

ARTICLE

TOWARDS THE STUDY OF AN ARTIFICIAL INTELLIGENCE AND ITS RESEARCH FIELDS

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ABSTRACT

AI being a revolutionary world has totally encapsulated our day to day lives. It makes the unique combination of minds & the machines. From the last couple of years there is gradual increase in the AI spreading its roots in all the fields such as machine learning, robotics, neural networks etc. Artificial intelligence is the intelligence exhibited by the computers. The word artificial means not natural or man-made and the word intelligence means the ability to acquire and apply knowledge and skills. There are many research fields of AI each having its own set of applications techniques and importance. This paper aims at focusing about the artificial intelligence at a glance and its applications/research fields. It helps in providing us the automation and hence leading to a very bright scope and future ahead.

INTRODUCTION

Artificial intelligence is defined as the ability of computers to think and respond like humans and to perform complex tasks. Just like Wright Brothers imitated a bird's flight to build the architecture of first successful flying plane; artificial intelligence is an approach to imitate human intelligence. John McCarthy coined the term Artificial Intelligence in 1956 as a branch of computer science concerned with making of computers which behaved like humans. AI is an emerging field of research area due to its very usefulness in daily life and expert systems. AI mimics the human intelligence and improves the quality and speed of work without any human errors.

Artificial intelligence not only mimics human intelligence but also the other intelligent species in nature. One example of such intelligence is swarm intelligence. In this the nature of ant colony is studied where they don't have independent functioning but altogether in a group, they prove to be highly efficient system. AI is capable enough to perform tasks with high precision rates which a human cannot do. This man-made computer-based intelligence is showing us better results than human intelligence in general. It's is a combination of physiological reasoning and perception along with mathematical computations. AI can be broadly divided into two categories naming strong AI and weak AI. [1]. The types of AI is being shown in Fig 1.

Strong AI- A computer system is said to be a strong AI if it is at-least as smart as humans i.e. replicate human level of intelligence. It is capable of performing all tasks independently without any human interaction. It has capabilities to think, reason, perceive and judge. There are ethics for creating a strong AI. But it is believed that a strong AI is not yet created and if created can replace humans completely.

Weak AI- Self intelligent machines used to perform particular tasks, witness Expert Systems, robots, predictions and recommendations etc.

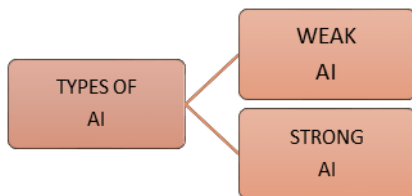


Fig. 1: Types of AI.

LITERATURE REVIEW

L.liu et al [2] projected a modified version of HMM called Self Adaptive HMM. A huge data set of 20,000 Chinese tweets were collected and classified on the basis of anger, happiness, sadness and fear. It uses Swarm Optimization algorithm to optimize the parameters used. The model decided whether the unlabeled tweet will be classified to which category after being assigned an emotion. The data set which was analyzed scored a 76% on happiness and fear and 65% on anger, surprise & sadness.

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His research on self-adaptive HMM was proved to be better than Naïve Bayes & Support Vector Machine on identification of happiness, sadness & anger.

B. Yang et al [3] correctly identified type of land in terms of usage by remote sensing images. It combined several classifier systems like Support vector machine, maximum likelihood classifier, minimum distance classifier, back propagation neural networks and Fuzzy c-means to build a three multiple classifier system. They used the ground truth map to compare the results of 3 multiple classifier system and various other base classifier such as Bayesian average (BA). Performance of multiple classifier system was compared with overall accuracy of 94.2% which is higher than others.

S. R. Devi et al [4] various neural network models were compared to predict rainfall one-day advance of Nilgiri. The various neural network models used are cascade -forward back propagation neural network (CBPN), nonlinear autoregressive exogenous network (NARX), feed forward back propagation neural network (BPN) and distributed time delay neural network (DTDNN). Parameters used to measure are daily rainfall, humidity and temperature and their forecasting capabilities are compared. Gradient Descent Graphs are used to do so. The data is collected from 14 rain gauge stations located near Nilgiri. According to performance analysis nonlinear autoregressive exogenous network (NARX) proved to be the best forecasting model.

