OVERVIEW ANDAPPLICATION OFARTIFICIALINTELLIG ENCE

By

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ND/COM.SCI/18/011

A project report submitted to the Bayelsa State Polytechnic, Aleibiriin partial fulfillment of the requirement for the award of National Diploma in Computer Science.

June, 2021

Certification Page

This is to certify that this project report by **Shilo, Victoria** with registration number: **ND/COM.SCI/18/011** has been read and approved as having met the requirement for the award of National Diploma in Computer Science of Bayelsa State Polytechnic, Aleibiri.

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Dedication

I dedicate this research report to God Almighty who has given me the strength to complete this project work.

Acknowledgement

I am grateful to God Almighty for making and giving me the strength and sense of reasoning in writing this project report, may His Name be praised forever.

My appreciation also goes to supervisor, Mr. Lawrence Ikulugan who took time to read between the lines and made the necessary corrections.

I am also grateful to many individuals who aided in the preparation of this project report, many helpful suggestions and valuable comments were received from my colleagues, Mr. Ambedi Goodluck, Ayibawanemi Jonah, TonprebofaGodgift, and Ayakabowei Happy.

Finally, I want to thank my dad, Mr. Shilo F. Ogomu, also my family members, Mrs. Gowon Silver, Mrs. Okoi Mary, Anda Johnson, Akintola Godgift, and Chester E. Vivian.

And to my darling caring sweet mother, Mrs. Shilo A. Lucky and also the ones on the line for the love and expressed in their willingness to trade off our companionship in order to concentrate and complete the work schedule, I am forever grateful.

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ABSTRACT

This is a project on overview of artificial intelligence (AI). It takes a wide look at the basic theories of artificial intelligence and its potential application. The different approaches to AI problem solving used by various researchers, such as Neural Networks, Expert Systems, Generic Algorithms and Fuzzy Logic were discussed in the process. Furthermore, the skills applied to these approaches (elements) were herein identified and discussed. Summarily, while the report identifies the most important and basic theories of Artificial Intelligence (AI) and its applications. It aims at inspiring advanced research in the constantly evolving technologies of AI.

CHAPTER ONE

1.0 INRODUCTION

Artificial Intelligence (AI) has come a long way from its early roots, driven by dedicated researchers. AI really began to intrigue researchers with the invention of the computer in 1943. The technology finally became available, to stimulate intelligent behaviour. Over the last four decades, despite many stumbling blocks, AI has grown from a dozen researchers, to thousands of engineers and specialists; and from programmes capable of playing checkers, to systems designed to diagnose diseases, expert security systems and the likes of it.

The beginning of artificial intelligence dates back before electronics, to philosophers and mathematicians such as Boole and others who theorized on principles that were used as the foundation of AI logic. This topic looks to convey the exciting prospects of Artificial Intelligence and its application.

1.1 REVIEW

It was in the early 1950s that the link between human intelligence and machines was really observed. Nobert Wiener was one of the first Americans to make observations on the principle of feedback theory, and the term “artificial intelligence” was first coined in 1956, at the Dartmouth Conference, organized by John McCarthy who is regarded as the father of AI.

The most familiar example of feedback theory is the thermostat: it controls the temperature of an environment by gathering the actual temperature of the house, comparing it to the desired temperature, and responding by turning the heat up or down. What was so important about his research into feedback loops was that Wiener theorized that all intelligent behaviour was the result of feedback mechanisms.

In late 1995, Newel and Simon developed the *logic theorist*, considered by many as to be the first AI programme, representing each problem as a tree model, would attempt to solve it by selecting the branch that would most likely result in the correct conclusion. In 1957, the first version of a new programme*The General Problem Solver* (GPS) was tested. The programme developed by the same pair which developed the Logic Theorist. The GPS was an extension of Wiener's feedback principle, and was capable of solving a greater extent of common sense problems.

A couple of years after the GPS, IBM contracted a team to research artificial intelligence. Herbert Gelernter spent three years working on a programme for solving geometry theorems. While other programmes were being produced, McCarthy was busy developing a major breakthrough in AI history.

In 1958, McCarthy announced his new development; the LISP language, which is still used today. LISP was soon adopted as the language of choice among most AI developers, and since then Artificial Intelligence has expanded because of the theories and principles developed by its dedicated researchers (Wikipedia, 2007).

Artificial Intelligence is a combination of computer science, physiology, philosophy with mathematics and several other disciplines. AI is a broad topic, consisting of different fields, from machine vision to expert systems. The element that fields of AI have in common is the creation of machines that can "think". Application of artificial intelligence involves several techniques including expert/knowledge base system, neural networks, case-based reasoning, pattern matching, machine leaning and fuzzy logic.

1.2 OBJECTIVE OF THE TOPIC

The issue of Artificial Intelligence is more than five decades old. But what we really need to know as science and technology enthusiasts or practitioners is how we can apply AI to improve our daily lives and what researchers have done and are still doing to make the dream of perfect AI systems a reality.

