Machine Learning Applications

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ABSTRACT

 Machine learning is one of the fields in the modern computer world. Machine learning leverages statistical and computer science principles to develop algorithm capable of improving performance through interpretation of data rather than through explicit instruction. There are plenty of researches that has been initiated to make machine intelligent. Field of machine learning aims to develop computer algorithm to improve experience and to solve daily life problems efficiently. Learning is a natural process in humans and it becomes an important process in machines as well.

 Machine learning and artificial intelligence techniques have an ever-increasing presence and impact on a wide-variety of research and commercial fields. Machine learning techniques have deeply rooted in our everyday life. However, since it is knowledge and labour intensive to pursue good learning performance, human experts are heavily involved in every aspect of machine learning.

**Keywords – Supervised, Reinforcement, Unsupervised, Decision tree, Random forest**

1. INTRODUCTION

Artificial Intelligence ( AI ) is the branch of computer science which deals with intelligence of machines where an intelligent agent is a system that takes actions which maximize its chances of success. It is the study of ideas which enable computers to do the things that make people seem intelligent. The central principles of AI include such as reasoning, knowledge, planning, learning, communication, perception and the ability to move and manipulate objects. It is the science and engineering of making intelligent machines, especially intelligent computer programs.

 Artificial Intelligence (AI) has now reached in every industry. The impressive success and AI methods are so good that they should be taught even in basic course. So , Artificial Intelligence (AI) is a broad field of computer science that focuses on creating systems or machines that can perform tasks that typically require human intelligence .These tasks include reasoning, problem-solving, learning , understanding natural language , recognizing patterns and making decision. AI system aims to simulate human-like cognitive functions in machines.

1. USES OF ARTFICIAL INTELLIGENCE

 Artificial Intelligence has various applications in today's society. It is becoming essential for today's time because it can solve complex problems with an efficient way in multiple industries, such as Healthcare, entertainment, finance, education, etc. AI is making our daily life more comfortable and fast.

 The application of artificial intelligence includes:

1. AI in space technology:

a.) AI can help improve the communication between spacecraft and Earth or between spacecraft.

b.)  Machine learning algorithms can routinely test significant troves of astronomical pix, figuring out items consisting of galaxies, stars, and asteroids with splendid accuracy.

2.) AI in medical industry:

a.) AI becoming more advantageous for the healthcare industry and going to have a significant impact on this industry.

b.) Healthcare Industries are applying AI to make a better and faster diagnosis than humans. AI can help doctors with diagnoses and can inform when patients are worsening so that medical help can reach to the patient before hospitalization.

3.) AI in Finance:

a.) AI and finance industries are the best matches for each other. The finance industry is implementing automation, chatbot, adaptive intelligence, algorithm trading, and machine learning into financial processes.

4.) AI in Robotics:

a.) Artificial Intelligence has a remarkable role in Robotics. Usually, general robots are programmed such that they can perform some repetitive task, but with the help of AI, we can create intelligent robots which can perform tasks with their own experiences without pre-programmed.

5.) AI in gaming:

a.) AI can be used for gaming purpose. The AI machines can play strategic games like chess, where the machine needs to think of a large number of possible places.

6.)AI in automobile industry:

a.) Some Automotive industries are using AI to provide virtual assistant to their user for better performance. Such as Tesla has introduced Tesla Bot, an intelligent virtual assistant.

b.) Various Industries are currently working for developing self-driven cars which can make your journey more safe and secure.

III. ARTFICIAL INTELLIGENCE METHODS

Machine Learning:

 It is one of the applications of AI where machines are not explicitly programmed to perform certain tasks; rather, they learn and improve from experience automatically. Deep Learning is a subset of machine learning based on artificial neural networks for predictive analysis. There are various machine learning algorithms, such as Unsupervised Learning, Supervised Learning, and Reinforcement Learning. In Unsupervised Learning, the algorithm does not use classified information to act on it without any guidance. In Supervised Learning, it deduces a function from the training data, which consists of a set of an input object and the desired output. Reinforcement learning is used by machines to take suitable actions to increase the reward to find the best possibility which should be taken in to account.

