WALCHAND INSTITUTE OF TECHNOLOGY

A PAPER PRESENTATION ON:

Artificial Intelligence

By

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Abstract :

Artificial intelligence (AI) is a field of computer science that explores computational models of problem solving, where the problems to be solved are of the complexity of problems solved by human beings. Artificial Intelligence is the study of how to make computers do things which, at the moment, people do better. It is the intelligence of machines and the branch of computer science that aims to create it. The study and design of intelligent agents is also called as Artificial Intelligence. The central problems of AI include such traits as reasoning, knowledge, planning, learning, communication, perception and the ability to move and manipulate objects.

This paper elaborates the new approaches to AI. Artificial intelligence in the future will churn out machines and computers, which are much more sophisticated than the ones that we have today.

It is expected that the robots in future, will take on everybody's work. Whether it is office work or the work at home, robots will accomplish it even faster and efficiently than human beings. So if somebody's falling ill, they can obtain a robot nurse who will give periodic medicines to them. How much care, concern and empathy the robot nurse will have towards the patient is anybody's guess!

This paper intends to study the techniques developed in artificial intelligence (AI) from the standpoint of their applications in all fields related to engineering. In particular, it focuses on techniques developed (or that are being developed) in artificial intelligence that can be deployed in solving problems associated with distinct processes. This paper highlights a comparative study between approaches and its applications.

Introduction:

The term artificial intelligence was first coined in 1956, at the Dartmouth conference, and since then Artificial Intelligence has expanded because of the theories and principles developed by its dedicated researchers. Artificial Intelligence (AI) is the area of computer science focusing on creating machines that can engage on behaviors that humans consider intelligent. In 1957, the first version of a new program The General Problem Solver (GPS) was tested. The program 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.

Fig 1: Artificial Intelligence

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. Find out how the military is applying AI logic to its hi-tech systems, and how in the near future Artificial Intelligence may impact our lives. AI is a combination of computer science, physiology, and philosophy. AI is a broad topic, consisting of different fields, from machine vision to expert systems. The element that the fields of AI have in common is the creation of machines that can "think". In order to classify machines as "thinking", it is necessary to define intelligence. To what degree does intelligence consist of, for example, solving complex problems, or making generalizations and relationships? And what about perception and comprehension? Research into the areas of learning, of language, and of sensory perception have aided scientists in building intelligent machines. One of the most challenging approaches facing experts is building systems that mimic the behavior of the human brain, made up of billions of neurons, and arguably the most complex matter in the universe. Perhaps the best way to gauge the intelligence of a machine is British computer scientist Alan Turing's test. He stated that a computer would deserves to be called intelligent if it could deceive a human into believing that it was human.

During the 1970's Many new methods in the development of AI were tested, notably Minsky's frames theory. Also David Marr proposed new theories about machine vision, for example, how it would be possible to distinguish an image based on the shading of an image, basic information on shapes, color, edges, and texture. With analysis of this information, frames of what an image might be could then be referenced. another development during this time was the PROLOGUE language. The language was proposed for In 1972.

During the 1980's AI was moving at a faster pace, and further into the corporate sector. In 1986, US sales of AI-related hardware and software surged to $425 million. Expert systems in particular demand because of their efficiency. Companies such as Digital Electronics were using XCON, an expert system designed to program the large VAX computers. DuPont, General Motors, and Boeing relied heavily on expert systems Indeed to keep up with the demand for the computer experts, companies such as Teknowledge and Intellicorp specializing in creating software to aid in producing expert systems formed. Other expert systems were designed to find and correct flaws in existing expert systems.

We have been studying this issue of AI application for quite some time now and know all the terms and facts. But what we all really need to know is what can we do to get our hands on some AI today. How can we as individuals use our own technology? We hope to discuss this in depth (but as briefly as possible) so that you the consumer can use AI as it is intended.

First, we should be prepared for a change. Our conservative ways stand in the way of progress. AI is a new step that is very helpful to the society. Machines can do jobs that require detailed instructions followed and mental

alertness. AI with its learning capabilities can accomplish those tasks but only if the worlds conservatives are ready to change and allow this to be a possibility. It makes us think about how early man finally accepted the wheel as a good invention, not something taking away from its heritage or tradition.

Secondly, we must be prepared to learn about the capabilities of AI. The more use we get out of the machines the less work is required by us. In turn less injuries and stress to human beings. Human beings are a species that learn by trying, and we must be prepared to give AI a chance seeing AI as a blessing, not an inhibition.

