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APPLICATIONS OF DEEP LEARNING AND MACHINE LEARNING: A VISION

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Abstract:
Machine learning is an application of artificial intelligence that is now being discussed in the world of computers and in relation to the COVID-19 pandemic. Many contributions have been made by researchers to improve the accuracy of machine learning algorithms, and a great deal of work is being done quickly to increase machine intelligence. Learning is a basic human behavior process that also plays a crucial role in machines. In addition, a different deep learning concept starts to take center stage. A subset of machine learning is called deep learning, or deep neural networks. Although deep learning has been studied and applied in a number of contexts with impressive outcomes, further research in this area is necessary to support future practical uses. This paper's primary goal is to offer an insight survey for machine learning in addition to deep uses for learning in many fields. Certain applications have the new standard COVID-19 blues as well. A survey of recent and ongoing machine learning and deep neural learning applications across several fields is provided, including examples.

Keywords: *Deep neural learning (DL),Machine Learning (ML),Machine intelligence (artificial intelligence-AL)*

1. Introduction

Fig. 1 illustrates machine learning, a subclass of artificial intelligence. The system learns from its experience because it is self-learning and is built on algorithms. For example, the kind of data that is sent into the system helps it identify patterns and responds to those patterns at the output. In this instance, the system learns over time and becomes the smartest without human input. It makes use of a statistical learning algorithm that gains knowledge and gets better on its own without human assistance. Conversely, a deep learning system gains knowledge not only from its incoming data but also from its vast database. The broad field of artificial intelligence is the creation of intelligent machines. Machine learning is a major component of artificial intelligence development because intelligent behavior requires a great deal of information or understanding. Technology never stops

trying to mimic human intelligence, which is why artificial intelligence has greatly now pay attention. Since the 1950s, the majority of computer scientists have focused on machine learning. As a result, as deep learning efforts continue in this direction and have garnered significant attention due to the COVID-19 outbreak, expectations from machines are rising [1].

Face recognition is one of the many applications that has acquired in the world without touch since it gives people a greater sense of authenticity because each person's face is different. Furthermore, a lot of businesses are switching to using machine learning technology to improve their systems during and after the COVID-19 pandemic, including the health sector, face recognition attendance systems, banks with face ageing and face recognition, retailers, travel, airports, Amazon Alexa, Google Home for voice help, YouTube, Netflix for recommendation systems, search engines for a translator, and many more [2, 3].

2. Approaches in machine learning

As illustrated in Fig. 2, ML algorithms are classified into three groups for wide classification: supervised, unsupervised, and reinforcement learning. Supervised learning makes use of an algorithm that needs outside assistance. Training and testing datasets are separated in the input database that is provided. The training database is used to forecast or categorize the output variable. During the database's training phase, algorithms attempt to identify certain shapes. They then apply these patterns to the database's testing phase, yielding estimation results [4].

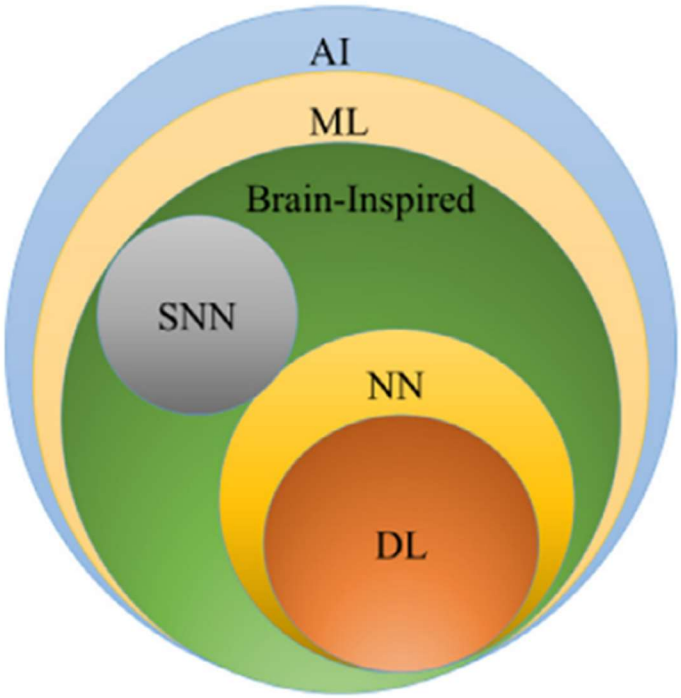

Fig. 1. Shows the correlation between artificial intelligence (AL), machine learning (ML), and deep learning (DL) [34].

