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Artificial Intelligence and Expert Systems

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Abstract: *Artificial Intelligence (AI) is a specialized field of computer science focused on creating machines that can emulate human intelligence and behaviour. The term "Artificial Intelligence" was first introduced by John McCarthy in 1956 at the Massachusetts Institute of Technology (MIT) in the USA. AI encompasses a variety of applications including game playing, expert systems, natural language processing, neural networks, and robotics.*

As of now, no computer systems have achieved true artificial general intelligence, which would enable them to perform any intellectual task that a human can. However, significant progress has been made in specific domains, particularly in game playing. Modern computer chess programs, for instance, have surpassed human players in terms of skill and performance.

In the early 1980s, expert systems were heralded as the future of AI and computing. These systems are designed to mimic the decision-making abilities of human experts in specialized fields such as medicine and engineering. Despite their potential, expert systems have not fully met the high expectations set for them. They tend to be costly to develop and maintain, and their utility is often limited to specific, well-defined tasks.

Currently, neural networks represent one of the most dynamic and rapidly advancing areas of AI. These algorithms, inspired by the structure of the human brain, have demonstrated success in various applications, including voice recognition and natural language processing.

When it comes to programming AI applications, LISP (List Processing) and Prelog (Programming in Logic) are two of the most widely used languages due to their suitability and flexibility for AI-related tasks.

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

I. INTRODUCTION

Artificial Intelligence (AI) is a specialized field within Computer Science that aims to develop computers and machines capable of exhibiting human-like intelligence. As defined by John McCarthy, a pioneer in the field of AI, it involves "The science and engineering of creating intelligent machines and intelligent computer programs." The objective of AI is to enable computers, computer-controlled robots, and software to think and operate in a manner similar to human intelligence. This is achieved by studying the cognitive processes of the human brain, including learning, decision-making, and problem-solving, and using this knowledge as a foundation to design intelligent software and systems.

The approach to AI in the industry has evolved beyond merely creating intelligent devices. Leading technology companies and researchers worldwide are now aiming to develop AI solutions that not only make intelligent decisions but also have the ability to learn from data, similar to humans. This has led to innovation in both machine learning and computational capabilities, with the goal of creating AI systems that mimic the human brain's functionality. The underlying curiosity driving this endeavour is the question, "Can machines think and behave like humans?" Thus, the development of AI initially aimed to replicate the high-level intelligence observed in humans.

AI encompasses various core areas of research, including:

- **Knowledge**: Equipping machines with a comprehensive understanding of the world is crucial for them to act and react like humans.
- **Reasoning**: Developing the ability for machines to engage in logical thinking and problem-solving
- **Problem Solving**: Enabling machines to analyse and solve complex problems efficiently.
- **Perception**: Allowing machines to interpret and understand sensory information from the environment.

- **Learning**: Implementing algorithms that enable machines to learn from data and improve over time.
- **Planning**: Enabling machines to strategize and plan actions to achieve specific goals.
- **Manipulation and Object Movement**: Developing machines capable of handling and moving objects with precision.

Knowledge engineering plays a vital role in AI research. For machines to emulate human-like intelligence, they require access to extensive knowledge about objects, categories, properties, and the relationships between them. This involves instilling common sense, reasoning, and problem-solving abilities in machines, which is a complex and challenging task.

Machine learning is another integral component of AI. It encompasses two main types of learning:

- **Unsupervised Learning**: Involves identifying patterns in data streams without explicit supervision.
- **Supervised Learning**: Involves classification and numerical regression tasks. Classification determines the category to which an object belongs, while regression involves generating appropriate outputs based on input data.

The mathematical analysis and performance evaluation of machine learning algorithms are part of a well-established branch of theoretical computer science known as computational learning theory.

1.1 Discrimination between Artificial Intelligence and Human Intelligence

The given table show the difference between AI and HI.