Finally, we need to be prepared for the worst of AI. Something as revolutionary as AI is sure to have many kinks to work out. There is always that fear that if AI is learning 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 this new technology.

However, even though the fear of the machines are there, their capabilities are infinite Whatever we teach AI, they will suggest in the future if a positive outcome arrives from it. AI 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 programmers are keeping things on the level. We should be sure they are doing the job correctly, so that no future accidents occur.

Description:

Artificial Intelligence is concerned with the study and creation of computer systems that exhibit some form of intelligence and attempts to apply such knowledge to the design of computer based systems that can understand a natural language or understanding of natural intelligence. In the following we will see the different approaches and techniques in the software engineering.

APPROACHES:

CYBERNETICS AND BRAIL SIMULATION :

Traditional Symbolic AI -

When access to digital computers became possible in the middle 1950s, AI research began to explore the possibility that human intelligence could be reduced to symbol manipulation.

Cognitive simulation -

Economist Herbert Simon and Alan Newell studied human problem solving skills and attempted to formalize them, and their work laid the foundations of the field of artificial intelligence, as well as cognitive science, operations research and management science. Their research team performed psychological experiments to demonstrate the similarities between human problem solving and the programs (such as their "General Problem Solver") they were developing. This tradition, centered at Carnegie Mellon University, would eventually culminate in the development of the Soar architecture in the middle 80s.

When computers with large memories became available around 1970, researchers from all three traditions began to build knowledge into AI applications. This "knowledge revolution" led to the development and deployment of expert systems (introduced by Edward Feigenbaum), the first truly successful form of AI software. The knowledge revolution was also driven by the realization that truly enormous of amounts knowledge would be required by many simple AI applications.

NEURAL NETWORKS AND PARALLEL COMPUTATION :

The human brain is made up of a web of billions of cells called neurons, and understanding its complexities 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. By itself, a neuron is

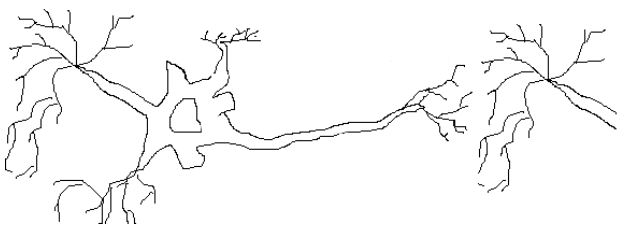

Fig 2:The neuron "firing", passing a signal to the next in the chain.

not intelligent, but when grouped together, neurons are able to pass electrical signals through networks.

Research 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.

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

A century earlier the true / false nature of binary numbers was theorized in 1854 by George Boole in his postulates concerning the Laws of Thought. Boole's principles make up what is known as Boolean algebra, the collection of logic concerning AND, OR, NOT operands.

TOP DOWN APPROACHES :

Because of the large storage capacity of computers, expert systems had the potential to interpret statistics, in order to formulate rules. An expert system works much like a detective solves a mystery. Using the information, and logic or rules, an expert system can solve the problem. For example it the expert system was designed to distinguish birds it may have the following as shown in Fig 3.

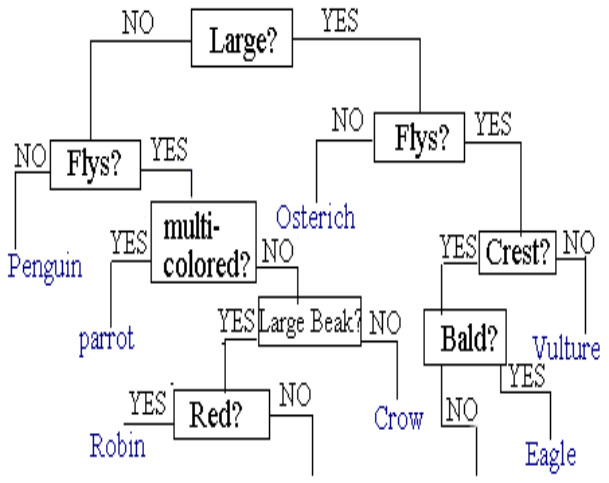

Fig 3: Charts like these represent the logic of expert systems. Using a similar set of rules, experts can have a variety of applications. With improved interfacing,

ARTIFICIAL INTELLIGENCE TECHNIQUES IN SOFTWARE ENGINEERING (AITSE):

Software Engineering is a knowledge-intensive activity, requiring extensive knowledge of the application domain and of the target software itself. Many Software products costs can be attributed to the ineffectiveness of current techniques for managing this knowledge, and Artificial Intelligence techniques can help alleviate this situation.

