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A Comparative Study on Artificial Intelligence and Expert Systems

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Abstract - Artificial intelligence is highly concerned with the methods of developing systems that display the aspects of Intelligent Behavior. These systems are designed to imitate the Human Capabilities of Thinking and Sensing. Artificial Intelligence is highly increasing day by day. This is efficient to the existing economy. But, it may have an even larger impact by serving as a new general-purpose Method of inventions that can reshape the natural innovation process and the organization of Research &Development. Currently many researches are going on in Robotics, Deep learning, Artificial Neural Networks and Machine Learning. Expert Systems are a Computer System that emulates the Decision ability of a Human Expert. In this paper, we are going to discuss about the Artificial Intelligence and its applications along with the Study of Expert Systems. Artificial Intelligence is having a huge scope in future. By the help of Artificial Intelligence, we can do many researches based on Robotics and Automated Cars which has its own programmed code to perform any action with in a car or vehicle and Pattern Recognition and Natural Language Processing.

Keywords: Artificial Intelligence, Human intelligence, Expert systems, Machine Learning, Deep Learning.

1. INTRODUCTION

AI is a branch of Computer Science named "Artificial Intelligence" pursues creating the computers or machines as intelligent as human beings. According to the father of Artificial Intelligence, John McCarthy, it is "The science and engineering of making intelligent machines, especially intelligent computer programs". Artificial Intelligence is a way of making a computer, a computer-controlled robot, or a software think intelligently, in the similar manner the intelligent humans think. AI is accomplished by studying how human brain thinks, and how humans learn, decide, and work while trying to solve a problem, and then using the outcomes of this study as a basis of developing intelligent software and systems [1]. Artificial Intelligence involves the science and engineering of developing intelligent machines. Industry approach to Artificial Intelligence has moved away from developing merely intelligent devices. Technology companies and researchers across the world have now set an ambitious goal of developing Artificial Intelligence solutions that are not just intelligent in terms of decisions taken but can also learn from data - like humans do. This is driving companies to innovate both on the machine learning and computing sides to develop solutions that resemble the human brain. While exploiting the power of the computer systems, the curiosity of human, lead him to wonder, *"Can a machine think and behave like humans do?"* Thus, the development of AI started with the intention of creating similar intelligence in machines that we find and regard high in humans.

Artificial intelligence is a branch of computer science that aims to create intelligent machines. It has become an essential part of the technology industry [1]. Research associated with artificial intelligence is highly technical and specialized. The core problems of artificial intelligence include programming computers for certain traits such as:

- Knowledge
- Reasoning
- Problem solving
- Perception
- Learning
- Planning
- Ability to manipulate and move objects.

Knowledge engineering is a core part of AI research. Machines can often act and react like humans only if they have abundant information relating to the world. Artificial intelligence must have access to objects, categories, properties and relations between all of them to implement knowledge engineering. Initiating common sense, reasoning and problem-solving power in machines is a difficult and tedious approach [2]. Machine learning is another core part of AI. Learning without any kind of supervision requires an ability to identify patterns in streams of inputs, whereas learning with adequate supervision involves classification and numerical regressions. Classification determines the category an object belongs to and regression deals with obtaining a set of numerical input or output examples, thereby discovering functions enabling the generation of suitable outputs from respective inputs. Mathematical analysis of machine learning algorithms and their performance is a well-defined branch of theoretical computer science often referred to as computational learning theory.

1.1. Discrimination between Artificial Intelligence and Human Intelligence

Below table shows the differences between the AI and HI [3] as follows:

Table-1: Differences between Artificial Intelligence and Human Intelligence

Artificial Intelligence	Human Intelligence
It is created by human	It is created by Divine intelligence
Process information faster	Process information slower
Highly objective	May be subjective
It is more Accurate	It is less accurate
It uses 2 Watts	It uses 25 Watts
It cannot adapt to changes well	It can easily adapt to changes
Below average social skills	Excellent Social Skills
Still working towards self-awareness	Has Self-awareness
It is optimization	It is Innovation