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

- **Enhanced Computing Power**: AI systems can utilize more potent and beneficial computers.
- **Advanced Interfaces**: The development of new and improved user interfaces.
- **Problem-Solving Capabilities**: AI's ability to tackle novel challenges.
- **Efficient Information Management**: Improved handling and organization of vast amounts of data.
- **Mitigation of Information Overload**: AI can transform overwhelming information into meaningful knowledge.
- **High Accuracy and Precision**: When programmed correctly, AI systems can operate with remarkable accuracy, speed, and precision. They are not susceptible to hostile environments, allowing them to perform hazardous tasks, explore outer space, and handle challenges that could be dangerous for humans [4]. For instance, AI can be employed in mining and extracting resources from environments that are inhospitable to humans.
- **Automation of Repetitive Tasks**: AI can replace humans in monotonous and labour-intensive jobs. For instance, AI can predict user behaviour in smartphones, suggesting and executing various actions
- **Fraud Detection and Record Management**: AI can identify fraudulent activities in card-based systems and potentially in other systems in the future. It is also proficient in organizing and managing records.
- **Human Interaction**: AI can engage with humans for entertainment or tasks through avatars or robots. For example, AI algorithms are used in numerous video games. Robotic pets can interact with humans, potentially assisting in alleviating depression and promoting activity.

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- **Logical and Emotion-Free Decision Making**: AI operates on logic without being influenced by emotions, leading to rational decision-making with minimal errors. AI can evaluate individuals for medical purposes, assessing health risks and emotional states. It can simulate medical procedures and provide information on potential side effects. In the medical field, technologies like robotic radiosurgery and other advanced surgical techniques can achieve precision beyond human capabilities.
- **Continuous Operation**: Unlike humans, AI systems do not require rest, breaks, or entertainment, as they do not experience boredom or fatigue.

1.3 Disadvantages of AI

- **Elevated Costs**: Implementing AI can lead to increased expenses.
- **Challenges in Software Development**: The process of developing AI software can be slow and costly.
- **Limited Experienced Programmers**: There is a scarcity of programmers with sufficient expertise in AI.
- **Limited Availability of Practical Products**: Few AI-driven products have been successfully introduced to the market.
- **Costly Maintenance**: Building, repairing, and maintaining AI systems can be time-consuming and expensive. While robotic repair can reduce the need for human intervention, it also requires additional financial and resource investments.
- **Ethical Considerations**: The creation of androids or human-like robots raises ethical and moral concerns. There is ongoing debate about the appropriateness of recreating intelligence, a unique natural gift.
- **Storage and Retrieval Limitations**: Despite the expansive storage capacity, AI may not be as efficient as humans in forming meaningful connections between memories.
- **Learning Capabilities**: While AI can improve and learn specific tasks through programming, there is scepticism about whether it can ever match human proficiency.
- **Limited Functionality**: AI systems are confined to the tasks they are programmed for and cannot operate beyond their designated scope.
- **Lack of Creativity**: AI lacks the innate creativity that humans possess.
- **Emotional Sympathy**: AI may struggle to empathize with human emotions, potentially impacting roles such as nursing. This limitation can also affect wisdom and understanding.
- **Common Sense and Intuition**: Even when programmed to learn and apply common sense, AI may not achieve the same level of intuitive understanding as humans.
- **Job Displacement**: The automation of jobs by robots can lead to significant unemployment unless new job categories are created that AI cannot perform, or there are substantial governmental changes, such as a shift to communism.

- **Overdependence on AI**: Excessive reliance on AI, as seen with smartphones and other technologies, can diminish human cognitive abilities.
- **Potential for Misuse**: AI-powered machines can be weaponized or misused, posing a threat to humanity.
- **Supremacy Concerns**: There is a fear among many that AI-powered robots could surpass and dominate humans.

1.4 Goals of AI

- **Development of Expert Systems**: Creating systems capable of exhibiting intelligent behaviour, learning, explaining, and providing advice to users.
- **Replicating Human Intelligence in Machines**: Designing systems that can understand, think, learn, and behave similarly to humans [5].
- **Singularity and Transhumanism (AI Takeover)**
- **An Empty Disneyland**: A scenario without children, akin to a play without an audience.
- **Singleton Concept**: A single global governing entity.
- **AI as a Deity**
- **Warning of Human Extinction by Stephen Hawking**
- **Idealized Humans & Silicon Consciousness by Michio Kaku**
- **AI for Augmentation, Not Replacement of Humans**
- **"Life 3.0" by Max Tegmark**

