

# A Review on Significance of Sub Fields in Artificial Intelligence

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**Abstract-** This paper describes the significance of subfields of Artificial Intelligence (AI), application areas of AI technologies and the future of Artificial Intelligence in the real world. Artificial Intelligence is becoming a popular field in computer science as it has enhanced the human life. In the last two decades, Artificial intelligence has greatly improved the performance of manufacturing and service systems. Many subfields of AI and robotics regularly host competitions, which impact research communities in several ways, including science, engineering, business, medicine and weather forecasting. Application areas of AI are having a huge impact on various fields of human everyday life as expert system is widely used these days to solve the complex problems. AI for robotics will permit us to speak the challenges in taking care of an aging population and agree much longer independence. It will enable significantly reducing, even bringing to zero, traffic accidents and deaths. This article mainly focused on discussion, attracts publicity for the subfields of AI and helps enroll young researchers in a research community. Future systems may work via improved reality or by giving us physical abilities far beyond existing vision, hearing, and manipulation.

**Keywords:** Artificial Intelligence, Robotics, Expert Systems, Machine Learning and Neural Networks

## I. INTRODUCTION

By the definition, Artificial Intelligence states to the branch of computer science which deals with intelligence exhibited by software and machines. It states to the design formerly study of an intelligent agent that could perceive the environment and act accordingly. It is an extremely technical and specialized field involving some of the greatest thinkers and scientists working hard to sense of taste success in this relatively new field of research. The fundamental problems of AI research include intellectual, knowledge, scheduling, education, communication, insight and the ability to move and manipulate objects. Universal intelligence is still amongst the arena's extended term goals. Presently popular methodologies include numerical methods, computational intelligence and outdated symbolic AI. There are an enormous number of tools used in AI, including many versions of search and mathematical optimization, logic, methods based on probability, economics, and many others.

Consequently different innovations have reduced human effort, and then on the other hand, made people idle too. Societies desire having a machine-driven slave do things designed for you rather than engaging their own muscles. This motivation managed the modern day scientists to invent newer devices which could 'ease' human life. With a goal to mechanize the robots, AI emerged out to be sole answer to all the questions.

The world is now housing over 1.1 billion functioning robots, but furthestmost of them have certain sort of artificial intelligence which enables them to think and learn on their own. For example, the fact those industry robots are now completing over 80% of the assembly of a car. The state of the artificial intelligence can be understood from the Blue Brain Project in Switzerland. They believe that they can recreate the human brain in a super computer, and so far they have recreated 10 billion of our brain's 85.9 billion neurons.

The vital goal of AI is to enable machines to do everything that a human intelligence is proficient, which consist of the possessions of being self-aware. The whole thing from being able to drive cars, play games like chess and Go, winged planes, lettering poetry, innovative, or literature to self-governing development and scheduling for flying machine, logistics scheduling to medical diagnosis and coding.

An American scientist John McCarthy invented the term Artificial Intelligence and he got a credit of forefather of AI. He was a supercomputer and cognitive scientist and was very popular early development of AI in Stuart J, Russell, Norvig, Peter (2003), [1]. During 1940s and 50s, many scientists from diversity fields like mathematics, psychology, engineering, economics and political science started to try to make an artificial mind which work like human. The semantic net first program of AI was written by Ross Quillian. Semantic net is a graph in which nodes represent the concept and arrow is used for providing link between the nodes in Daniel, Crevier , [2]. A quiz was done in Feb 2011, named with Jeopardy! Quiz showed, it was an exhibition match. Further, the competition was in between the IBM's question answering system named as Watson and two champions named as Brad Rutter and Ken Jennings then that IBM system beaten them by a great margin.

## II. SUB-FIELDS OF ARTIFICIAL INTELLIGENCE

AI now consists many sub-fields, few of them include:

1. Neural Networks
2. Evolutionary and Genetic Computing
3. Vision Recognition
4. Robotics
5. Expert Systems
6. Speech Processing
7. Natural Language Processing
8. Machine Learning

Most of the above include both engineering and scientific aspects.