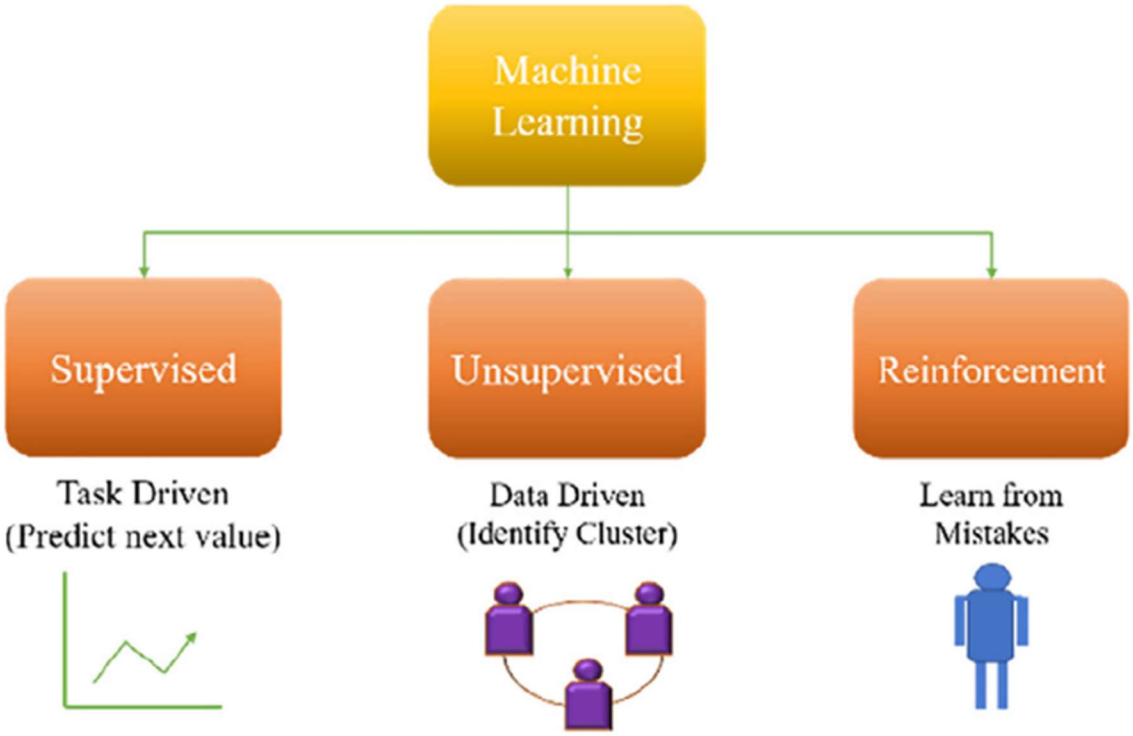

Fig. 2. Machine learning approaches [4].

B An algorithm for machine learning that picks up certain traits from input data is called unsupervised learning. It uses previously learnt characteristics to identify the class of data after supplying a fresh database. The main use case for it is feature reduction required for grouping.