1.5 Applications of AI

AI has made significant advancements in various sectors, including:

- **Gaming**: AI plays an essential role in strategic games like chess, poker, and tic-tac-toe. Machines utilize heuristic knowledge to evaluate a vast number of potential positions [6].
- **Natural Language Processing**: AI enables computers to understand and interact using natural human language.
- **Expert Systems**: These applications combine machine capabilities, specialized software, and specific information to offer reasoning and advice, providing explanations and recommendations to users.
- **Vision Systems**: These systems can interpret and understand visual data on computers. Examples include:
  - Surveillance aircraft capturing images to extract spatial information or create area maps.
  - Clinical expert systems assisting doctors in patient diagnosis.
  - Police utilizing software to identify criminals by matching stored forensic artist sketches with facial recognition.
- **Speech Recognition**: Advanced systems can understand and interpret spoken language, comprehending sentences and their meanings, even accounting for accents, slang, background noise, and changes in speech due to factors like illness.
- **Handwriting Recognition**: This software can interpret handwritten text from paper or digital screens, identifying letter shapes and converting them into editable text.
- **Intelligent Robots**: These robots can execute tasks assigned by humans. They are equipped with sensors to perceive real-world data such as light, heat, temperature, motion, sound, impacts, and pressure. Featuring powerful processors, multiple sensors, and extensive memory, they can demonstrate intelligence.Furthermore, they can learn from errors and adapt to new environments.

1.6 Real Life Applications of AI

- **Expert Systems**
  Examples: Flight-tracking systems, Clinical Systems.

- **Natural Language Processing**
  Examples: Google Now features, Speech recognition, Automatic voice output.
- **Neural Networks**
  Examples: Pattern recognition systems like face recognition, Character recognition, and Handwriting recognition
- **Robotics**
  Examples: Industrial robots used for tasks such as movement, spraying, painting, precision checking, drilling, cleaning, coating, and carving.
- **Fuzzy Logic Systems**
  Examples: Consumer electronics, Automotive applications, etc.

1.7 Future Enhancement of Artificial Intelligence:

- **Agriculture**: Utilizing Precision Agriculture techniques.
- **Healthcare**: Implementing Personalized Treatment approaches.
- **Manufacturing**: Adopting Edge Computing solutions.
- **Automobiles**: Incorporating Infotainment Systems.
- **Social media**: Employing Facial Identification technologies.
- **Financial Services**: Utilizing Fraud Detection methods.

II. EXPERT SYSTEMS IN ARTIFICIAL INTELLIGENCE

In the realm of artificial intelligence, an expert system is a computer program designed to mimic the decision-making skills of a human expert. These systems tackle intricate problems by employing a body of knowledge primarily represented as if-then rules, rather than using traditional procedural code [8]. Expert systems (ES) stand as a prominent area of AI research, initially introduced by researchers at the Computer Science Department of Stanford University.
Expert systems are computer applications crafted to address complex issues within a specific domain, approaching the level of exceptional human intelligence and expertise.

2.1 Characteristics of Expert systems:

- High performance
- Understandable
- Reliable
- Highly responsive

2.2 Capabilities and incapabilities of Expert Systems:

Capabilities

Offer Advice:

- Expert systems can provide recommendations and suggestions based on the knowledge and rules they have been programmed with. This advice is often tailored to the specific problem or situation presented to the system.

Guide and Assist Humans in Decision-Making [8]:

- These systems can help users make informed decisions by presenting relevant information, options, and potential outcomes. They assist in navigating complex decision-making processes by providing logical and reasoned suggestions.

Demonstrate:

- Expert systems can showcase how a particular decision or solution is derived. They can walk the user through the reasoning process, demonstrating the steps taken to reach a conclusion.

Generate a Solution:

- Based on the input provided and the knowledge stored in its database, an expert system can produce a solution to a specific problem. This solution is derived from the system's extensive knowledge base and logical reasoning.

Diagnose:

- In fields like medicine, expert systems can diagnose illnesses or conditions based on the symptoms and data provided. They compare the symptoms against their database of medical knowledge to suggest potential diagnoses.