1.3 SIGNIFICANCE

Artificial Intelligence and its applications is a very important aspect of computer and science revolution. As the world is fast rising, as it is believed will relieve menial works and duties that pose risk to life. However, many AI based technologies have filtered into general applications, and often, once a technology becomes of household use, its significance as an Artificial Intelligence innovation is underplayed. Many thousands of AI applications are deeply embedded in the infrastructure of every home and industry.

1.4 SCOPE OF WORK

This project covers a basic knowledge, overview and applications of Artificial Intelligence. AI research theories were broadly represented as more than problem solving solutions and written programmes that can be found in advanced AI studies.

CHAPTER TWO

2.0 OVERVIEW OF ARTIFICIAL INTELLIGENCE

All Artificial Intelligence computer programmes are built on two basic elements. A knowledge base, and an influencing capability, i.e. drawing conclusion based on logic and prior knowledge. A knowledge base is made up of many discrete units of information representing facts, concepts, theories, procedures, and relationships. All relevant to a particular task or aspect of the world.

Programmes are written to give the computer the ability to manipulate this information and to reason, make judgements, reach conclusions, and choose solutions to the problem at hand, such as guessing whether a series of credit-card transactions involve fraud or driving an automated rover across a rocky Martian landscape.

Whereas conventional, deterministic software must follow a strictly logical series of steps to reach a conclusion. AI software used the techniques of search and pattern matching; it may also, in some cases, modify its knowledge bases or its own structure ("learn"). Pattern matching may still be algorithmic; that is, the computer must be told exactly where to look in its knowledge base and what constitutes a match. The computer searches its knowledge base for specific conditions or patterns that fits the criteria of the problem to be solved.

Microchip technology has increased computational speed, allowing AI programmes to quickly scan huge arrays of data. For example, computers can scan enough possible chess moves to provide a challenging opponent for even the best human players. Artificial Intelligence has many other applications, including problem solving in mathematics and other fields, expert systems in medicine, natural language processing, robotics and education.

The ability of some AI programmes to solve problems based on facts rather than on a predetermined series of steps is what most closely resembles "thinking" and causes some in the AI field to argue that such devices are indeed intelligent.

2.1 ARTIFICIAL INTELLIGENCE PRE-HISTORY FIELDS

AI notably is an interdisciplinary field that draws its roots, and requires knowledge in fields such as physiology, mathematics, psychology, economy, linguistics, neuroscience, control theory and so on. These fields apply to AI as follows:

- Philosophy: This field is necessary to demonstrate the logic and methods of reasoning mind as physical system foundations of learning, language, rationality.
- Mathematics: This provides the formal representation and proof algorithms, computations, (un) decidability, (in) tractability probability.
- Psychology: This is necessary in the adaptation phenomena of perception and motor control experimental techniques (psychophysics, etc.) of AI.
- Economics: This provides the formal theory of rational decisions.
- Linguistics: This provides the knowledge of representing grammar.
- Neuroscience: This field is necessary for the plastic physical substrate for mental activity.
- Control theory: This field provides study of the homeostatic system, stability simple optimal agent designs in AI (Hunter, 2000).

2.2 HISTORICAL TIMELINE

1943: McCulloch and Pitts-Boolean circuit model of brain.

1950: Turing's "Computing Machinery and Intelligence"

1952 - 69: Early enthusiasm and great expectations "A machine can (never) do X"

1950s: Early AI programmes, including Samuel's checkers programme, Newell and Simon's Logic Theorist, Gelernter's Geometry Engine.

1956: Dartmouth meeting – Artificial Intelligence" adopted.

1965: Robinson's complete algorithm for logical reasoning.

1966 - 74: AI discovers computational complexity; neutral network research almost disappears.

1969 - 79: Early development of knowledge-based system.

1980 - 88: Expert systems industry booms.

1988 - 93: Expert systems industry bust – "AI Winter"

1985 - 95: Neural networks return to popularity.

1988: Resurgence of probability; general increase in technical depth; "Nouvelle AI" – Alife, GAS, soft computing.

1995: Multiples of agents everywhere.

2003: Human-level AI back to the agenda. (Hunter, 2000).

2.3 DEFINITION OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) for short can simply be said to be the intelligence of machines and the branch of computer science that aims to create it.

It is the area of computer science focusing on creating machines that can engage on behaviours that humans consider intelligent. The primary aim of AI is to produce intelligent machines. The intelligence should be exhibited by thinking, making decisions, solving problems, and most importantly by learning.

The ability to create intelligent machines has intrigued humans since ancient times and today with the advent of the computer and 50 years of research into AI programming techniques, the dream of smart machines is becoming a reality. Researchers are creating systems which can mimic human thought, understand speech, beat the best human chess player, and countless other feats never before possible.

Thus, in any definition, AI systems can generally be inferred as:

- Systems that think like humans.
- Systems that act like humans.
- Systems that think rationally.
- Systems that act rationally.

Artificial Intelligence can be classified into strong and weak AIS.