M. Sahami et al [5] email filtering was performed to separate spam mails from important messages. The important mails and spam were classified accordingly. Initially this might seem to be a straight forward text classification problem, but they showed that by including domain specific features of this problem along with text and words, they can improve the classifier and produce accurate results of filtration. Therefore they displayed this problem as a decision theoretic framework and used probabilistic learning methods along with differential misclassification cost to produce better filters. They also showed the efficiency of such filters in practical and real life applications.

Turing test [6]

Turing test is used to test how intelligent an AI is. The test is conducted between two humans and a machine. The one human acts as a judge and test the other two on certain parameters by asking questions in text format. If the judge is unable to differentiate between the human and the machine, it is concluded that the machine is a good AI and has the ability to think just like humans can.

CAPTCHA- “Completely Automated Public Turing Test to tell Computers and Humans Apart” is a test developed by Alan Turing to distinguish between human users and robots. It includes distorted text and numbers which can easily be read by humans but difficult for robots to read and prevents robots from access.

GOALS OF AI

Artificial intelligence central goal is to make computers more useful and improve lifestyle. It is built for easy execution of complex tasks. The long-term goal is to study the existing intelligent systems and understand human working techniques and improving it. Providing more accurate results to the problems stated through logic and reasoning. To create correct results AI needs to have extensive knowledge of the world and represents various relationships, objects. In order to achieve the goals, the agents require a Path to be followed which is well planned and defined. To be able to make predictions one need to visualize the future i.e. has a perception of what the expected result is. And to obtain these results the machine needs to be trained which is also known as machine learning. The various goals of an AI are depicted in Fig 2 below.



Fig. 2: Goals of AI.

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Many machines these days use not only software interface but also hardware interface and responds in the real time environment. Such machines which interact with the real time environment are called robots. And we need motion and manipulations of these robots.

ROOTS OF ARTIFICIAL INTELLIGENCE

As Artificial intelligence is based on the various disciplines such as computer science, biology, psychology, physiology, math's, computation and engineering. All of this basis doesn't always work independently but are overlapped to create a good AI. Fig 3 denotes roots of an AI.

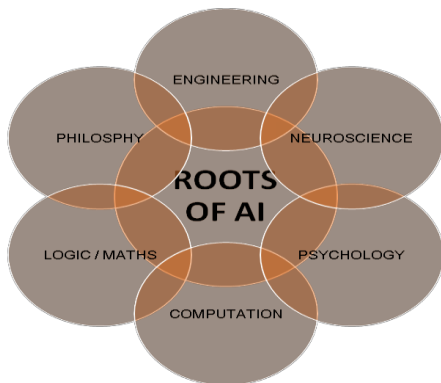


Fig. 3: Roots of AI.

Advantages and disadvantages of AI

Artificially intelligent systems mimic the human intelligence but unlike humans the results are not affected by emotions and there are no distractions to perform a task. A computer system can perform task at much faster speed than a typical human being and is also faster than the traditional methods used and unlike humans a machine doesn't get tired and has the ability to work continuously without any breaks. AI requires large training set and knowledge which in case of humans will take forever to learn but in case of AI the once a machine is trained the knowledge can be transferred quickly.

Apart from the advantages over human beings artificial intelligent systems also perform better than traditional computing methods because traditional computing methods work on specific problems whereas the AI works on generic problems.

With the rise of artificial intelligence and increasing research it also has some disadvantages. Cost of development of an AI is huge and the skills require to build a good AI is vast. Due to the increasing use of robots in our daily life it is replacing human work and thus creating unemployment. On the other hand it is believed that computer can never replace human interaction and high posting jobs like care given by nursing in medical care, police enforcement and judges. There is a lack of common sense. It is believed that if we are successful in building a strong AI which can completely replace humans it can overpower humans and if in wrong hands can lead to mass scale destruction of humanity.

FIELDS OF ARTIFICIAL INTELLIGENCE

There are several research fields in AI each with a different purpose and set of applications.

Machine learning [7] is one such field of artificial intelligence that mimics the human abilities by machine. Both explanation and experienced based learning are parts of ML. Machine these days are replacing human labour. But the question arises of how to train these machines according to our requirements. Instead of building heavy machinery with explicit programming, different algorithms are introduced which will help the machine to understand the virtual environment and take decisions. Because of this machines have become independent and have capabilities to take decisions on their own. Machine learning can be classified into 3 broad categories on the basis of nature of learning. These are:

Supervised learning- given the "right answer" for each example. The computer is presented with example training sets and their desired output is mapped, just like a "teacher" supervises the student to do work. The goal is to learn a general rule that maps inputs to outputs.