Explain:

- Expert systems can clarify and elucidate the reasoning behind a particular decision, recommendation, or diagnosis. They can break down complex concepts into understandable explanations for the user.

Interpret Input:

- These systems are capable of understanding and interpreting the input provided by the user or another system. They can process and analyse this input to derive meaningful conclusions.

Predict Outcomes:

- Using historical data and established rules, expert systems can forecast potential outcomes of specific decisions or scenarios. They evaluate the input data to project possible future events or results.

Justify Conclusions:

- Expert systems can provide logical reasoning and evidence to support their conclusions. They can articulate why a particular decision or recommendation was made, offering transparency and understanding to the user.

Propose Alternative Solutions to a Problem:

- In situations where multiple solutions may exist, expert systems can suggest various alternative approaches. They evaluate different options based on their knowledge and rules to provide a range of potential solutions to a problem.

Overall, expert systems leverage their extensive knowledge base, logical reasoning capabilities, and rule-based approach to assist users in problem-solving, decision-making, and understanding complex scenarios within specific domains.

Incapabilities

Replacing Human Decision-Makers:

- While expert systems are designed to emulate human decision-making processes, they cannot entirely replace human expertise. They lack the intuition, experience, and nuanced understanding that human experts possess, which can sometimes be crucial in certain situations.

Mimicking Human Capabilities:

- Despite their advanced algorithms and rule-based reasoning, expert systems cannot replicate all human capabilities. They lack emotions, creativity, and the ability to adapt to new, unforeseen situations in the same way humans can.

Generating Accurate Output with an Insufficient Knowledge Base:

- The accuracy and reliability of an expert system heavily depend on the quality and completeness of its knowledge base. If the system encounters a situation that falls outside its knowledge domain or if it has incomplete or outdated information, the output or recommendations it provides may be inaccurate or misleading.

Updating or Refining Their Own Knowledge:

- Unlike humans who can continually learn, adapt, and refine their knowledge and skills over time, expert systems cannot autonomously update or refine their own knowledge base. They rely on human experts to update and maintain their databases, which can be a time-consuming and resource-intensive process.

In summary, while expert systems are powerful tools for problem-solving and decision-making within specific domains, they have inherent limitations that prevent them from fully replacing human experts or adapting to new and unforeseen situations independently.

2.3 Components of Expert Systems:

The components of an Expert System (ES) include:

- Knowledge Base
- Inference Engine
- User Interfaces

Knowledge Base: The knowledge base of an expert is derived from formal education, interactions with colleagues, and years of hands-on experience. Generally, the more experience an expert has, the more extensive their knowledge base becomes. This knowledge enables the expert to interpret information within their databases effectively, aiding in diagnosis, design, and analysis. While an expert system primarily consists of a knowledge base and an inference engine, it may also include additional features such as reasoning with uncertainty and providing explanations for the reasoning process.

Inference Engine: The Inference Engine is the core component of an Expert System. It functions as the brain of the system, processing and evaluating the information stored in the knowledge base to derive conclusions and make decisions. It uses various algorithms and reasoning techniques to mimic the decision-making process of a human expert. The Inference Engine takes the data input by the user, applies the rules and logic from the knowledge base, and produces meaningful and actionable outputs. In doing so, it evaluates different scenarios, weighs the evidence, and applies the appropriate rules to arrive at a solution or recommendation.

User Interfaces: User Interfaces in an Expert System provide the means for interaction between the user and the system. It serves as the medium through which users input queries, receive recommendations, and interact with the system's functionalities. A well-designed user interface is crucial for the usability and effectiveness of the expert system. It should be intuitive, user-friendly, and capable of presenting complex information in an understandable manner. Depending on the system's design, the user interface can range from command-line interfaces to graphical user interfaces (GUIs) with interactive features. The primary goal of the user interface is to facilitate seamless communication between the user and the expert system, ensuring that the user can easily access and benefit from the system's capabilities.