2.3.0 Strong Artificial Intelligence

This deals with creation of real intelligence artificially. Strong AI believes that machines can be made sentient or self-aware. There are two types of strong AI: *human-like* AI, in which the computer programme thinks and reasons to the level of human beings. *Non-human-like* AI, in which the computer programme develops a non-human way of thinking and reasoning.

2.3.1 Weak Artificial Intelligence

Weak AI does not believe that creating human-level intelligence in machine is possible but AI techniques can be developed to solve many real-life problems.

2.4 ELEMENTS OF ARTIFICIAL INTELLIGENCE

Today, in the quest to create intelligent machines, the field of AI has split into different approaches or techniques based on varying opinions by researchers, on the most promising methods and theories. These methods could be considered as elements of AI. The techniques or methods include:

- Expert Systems
- Neural Network
- Fuzz Logic
- Generic Algorithms

However, researchers mainly use two (2) basic approaches: bottom-up and top-down.

2.4.0 Expert Systems

Expert system is a top-down approach which attempts to mimic the brain's behaviour with computer programmes. This uses serial processing and can be well organized step by step to achieve the treatment.

An expert system is an artificial intelligence programme that has expert-level knowledge about a particular domain and knows how to use its knowledge to respond properly. The source of knowledge may come from a human expert and/or from books, etc. Domain refers to the area within which the task is being performed.

Expert systems are also known as knowledge-based systems; they act as intelligent assistants to human experts or serve as a resource o people who may not have access to an expert. The major difference between an expert system and a simple database containing information on a particular subject is that the database can only give the user discrete facts about the subject, whereas an expert system uses reasoning to draw conclusion from stored information.

The purpose is this AI application is not to replace our human experts, but to make their knowledge and experience more widely available. Edward Feigenbaum of Stanford University has define expert system as "an intelligent computer programme that uses knowledge and inference produces to solve problems that are difficult enough to require significant human expertise for their solutions." (Girratano and Riley, 2000).

An expert system has three (3) parts: knowledge-based, inference engine, and user interface.

The knowledge base contains both declarative (factual) and procedural (rules-of-usage) knowledge in a very narrow field.

The inference engine runs the system by determining which procedural knowledge to access in order to obtain the appropriate declarative knowledge, then draws conclusion and decides when an applicable solution is found.

An interface is usually defined at the point where the machine and human "touch". An interface is usually a keyboard, mouse, or similar device. In an expert system, there are actually two (2) different user interface: One is for the designer of the system (who is generally experienced with computers) and the other is for the user (generally a computer novice). Because most users of an expert system will not be computer experts, it is important that systems be easy for them to use.

All user interfaces are bi-directional that is; they are able to receive information from the user and respond to the user with its recommendations. The designer's user interface must also be capable of adding new information to the knowledge base.

Advantages of Expert Systems

- Availability: Experts are available easily due to mass production software.
- Cheaper: The cost of providing expertise is not expensive.
- Reduced Danger: They can be used in any risky environment where humans cannot work with.
- Permanence: The knowledge will last indefinitely.

- Multiple expertise: It can be designed to have knowledge of many experts.
- Explanation: They are capable of explaining in detail the reasoning that led to a conclusion.
- Fast response: They can respond at great speed due to the inherent advantages of computers over humans.
- Unemotional and respond at all times: Unlike humans, they do not get tensed, fatigue or panic and work steadily during emergency situations.

2.4.1 Neural Networks (Bottom Up)

This is the second major approach in achieving Artificial Intelligence. Bottom Up theorists believe that the best way to achieve artificial intelligence is to build electronic replicas of human brain's complex network of neutrons.

The most common application of neural networks is in pattern recognition. The human brain is made up of a web of billions of cells called neurons, and understanding its complexity is seen as one of the last frontiers in scientific research. It is the aim of AI researchers who prefer this bottom-up approach to construct electronic circuits that act as neurons do in the human brain. Although much of the working of the brain remains unknown, the complex network of neurons is what gives humans intelligent characteristics.

Researchers has shown that a signal received by a neuron travels through the dendrite region, and down the axon. Separating nerve cells is a gap called the synapse. In order for the signal to be transferred to the next neuron, the signal must be converted from electrical to chemical energy. The signal can then be received by the next neuron and processed.

At an individual level, a neuron has very little intelligence, in the sense that it operates by a simple set of rules, conducting electrical signals through its network. However, the combined network of all these neurons creates intelligent behaviour that is unrivalled and unsurpassed. So these researchers created network of electronic analogues of a neuron, based on Boolean logic. Memory was recognized to be an electronic signal pattern in a closed neural network.

How the human brain works is, it learns to realize patterns and remembers them similarly, the neural networks developed have the ability to learn patterns and remember. This approach has its limitations due to the scale and ability to learn patterns and remember. This approach has its limitations due to the scale and complexity of developing an exact replica of a human brain, as the neurons number in billions currently through simulation techniques, people create virtual neural networks. This approach has not been able to achieve the ultimate goal but there is a very positive progress in the field. The progress in the development of parallel computing will aid it in the future.