C Action-based decision-concept learning is known as reinforcement learning. Actions in this learning process are determined by the decisions made in order to increase the value of the output or desired favorable situation. The student, however, lacks any prior knowledge of the data. Once the scenario is provided, it gains the ability to determine the appropriate course of action based on the supplied circumstances. The learner's choice, or action, has an impact on the circumstances both now and in the future. Reinforcement learning is only possible under these two circumstances:

3. Overview of machine learning

Arthur Samuel, a pioneer in artificial intelligence (AI) and computer games, contributed to the evolution of machines in 1959 by coining the term "machine learning." Prior to then, the most popular computer-based chess game. Turing and Chambernowne designed a paper-and-pencil program in 1948. Subsequently, Dietrich Prinz unveiled his innovative chess playing system in 1951. Christopher Strachey developed the first draughts method in 1952. The draught session

proceeded at a good clip. Nilsson wrote a book on machine learning using pattern categorization in the 1960s. Duda and Hart noted in 1970 that pattern classification remained popular.
In addition, neural networks on computer terminals started learning 40 characters in 1981. Neural network scientists Hinton, Nielsen, Rumelhart, and Williams Hetch presented the multilayer perceptron (MLP) with useful backpropagation (BP) training in 1985 and 1986, respectively. As approaching Deep learning, a new era of neural networks, has emerged in the modern period. In 2005, researchers Andrew Ng, Hinton, Bengio, LeCun, and several others started the third wave of the neural network's development.

3.1. Applications of machine learning

Several machine learning-related application sectors and subfields have been demonstrated in the literature. The following is a list of the practical uses. as seen in Figure 3. Machine learning's broad field of computer vision teaches computers how to interpret, analyze, and recognize visual input. Key algorithms in computer vision include KNN, SVM, and Naïve Bayes. This field's subdomains include object detection, object processing, and object identification.
Owing to the COVID-19 epidemic, modern technologies like facial recognition and iris scanning are in high demand right now because fingerprint authentication does not comply with distance standards. The face recognition with ML feature for banks and Aadhar cards in India will be helpful.
Applications for handwritten recognition simplify labor for businesses with a lot of handwritten paperwork. For instance, colleges, testing facilities, law enforcement, etc. Documents can be scanned and digitalized in a matter of minutes. The technique of converting spoken words into writing is called speech recognition. It is helping to increase accessibility and is beneficial for the military, healthcare, automobile systems, and the creation of speech interfaces and voice assistants for daily use. Speech to text and automatic speech recognition are other names for speech recognition. Artificial neural networks, vector quantization, and dynamic temporal wrapping are a few of the algorithms that are employed. The forward translation of Indonesian informal to formal language using semi-supervised learning is provided by Wibowo, H. et al. 2020 [7], who also demonstrate an improvement in the translated results.
Through investigation, specialized algorithms in the medical field may precisely identify human variation. It has the ability to simultaneously identify several factors and process them for real-time applications involving medical information. Furthermore, statistical analysis of medical records is demonstrating its value as a benchmark.
Machine learning can be used to make predictions based on past data. Numerous uses, including marketing efforts, scientific research, stock price forecasts, and many more. Predictions are typically made using random forest techniques and artificial neural networks. Text classification, picture classification, medical diagnosis, etc. are some of its numerous sub-domains.
The banking and financial industries are among the most advantageous areas for machine learning, as there is a greater likelihood of fraud detection in the event that financial transactions become digitized. The discovery of unusual behavior, credit ratings, and trends in customer transactions

serve as the foundation for fraud detection and prevention. For the most part, classification and machine learning regression techniques in addition to neural networks are employed in scam identification. In order to detect credit card fraud, auto encoders using Tensor Flow and Keras are being developed. This technology saves a significant amount of money for cost recoveries and insurance for financial institutions.