1.2. Advantages of AI:

- More powerful and more useful computers
- New and improved interfaces
- Solving new problems
- Better handling of information
- Relieves information overload.
- Conversion of information into knowledge.
- AI would have a low error rate compared to humans, if coded properly. They would have incredible precision, accuracy, and speed. They won't be affected by hostile environments, thus able to complete dangerous tasks, explore in space, and endure problems that would injure or kill us [4].This can even mean mining and digging fuels that would otherwise be hostile for humans. Replace humans in repetitive, tedious tasks and in many laborious places of work. Predict what a user will type, ask, search, and do. They can easily act as assistants and can recommend or direct various actions. An example of this can be found in the smartphone.
- Can detect fraud in card-based systems and possibly other systems in the future. Organized and manages records.
- Interact with humans for entertainment or a task as avatars or robots. An example of this is AI for playing many videogames. Robotic pets can interact with humans. Can help w/ depression and inactivity.

They can think logically without emotions, making rational decisions with less or no mistakes. Can assess people, this can be for medical purposes, such as health risks and emotional state. Can simulate medical procedures and give info on side effects. Robotic radiosurgery, and other types of surgery in the future, can achieve precision that humans can't. They don't need to sleep, rest, take breaks, or get entertained, as they don't get bored or tired.

1.3. Disadvantages of Artificial Intelligence

- Increased costs.
- Difficulty with software development-slow and expensive
- Few experienced programmers
- Few practical products have reached the market yet.
- Can cost a lot of money and time to build, rebuild, and repair. Robotic repair can occur to reduce time and humans needing to fix it, but that'll cost more money and resources.
- It's questionable: is it ethically and morally correct to have androids, human-like robots, or recreate intelligence, a gift of nature that shouldn't be recreated? This is a discussion about AI that's popular in the days.
- Storage is expansive, but access and retrieval may not lead to connections in memory as well as humans could.
- They can learn and get better with tasks if coded to, but it's questionable as to if this can ever become as good as humans can do such.
- They cannot work outside of what they were programmed for.
- They could never, or, at least, seemingly never with our technological perceptions, receive creativity that humans have.
- This can prevent sympathizing with emotions for human contact, such as in being nurses. This can also reduce wisdom can understanding [4].

- This can prevent common sense occurring. Even if coded with common sense and to learn, it seems hard for them to get as much common sense that humans could.
- Robots, with them replacing jobs, can lead to severe unemployment, unless if humans can fix the unemployment with jobs AI can't do or severely change the government to communism.
- As seen partially with smartphones and other technology already, humans can become too dependent on AI and lose their mental capacities.
- Machines can easily lead to destruction, if put in the wrong hands. That is, at least a fear of many humans.
- AI as robots can supersede humans, enslaving us.

1.4. Goals of AI:

- To Create Expert Systems – the systems which exhibit intelligent behaviour, learn, demonstrate, explain, and advice its users.
- To Implement Human Intelligence in Machines – Creating systems that understand, think, learn, and behave like humans [5].

- Singularity and Transhumanism (AI Takeover)
- A Disneyland without Children. A Play Without Audience
- Singleton - Single Global Government
- AI becomes God
- End of Mankind Warning by Stephen Hawking
- Perfect Human Beings & Silicon Consciousness by Michio Kaku
- Artificial Intelligence for Enhancing, Not Displacing Humans
- Life 3.0 by Max Tegmark

1.5. Applications of Artificial Intelligence:

AI has been dominant in various fields such as:

- **Gaming** – AI plays crucial role in strategic games such as chess, poker, tic-tac-toe, etc., where machine can think of large number of possible positions based on heuristic knowledge[6].
- **Natural Language Processing** – It is possible to interact with the computer that understands natural language spoken by humans.
- **Expert Systems** – There are some applications which integrate machine, software, and special information to impart reasoning and advising. They provide explanation and advice to the users.
- **Vision Systems** – these systems understand, interpret, and comprehend visual input on the computer. For example,
- A spying aeroplane takes photographs, which are used to figure out spatial information or map of the areas.
- Doctors use clinical expert system to diagnose the patient.
- Police use computer software that can recognize the face of criminal with the stored portrait made by forensic artist.
- **Speech Recognition** – Some intelligent systems are capable of hearing and comprehending the language in terms of sentences and their meanings while a human talk to it. It can handle different accents, slang words, noise in the background, change in human's noise due to cold, etc.
- **Handwriting Recognition** – The handwriting recognition software reads the text written on paper by a pen or on screen by a stylus. It can recognize the shapes of the letters and convert it into editable text.
- **Intelligent Robots** – Robots are able to perform the tasks given by a human. They have sensors to detect physical data from the real world such as light, heat, temperature, movement, sound, bump, and pressure. They have efficient processors, multiple sensors and huge memory, to exhibit intelligence. In addition, they are capable of learning from their mistakes and they can adapt to the new environment.

1.6. Real life Applications of AI:

- **Expert systems**

Ex: Flight-tracking system, Clinical Systems[7].

- Natural Language Processing

Ex: Google Now feature, Speech recognition, Automatic voice output

- **Neural Networks**

Ex: Pattern recognition systems such as face recognition, Character recognition, and Handwriting recognition.

- **Robotics**

Ex: Industrial robots for moving, spraying, painting, precision checking, drilling, cleaning, coating, craving

- **Fuzzy Logic Systems**

Ex: customer electronics, automobiles, etc.

1.7. Future Enhancement of Artificial Intelligence:

- In Agriculture we use Precision Agriculture
- In Healthcare we use Personalized Treatment
- In Manufacturing we use Edge Computing
- In Automobiles we use Infotainment Systems
- In Social Media we use Facial Identification
- In Financial Services we use Fraudulent detection

2. Expert Systems in Artificial Intelligence:

In artificial intelligence, an expert system is a computer system that emulates the decision-making ability of a human expert. Expert systems are designed to solve complex problems by reasoning through bodies of knowledge, represented mainly as if-then rules rather than through conventional procedural code [8]. Expert systems (ES) are one of the best researches of AI which is introduced by the researches at Stanford University, Computer science department.

Expert systems are the computer applications developed to solve complex problems in a domain, at the level of extra-ordinary human intelligence and expertise.

2.1. Characteristics of Expert systems:

High performance

- Understandable
- Reliable
- Highly responsive

2.2. Capabilities of Expert Systems:

The Expert systems that is capable of-

- Advising
- Instructing and assisting human in decision making[8].
- Demonstrating
- Deriving a solution
- Diagnosing
- Explaining
- Interpreting input
- Predicting results
- Justifying the conclusion
- Suggesting alternative solutions to a problem

They are incapable of-

- Subtracting human decision makers
- Possessing human capabilities
- Producing accurate output for in adequate knowledge base
- Refining their own knowledge

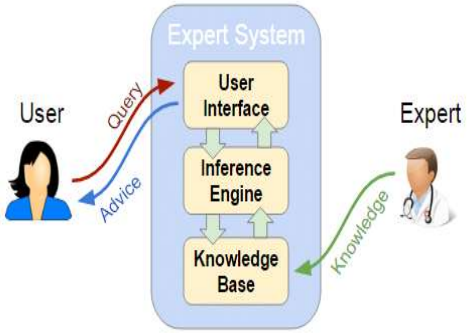
2.3. Components of Expert Systems:

The components of ES are as follows

- Knowledge base
- Inference Engine
- User interfaces

Let us see them one by one briefly:

The *knowledge base* an expert use is what he learned at school, from colleagues, and from years of experience. Presumably the more experience he has, the larger his store of knowledge. Knowledge allows him to interpret the information in his databases to advantage in diagnosis, design, and analysis. Though an expert system consists primarily of a knowledge base and an inference engine, a couple of other features are worth mentioning reasoning with uncertainty, and explanation of the line of reasoning.