Deep learning:

 Deep learning allows computational models that are composed of multiple processing layers to learn representations of data with multiple levels of abstraction. These methods have dramatically improved the state-of-the-art in speech recognition, visual object recognition, object detection and many other domains such as drug discovery and genomics. Deep learning discovers intricate structure in large data sets by using the backpropagation algorithm to indicate how a machine should change its internal parameters that are used to compute the representation in each layer from the representation in the previous layer. Deep convolutional nets have brought about breakthroughs in processing images, video, speech and audio, whereas recurrent nets have shone light on sequential data such as text and speech.

Machine Vision:

 Machines can capture visual information and then analyse it. Here cameras are used to capture the visual information, the analogue to digital conversion is used to convert the image to digital data, and digital signal processing is employed to process the data. Then the resulting data is fed to a computer. In machine vision, two vital aspects are sensitivity, which is the ability of the machine to perceive impulses that are weak and resolution, the range to which the machine can distinguish the objects. The usage of machine vision can be found in signature identification, pattern recognition, and medical image analysis, etc.

Natural Language Processing(NLP):

 It is the interactions between computers and human language where the computers are programmed to process natural languages. Machine Learning is a reliable technology for Natural Language Processing to obtain meaning from human languages. In NLP, the audio of a human talk is captured by the machine. Then the audio to text conversation occurs, and then the text is processed where the data is converted into audio. Then the machine uses the audio to respond to humans. Applications of Natural Language Processing can be found in IVR (Interactive Voice Response) applications used in call centres, language translation applications like Google Translate and word processors such as Microsoft Word to check the accuracy of grammar in text. However, the nature of human languages makes the Natural Language Processing difficult because of the rules which are involved in the passing of information using natural language, and they are not easy for the computers to understand. So NLP uses algorithms to recognize and abstract the rules of the natural languages where the unstructured data from the human languages can be converted to a format that is understood by the computer.

IV. MACHINE LEARNING IN DETAIL

 Machine learning is a pat of artificial intelligence. **which enables the machine to automatically learn from data, improve performance from past experiences, and make predictions.**It consist of set of algorithm each has its own working principles and ideology.

Types of Machine Learning:

1. Supervised machine learning:

 As the name says, supervised machine learning is based on supervision. In this we train machine using “labelled” dataset and based on it , The machine produce the outcomes.

 There are two categories of supervised machine learning:

a.) Classification: This algorithm is used to solve problems and the outputs are categorised .some examples include email filtering, spam detection etc.

some of the classification algorithms are:

* Random Forest
* Decision Tree
* Logistic Regression

b.) Regression: This algorithm are used to solve problems which has relationship between input and output variables.

Some of the regression algorithm are:

* Simple Linear Algorithm
* Multivariate Regression Algorithm
* Lasso Algorithm
* Decision Tree

2.)Unsupervised:

 Machine Learning: In this, the machine is trained using the unlabeled dataset, and the machine predicts the output without any supervision.

 **The main aim of the unsupervised learning algorithm is to group or categories the unsorted dataset according to the similarities, patterns, and differences.**

Categories of unsupervised machine learning:

1. Clustering:

 Clustering is a fundamental concept in unsupervised machine learning. It refers to the process of grouping similar data points together based on their inherent characteristics or patterns, without the need for labeled data. In clustering, the goal is to discover natural groupings or clusters within a dataset. Clustering algorithms aim to partition data into subsets in such a way that data points within the same group are more similar to each other than they are to data points in other groups.

Some of the clustering algorithms are:

* K-means clustering algorithm
* Mean-shift algorithm
* Principal component analysis
* Independent component analysis

b.) Association:

 Association in the context of unsupervised machine learning typically refers to association rule mining, a data mining technique that aims to discover interesting patterns or relationships in large datasets. It falls under the category of unsupervised learning because it doesn't involve the prediction of a specific target variable or the use of labeled data. Instead, it focuses on identifying associations, correlations, and co-occurrences within the data.