Unsupervised learning-No labels associated with it. It is algorithm's duty to find some structure in the data set for us. Unsupervised learning can itself be a goal in discovering hidden patterns in the data. Clustering is an example of unsupervised learning.

Reinforcement learning- it is inspired by behavioral psychology. A computer program is made to interact with environment in which it must perform a certain goal and on achieving the goal it is awarded for the good response.

Some of the machines learning algorithms are linear regression, decision tree learning, association rule learning, similarity and matrix learning.

Applications for machine learning include: Bioinformatics, Classifying DNA sequences, Computational anatomy, Computer vision, including object recognition , Detecting credit card fraud, Game playing, Information retrieval, Internet fraud detection [8], Marketing, Machine learning control, Medical diagnosis, Economics, Natural language understanding, Online advertising, Recommender systems[9], Robot locomotion, Search engines, Sentiment analysis, Software engineering, Speech and handwriting recognition, Financial market analysis, Structural health monitoring.

Neural networks are another field of artificial intelligence. An artificial neural network (ANN) [10] is based upon the structural and functional aspects of the biological neural networks. Computations are structured in terms of interconnected groups of artificial neuron mimicking the functioning of neurons in human body, processing information. Modern neural networks are non-linear statistical data modelling tools. There are many layers to it called as nodes and like a neuron transmits the data to our brain nodes work in a similar fashion.

Deep learning consists of multiple hidden layers of artificial neural networks (Fig-4).

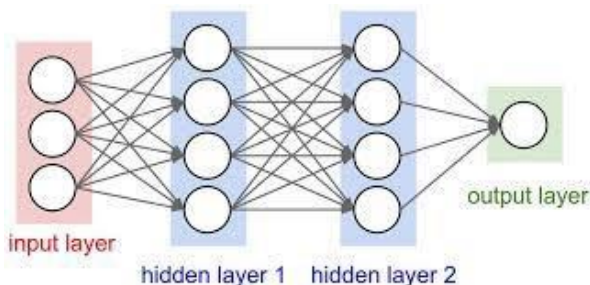


Fig. 4: Deep learning.

Logic-Fuzzy logic is a method of reasoning which resembles human reasoning. In digital world we have only two discrete possibilities i.e. 0/1 or true/false or yes/no. but in real world there are many more possibilities like maybe, certainly, possibly, greatly, surely etc. there are several application of fuzzy systems in our daily life including automotive systems –aviation, automatic gearboxes, four-wheel steering vehicle environment, environment control- air conditioners /dryers /heaters, humidifiers, microwave ovens, refrigerators, toasters, vacuum cleaners, washing machines.

Expert System [11] In artificial intelligence, an expert system is a computer system that copies the decision-making ability of a human professional. Expert systems are basically used for solving the complex problems through reasoning about the knowledge. An expert system can be classified in two parts: the inference engine and the knowledge base. The knowledge base represents rules & facts. The inference engine applies the rules to the known facts to infer new facts. Inference engines can also include justification and debugging facility. Apart from this expert system are capable of Recommending, directing and supporting human in decision making, Representing, obtaining a solution, Diagnosing, predicting results, Suggesting alternative options to a problem.

Applications of expert systems are Diagnosis Systems to realize cause of disease from experiential data, conduction medical operations on humans. Evaluating data continuously with observed system or with approved behavior such as leakage monitoring in long petroleum pipeline. Recognition of possible fraud, doubtful transactions. Robotics [Fig-5]–robots are the artificial agents acting in real world environment and reducing man power from performing certain tasks. The other AI fields work mostly on software whereas the robotics requires separate hardware. There is movement in a robot which helps it to interact with the real world. The higher the number of movements in a robot the greater will with the number of possible movements and much more complexity. Robots are mainly used in industries to perform heavy tasks for which large human force will be required. Along with industries robots are also used in medical treatments to perform operations requiring high precision. Other than this robot are used for many scientific purposes like mars rover. It can also be used just for entertainment purposes like camera drones.

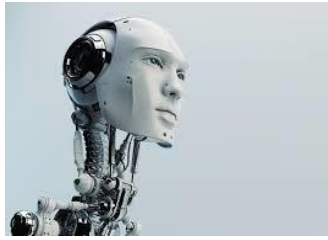


Fig. 5: Robotics [12].