### A. Neural Networks

The study of Neural Networks (NNs) began with an aim to replicate the thought process of a human brain into a few microchips. It refers to a huge network of data sets which are interconnected and continuously sending data to each other. Artificial Neural Network (ANN) is a computational structure intended to mimic biological neural networks. NNs consist of computational units called neurons, which are connected by means of weighted interconnections. The mass of an interconnection is a quantity that states the strength of the associated interconnection. The foremost representative of ANNs is their capability to study. The erudition method is achieved by adjusting the weights of the interconnections rendering to some realistic learning algorithms. Medha Sharma and Sandeep Kumar (2012) [3], discussed that the basic attributes of ANNs can be categorized into architectural attributes and Neurodynamic qualities. The architectural attributes define the network construction, i.e., numeral and topology of neurons and their interconnectivity. The Neurodynamic attributes define the functionality of the ANN.

Artificial Neural Networks were actually recognized in 1940s. Warren McCulloch and Walter Pitts (1943) [4], designed the first ANNs. The major erudition rule for ANNs was established by Donald Hebb in McGill University(1949) [5]. According to an experimentation led in the University of Stanford, article recognition through outdated computer centered vision used to be round 87% accurate; however those based on neural network were 97% accurate. Though NN is a new field, it has shown excessive promise in the future.

### Applications of Neural Networks

- **Character Recognition** - Character recognition has become very significant as handheld devices like the Palm Pilot are flattering gradually popular. Neural networks can be used to recognize handwritten characters.

- **Image Compression** - NNs can receive and process huge amounts of information at once, building them beneficial in image compression. With the cyber explosion and many sites using more images on their sites, using neural networks for image compression is value a look.
- **Stock Market Prediction** – Now a day, the stock market is becoming extremely complicated. Several factors weigh in whether a given stock will go raise or fall on any given day. Meanwhile neural networks can inspect a proportion of information quickly and grouping it all out; they can be used to forecast stock prices.
- **Medicine, Security, and Loan Applications** - These are few applications that are with the acceptance of a neural network that will resolve whether or not to endowment a loan, something that already has been used more successfully than many human beings.

### *B. Evolution of Genetic Computing*

In environment, evolution is mostly resolute by natural selection or various individuals competing for resources in the environment. Those personalities that are well are more likely to survive and disseminate their genetic material. The encoding procedure for genetic information (genome) is done in a way that confesses asexual reproduction, which outcomes in children that are genetically identical to the parent. Sexual reproduction allows some exchange and restructuring of chromosomes, producing offspring that contain a grouping of information from each parent. This is the recombination operation, which is often named to as crossover because of the way strands of chromosomes cross over during the exchange. The assortment in the population is achieved by mutation operation procedure.

Generally found grouped under the term evolution of computation or evolutionary algorithms in the paper Laurene, Fausett(1994) [6], are the domains of genetic algorithms(GAs) in Holland, Jon(1975) [7], evolution techniques in Rechenberg, I.(1965) [8], evolutionary programming methods in the paper Fogel, L(1995) [9], and genetic programming in Koza, J.(1992) [10]. These are all parts of a common theoretical base of pretending the evolution of individual patterns through processes of selection, recombination, and mutation reproduction, in that way producing better solutions.