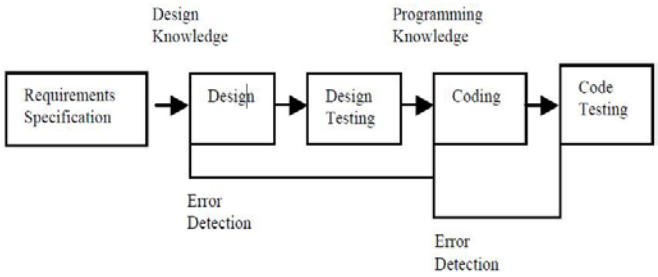

Fig 4:Traditional software development process.

The traditional view of software development process begins at the requirements specification and ends at testing the software. At each of these stages, different kinds of knowledge (design knowledge at design stage and programming and domain knowledge at the coding stage) are required. At each of the two stages: design and coding, exist a cycle: error recognition and error correction. Experience shows that errors can occur at any stage of software development. Errors due to coding may occur because of faulty design. Such errors are usually expensive to correct.

A basic problem of software engineering is the long delay between the requirements specification and the delivery of a product. This long development cycle causes requirements to change before product arrival. In addition, there is the problem of phase independence of requirements, design and codes. Phase independence means that any decision made at

one level becomes fixed for the next level. Thus, the coding team is forced to recode whenever there is change in design.

Expert system use knowledge rather than data to control the solution process. Knowledge engineers build systems by eliciting knowledge from experts, coding, that knowledge in an appropriate form, validating the knowledge, and ultimately constructing a system using a variety of building tools. The main phases the expert system development processes are:-

- Planning
- Knowledge acquisition and analysis
- Knowledge design
- Code
- Knowledge verification
- System evaluation

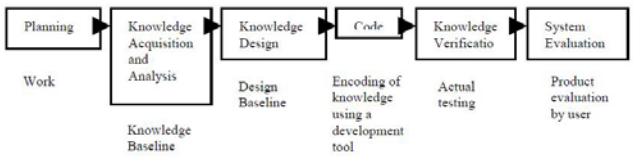

Fig 5: Expert System development.

The Risk Management process is a method of identifying risks in advance and establishing methods of avoiding those risks and /or reducing the impact of those risks should they occur. The process of risk management begins during the analysis phase of software development life cycle. However, the actual process of managing risks continues throughout the product development phase. The given Figure displays the steps of the risk management process. Formally, articulated, risk management process consists of three steps:

Risk management strategies utilize lot of developer time and in software development phases there is a link between all the phases by introducing a isolation phase among the phases we can reduce the time in development by revisiting each phase after changes in requirements. By using AI based systems with the help of automated tool or automated programming tool we can eliminate risk assessment phase saving our time in software development. Because of AITSE we can reduce the development time in software development. Coding phase in software development process can be changed into Genetic Code.

Applications:

Current Usage:

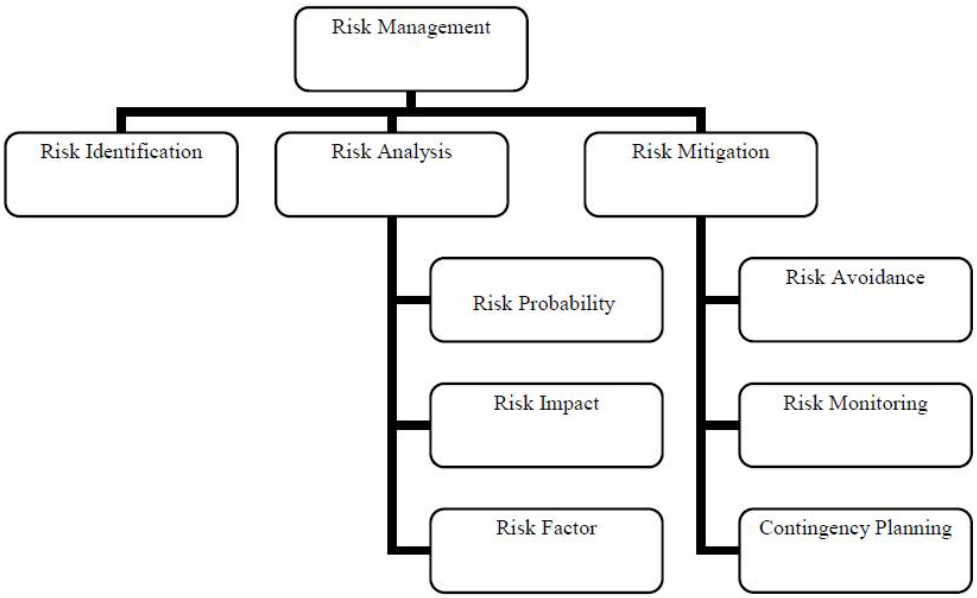

Fig 6: Risk Management Process.

- There are many applications of artificial intelligence at present. Some of them have been listed here.
- Banks and other financial institutions rely on intelligent software, which provide accurate analysis of the data and helps make predictions based upon that data.
- Stocks and commodities are being traded without any human interference - all thanks to the intelligent systems.
- Artificial intelligence is used for weather forecasting.
- It is used by airlines to keep a check on its system.
- Robotics is the greatest success story, in the field of artificial intelligence. Spacecrafts are send by NASA and other space organizations into space, which are completely manned by robots. Even some manufacturing processes are now being completely undertaken by robots. Robots are being used in industrial processes, that are dangerous to human beings, such as in nuclear power plants.
- Usage of artificial intelligence is quite evident in various speech recognition systems, such as IBM ViaVoice software and Windows Vista.

Game playing

You can buy machines that can play master level chess for a few hundred dollars. There is some AI in them, but they play well against people mainly through brute force computation--looking at hundreds of thousands of positions. To beat a world champion by brute force and known reliable heuristics requires being able to look at 200 million positions per second.

Speech recognition

In the 1990s, computer speech recognition reached a practical level for limited purposes. Thus United Airlines has replaced its keyboard tree for flight information by a system using speech recognition of flight numbers and city names. It is quite convenient. On the the other hand, while it is possible to instruct some computers using speech, most users have gone back to the keyboard and the mouse as still more convenient.

Understanding natural language

Just getting a sequence of words into a computer is not enough. Parsing sentences is not enough either. The computer has to be provided with an understanding of the domain the text is about, and this is presently possible only for very limited domains.

Computer vision

The world is composed of three-dimensional objects, but the inputs to the human eye and computers' TV cameras are two dimensional. Some useful programs can work solely in two dimensions, but full computer vision requires partial three-dimensional information that is not just a set of two-dimensional views. At present there are only limited ways of representing three-dimensional information directly, and they are not as good as what humans evidently use.

Expert systems

A ``knowledge engineer'' interviews experts in a certain domain and tries to embody their knowledge in a computer program for carrying out some task. How well this works depends on whether the intellectual mechanisms required for the task are within the present state of AI. When this turned out not to be so, there were many disappointing results. One of the first expert systems was MYCIN in 1974, which diagnosed bacterial infections of the blood and suggested treatments. It did better than medical students or practicing doctors, provided its limitations were observed. Namely, its ontology included bacteria, symptoms, and treatments and did not include patients, doctors, hospitals, death, recovery, and events occurring in time. Its interactions depended on a single patient being considered. Since the experts consulted by the knowledge engineers knew about patients, doctors, death, recovery, etc., it is clear that the knowledge engineers forced what the experts told them into a predetermined framework. In the present state of AI, this has to be true. The usefulness of current expert systems depends on their users having common sense.

Heuristic classification

One of the most feasible kinds of expert system given the present knowledge of AI is to put some information in one of a fixed set of categories using several sources of information. An example is advising whether to accept a proposed credit card purchase. Information is available about the owner of the credit card, his record of payment and also about the item

he is buying and about the establishment from which he is buying it (e.g., about whether there have been previous credit card frauds at this establishment).

Advantages :

While we already deal with some virtual AI -- notably in action games against computer-controlled "bots" or challenging a computer opponent to chess -- the work of Novamente, Electric Sheep Company and other firms has the potential to initiate a new age of virtual AI, one where, for better or worse, humans and artificial intelligences could potentially be indistinguishable.