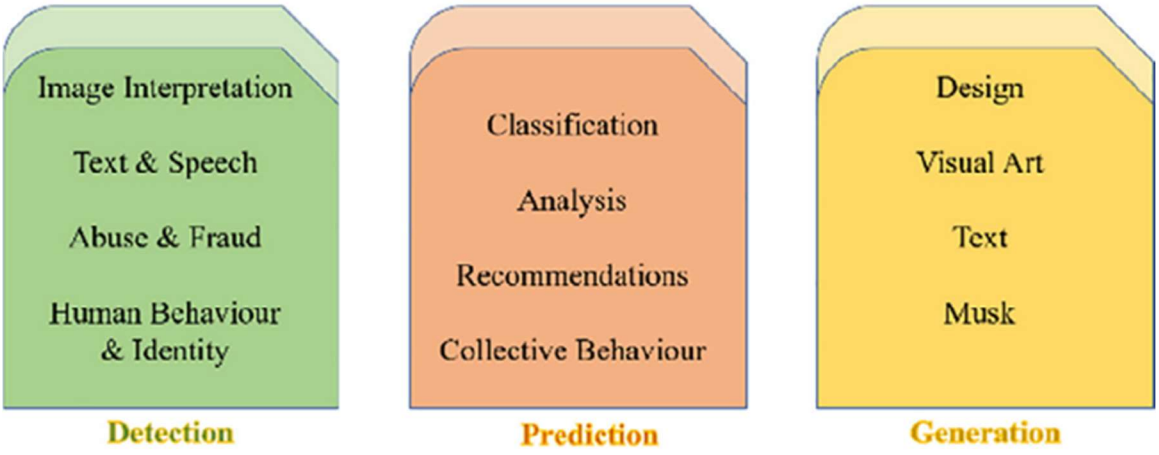

Fig. 3. Applications of machine learning and deep learning.

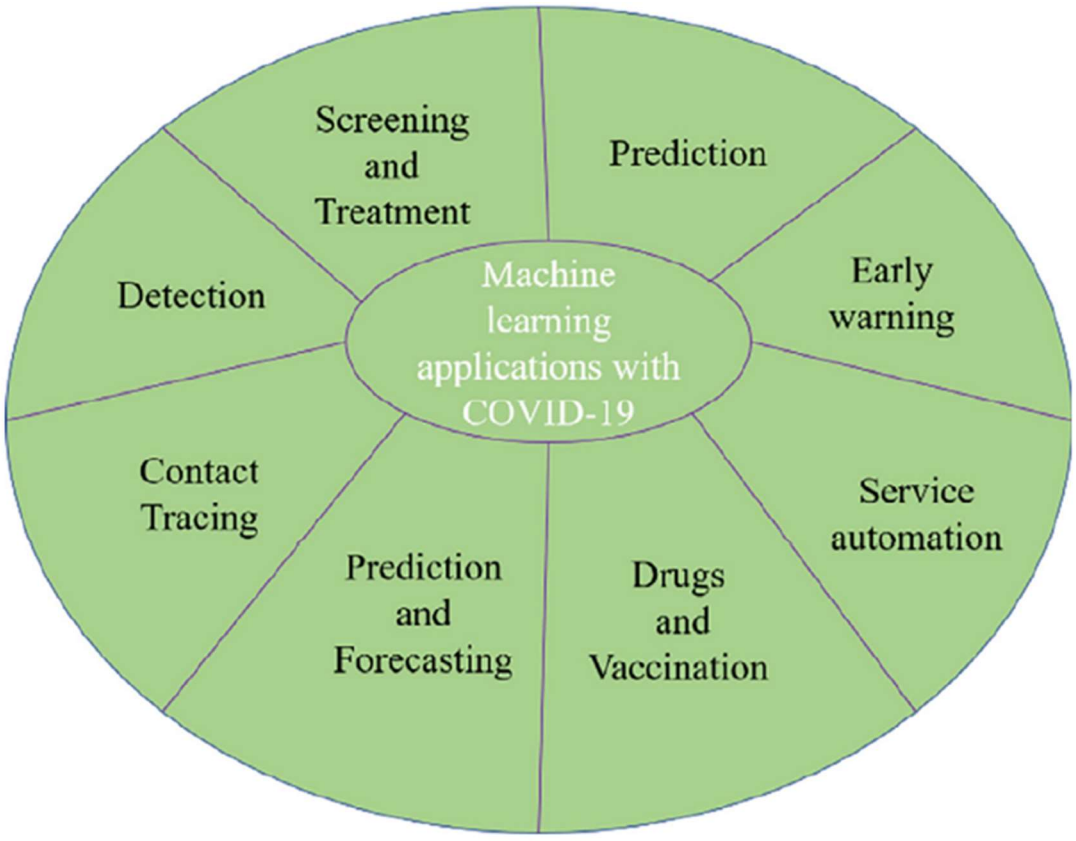

Fig. 4. Machine learning applications with COVID-19.