2.4 Roles in Expert System Development

The three fundamental roles in building expert systems are:

- **Expert** - The success of Expert Systems relies heavily on the expertise and knowledge that individuals can contribute during its development. Larger systems often require the collaboration of multiple experts.
- **Knowledge Engineer** - The knowledge engineer plays a dual role in the development of an expert system. Firstly, they must extract knowledge from the expert, gradually gaining insight into the specific area of expertise. This role demands intelligence, tact, empathy, and proficiency in various knowledge acquisition techniques. These techniques may include structured interviews, protocol analysis, observing experts in action, and analysing specific cases. Secondly, the knowledge engineer is responsible for selecting an appropriate tool for the project and utilizing it to represent the acquired knowledge effectively.
- **User** - When a system is developed by an end-user using a simple shell, it can be constructed quickly and cost-effectively. However, larger systems require a more structured development approach. A prototype-oriented iterative development strategy is commonly employed in these cases. Expert Systems are particularly well-suited to prototyping. An efficient Expert System User Interface should:

Assist users in achieving their goals as quickly as possible.

Be designed to align with the user's existing or desired work practices.

Adapt to the user's requirements rather than forcing the user to adapt to the technology.

Make optimal use of user input

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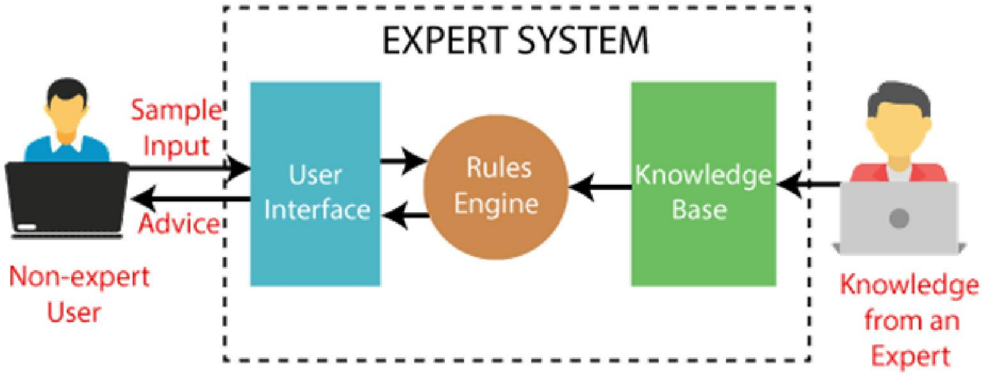

2.5 Expert Systems Limitations

No technology can provide a simple and comprehensive solution. Developing large systems is expensive, time-consuming, and demands substantial computer resources. Expert Systems also have their constraints, including:

- **Technological Limitations:** Every technology has its constraints and shortcomings, and Expert Systems are no exception. These limitations may include constraints on processing power, memory, or the ability to handle complex scenarios efficiently.
- **Challenges in Knowledge Acquisition:** Acquiring the necessary knowledge from domain experts can be a challenging and time-consuming process. It requires effective communication, understanding, and collaboration between the knowledge engineer and the domain experts.
- **Difficulty in Maintenance:** Maintaining Expert Systems over time can be arduous due to the constant need for updates, improvements, and bug fixes. As the domain evolves and new knowledge emerges, the system must adapt accordingly, which can be a complex and resource-intensive task.
- **High Development Costs:** Developing Expert Systems, particularly large-scale ones, entails significant costs in terms of manpower, time, and resources. From gathering initial requirements to implementing and testing the system, each stage of development requires careful planning and investment

In summary, while Expert Systems offer valuable capabilities for problem-solving and decision-making within specific domains, they also come with inherent limitations and challenges that need to be addressed during their development and maintenance.

2.6 Applications of Expert System

Classification:

- **Definition**: Identify an object based on specified characteristics.
- **Explanation**: This type of Expert System is designed to categorize or classify objects based on their features or attributes. For example, it could be used in identifying types of plants, animals, or products based on given characteristics.

Diagnosis Systems:

- **Definition**: Infer malfunction or disease from observable data.
- **Explanation**: These systems are employed in the medical field and other industries to diagnose issues or problems based on observed data. They analyse symptoms, test results, and other relevant information to identify potential diseases, malfunctions, or problems.

Monitoring:

- **Definition**: Compare data from a continually observed system to prescribe behaviour.
- **Explanation**: Monitoring Expert Systems continuously observe and analyse data from a system. They compare the real-time data to predefined standards or thresholds and recommend or prescribe specific actions or behaviours based on the analysis.