Warren McCulloch, a medical practitioner and Walter Pitts, a mathematician proposed a hypothesis to explain the fundamentals of how neural networks made the brain work. Based on experiment with neurons, McCulloch and Pitts showed that neurons might be considered devices for processing binary numbers. An important back of mathematic logic, binary numbers (representing as 1s and 0s or true and false) were also the basis of the electronic computer. This link is the basis of computer-simulated neural networks, also known as a parallel computing.

Advantages of Neural Networks

- Neural network learning: Network relations can be maintained with the input and output and changes in the network changes.
- Neural networks can create new knowledge to cope with environmental changes.
- Neural networks are also very flexible, because it is not a pre-determined set of conditions of bondage.

- Neural networks use parallel processing system while expert systems use serial processing.
- Neural networks have greater advantages than the expert system. For example, the neural network is adaptive and can learn from the information to explain the hidden patterns and relationships.

2.4.2 Generic Algorithm

Generic algorithm provides computers with a method of problem solving which is based upon implementations of evolutionary processes. The computer programme begins with a set of variables which internally resemble the chromosomes which stores the generic information in humans. Each genome of these digital chromosomes represents a trait of whatever the data structure is supposed to represent, this information can be stored either in bit-field form, in which each genome is classified as being on or off (0 or 1, respectively).

Alternatively, they can be stored in a character string in which each character represents an integer value which describes the magnitude of a trait. For example, it could be a number from 0 to 255, with 0 being a total absence of a trait and 255 being a total presence of a trait, and all numbers in between representing a gradient between the two polarities.

The computer programme first creates these digital chromosomes through random means, and then tests their "fitness". This can be done through one of two methods:

- Fitness-proportionate selection: This is a kind of generic selection in which the computer would use a model or procedure to test the fitness of the chromosomes and assign some kind of numeric value for its fitness in comparison to other chromosomes.

- Tournament selection: This form of selection involves “pitting” the chromosomes against each other in some kind of modeled environment. Those which survive the competition are deemed to be the fittest.

The computer programme then takes the fittest chromosomes and creates another generation through the use of some kind of generic operators. That is, the new generation of chromosomes can be created in either (or both) of two ways:

- Generic recombination: This is analogous to sexual reproduction; new offspring are created from the fittest chromosomes of the previous generation.
- Mutation: In generic mutation, the offspring are identical to their parents but have random changes in their structure (and thus their traits are somewhat modified).

These two (2) generic operators can be used in different combinations, all of them producing different results. Using both would imply first genetically recombining the chromosomes and then mutating them and would most closely approximate the natural reproduction pattern of humans. Using mutation only would simulate asexual reproduction, in which not as diverse a gene pool of chromosomes is created because no genetic crossing occurs.

One interesting aspect of this computer simulated Darwinist environment is that certain limiting factors such as an organism’s life span or age of reproduction need not hinder the process of natural selection. For example, a parent’s offspring could actually be inferior to the parent(s) because the process of reproduction may have made the offspring in such a way (e.g. if mutation deleted a good trait or generic crossing combined many bad aspects of each parents’ genotype). But because all of the chromosomes are ageless the parents still stand just as good a chance of surviving over its offspring’s generation.

This process of testing for fitness and creating new generations is repeated until the fitness chromosomes are deemed as optimized enough for the task which the genetic algorithm was created for.

2.4.3 Uses of Generic Algorithm

Genetic algorithm begins with a stochastic process and arrive at an optimized solution. Because of this, it will probably take much longer to arrive at a problem's solution through the use of a genetic algorithm then if a solution is found through analytical means and hardwired into the code of the computer programme itself. For this reason, generic algorithms are best suited for those tasks which cannot be solved through analytical means or problems where efficient ways of solving them have not been found. They exist a wide variety of such situations.

Generic algorithms can be used in scientific design. For example, if physicians had to design a turbine blade, they could make a different chromosome which had different genomes for properties of the blade such as the shape of the fan blade, its thickness, and its twist. The fitness function could then be a model which stimulates the fan blade in different environments, and the algorithm could take the fittest blades and digitally interbreed them to arrive at the most optimum design.

2.4.4 Fuzzy Logic

Fuzzy logic can be seen as a language. It can be described in natural language into a complex mathematical formula. Fuzzy logic, first pioneered in the US has the unique ability to make decisions under uncertain conditions. Its input and output links, people do not understand all the intermediate steps. Input from the sensors rather than people. Fuzzy logic expert system requires fewer than the rule, less than the value of neural networks. It uses the languages rather than the number of variables. Its use can produce greater flexibility and more options. Fuzzy logic for wide range of hidden behaviour and high uncertainty customer problems develop acceptable solutions very useful.

CHAPTER THREE

3.0 INTRODUCTION TO APPLICATIONS OF ARTIFICIAL INTELLIGENCE

Applications of artificial intelligence (AI) are a convergence of cuing edge research in computer science and robotics. The goal is to create smart machines that can perform complex tasks on their own. Application of artificial intelligence is possible in every field, where intelligent analysis, precision and automation are necessary.