If you think about it, we take in numerous pieces of information just walking down the street, much of it unconsciously. You might be thinking about the weather, the pace of your steps, where to step next, the movement of other people, smells, sounds, the distance to the destination, the effect of the environment around you and so forth. An artificial intelligence in a virtual world has fewer of these variables to deal with because as of yet, no virtual world approaches the complexity of the real world. It may be that by simplifying the world in which the artificial intelligence operates (and by working in a self-contained world), some breakthroughs can be achieved. Such a process would allow for a more linear development of artificial intelligence rather than an attempt to immediately jump to lifelike robots capable of learning, reason and self-analysis.

Limitations:

If robots start replacing human resources in every field, we will have to deal with serious issues like unemployment in turn leading to mental depression, poverty and crime in the society. Human beings deprived of their work life may not find any means to channelize their energies and harness their expertise. Human beings will be left with empty time.

Secondly, replacing human beings with robots in every field may not be a right decision to make. There are many jobs that require the human touch. Intelligent machines will surely not be able to substitute for the caring behavior of hospital nurses or the promising voice of a doctor. Intelligent machines may not be the right choice for customer service.

One of the major disadvantages of intelligent machines is that they cannot be ‘human’. We might be able to make them think. But will we be able to make them feel? Intelligent machines will definitely be able to work for long hours. But will they do it with dedication? Will they work with devotion? How will intelligent machines work wholeheartedly when they don’t have a heart? Apart from these concerns, there are chances that intelligent machines overpower human beings. Machines may enslave human beings and start ruling the world. Imagine artificial intelligence taking over human intellect! The picture is definitely not rosy.

Some thinkers consider it ethically wrong to create artificial intelligent machines. According to them, intelligence is God’s gift to mankind. It is not correct to even try to recreate intelligence. It is against ethics to create replicas of human beings. Don’t you also think so.

The ultimate goal of research in AI and Robotics is to produce an android which can interact meaningfully with human beings. A huge amount of research effort is being exerted in order to achieve this aim and a lot of progress has already been made. Researchers have manufactured androids that can walk on two legs, that can climb stairs, that can grasp objects without breaking or dropping them, that can recognise faces and a variety of physical objects, that can imitate what they see human beings doing and so on. It is hard to make robots that can do these things and I have no desire to belittle the scientific achievements that have already been made, but even if a robot succeeds in doing all these things as well as a human being it will still lack at least one essential human ability, namely that of learning from other people by accepting what they say and by believing what they have written. The ultimate goal of AI cannot be achieved until we have implemented in a computer system the ability to acquire information from testimony.

A number of people, who should know better , make predictions about when AI will achieve its ultimate goal. There is no possibility of AI succeeding in the foreseeable future. People who say otherwise are simply ignorant of the state of research into testimony. AI cannot succeed until an android (or computer program) can evaluate testimony in a similar way to that in which a human being can.

Conclusion:

Technology is neither good nor bad. It never has been. What man does with it is another story entirely. Technological changes are certainly coming. They are already taking place. They are constant and ubiquitous. Many believe that they are accelerating. They are probably also

unstoppable. Just as with the scientific knowledge that went into making the atomic bomb, once it is possible to do something, someone will eventually do it.

Artificial intelligence has successfully been used in a wide range of fields including medical diagnosis, stock trading, robot control, law, scientific discovery and toys. Frequently, when a technique reaches mainstream use it is no longer considered artificial intelligence.

These rivaling theories have lead researchers in one of two basic approaches; bottom-up and top-down. Bottom-up theorists believe the best way to achieve artificial intelligence is to build electronic replicas of the human brain's complex network of problems, or making generalizations and relationships.

One of the most challenging approaches facing experts is building systems that mimic the behavior of the human brain, made up of billions of neurons.

Artificial intelligence has successfully been used in a wide range of fields including medical diagnosis, stock trading, robot control, law, scientific discovery and toys. Frequently, when a technique reaches mainstream use it is no longer considered artificial intelligence.

In the quest to create intelligent machines, the field of Artificial Intelligence has split into several different approaches based on the opinions about the most promising methods and theories neurons, while the top-down approach attempts to mimic the brain's behavior with computer programs.

The more use we get out of the machines the less work is required by us. In turn less injuries and stress to human beings. Human beings are a species that learn by trying, and we must be prepared to give AI a chance seeing AI as a blessing, not an inhibition.

In conclusion, in some fields such as forecasting weather or finding bugs in computer software, expert systems are sometimes more accurate than humans. But for other fields, such as medicine, computers aiding doctors will be beneficial, but the human doctor should not be replaced. Expert systems have the power and range to aid to benefit, and in some cases replace humans, and computer experts, if used with discretion, will benefit human kind.

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