Fi-1: Components of Expert System

For the Doctor and Patient Communication

2.4. Roles in Expert System Development:

Three fundamental roles in building expert systems are:

1. Expert - Successful ES systems depend on the experience and application of knowledge that the people can bring to it during its development. Large systems generally require multiple experts [9].

2. Knowledge engineer - The knowledge engineer has a dual task. This person should be able to elicit knowledge from the expert, gradually gaining an understanding of an area of expertise. Intelligence, tact, empathy, and proficiency in specific techniques of knowledge acquisition are all required of a knowledge engineer. Knowledge-acquisition techniques include conducting interviews with varying degrees of structure, protocol analysis, observation of experts at work, and analysis of cases.

On the other hand, the knowledge engineer must also select a tool appropriate for the project and use it to represent the

knowledge with the application of the ***knowledge acquisition facility***.

3. **User** - A system developed by an end user with a simple shell, is built rather quickly an inexpensively. Larger systems are built in an organized development effort. A prototype-oriented iterative development strategy is commonly used. ESs lends them particularly well to prototyping, Requirements of Efficient ES User Interface. It should help users to accomplish their goals in shortest possible way. It should be designed to work for user's existing or desired work practices. Its technology should be adaptable to user's requirements; not the other way around. It should make efficient use of user input.

2.5. Expert Systems Limitations:

No technology can offer easy and complete solution. Large systems are costly, require significant development time, and computer resources. Expert Systems have their limitations which include –

- Limitations of the technology
- Difficult knowledge acquisition
- ES are difficult to maintain
- High development costs

2.6. Applications of Expert System

Classification - identify an object based on stated characteristics [10].

Diagnosis Systems - infer malfunction or disease from observable data

Monitoring - compare data from a continually observed system to prescribe behavior.

Process Control - control a physical process based on monitoring.

Design - configure a system according to specifications

Scheduling & Planning - develop or modify a plan of action,

Generation of Options - generate alternative solutions to a problem.

2.7. Expert System Technology

There are several levels of ES technologies available. Expert systems technologies include: -

The Expert Systems development environment includes hardware and tools. They are –

- Workstations, minicomputers, mainframes.
- High level Symbolic Programming Languages, such as **Lis**t **P**rogramming (LISP) and **pro**gramming in **Log**gie (PROLOG) and Large databases.

1. Tools:
They reduce the effort and cost involved in developing an expert system to large extent. Powerful editors and debugging tools with multi-windows [10]. They provide rapid prototyping. Have Inbuilt definitions of model, knowledge representation, and inference design.

2. Shells: A shell is nothing but an expert system without knowledge base. A shell provides the developers with knowledge acquisition, inference engine, user interface, and explanation facility. For example, few shells are such as Java Expert System Shell (JESS) that provides fully developed Java API for creating an expert system. *Vidwan*, a shell developed at the National Centre for Software Technology, Mumbai in 1993. It enables knowledge encoding in the form of IF-THEN rules.

2.8. Benefits of Expert Systems:

- **Availability** – they are easily available due to mass production of software.
- **Less Production Cost** – Production cost is reasonable. This makes them affordable.
- **Speed** – they offer great speed. They reduce the amount of work an individual puts in.
- **Less Error Rate** – Error rate is low as compared to human errors.
- **Reducing Risk** – they can work in the environment dangerous to humans.
- **Steady response** – they work steadily without getting motional, tensed or fatigued.

3. Discrimination between Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL):

3.1. Artificial Intelligence (AI):

- AI stands for Artificial intelligence, where intelligence is defined acquisition of knowledge intelligence is defined as a ability to acquire and apply knowledge.
- The aim is to increase chance of success and not accuracy[12].
- It works as a computer program that does smart work
- The goal is to simulate natural intelligence to solve complex problem
- AI is decision making.

- It leads to develop a system to mimic human to respond behave in a circumstance.
- AI will go for finding the optimal solution.
- AI leads to intelligence or wisdom.