Process Control:

- **Definition**: Control a physical process based on monitoring.
- **Explanation**: This type of Expert System is used to control and manage physical processes based on real-time monitoring and analysis. It can adjust and optimize the operation of machinery, equipment, or systems to maintain efficiency and performance

Design:

- **Definition**: Configure a system according to specifications.
- **Explanation**: Design Expert Systems assist in designing or configuring systems, products, or solutions based on specified requirements and constraints. They utilize predefined rules, constraints, and best practices to generate optimal design solutions.

Scheduling & Planning:

- **Definition**: Develop or modify a plan of action.
- **Explanation**: These systems are utilized to develop, modify, or optimize schedules and plans of action. They consider various factors, constraints, and objectives to generate efficient and effective schedules or plans.

Generation of Options:

- **Definition**: Generate alternative solutions to a problem.
- **Explanation**: This type of Expert System is designed to generate multiple alternative solutions or options to a given problem or challenge. It analyses the problem, considers various constraints and criteria, and produces a range of potential solutions for evaluation.

2.7 Expert System Technology

Levels of ES Technologies: There are various levels of Expert Systems technologies available, which encompass:

1. Expert Systems Development Environment: This environment includes both hardware and software tools. The components typically consist of:

- **Hardware**: Workstations, minicomputers, and mainframes.
- **Software**: High-level Symbolic Programming Languages, such as LISP (List Processing) and PROLOG (Programming in Logic), and extensive databases.

2. Tools: These tools significantly reduce the effort and cost associated with developing an expert system. They include:

- **Powerful Editors and Debugging Tools**: These facilitate the creation and debugging of the expert system by providing multi-window interfaces and advanced editing capabilities.
- **Rapid Prototyping**: Tools enable quick and efficient prototyping of the expert system.
- **Inbuilt Definitions**: They come with predefined models, knowledge representation methods, and inference design templates.

3. Shells: An Expert System shell is essentially an expert system framework without a knowledge base. It provides developers with essential components such as:

- **Knowledge Acquisition**: Tools and methods to gather and input expert knowledge into the system.
- **Inference Engine**: The core component that processes the knowledge and makes decisions or recommendations.
- **User Interface**: The interface through which users interact with the expert system.
- **Explanation Facility**: Capabilities to provide explanations for the system's decisions or recommendations.

2.8 Benefits of Expert Systems:

Availability:

- **Readily Accessible**: Due to mass software production, Expert Systems are easily accessible to organizations and individuals.

Production Cost:

- **Cost-Effective**: The production cost of Expert Systems is reasonable, making them affordable for a wider range of applications and organizations.

Speed:

- **Efficiency**: Expert Systems operate at high speeds, reducing the workload and effort required by individuals in problem-solving and decision-making tasks.

Error Rate:

- **Accuracy**: Expert Systems exhibit a low error rate compared to human errors, ensuring consistent and reliable performance in decision-making and problem-solving.

Risk Reduction:

- **Safety**: Expert Systems can operate in environments that are dangerous or hazardous to humans, reducing the risk of human exposure to potential harm.

Consistent Performance:

- **Reliability**: Expert Systems provide steady and consistent performance without being affected by emotions, stress, or fatigue, ensuring reliable and continuous operation.

III. DISCRIMINATION BETWEEN ARTIFICIAL INTELLIGENCE (AI), MACHINE LEARNING (ML), DEEP LEARNING (DL)

3.1 Artificial Intelligence (AI)

AI Definition:

- **AI stands for Artificial Intelligence**, where intelligence is characterized as the ability to acquire and apply knowledge.

Objective of AI:

- **Goal**: The primary aim of AI is to increase the likelihood of success rather than just accuracy [12].

Functionality:

- **Smart Computing**: AI operates as a computer program that performs tasks intelligently and efficiently.

Problem-Solving:

- **Simulating Human Intelligence**: AI aims to simulate natural human intelligence to address and solve complex problems.

Decision Making:

- **Decision-Making Capability**: AI is essentially about making decisions based on data and algorithms.

Mimicking Human Behaviour:

- **Human-like Response**: AI development leads to creating systems that mimic human responses and behaviours in various circumstances.