Artificial intelligence combines precision and computation power with pure logic, to solve problems and reduce error in operation. Already, robot expert systems are taking over many jobs in industries that are dangerous for or beyond human ability. Application of AI can be found in various domains such as; heavy industries and space, finance, computer science, aviation, swarm intelligence, toys and games, weather forecasts, transportation, medicine, and telecommunications, to mention but a few.

However, these applications are made possible by intelligent skills such as; pattern recognition, artificial creativity, natural language processing computer vision, diagnosis, robotics, game theory, non-linear control, chatter bots, virtual reality, and image processing, etc. These are but a few typical problems to which AI techniques are applied to achieve the desired application, as various tools of artificial intelligence are also being widely deployed. Some of them are further discussed in the next chapter.

3.1 AI APPLICATION

Some of the applications of artificial intelligence (AI) as implemented by AI methods include;

- Heavy industries and Space; Robotics and cybernetics have taken a leap combined with artificially intelligent expert systems. An entire manufacturing process is now totally automated, controlled and maintained by a computer system in car manufacture, machine tool production, computer chip production and almost every high-tech process. They carry out dangerous tasks like handling hazardous radioactive materials. Robotic pilots carry out complex maneuvering techniques of unmanned spacecrafts sent in space. Japan is the leading country in the world in terms of robotics research and use.
- Finance; Banks use intelligent software applications to screen and analyze financial data. Softwares that can predict trends in the stock market have been created which have been known to beat humans in predictive power. In August 2001, robots beat humans in a simulated financial trading competition. Financial institutions have long used artificial neural network system to detect charges or claims outside of the norm, flagging these for human investigation.
- Medicine; A medical clinic can use artificial intelligence system to organize bed schedules, make a staff rotation, and provide medical information.
- Computer Science; Researchers in quest of artificial intelligence have created spin offs like dynamic programming, object oriented programming, symbolic programming, intelligent storage management systems and many more such tools. The primary goal of creating an artificial intelligence still remains a distant dream but people are getting an idea of the ultimate path which could lead to it.

- Aviation; Airlines use expert systems in planes to monitor atmospheric conditions and system status. The plane can be put on auto-pilot once a course is set for the destination.
- Weather Forecasting; Neural networks are used for prediction of weather conditions. Previous data is fed to a neural network which learns the pattern and uses that knowledge to predict weather patterns.
- Swarm Intelligence; This is an approach to, as well as application of artificial intelligence similar to a neural network. Here, programmers study how intelligence emerges in natural systems like swarm of bees even though at individual level, a bee just follows simple rules they study relationships in nature like the prey-predator relationships that give an insight into how intelligence emerges in a swarm or collection from simple rules at an individual level. They develop intelligent systems by creating agent programmes that mimic the behaviour of these natural systems.
- Toys and Games; The 1990s saw some of the first attempts to mass-produce domestically aimed types of basic Artificial Intelligence for education, or leisure. This prospered greatly with the Digital-Revolution, and helped introduce people, especially children to a life of dealing with various types of AI, specifically in the form of Tamagotchi and Giga pets, the internet (example; basic search engine interfaces are one simple form), and the first widely released robot, Furby. A mere year later, an improved type of domestic robot was released in the form of Aibo, a robotic dog with intelligent features and autonomy. AI has also been applied o video games.

Other fields in which AI methods are implemented include artificial life, automated reasoning, biologically inspired computing, robotics (behaviour-based robotics, cognitive, cybernetics, developmental, epigenetic, revolutionary robotics), concept mining, data mining, hybrid intelligent system, intelligent agent, intelligent control and so on.

3.2 INTELLIGENT AGENTS

AI applications require agents to solve the multiple problems in AI (in reasoning, planning, learning, perception and robotics), to simulate (or arrive at) a working system.

In artificial intelligence, an intelligent agent (IA) is an autonomous entity which observes and acts upon an environment (i.e. it is an agent) and directs is activity towards achieving goals (i.e. it is rational). Intelligent agents also learn and use knowledge in other problem solving skills to achieve their goals. They may be very simple or very complex; a reflex machine such as a thermostat is an intelligent agent as is a human being, as is a community of human beings working together towards a goal, robots, soft bots, etc.

The agent function is given as Ƒ = p*→*A,* maps from precept histories to actions. The agent function describes what the agents does in all circumstances. Agents interact with environments through actuators and sensors. A rational agent chooses whichever action maximizes the expected value of the performance measure given the percept sequence to date; a perfectly rational agent maximizes expected performance. To design a rational agent, we must specify the task environment. For instance, consider the task of designing an automated taxi. The following are examined; performance measure (safety, destination, profits, legality, comfort, etc.); environment (streets/freeways, traffic, pedestrians, weather, etc.); actuators (steering, accelerators, brakes, horns, speaker/display …); sensors (video, accelerometers, gauges, engine sensors, keyboard, GPS, …) (Hutter, 2000).