3.1. Machine Learning (ML):

- ML stands for Machine Learning which is defined as the acquisition of knowledge or skill
- The aim is to increase accuracy, but it does not care about success
- It is a simple concept machine takes data and learn from data.
- The goal is to learn from data on certain task to maximize the performance of machine on this task.
- ML allows system to learn new things from data.[12]
- It involves in creating self-learning algorithms.
- ML will go for only solution for that whether it is optimal or not.
- ML leads to knowledge.

3.2. Deep Learning (DL):

- DL stands for Deep Learning. A key ML approach that remained dormant for a few decades was artificial neural networks. This eventually gained wide acceptance when improved [11] processing capabilities became available. A neural network simulates the activities of brain's neurons in a layered fashion, and the propagation of data occurs in similar a manner, enabling machines to learn more about a given set of observations and make accurate predictions. The accuracy of these models allows reliable services to be offered to end user, since the fall positives has been eliminated entirely.

4. Impact of Artificial Intelligence Technologies

4.1. Impact of Artificial Intelligence —

A Dark Future and A Bright Future

I am all for optimism. But as much as I'd like to believe all the above, this bright outlook on the future relies on shaky premises. Namely:

- The past is an accurate predictor of the future.
- We can weather the painful transition.
- There are some jobs that only humans can do.

1) The transition will be extremely painful

The transition could be very painful. It's no secret that rising unemployment has a negative impact on society; less volunteerism, higher crime, and drug abuse are all correlated. A period of high unemployment, in which tens of millions of people are incapable of getting a job because they simply don't have the necessary skills, will be our reality if we don't adequately prepare.

2) Here, 99% of jobs will be eliminated

This claim may seem bold, and yet it's all but certain. All you need are two premises:

- We will continue making progress in building more intelligent machines.
- Human intelligence arises from physical processes.

With these two premises in hand, we can conclude the following**:** we will build machines that have human-level intelligence and higher it's unlikely that the future will play out like the past. There's no guarantee that more jobs will be created than are destroyed by AI and automation.

4. Even if the future *does* play out like the past, the jobs being created will require re-skilling and better education. These services aren't currently provided. Unless we make major changes, we'll have hundreds of millions of people who can't get jobs and all—both "blue" and "white" collar workers—will suffer from it.

- Even if we manage to deal with this transition effectively, virtually all jobs will eventually be eliminated by machines.
- By leveraging our humanity—our ability to organize and lead social movements, self-educate, and synthesize information creatively—we give ourselves the best chance of success in a rapidly changing world.

5. CONCLUSION

Now, the time to sit and think upon for the future of Artificial intelligence in expert systems think that as to go with traditional programming or to adapt the science of artificial intelligence. The overall motivation behind the paper is to modernize that our ancestral methods to cater the needs of growing population. The development process may be incremental, but the overall concept requires a paradigm shift in the way we think about our modernization of production that is based more on needs rather than modifying existing techniques.

REFERENCES

1) https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_overview.htm("Introduction of AI and Goals")

2) https://www.researchgate.net/post/What_is_Artificial_Intelligence_AI("AI_introducton")

3) http://cdn.differencebetween.net/wp_content/uploads/2018/08/Artificial-Intelligence-vs-Human-Intelligence("AI vs. HI")

4) https://futuremonger.com/what-is-the-ultimate-goal-of-artificial-intelligence-e9cd4d07e172("Goals of AI")

5) https://www.researchgate.net/post/advantages_and_disadvantages Artificial_Intelligence_AI ("advantages and disadvantages of AI")

6) https://futuremonger.com/what-are applications("Applications-of AI")

7) http://cdn.differencebetween.net/wp_real_timeapplications("Applications in real life")

8) http://www.umsl.edu/~joshik/msis480/chapt11.htm("Expert systems")

9) https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_expert_systems.htm("Expert systems & applications")

10) https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_expert_systems.htm ("Expert systems & applications")

11) https://www.esds.co.in/artificialintelligence("Difference b\w AI, ML, DL")

12) https://medium.com/iotforall/the-difference-between-artificial-intelligence-machine-learning-and-deep-learning-3aa67bff5991 ("differences AI, ML, CL").

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