Natural language processing is a field of computational linguistics and artificial intelligence. The main focus of NLP is to understand the natural languages spoken by humans like English and grammar by the machines. This understanding provides a medium of communication between the intelligent systems and the humans. A set of ML algorithms and models can be used to achieve NLP based AI.

Some of the aspects of NLP are translation, classification, clustering, and information extraction [Fig-6].



Fig. 6: Steps involved in natural language processing.

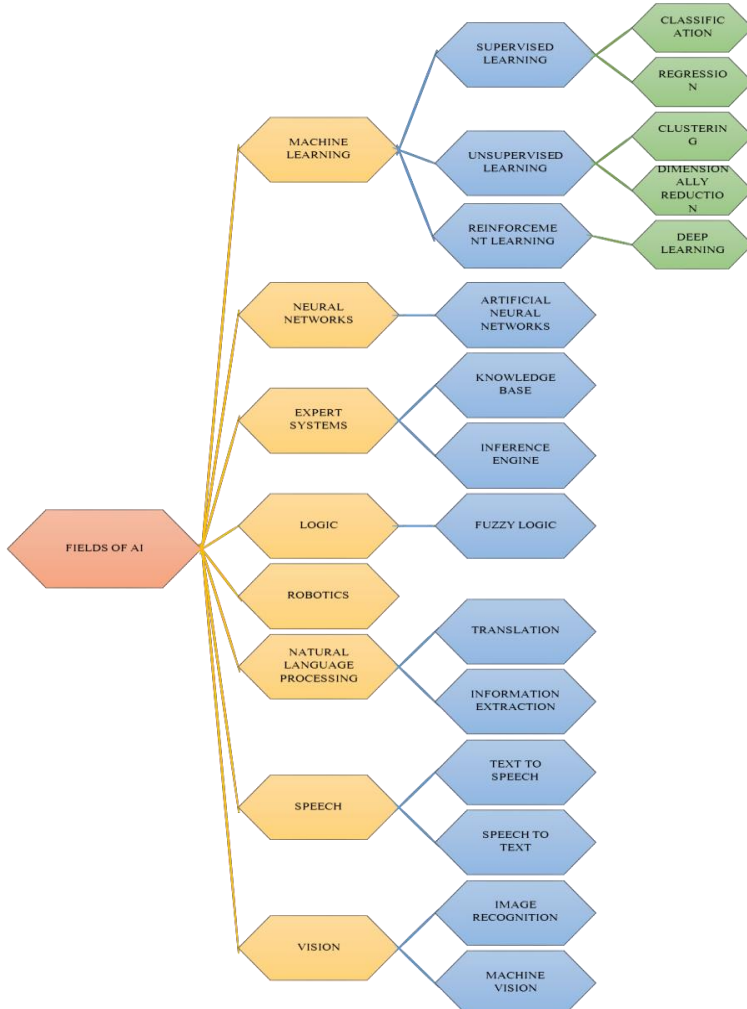


Fig. 7: Fields of AI.

Speech

Speech recognition is an important field these days. It includes speech to text conversion and text to speech conversion. Speech recognition is different from voice recognition as speech recognition is user independent and only focuses on the words being spoken and not the person speaking [13].

Vision

Image recognition and machine vision are two major aspects of vision. Remote sensing using images is done by this method. Snapchat filters also use face detection which is a part of image recognition. In the fields of robotics machine vision is used along with sensors to guide the path to the robot for [14,15] movement. The fields of AI is represented in Fig-7.

CONCLUSION

From the last couple of decades, a drastic rise is being seen in every area of the AI including robots, automatic vehicles etc. It has completely transformed the world by making every aspect so easy especially by the help of the machine learning principles/techniques. The current progress in AI is just the beginning of the future trend. Now ('vicarious') AI is so advanced that it can surpass the CAPTCHA test. Latest advancements in robotics include human like robot SOPHIA made by Hanson robotics capable of having full conversations, showing empathy, understanding emotions and responding to them and also having facial expressions. In the hypothetical future there will be singularity where the super-intelligent machines far beyond the capability of humans will exist. Morality could determine the ethics of AI. Being advancement, it is giving an automated path to us leading to a very bright future & things like drones, humanoid robot that can ride a motorcycle & self-driving car are becoming the main driver of innovation for an automotive industry. Along with it a lot of employment opportunities also exists with this technique.

CONFLICT OF INTEREST

There is no conflict of interest.

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