### *Applications of Evolution of Genetic Computing*

- **Automotive Design**- Use of Genetic Systems to both enterprise compound materials and aerodynamic shapes for race cars and consistent means of shipping (including aeronautics) can return groupings of best materials and best engineering to deliver faster, sunnier, more fuel efficient and harmless vehicles for all the possessions we use vehicles for.
- **Engineering Design**- The most of the resources to enhance the organizational and functioning design of constructions, manufacturing works, machines, heat exchangers, robot fascinating arms, satellite blasts, building trusses, flywheels, turbines etc...
- **Robotics**- GAs can be encoded to search for a range of optimal designs and machineries for each specific use, or to return results for absolutely new types of robots that can achieve multiple tasks and have more universal application. The Jetsons as kids, who will prepare our meals, do our dirty washing and even clean the bathroom for us!
- **Evolvable Hardware**- Hardware applications are electronic circuits which are created by GA computer prototypes which will use stochastic (statistically random) operators to progress new patterns from old ones. Consequently, GAs would enable self-adaptation and self-repair.
- **Optimized Telecommunications Routing**-The GAs have been developed that will allow for dynamic and anticipatory routing circuits for networks telecommunications. GAs are being developed to enhance placement and routing of cell towers for good coverage and comfort of switching. Hence, cell phone and blackberry will be thankful for GAs too.
- **Invention of Biomimetics** -Biomimetic is the term which indicates the development of technologies encouraged by designs in nature. Programmers of GAs are working on applications that not only to analyze the natural designs themselves for a return on how they work, but also join natural designs to create something entirely new that can have wonderful applications.

- **Computer Gaming** - The individuals who spend little of their time playing computer games of Sims will frequently find themselves playing over sophisticated GAs in its place of against other human players online.
- **Code breaking and Encryption** - For the security front, GAs can be used both to create encryption for data as well as to break the codes.
- **Computerized Molecular Design** - The denovo construction of new chemical molecules is a growing field of applied chemistry in both medicine and industry. The GAs are used to help in the understanding of protein folding, evaluating the effects of substitutions on protein functions, and to identify the binding attractions of several designed proteins industrialized by the pharmaceutical industry for better treatment of special infections.

### C. Vision Recognition

Computer Vision is the science and technology of gaining models, sense and control information from visual data. The dualistic key arenas of computer vision are computational vision and machine vision. Computational vision takes to ensure with simply recording and exploring the visual acuity, and trying to recognize it. Machine vision has to do with by means of what is found from computational vision and relating it to profit people, animals, environment, etc.

#### *Applications of Vision Recognition*

Computer Vision has prejudiced the arena of AI prominently. The Robocup competition and ASIMO are models of AI by means of Computer Vision to its extreme extent. The Robocup competition is a tournament for robot dogs frolicking soccer. To be competent to play soccer, these dogs must be capable to perceive the ball, and then respond to it consequently. Engineers of these robot dogs have been faced to produce robot dogs that can beat the best soccer performers at soccer in about fifty years. ASIMO is a robot created by Honda, but of course, all robots requisite to be competent to know where to move around and what is in its environments. To be intelligent to do this, ASIMO uses cameras to envision computationally what is in its environs, and then uses it to attain its penalty area.

In several computer vision applications, the computers are pre-programmed to solve a certain task, but techniques based on learning are now becoming gradually common. Examples of applications of computer vision include systems for:

- Monitoring processes, *e.g.*, Industrial robot
- Collaboration, *e.g.*, as the input to a device for computer-human interaction
- Military, *e.g.*, discovery of enemy soldiers or vehicles and missile guidance
- Automatic inspection, *e.g.*, in industrialized applications
- Agriculture process, *e.g.*, optical sorting
- Navigation, *e.g.*, by an autonomous vehicle or mobile robot
- Modeling substances or surroundings, *e.g.*, medical image analysis
- Support of visual effects design for cinema and broadcast, *e.g.*, camera tracking

### D. Speech Recognition

Speech recognition is one of the most innovative conceptions of electrical engineering and computer science. Essentially, this approach compacts with the conversion of the spoken words into text. Speech recognition is also stated as ASR (Automatic Speech Recognition), STT (Speech to text) or just computer speech recognition. On the contrary, it has been appealed by Dalby, Jonathan, and Diane Kewley-Port(2013) [11], that speech recognition can also be understood as the arena of computer science, which compacts with the organization and development of computer systems, in order to recognize the spoken words. In this esteem, Saini et al (2013) [12] has emphasized that speech recognition or computer speech recognition or ASR is nothing more than the approach of transforming a speech signal into the sequence of words, by the help of different systems and procedures.