3.2. For machine learning applications related to COVID-19

Making a diagnosis, determining who is most vulnerable, learning more about viruses, forecasting the disease's progress, mapping the virus's origins, finding helpful medications already on the market, and creating new medications. The critical duty completed by machine learning, as illustrated in Fig. 4, is predicting the next pandemic at the fastest pace possible.
In COVID-19, machine learning is utilized to predict infection. The rapid global spread of this pathogen necessitates international response. As a result, ML may be used to forecast how new situations would behave. stop the disease from spreading while mathematical models for learning and analysis are taught to the machines through machine learning. An intriguing pattern can be found once the system has been trained. Researchers Li et al. [8] created a machine learning prediction model to identify cases that have been reported worldwide and in China, and Kumar et al. [9] used the autoregressive integrated moving average (ARIMA) model to forecast the spread of the coronavirus in the 15 most afflicted nations. Using CNN, Huang et al. [10] demonstrated the CNN model's efficiency in comparison to the MLP, LSTM, and utilized the susceptible exposed-infectious-recovered (SEIR) and regression models statistical methods to assess and predict the COVID-19 distribution in India.

Machine learning is an amazing subfield of artificial intelligence that is constantly and valuablely contributing to technological advancement. When included, it has simplified several advances and produced numerous useful applications across a wide range of industries.

4. Deep learning review

Machine learning's subclassification of deep neural networks. It is a network model where the neurons have multiple layers and parameters. between the two parameters, input and output. DL employs an architecture based on neural networks. hence the term "deep neural networks." With DL, characteristics can be automatically learned and represented at several levels in a hierarchical fashion. In other words, the deep learning entire architecture is employed for the feature extraction and modification process. This robustness of deep learning is due to its powerful process, which sets it apart from traditional machine learning methods.
The lower layers handle input data in a straightforward way or learn the easy features; the output is then sent to the upper layers for learning complex features. Deep learning is therefore appropriate for handling more complicated and large-scale data [12].

4.1. Background

The Turing machine built by connecting the neurons was demonstrated by McCulloch & Pitts (1943) [13]. Rosenblatt [14] shown in 1958 that the perceptrons would overlap if the information they were trying to learn was capable of being voiced. The limitations of perceptrons were first

described by Minsky and Papert in 1969 [15], who suggested stopping research on neurons after at least ten years of operation. After then, the back-propagation technique was introduced by Geoffrey Hinton et al. (1985) [16]. Subsequently, in 1988, a hierarchical neural network known as Neocognitron [17] demonstrated proficiency in visual pattern recognition. Additionally, Yan LeCun examined back propagation using CNN for document analysis in 1998 [18]. Subsequently, the Hinton laboratory resolved the DNN training problem in 2006 [19,20]. Between 2012 and 2020, a deep learning algorithm has become more and more developing in various domains.

The necessity of using DL

These days, DL is used in practically every industry. As a result, this approach is commonly referred to as a universal learning approach. DL is employed in There are many scenarios in which machine intelligence can be useful, including navigation on Mars in the absence of a human expert, vision, speech recognition, language understanding, biometrics, and customization of solutions for specific conditions.

A universal learning approach: Since the DL method is proven to be a helpful methodology in practically every application sector, it is now sometimes referred to as universal learning.

B Precise design features are not necessary for robust deep learning approaches. Rather, its robustness comes from its autonomous learning process that represents the optimal characteristics for any given task.

C The generalization of the deep learning approach allows for the use of the same DL technique to a variety of datasets and applications. Another name for this approach is transfer learning. Additionally, this approach helps when there is a lack of data to solve the problem.