There are four (4) basic types of intelligent agents in order of increasing generality, they include; simple reflex agents, reflex agents with state, goal-based agents, and utility-based agents.

CHAPTER FOUR

4.0 ARTIFICIAL INTELLIGENCE GENERAL PROBLEM SOLVING

Problem solving is something AI does very well as long as the problem is narrow in focus and clearly defined. For example, mathematicians, scientists, and engineers are often called upon to prove theorems (A theorem is a mathematical statement that is part of a larger theory or structure of ideas), because the formulas involved in such tasks may be large and complex, this can take an enormous amount of time, thought, trial and error. A specially designed AI programme can reduce and simplify such formulas in a fraction of the time needed by human workers.

Artificial intelligence can also assist with problems in planning. An effective step-by-step sequence of actions that has the lowest cost and fewest steps is very important in business and manufacturing operations. An AI programme can be designed that includes all possible steps and outcomes. The programmer must also set some criteria with which to judge the outcome, such as whether speed is more important in accomplishing the task, or if lowest cost is the desired result, regardless of how long it takes. The plan generated by this type of AI programme will take less time to generate than by traditional methods.

The general problem of creating (or stimulating) intelligence has been broken down into a number of specific sub-problems. These consist of particular traits or capabilities that researchers would like an intelligent system to display. The traits describe below have received the most attention.

- Deduction, reasoning, problem solving; Early AI researchers developed algorithms that imitated the step-by-step reasoning that humans were often assumed to use when they solve puzzles, play board games or make logical deductions. By the late 1980s and 90s, AI research had also developed highly successful methods for dealing with uncertain or incomplete information, employing concepts from probability and economics.

  Human beings solve most of their problems using fast, intuitive judgments rather than the conscious, step-by-step deduction that early AI research was able to model. AI has made some progress at imitating this kind of "sub-symbolic" problem solving; embodied agent approaches emphasize the importance of sensor motor skills to higher reasoning; neural network research attempts to stimulate the structures inside human and animal brains that give rise to this skill.
- Knowledge representation; Knowledge representation and knowledge engineering are central to AI research. Many of the problems machines are expected to solve will require extensive knowledge about the world. Among the things that AI needs to represent are; objects, properties, categories and relations between objects; situations, events, states and time; causes and effects; knowledge about knowledge (what we know about what other people know); and many more, less well researched domains. A complete representation of "what exists" is an ontology (borrowing a word from traditional philosophy), of which they most general are called upon upper anthologies.

Among the most difficult problems in knowledge representations are:

- Default reasoning and the qualification problem: Many of the things people know take the form of "working assumptions". For example, if a bird comes up in conversation, people typically picture an animal that is fist sized, sings and flies. None of these things are true about all birds. John McCarthy identified this problem in 1969 as the qualification problem; for any commonsense rule that AI researchers care to represent, there tend to be a huge number of expectations. Almost nothing is simply true or false in the way that abstract logic requires. AI research has explored a number of solutions to this problem.

- The breadth of commonsense knowledge; The number of atomic facts that the average person knows is astronomical. Research projects that attempt to build a complete knowledge base of commonsense knowledge requires enormous amounts of laborious ontological engineering – they must be built by hands. One complicated concept at a time. A major goal is to have the computer understand enough concepts to be able to learn by reading from sources like the internet, and thus be able to add its own ontology.
- The sub symbolic form of some commonsense knowledge; Much of what people know is not represented as "facts" or "statements" that they could express verbally. For example, a chess master will avoid a particular chess competition because it "feels too exposed" or an art critic can take one look at a statue and instantly realize that it is a fake. These are intuitions or tendencies that are represented in the brain non-consciously and sub-symbolically. Knowledge like this informs, supports and provides a context for symbolic, conscious knowledge. As with the related problem of sub-symbolic reasoning, it is hoped that situated AI or computational intelligence will provide ways to represent this kind of knowledge.
- Planning; Intelligent agents must be able to set goals and achieve them. They need a way to visualize the future (they must have a representation of the state of the world and be able to make predictions about how their actions will change it) and be able to make choices that maximize the utility (or

"value") of the available choices. In classical planning problems, the agent can assume that it is the only thing, acting on the world and it can be certain what the consequences of its actions may be. However, if this is not true, it must periodically check if the world matches its predictions and it must change its plan as this becomes necessary, requiring the agent to reason under uncertainty.

Multi-agent planning uses the cooperation and competition of many agents to achieve a given goal. Emergent behaviour such as this is used by evolutionary algorithms and swarm intelligence.

- Learning; Machine learning has been central to AI research from the beginning. Unsupervised learning is the ability to find patterns in a stream of input. Supervised learning includes both classification and numerical regression. Classification is used to determine what category somethings belong in. after seeing a number of examples of things from several categories. Regression takes a set of numerical input/output examples and attempts to discover a continuous function that would generate the outputs from the inputs. In reinforcement learning, the agent is rewarded for good responses and punished for bad ones. These can be analyzed in terms of decision theory, using concepts like utility. The mathematical analysis of machine learning algorithms and their performance is a branch of theoretical computer science known as computational learning theory.

