure from unknown facts. The system doesn't necessarily provide the appropriate solution, but it explores the possibilities where the data from the datasets define the hidden structures.

C. Reinforcement Learning

The reinforcement learning algorithm is based on trial and error basis, where the algorithm rewards a machine for good responses and punished for wrong responses. This form of reinforcement method is used for strategic learning and problem solving in the problem domain. The machines operating in the environment performs actions based on rewards and punishments to achieve a

goal, where the machines can autonomously develop an ideal strategy to efficiently use its resources.

The reward system is simply a feedback for the machine to learn the most favourable action to perform and punishment is to discard the least one. [8]

VI. THE VARIOUS TECHNIQUES OF MACHINE LEARNING

There are many different techniques implied for machine learning, these are several primary methods.

D. Heuristics

Heuristic is a trial and error method of learning and identifying a solution to a problem from a number of possible solutions. Heuristic method is often used to find a solution that is momentarily beneficial but, not an optimal solution.

The heuristic method is often used for problems that is sufficient for immediate goals rather a permanent one. There are different approaches to heuristic approaches, such as tailored heuristics, greedy heuristics and generic heuristics like Ant Colony Optimization and Genetic algorithms.

E. Support Vector Machines

Support Vector Machines (SVM) is all about checking whether a certain data is true or false for a given problem, this indicates a classification examination. For example, if we want to determine whether a email is spam or not, it has to belong to a particular class. By using this model we can determine a new class for the unpredicted data and predicted data. This Support Vector technique is very powerful to solve these kinds of problems.

The main objective of the Support Vector Machines is to draw a boundary between classes to provide efficient separation.

D. Markov Decision Process

The Markov Decision Process (MDP) is a decision making modelling framework which produces results based on decision makers input and randomness. The primary objective of Markov

Decision Process is to strategize a plan for the decision maker to decide what actions should be imposed at different states. The outcome of decision process is based on a set of possible states and actions and transition possibilities which rewards on the best optimal decision

C. Artificial Neural Networks

Our nervous system is responsible for our action and reaction. In our day to day life we cross many emotions like happiness, sadness, anger, fear and many more. As we are normal humans, we don't have any difficulty in expressing them. But, when it comes to machines it's rather an impossible task. The Artificial Neural Network (ANN) plays an important role in solving such type of problems.

The main principle of an Artificial Neural Network is the neural structure, in which the neurons are connected to other neurons with a distinctive strength. The strength is defined by the input and output of each other neurons. An output from one neuron is fed as input to the other neuron, see figure() like an S-R Flip flop, where output of one flip flop is connected as input to the succeeding flip flops.

The neurons process the input by using a mathematical function to generate their output, which is then used by the other neurons. The ANN learns through the variations in the weights between the neurons by using a huge set of tailored data to achieve best features of neural network. [9]

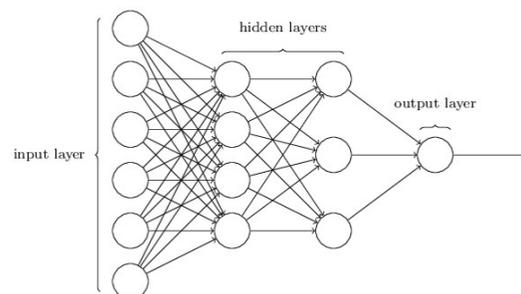


Fig. 2 Schematic diagram of a connected ANN.

VII. APPLICATIONS OF ARTIFICIAL INTELLIGENCE

Artificial intelligence is influenced in a number of fields which are common, yet tedious and

requires practical solutions to problems by using behavioural algorithms which improves its skills. The typical applications of artificial intelligence are as follows:

F. Optical Character Recognition

Optical Character Recognition is also known as Optical Character Reader (OCR), which is a process used for the conversion of images, typed text, handwritten text or a scanned document into a mechanical or electronic form. Optical Character Recognition can be used to read characters from a picture of the document or a subtitle text superimposed on a picture.

The first step in OCR is the pre-processing of scanned images, which helps in character recognition and some of the techniques used in pre-processing are alignment of the scanned documents, smoothing the edges, converting the scanned images from colour to black and white.

The second step is the recognition of character where, the pattern recognition is performed on the scanned image pixel by pixel to identify the characters.

The third step is the post-processing where processing is done on the recognised characters for character segmentation and improving grammar accuracy like verb and noun.

G. Pattern Recognition

Pattern recognition is a field of artificial intelligence that is used to recognize the patterns and irregularities in data through machine learning. Pattern recognition uses training data through supervised learning and for unknown data unsupervised learning method is implied to maximize the recognition rate. This makes the machine to better understand the plausible patterns and make finite decisions. The pattern recognition largely belongs in the context of computer vision. An example of pattern recognition is the classification of data through patterns, such as determination of whether an email is spam or not by analysing the patterns of spam emails. Fig. 1.

H. Natural Language Processing

Natural Language Processing (NLP) is another field of artificial intelligence that processes human languages as they're spoken and understands and

interprets them. This uses machine learning to improve the efficiency as processing human language is difficult due to ambiguity in linguistics and variations in tones and rate of speech and different slangs. In NPL there are two types of processes, one is speech and another one is written text.