D The data and computation scalability of the DL approach is very high. Microsoft developed ResNet, a deep network that was used at the supercomputing scale [21].

In addition, there are many more difficulties with DL, such as big data analytics. In this context, a survey was carried out by [22]. The author of the research described the benefits of using deep learning with big data and discussed the various principles like velocity, volume, and validity of big data. [23, 24]. Causal learning is addressed by DL methods' scalability, their capacity to generate meaningful data in situations where sufficient information is unavailable for system learning, such as in inverse graphics, computer vision tasks, mobile intelligence, energy-efficient techniques, FPGAs, and many other applications.

Up to this point, DL researchers have encountered all of the aforementioned difficulties. Conventional machine learning techniques demonstrated superior results with less data input. While the performance of DL approaches grows with increased data, that of traditional machine learning methods becomes stable after exceeding a threshold.

The main drivers behind deep learning's present acceptability include the development of machine learning initiatives, more affordable computer hardware, and expanded chip processing capabilities like GPU units. [25] GPU accelerates research since deep learning requires high-speed evaluation due to the vast amount of information. A larger dataset also necessitates a speed increase, which moves the GPU to a TPU (Tensor Processing Unit) and ultimately to HPC (high-performance computing/supercomputing), which handles the computational advances in terms of both software and hardware that will enable deep learning to be scaled up.

Every combination of weights can be stored as a matrix (m, n) on a GPU. GPUs are useful for solving common issues more quickly when solving them in parallel. Moreover, similar computations can all occur simultaneously. This greatly increases the efficiency of parallel computing.
A number of businesses have embraced new technologies in response to the COVID-19 pandemic, heavily investing in machine learning (ML) and deep learning (DL) methods to improve consumer communication, analysis, and prediction. American Express, for instance, established an AI and DL lab at IIT Madras, Prato is a medical software that leverages AI, the financial sector, modern security systems, and utilizing numerous enterprises to create a new normal during COVID-19. due to the fact that many businesses see artificial intelligence as a planned opportunity.

4.2. Applications of deep learning

Deep learning is used in big data for MAVIS-Microsoft voice recognition. Human voices and talks are helpful in this learning process. the audio and video file search. [26] Google has also implemented deep learning in the big data environment for image search, which facilitates picture understanding and makes image labeling, indexing, and annotation simple. Google's program, which can categorize photos and create bizarre and artificial artworks based on its expertise, is a deep fantasy. Furthermore, Facebook's announcement of deep text is also an artificial intelligence setup. This machine uses a deep learning-based method to comprehend language and can classify enormous amounts of data. It can also provide different related services, such cleaning spam messages and identifying handlers chatting messages.

DeepMind artificial intelligence is being used by Google Maps to estimate arrival times, and PSUs are using this technology for cybersecurity in light of the new normal COVID-19 blues breakout. In 2020, Beattie and colleagues [27] introduced DeepMind Lab2D, a simulator that offers a scalable setting for studies on artificial intelligence. Google and Improbable work together to use augmented reality (AR) to replicate the real environment. For instance, an enhanced navigation system overlays the path on top of the real-time view of the road using augmented reality (AR). Ground personnel at Singapore's airport utilize AR glasses to display more information about cargo containers and expedite load times.

The largest obstacle facing parents and the country in the future will be identifying and treating developmental delays in children. A computer system developed by MIT researchers is able to recognize language in addition to speech issues even prior to kindergarten. Children with autism, developmental disabilities, and speech difficulties have obstacles in living a fulfilling life. Physical, emotional, and mental health are just a few of the wonderful results that can result from early stage analysis and its treatment.
Amazingly, Photo Descriptions has made use of deep learning techniques. Rather than creating a statement that describes every aspect of the image, Andrej Karpathy and Li Fei-Fei worked on deep neural network training to identify several fascinating zones in the image. Computers typically operate automatically categorize pictures. Take Facebook and Google Photos, for instance. Deep learning techniques have demonstrated the ability to restore critically deteriorated vintage images (Wan, Z. et al., 2020 [28]).