Pattern recognition is a type of learning which is the assignment of output value (or label) to a given input value (or instance), according to some specific algorithm. An example of pattern recognition is classification, which attempts to assign each value to one of a given set of classes (for example, determine whether a given email is "spam" or "non-spam"). However, pattern recognition is a more general problem that encompasses other types of output to each input; sequence labelling, which assigns a class to each member of a sequence of values output (for example, part of speech tagging, which assigns a part of speech to each word in an input sentence); and parsing, which assigns a parse tree to an input sentence, describing the syntactic structure of the sentence.

Pattern recognition algorithms generally aim to provide a reasonable answer for all possible inputs and to do "fuzzy" matching of inputs. It could be speech recognition, handwriting recognition, optical character recognition.

Typical applications of pattern recognition are automatic speech recognition, classification of text into several categories (e.g. spam/non-spam email messages), the automatic recognition of handwritten postal codes on postal envelopes, or the automatic recognition of human faces.

- Perception; Machine perception is the ability to use input from sensors (such as cameras, microphones, sonar and other more exotic sensors) to deduce aspects of the world. Computer vision is the ability to analyze visual input.
- Computer vision is the science and technology of machines that see. In this case the machine is able to extract information from an image that is necessary, to solve some task. As a scientific discipline, computer vision is concerned with the theory behind artificial systems that extract information from images. The image data can take many forms, such as video sequences, views from multiple cameras, or multi-dimensional data from a medical scanner.
- As a technological discipline, computer vision seeks to apply its theories and models to the construction of the computer vision systems. Examples of applications of computer vision includes systems for; controlling process (e.g. for visual surveillance or people counting); organizing information (e.g. for indexing databases of images and image sequences); modelling objects

or environments (e.g. industrial inspection, medical image analysis or topographical modelling); interaction (e.g. as the input to a device for computer-human interact ion).

- Diagnosis; As a tool in artificial intelligence, diagnosis is concerned with the development of algorithms and techniques that are able to determine whether the behaviour of a system is correct. If the system is no functioning correctly, the algorithm should be able to determine, as accurately as possible, which part of the system is failing, and which kind of fault it is facing. The computation is based on observation, which provide information on the current behaviour. The expert diagnosis (or diagnosis by expert system) is based on experience with the system. Using this experience, a mapping is built that efficiently associates the observations to the corresponding diagnosis.
- An example of diagnosis is the process of a garage mechanic with an automobile. The mechanic will first try to detect any abnormal behaviour based on the observations on the car and his knowledge of this type of vehicle. If he finds out that the behaviour is abnormal, the mechanic will try to refine his diagnosis by using new observations and possibly testing the system, until he discovers the faulty component. It means that the mechanic plays an important role in the vehicle diagnosis.
- Natural language processing (NLP); This gives machines the ability to read and understand the languages that humans speak. Many researchers hope that a sufficiently powerful natural language processing system would be able to acquire knowledge on its own, by reading the existing text available over the internet. Some straight forward applications of natural language processing include information retrieval (or text mining) and machine translation. NPL is a tool in artificial intelligence and a field of computer

science and linguistics concerned with the interactions between computers and human (natural) languages. In theory, natural language processing is a very attractive method of human-computer interaction. Natural language understanding is something referred to as an AI-complete problem because it seems to require extensive knowledge about the outside world and the ability to manipulate it.

- Computational creativity; Computer creativity (also known as artificial creativity, mechanical creativity or creative computation) cuts across of the fields of artificial intelligence, creative psychology, philosophy, and the arts. The goal is to model, simulate or replicate real creativity using a computer, to achieve one or several ends;
  - To construct a programme or computer capable of human-level creativity.
  - To better understand human creativity and to formulate an algorithmic perspective on creative behaviours in humans.
  - To design programmes that can enhance human creativity without necessarily being creative themselves.

The field of computation creativity concerns itself with theoretical and practical issues in the study of creativity. Theoretical work on the nature and proper definition of creativity is performed in parallel with practical work on the implementation of systems that exhibit creativity, which one stand of work informing the other.

- Special intelligence; Emotion and social skills play two (2) roles for an intelligent agent. First, it must be able to predict the actions of others, by understanding their motives and emotional states (this involves elements of game theory, decision theory as well as the ability to model human emotions and the perceptual skills to detect emotions). Also, for good human-computer interaction, an intelligent machine also needs to display emotions. At the very least it must appear polite and sensitive to the humans it interacts with. At best, it should have normal emotions itself.

Most researchers hope their work will eventually be incorporated into a machine with general intelligence (known as strong AI), combining all the skills above and exceeding human abilities at most or all of them. A few believe that anthropomorphic features like artificial consciousness or an artificial brain may be required for such a project.

