Smarter Artificial Intelligence with Deep Learning

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ABSTRACT

Deep Learning was made necessary by the erratic rise in large-scale computing power, the accessibility of enormous datasets, the development of learning methodologies, etc. Numerous deep learning frameworks have emerged as a result of the aforementioned fields' explosive growth. However, from the perspective of the user and developer, these frameworks have a number of inefficiencies.

Deep learning (DL) is a collection of varied techniques that allow machine learning to be creative and assist computers in using large amounts of text, image, and audio data. Deep learning algorithms allow massive volumes of data to be used to train deep networks. Deep learning can be used to model high-level abstractions in data using a collection of techniques.

Popular search engines like Google utilize deep learning in their speech and image recognition algorithms. Netflix and e-commerce sites like Amazon use deep learning to determine what products customers want to buy next, while MIT academics use it to make future predictions. As a result, deep learning has become increasingly important recently.

Key Words: Deep learning, Knowledge Representation, Artificial Intelligence, Automated Reasoning

1. INTRODUCTION

Machine learning is a subset of artificial intelligence, while deep learning is a subset of machine learning . Artificial intelligence, machine learning, and deep learning are comparable to a series of Russian dolls that are stacked inside one another and are worked out from smallest to largest. This type of learning is known as "matryoshka dolling."

One use of artificial intelligence (AI) that gives systems the capacity to automatically learn from experience and get better without explicit programming is machine learning.

Device, the creation of computer programs that can obtain data and utilize it to educate themselves is the main goal of learning. The science and engineering of creating intelligent machines is known as artificial intelligence. A subfield of computer science called artificial intelligence studies how to simulate intelligent behavior in machines.

2. ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND DEEP LEARNING

The ability of a machine to mimic or simulate intelligent human behavior is known as artificial intelligence (AI). AI will enable a machine to carry out a variety of tasks that currently need human intelligence, such as speech recognition, visual perception, decision-making, and language translation. Basically, all of these activities call for a number of "if-then" clauses. Large volumes of data are essentially combined with quick, iterative processing to create AI. The program learns automatically from patterns or features in the data by using clever algorithms.

Artificially intelligent computers are made for a variety of tasks, including problem solving, learning, speech recognition, and planning.

A computer's intelligence can be ascertained using the Turing test (Allan Turing). A computer is considered intelligent in the Turing test if it can trick an interrogator by performing at a level equivalent to that of a human in all cognitive activities (i.e., the mental action or process of obtaining knowledge and understanding through thought, experience, and the senses). The computer needs to have the following in order to pass the Turing test and be considered artificially intelligent:

- It uses natural language processing, or NLP, to successfully communicate in English or another human language.
- During an interrogation, information presented can be stored using Knowledge Representation (KR).
- Automated Reasoning (AR) to answer queries and derive new conclusions based on the stored data.

While all machine learning may be defined as artificial intelligence (AI), not all AI can be defined as machine learning. Thus, ML (machine learning) is a subfield of AI .For example, knowledge graphs, expert systems, rules engines, and symbolic logic are all forms of artificial intelligence (AI), but they are not machine learning. Machine learning differs from knowledge graphs and expert systems in that it can adapt to new data and change on its own. Because machine learning is dynamic, some changes can be made without the need for human interaction.

According to Tom Mitchell, "A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P if its performance at tasks in T, as measured by P, improves with experience E."

A variety of methods are used in machine learning to optimize a particular machine dimension. This is referred to as a machine's "learning" component.

Therefore, through machine learning, computers aim to reduce error or increase the possibility that their predictions will come true. We refer to this as an objective function, loss function, or error function. One can obtain a general understanding of the machine learning algorithm's value by looking at its goal function.

By creating a framework that multiplies inputs to make educated estimates about the nature of the inputs, error can be reduced. All that remains when the inputs and the algorithm are combined are different outputs or educated estimates.

The primary goal of machine learning is to develop algorithms that can take in input data, process it using statistical analysis, and forecast an output value that falls into a reasonable range. Similar to data mining and predictive modeling, machine learning involves processes that entail sifting through data to find patterns and appropriately correcting program operations.

Consumers that shop online at sites like Amazon, Flipkart, and others are aware of machine learning because of the products that are relevant to their purchases. The majority of sectors benefit from machine learning technology because it allows businesses to operate more profitably or acquire a competitive edge by gaining insights from the massive amounts of data they gather in real time.