Optimal Solutions:

- **Optimization**: AI is designed to find the most optimal solution to a given problem.

Development of Intelligence:

- **Enhancing Intelligence**: AI contributes to the enhancement and development of intelligence or wisdom in systems.

3.2 Machine Learning (ML)

ML Definition:

- **ML stands for Machine Learning**, which is characterized as the acquisition of knowledge or skill by machines.

Objective of ML:

- **Goal**: The primary aim of ML is to increase accuracy in tasks, focusing less on the overall success.

Functionality:

- **Learning from Data**: Machine Learning is a concept where machines process data and learn from it.

Task Performance:

- **Optimizing Task Performance**: The goal of ML is to learn from data related to a specific task to enhance the machine's performance on that task.

Learning Capability:

- **Continuous Learning**: ML enables systems to learn and adapt to new information and tasks from the provided data.

Algorithm Development:

- **Self-learning Algorithms**: ML involves the creation and utilization of self-learning algorithms.

Solution Orientation:

- **Solution Focus**: ML aims to find a solution based on the given data, whether it is optimal or not.

Knowledge Enhancement:

- **Knowledge Acquisition**: ML leads to the acquisition and enhancement of knowledge in machines.

3.3 Deep Learning (DL)

DL Definition:

- **DL stands for Deep Learning**, a key approach within Machine Learning (ML) that was initially underutilized but gained widespread acceptance with advancements in processing capabilities.

Neural Networks in DL:

- **Artificial Neural Networks**: A central component of DL, neural networks simulate the activities of the brain's neurons in layered structures. Data propagation within these networks mimics the way neurons transmit signals, allowing machines to learn from a given set of observations and make accurate predictions.

Accuracy and Reliability:

- **Improved Accuracy**: The enhanced accuracy of deep learning models ensures the delivery of reliable services to end-users by significantly reducing false positives.

IV. IMPACT OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES

4.1 Impact of Artificial Intelligence

A Dark Future vs. A Bright Future

While I deeply appreciate optimism, I must express scepticism about the rosy picture painted for the future due to several questionable assumptions:

- The past reliably predicts the future.
- We can navigate through a painful transition.
- Certain jobs are exclusive to humans.

1) The Transition Will Be Incredibly Difficult

The transition period has the potential to be highly challenging. It's evident that escalating unemployment adversely affects society, leading to decreased volunteerism, increased crime rates, and elevated drug abuse. Without adequate preparation, we might face a prolonged period of high unemployment, leaving tens of millions of people jobless due to a lack of required skills.

2) An Estimated 99% of Jobs Will Disappear

This assertion might appear audacious, but its likelihood is high, grounded in two fundamental premises:

- Continued advancements in creating increasingly intelligent machines.
- Human intelligence is a product of physical processes.

Based on these premises, it's reasonable to infer that we will develop machines with human-level intelligence or even greater. Therefore, the future might not unfold similarly to the past, and there's no assurance that AI and automation will generate more jobs than they eliminate.

3) The Imperative for Reskilling and Enhanced Education

Even if the future replicates the past in terms of job creation, the new jobs are likely to demand re-skilling and higher educational qualifications. Presently, these essential services are not adequately available. Without significant reforms,

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we risk having hundreds of millions of people unable to secure employment, impacting both "blue-collar" and "white-collar" workers.

4) The Eventual Replacement of Most Jobs by Machines

Even if we effectively manage the initial transition, it's conceivable that machines will ultimately replace virtually all jobs.

5) Harnessing Our Humanity for Success

By capitalizing on our innate human abilities—such as organizing and leading social movements, engaging in self-directed learning, and creatively synthesizing information—we enhance our prospects of thriving in a rapidly evolving world.

V. CONCLUSION

Now is the time to contemplate the future of Artificial Intelligence (AI) in expert systems, deciding between sticking with traditional programming or embracing the field of artificial intelligence. The primary motivation behind this paper is to update our age-old methods to meet the demands of a growing population. While the development process may be gradual, the underlying concept calls for a paradigm shift in how we approach modernizing production, focusing more on fulfilling needs rather than merely tweaking existing techniques.

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