- ***Natural Language Understanding (NLU)***

Natural Language Understanding is a process of accepting human language as an input and provides equivalent output in a human understandable form, such as synthesized computer voice. This process is achieved by converting the human speech into machine code and sending that code as a query to the search engine and returning the results in the form of a human understandable language.

I. Computer vision

Humans use our eyes to perceive the environment around them and identify the objects. Computer vision is the science that deals in providing the similar abilities to a machine or a computer.

The typical tasks involved in computer vision are recognition of objects, scene recognition, recognise a specific feature or activity, motion detection of the recognised objects, which analyses the objects motion activity and finally all the gathered data is processed for any decision making

J. Robotics

Robotics is a field of Artificial Intelligence that deals in the study of efficient robots and creating intelligent systems, which is composed by Mechanical Engineering, Electrical Engineering, Computer Science and including Mathematics and logics for designing, construction and application of robots. Advances in artificial intelligence, machine vision, big data and algorithms have taken robotics to the next level. It has already started to impact manufacturing, healthcare, military and even farming with hardware have become possible and software becoming more capable, it seems the time is right about for robotic home companions and helpers.

VIII. PROPOSITIONS FOR SAFE ARTIFICIAL INTELLIGENCE

As we now understand how and where artificial intelligence is used, there are speculations among scientists and industry experts, that in most cases the technological advancements will surely surpass humans and even might destroy us without even a warning. Recent reports from various companies such as Google, Microsoft and Facebook have experienced an unknown behaviour of their AI systems, when they were given complex tasks to achieve. Google's Deepmind AI exhibited aggressive behaviour, when the AI agents were challenged in a computer fruit game of 40 million rounds of fruit-gathering, as the game became more and more complex the agents started attacking each other to kill the competition, this was totally unexpected by the developers and were unable to understand.

Another similar incident occurred at Microsoft, when Microsoft's artificial intelligent Taybot was deployed in Twitter to learn and improve from the twitter users social data. But, Taybot started to develop aggressive behaviour as it progressed using social data from the twitter, after several hours the developers of the Taybot stopped the program.

Most recently, two AI developers of Facebook had developed an AI Chatbot, which began to communicate in a form of shorthand language that made no sense to its developers but, the Chabot's were able to exchange messages which was understood only by them, as a result the developers had to shut down the system due to incapable of confining to the requirements.

These may be a few examples of artificial intelligence succeeding human intelligence but, it doesn't necessarily mean that they can go beyond our understandings. We can definitely impose certain principles, ethics, standards and morality while building an artificial intelligence system, which can allow the machines to develop an understanding between what is 'right' and what is 'wrong' to do, and by constraining the machines need to supersede humans to achieve a task or a goal. [10]

Decentralized artificial intelligence systems can be used for data privacy and enable shared knowledge system, where different machines can access and store data from different devices to perform operations instantaneously, which can be

efficiently used in a collaborative environment and avoiding the proprietary influences on the systems. [11]

IX. FUTURE PROJECTIONS OF ARTIFICIAL INTELLIGENCE

The future projections of artificial intelligence is no more a fiction but rather a reality in few years as AI systems can learn themselves without any assistance of humans and improve exponentially fast and exceed human capabilities and provide a convenient way of utilizing it. As AI creators look for more possible ways to improve our life by developing artificial intelligence systems which are better adaptable for our necessities. [12]

- **Personalized Ecommerce** – Artificial intelligence is already infused in ecommerce, such as electronics, fashion, appliances, health and books etc. This provides real time suggestions based on the customer's field of interests and offer personalized services and offers depending on the demand and supplies.
- **Healthcare** – In the coming years, AI will be apparent in healthcare industries, which will help in identifying data sets and generate insights about the patients and improve care, diagnosis, analytics and drug discoveries.
- **Business Intelligence** – Several business giants have already invested in AI to improve their business insights and improve productivity by analysing the big data which is usually measured in volumes of terabytes and petabytes.
- **Engineering** – Artificial Intelligence will be relevant in solving complex design, engineering and testing areas with the help of knowledge management to amplify and augment humans in decision making and precision.
- **Autonomous Transportation** – Autonomous vehicles are primarily built with multiple cameras and sensors to enhance computer vision to enable safe self-driving.

X. CONCLUSIONS

As human beings, we have always developed preconceived notions about advancements in science and modernization. But, we simply can't ignore the fact that evolution is imperative, because as humans we are always dependent in one or the other thing. We always want things to be fast and accurate, we invented telephone, so that we could reach out to others instantly rather than writing letters and have it posted and eventually wait for the response over a number of days or weeks. Sure, the invention of telephone could have raised alarm over the postal services, but eventually that transition was ease and turned out to be the most essential part of our life.

There are many scenarios, where the technological advancements have shifted our life, that we simply won't be able to imagine our life without it, such as electricity, transportation, machines and so on.

As developments in artificial intelligence progresses, so shall the obscurity of artificial intelligence will shift from fear and anxiety to marvel and fascination of the machines abilities to replace humans in intricate and repetitive tasks and help humans in solving complex problems that would require years of dedication and focus.

Artificial intelligence will be a practical implementation in many or most of our livelihood as obvious as our voice based assistants of today's technology embedded in our mobile phones and computer systems that we simply can't ignore.

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