Many of the problems above are considered AI-complete; to solve one problem, you must solve them all. For example, even a straightforward, specific task like machine translation requires that the machine follow the author's argument (reason), know what is being talked about (knowledge), and faithfully reproduce he author's intention (social intelligence). Machine translation, therefore is believed to be AI-complete. It may require strong AI to be done as well as humans can do it.

4.1 STATE OF THE ART

At present, we have artificial intelligence systems that can;

- Play a decent game of table tennis.
- Drive safely along a curving mountain road.
- Buy a week's worth of groceries on the web.
- Play a decent game of bridge.
- Give competent legal advice in specialized area of law.
- Translate English into other languages in real time.

Other potted achievements include;

- Deep Blue defeated the reigning world chess champion Garry Kasparov in 1997.

- In 1997, EQP proved a mathematical (Robbins) conjecture unsolved for decades.
- Alvin in Navlab drives autonomously 98% of the time from Pittsburg to San Diego.
- During the 1991 Gulf War, US forces developed an AI logistics planning and scheduling programme that involved up to 50,000 vehicles, cargo, and people.
- NASA's on-board autonomous planning programme controlled he scheduling of operations for a spacecraft.
- Proverb solves crossword puzzles better than most humans in 1991.

Also, the military put AI-based hardware to the test of war during Operation Desert Storm. AI-based technologies were used in missile systems, heads-up-displays, and other advancements. AI has also made the transition to the home. With the popularity of the AI computer growing, the interest of the public has also grown. Applications for the Apple Macintosh and IBM Compatible Computer, such as voice and character recognition have become available. Also AI technology has made steadying camcorders simple using fuzzy logic. With a greater demand for AI-related technology, new advancements are becoming available. Inevitably, Artificial Intelligence (AI) has and will continue to affect our lives.

4.2 PROS AND CONS OF ARTIFICIAL INTELLIGENCE

In the course of AI studies and research, the following are some arguments that have been made;

- People might lose their jobs to automation.
- People might have too much leisure or idle time.
- People might lose their sense of being unique.

- People might lose some of their privacy rights.
- The use of AI systems might result in a loss of accountability. For instance, who is responsible is a physician follows advice of a medical expert system whose diagnosis is problematic at a point?
- Artificial evolution will be replaced by natural solution; AI systems will be our mind children (Moravec, 2000).
- The success of AI might mean the end of the human race.

Alternatively,

- So far automation (via AI technology) has created more jobs and wealth than it has eliminated.
- AI frees us from boring routine jobs and leaves more time for pretentious and creative things.
- The machines can be kept under control.

4.3 FUTURE OF ARTIFICIAL INTELLIGENCE

AI is the best field for dreamers to play around. It must be evolved from the thought that making a human-machine is possible. Though many conclude that this is not possible, there is still a lot of research going on in this field to attain the final objective. There are inherent advantages of using computers as they do not get tired or loosing temper and are becoming faster and faster. Only time will say what will be the future of AI; will it attain human-level or above human-level intelligence or not.

CHAPTER FIVE

5.0 CONCLUSION

Is Artificial Intelligence real? In other words, can intelligence like a human mind surpass itself and create its own image? Even if such intelligence is created, will it share our sense of morals and justice? Will it share our secrets and dreams? This will be the next step in evolution of intelligence?

We need to be prepared for the worst of AI. Something as revolutionary as AI is sure to arouse some fears. For instance, if AI is learned based, will machines learn that being rich and successful is a good thing, then wage war against economic powers and famous people? There are so many things that can go wrong with a new system so we must be as prepared as we can be for new technology.

However, even though the fear of the machines is there, their capabilities are infinite. Whatever we teach AI, they will suggest in the future if a positive outcome arrives from it. AI systems are like children that need to be taught to be kind, well-mannered and intelligent. If they are to make important decisions, they should be wise. We as citizens need to make sure AI programmes are keeping things on the level. We should be sure they are doing the job correctly, so that no future accidents occur. Finally, it is true that AI has not yet achieved its ultimate goal. Still AI systems could not defeat even a three-year-old child on many counts; ability to recognize and remember different objects, adapt to new situations, understand and generate human languages and so on. The main problem is that we still have not understood how the human mind works, how we learn new things, especially how we learn languages and reproduce them properly.

5.1 RECOMMENDATIONS

The subject of artificial intelligence is a unique one and holds a lot for the future generation. As much as it has been in study and research for about fifty years now according to history, so much is yet to be discovered and learnt in the field. The researcher indeed recommends that everyone in the field of science should know the basic theories of AI, as we all in one way or the other have roles to play in building a secured future of intelligent technologies.

Lesson and inspiration in AI can be found in science fiction movies like; Star Wars, I Robots, Knight Rider, The Matrix, The Terminator, Transformers, and so on. A lot can be learnt and if possible added to the real arguments and issues (known as robot's rights) for and against evolution of artificial intelligence in these fictions. The robot rights thus states:

- A robot may not injure a human being through its actions or allow a human being to come to harm.
- A robot must obey the orders given to it by human beings except where such orders would conflict with the first law.
- A robot must protect its own existence as long as such protection does not conflict with the first and second laws.

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