Google makes extensive use of machine learning. For instance, when YouTube or Google Music recommends other movies or songs you might like. When sending emails, Google Inbox has a feature called "smart replies". Text translations that seem natural were produced by the new Google Translate premium using a neural machine translation technology.

When it comes to machine learning, deep learning is a subset of it .Deep reinforcement learning and deep artificial neural networks are other names for deep learning.

3. GET STARTED WITH DEEP LEARNING

The word "deep" is technical. It speaks about how many layers a neural network has. A deep network has multiple "hidden layers," whereas a shallow network just has one. Because simple features, like two pixels, recombine from one layer to the next to generate more complex features, like a line, multiple hidden layers enable deep neural networks to learn aspects of the data in a process known as feature hierarchy. In comparison to nets with few layers, nets with multiple layers undergo more mathematical operations on their input data (features), making their training process more computationally demanding.

Deep learning is known for its computational intensity, which is one of the reasons GPUs are needed for deep learning model training. Deep learning can be defined as a "field of study that gives computers the ability to learn without being explicitly programmed," in the same way that Arthur Samuel defined machine learning. However, one should also note that deep learning typically yields higher accuracy, requires more hardware or training time, and performs remarkably well on machine perception tasks that involve unstructured data, like text or blobs of pixels.

The idea of generalization distinguishes machine learning, AI, and deep learning, which is presently on the edge of our comprehension of AI.

Finding patterns, relationships, and invariants in (large amounts of) data is the goal of machine learning.

Prior to the development of artificial neural networks (ANNs), this was the area of focus: identifying and comprehending those previously unidentified relationships. By displaying generalizations in ways that were frequently not comprehended by deep networks, ANNs upped the bar for machine learning. Recent developments in deep learning raised it even higher by employing deeper networks with larger amounts of data, and they are being widely used by top tech companies like Google, Facebook, and others.

A. Examples of Deep Learning

Medical devices and autonomous driving are two businesses that apply deep learning technologies.

1**. Aerospace and Defense**: Deep learning is used to recognize items from satellite imagery that pinpoints interesting regions and determines whether an area is safe or dangerous for military personnel.

2. **Medical Research:** Deep learning is being used by cancer researchers to automatically identify malignant cells.

UCLA researchers developed a cutting-edge microscope that produces a high-dimensional data set that is used to precisely identify cancer cells using a deep learning program.

4. **Industrial Automation:** By automatically recognizing whether people or things are near an uncomfortable distance of machines, deep learning is assisting in enhancing worker safety around heavy gear.

5. DEEP LEARNING ARCHITECTURES

AlexNet, VGG (Visual Graphics Group) Net, GoogleNet, ResNet (Residual Networks), ResNeXt, RCN (Region Based CNN), YOLO (You Only Look Once), SqueezeNet, SegNet, and SegNet are the most significant Deep Learning Architectures.
Below is a brief overview of GoogleNet as an illustration:

A. GoogleNet

Google researchers created a class of architecture known as GoogleNet, sometimes known as Inception Network.GoogleNet emerged victorious in ImageNet 2014, demonstrating its potent model.

B. Depth

A flow graph is a graph that represents a computation, in which each node represents an elementary computation and a value (the computation's result applied to the values at that node's children). This allows for the representation of the computations involved in creating an output from an input. This describes a family of functions. Take into consideration the set of computations permitted in each node and potential graph structures. The input nodes are childless.No parents exist for output nodes.

C. Motivations for Deep Architectures

The following are the primary reasons to research learning algorithms for deep architectures:

- Inadequate depth can cause harm.
- There is a profound architecture in the brain.
- The mental processes appear profound.

6. CONCLUSION

Deep Learning is applied in the value and policy assessments of AlphaGo, a far more complex search algorithm, as a function evaluation component. Google combined beam searching and DL in their Gmail auto-reply system. In the future, more hybrid algorithms are expected rather than new end-to-end trained deep learning systems. Completely although research on deep learning is exciting, hybrid systems will work better in application areas for the time being.Deep Learning (DL) architectures and algorithms have achieved remarkable strides in speech processing and picture recognition over the last several years.Although their use in Natural Language Processing (NLP) was first less spectacular, it has since shown to make a substantial contribution and produce state-of-the-art outcomes for some typical NLP tasks.

6. REFERENCES

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