It has been renowned in the research, which was approved out by Chen, Lijiang (2012) [13] that these methodologies include AI methodology, pattern recognition method, as well as acoustic phonetic approach. In accordance with the assessments and observations of Choudhary, A. and Kshirsagar, R.(2012) [14], artificial intelligence is the most developing and effective techniques, which supports faultless and exact speech recognition. It is for AI integrates certain algorithmic approaches, which raises coherent conversion and revolution of speech into readable patterns, and vice versa.

#### *Applications of Speech Recognition*

It has been documented from the studies of that AI is widely used in different areas, including prosaic signals and traffic lights, robotic household gear, conservation systems and homemade security, healthcare robotics, credit card trades, cell phones (smart phones), and video games.

- **Automated identification** - Australia's 8th largest insurers, ahm Health Management is effectively using speech biometrics to allow present account holders to speak to customer service representatives rapidly and securely. The company has registered more than 20,000 customers' voiceprints.
- **Removing IVR menus** - By announcing Natural Language Speech Recognition (NLSR), universal insurance company Suncorp substituted its original push button IVR, supporting the customer to just say what they wanted.

#### *E. Robotics*

Robotics is the area of Artificial Intelligence technology most pretty to the community. In fact, robotics could be the area where AI can be supreme beneficial to mankind. It includes mechanical, generally computer controlled devices to accomplish tasks that necessitate extreme accuracy or monotonous or dangerous work by people. Traditional Robotics uses AI design procedures to driver robot activities and works toward robots as mechanical devices that have to be industrialized and measured by a human engineer. The Autonomous Robotics methodology recommends that robots could improve and control themselves independently. These robots are able to adjust to both indeterminate and imperfect information in continuously changing environs. This is probable by emulating the learning progression of a single natural organism or through Evolutionary Robotics, which is to put on selective duplicate on people of robots. It lets a simulated development process grow adaptive robots.

#### *Applications of Robotics*

- **Galaxy Robotics** - Improvement of robot systems for amorphous, uneven territory based on biologically enthused inventive kinetic energy perceptions
- **Subaquatic Robotics** - Development of schemes for user provision in remote-controlled underwater vehicles retaining essential entanglement methods
- **Rechargeable Mobility** - Conceptions for electric vehicles, battery charge technologies, and the group of vehicle data. Prototypes for intellectual, environmentally sound, and integrated urban mobility are created.
- **Logistics, Production and Consumer (LPC)** - Novel systems are established which will improve handling and planning tasks, fast, self-learning image recognition and classification to identify construction faults.
- **Search and Rescue (SAR) & Security Robotics** - Robots will be technologically advanced to support rescue and security personnel, mission planning and independent navigation.

#### *F. Expert Systems*

The first extent of Artificial Intelligence application is expert systems, which are AI suites that can create resolutions which generally necessitate human level of proficiency. Expert systems are possibly the furthestmost simply implemented and maximum extensively used AI technology. Even though the special effects of such systems may not be enthusiastically apparent, they have had a tremendous influence on our lives. In fact, several of the computer suites we use today can be deliberated expert systems.

#### *Applications of Expert System*

- A software package called DENDRAL, developed at the Stanford Research Institute in 1965, was the ancestor of expert systems. Considerably like a human chemist, it could investigate information about chemical compounds to define their molecular construction. The advanced suite called MYCIN was developed in the mid-1970s and was proficient of serving physicians in analysis of bacteriological infections. It is regularly denoted as the first real expert system.
- The spell-checking efficacy in our word processor is an expert system. It takes the role of a checker by evaluation a set of sentences, testing them against the known spelling and linguistic rules, and constructing propositions of probable modifications to the writer. Expert systems, shared with robotics, carried about computerization of the engineering process which enhanced production rate and condensed error. A typical association line that required hundreds of persons in the 1950s now merely requires ten to twenty persons who handle the expert systems that do the work. The inventors in manufacturing mechanization are Japanese automobile industrialists such as Toyota and Honda, with up to 80% automation of the industrialized process.
- The furthestmost advanced expert systems, similar to several other innovative technologies, are used widely in army applications. An instance is the succeeding peer group warrior aircraft of the U.S. Air Force -- the F-22 Raptor. The pointing supercomputer on the team the Raptor precedes the role of a radar controller by inferring radar signals, detecting a target, and testing its radar signature against known opponent types deposited in its database.