Some of the association algorithms are:

* Apriori algorithm
* Eclat algorithm
* FP-growth algorithm

3.) Semi-supervised learning:

 Semi-supervised learning is a machine learning paradigm that combines elements of both supervised and unsupervised learning. In semi-supervised learning, the training data consists of a mixture of labeled examples (data points with known target values) and unlabeled examples (data points without target values). The goal is to use this limited amount of labeled data in conjunction with a larger set of unlabeled data to build a predictive model. This approach can be particularly useful when obtaining labeled data is expensive or time-consuming.

4.) Reinforcement Learning:

Reinforcement learning (RL) is a branch of machine learning that focuses on training intelligent agents to make sequences of decisions in order to achieve a specific goal or maximize a cumulative reward. In RL, an agent interacts with an environment, observes the outcomes of its actions, and learns to make better decisions through a trial-and-error process. It is inspired by behavioural psychology and is often used to model and solve problems in which an agent needs to learn how to make a sequence of decisions over time.

Some of methods in reinforcement learning:

* Positive Reinforcement Learning:

Positive reinforcement learning specifies increasing the tendency that the required behaviour would occur again by adding something. It enhances the strength of the behaviour of the agent and positively impacts it.

* Negative reinforcement learning:

Negative reinforcement learning works exactly opposite to the positive RL. It increases the tendency that the specific behaviour would occur again by avoiding the negative condition.

V. FUTURE OF AI/ML

1.) The future of artificial intelligence (AI) and machine learning (ML) holds tremendous promise and is expected to have a profound impact on various aspects of society, technology, and industry. While it's challenging to predict all the specific developments and outcomes, here are some key trends and directions that can be anticipated in the coming years:

2.) AI and ML technologies will become increasingly integrated into our daily lives, enhancing convenience, personalization, and efficiency in areas such as smart homes, voice assistants, and content recommendations.

3.) In healthcare, AI and ML will improve disease diagnosis, drug discovery, and personalized treatment plans, with advancements in medical imaging accuracy.

4.) Autonomous systems like vehicles, drones, and robots will continue to advance, making decisions and navigating complex environments with AI at the core.

5.) Education will see a revolution with AI-driven personalized learning experiences, intelligent tutoring systems, and adaptive educational content.

6.) Natural Language Processing (NLP) will advance, making conversational AI more natural and capable, impacting chatbots, virtual assistants, and content generation.

7.) Ethical and regulatory considerations for AI will gain importance as systems become more powerful and autonomous, emphasizing fairness, transparency, and accountability.

8.) AI will play a significant role in addressing environmental challenges, from climate modeling to sustainability efforts.

9.) AI will transform various aspects of business, optimizing supply chains, enhancing customer service, and aiding in decision support.

10.) The financial industry will see AI applications in risk assessment, fraud detection, algorithmic trading, and more, significantly impacting operations.

11.) AI-generated art, music, and content will become more prevalent, and AI will collaborate with human creatives in artistic fields.

12.) AI will address privacy concerns as it processes large datasets, leading to the development of privacy-preserving AI techniques.

13.) Quantum computing could accelerate AI significantly, solving complex problems much faster than classical computers.

14.) AI-driven drug discovery will expedite the development of new pharmaceuticals and treatments.

15.) AI will have implications for national security, including cyber defense, autonomous military systems, and surveillance.

VI. conclusion

 In conclusion, artificial intelligence (AI) and machine learning (ML) are poised to continue their rapid evolution, transforming various aspects of our lives and industries. The integration of AI into daily life, healthcare, education, and business will enhance efficiency and personalization. As AI technologies advance, they will play a pivotal role in addressing complex challenges, from climate change to drug discovery. However, ethical considerations and responsible development must be at the forefront, ensuring transparency, fairness, and accountability. Collaboration on a global scale, along with interdisciplinary efforts, will be essential in shaping a future where AI and ML benefit society, while addressing potential risks and challenges.

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