### *G. Natural Language Processing*

Natural-language-processing software package use AI to let a user to communicate with a computer in the user's natural language. The computer can both recognize and reply to instructions given in a natural language. The penalty area of Natural Language Processing (NLP) is to plan and construct a computer system that will investigate, recognize, and produce natural human-languages. Usages of NLP comprise machine transformation of one human-language text to another; group of human-language text such as literature, booklets, and universal explanations; interfacing to additional systems such as databases and robotic systems accordingly facilitating the use of human-language type commands and enquiries; and accepting human-language text to provide a summary or to appeal conclusions. One of the easiest jobs for a NLP structure is to parse a sentence to govern its syntax. A more difficult assignment is defining the semantic meaning of a sentence. One of the furthestmost challenging tasks is the analysis of the framework to determine the exact meaning and associating that with other text.

#### *Applications of Natural Language Processing (NLP)*

- Spelling amendment, syntax checking
- Enhanced search engines
- Information mining
- Psychoanalysis, Harlequin passions;
- Innovative interfaces
- Speech appreciation (and text-to-speech)
- Negotiation Systems (USS Enterprise onboard computer)
- Machine transformation (Babel fish)

### *H. Machine Learning*

Machine learning programs identify patterns in data and adjust program actions consequently. For instance, Facebook's News Feed changes according to the customer's private communications with other consumers. If a customer regularly tags a friend in snapshots, writes on his wall or likes his/her links, the News Feed will display more of that friend's movement in the user's News Feed due to assumed closeness.

#### *Applications of Machine Learning*

- **Face detection in Mobile Camera:** Usually Cameras can automatically snap a photo when someone smiles more perfectly now than ever before because of developments in machine learning methods.

- **Face recognition:** An efficient program can identify an individual from a picture. We can find this feature on Facebook for mechanically tagging people in snapshots where they appear. An advancement in machine learning is additional accurate auto-face group software.
- **Image classification:** The major application of deep learning is to improve image classification or image categorization in applications such as Google photos. Google pictures would not be possible without advancements in deep learning.
- **Speech recognition:** Enhancements in speech recognition systems have been made possible by machine learning explicitly deep learning.
- **Google:** Google explains itself as a machine learning syndicate now. It is also a front-runner in this area because machine learning is a precise important component to its primary advertising and search businesses.
- **Anti-virus:** Machine learning has been used in Anti-virus software to improve discovery of malicious software on computer procedures.
- **Anti-spam:** The machine learning can also be used to train best anti-spam software systems.
- **Genetics:** In machine learning, the classical data mining or clustering algorithms such as agglomerative clustering are used in genetics to give assistance find genes associated with a particular disease.

### III. CONCLUSION

This paper mainly described on discussion, attracts publicity for the subfields of AI and helps enroll young researchers in a research community. Artificial intelligence has been fluctuating lives of human beings for decades, but never has AI felt more pervasive than now. Still it appears as though not a week passes without another AI system overcoming an exceptional hurdle or overtaking humans. But, how the future of AI will disparage out for humans remains to be perceived. AI could either fulfill all our dreams come true or may destroy the society and the world. In order to get a genuine handle on what that future will look like, Tech Insider spoke to 18 AI researchers, robot cists, and computer scientists about the most thoughtful change AI would bring. AI for robotics will permit us to speak the experiments or challenges in taking care of an aging population and agree much longer independence. Artificial Intelligence will enable significantly falling, even taking to zero, traffic accidents and deaths. A central implication of the kind of AI technology that will be coming soon will be in the area of personalized medicine. A great application of machine learning technology applied to big data is in personalized medicine. Future systems may work via improved reality or by giving us physical abilities far beyond existing vision, hearing, and manipulation.

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