The concept of zooming in videos was made possible by deep learning and pixel restoration or pixel recursive super resolution. In 2017, Google researchers trained a deep learning network with incredibly low-resolution face photos in order to predict a person's face using such photographs.
The CNN and LSTM-equipped recurrent neural network adds sound to silent films or videos. To select the suitable noises, a dataset of pre-recorded sounds is synchronized with the video frames. for a certain scenario. As a result, it indicates if the sound is real or artificial and also provides a Turing-test setup for good results. A dynamic sky replacement and deep learning-assisted video harmonization are presented by Zou, Z. 2020 [29].
The hardest things for a human to learn are the complexities of language, which include syntax, tonal nuances, semantics, and expressions. Natural language processing (NLP) is attempting to reach the best possible level with the use of deep learning. of achievement. While SVM and logistic regression required a lot of time, results from CNN, RNN, and reinforcement learning are now significantly better. A new toolset is offered by Ramamurthy, R. et al. 2020 [30] for the assessment of reinforcement learning on NLP tasks.
Autonomous AI-equipped cars are the new thing. Uber's AI lab is developing various intelligent features for driverless vehicles. According to Forbes, MIT is working on creating a system that would enable autonomous vehicles to navigate without a map. Due to its ineffectiveness un preventing accidents, 3-D mapping is still prohibited in several of the world's most important areas. The open-source "scalable multi-agent reinforcement learning training school for autonomous driving," or SMARTS, was created by Zhou, M. et al. 2020 [31] and aids in teaching users how to use accumulating varied road user behavior model.

4.3. Applications with COVID-19 for deep learning

Deep learning is utilized in X-ray diagnosis to examine the body part that is impacted, such as lung ailments, tumors, fractures, and traumas. [32, 33], ResNet-50, Inception-v3, and Inception-ResNet-v2 models based on CNN utilized by Narin et al. [32] to predict COVID-19 patients with chest X-ray pictures and found that ResNet-50 had the highest detection accuracy (98%). Furthermore, by using chest X-ray pictures for feature extraction, a deep learning algorithm and

support vector machine (SVM) are employed to classify the image as healthy or sick. A 95.38% accuracy was attained with ResNet50 and SVM using a variety of deep learning models, including Inception-v3, AlexNet, VGG16, Inception-ResNet-v2, VGG19, ResNet-18, ResNet-50, GoogLeNet, ResNet-101, DenseNet201, and XceptionNet. In 1972, Godfrey Hounsfield and Allan Cormack created the CT scan. Using X-ray technology and deep learning, the CT scan diagnosis method meticulously diagnoses inside organs that are sensitive [30, 34]. A CovidGAN is presented by Waheed, A. et al. 2020 [35] for enhanced Covid-19 detection.

5. Discussion

Many uses, including deep learning techniques, computer vision, natural language processing, semantic analysis, and machine learning-based prediction fields. The newest field to use deep learning is ECRM (electronic customer relationship management). The primary objective of utilizing GPU (Graphics Processing Unit) hardware in deep learning feature engineering and data dependencies. Data dependencies refer to systems that handle vast volumes of data. The capacity of DL to extract high-level properties from input data—a process known as feature engineering—sets it apart from ML. As a result, deep learning is developing and will likely find new uses in a number of fields. According to Andrew Ng's Quora post, "deep learning is having a significant impact on and expanding quickly in a number of fields, including consumer finance, medicine, and precision agriculture."

6. Conclusion

Machine learning uses a collection of algorithms to analyze and comprehend data, draw conclusions from it, and then make the best decisions possible. For deep learning, the system is dependent on artificial neural network layers. Comprehensive analyses of machine learning and deep learning are presented, along with their various applications. These days, machine learning is being used by everyone, either directly or indirectly. From getting product recommendations when shopping online to updating photos on social media platforms. The evolution, salient characteristics, shared characteristics, and distinctions between deep learning and machine learning are also explained. That tells us that there is a new scope of deep learning with various applications that can produce remarkable results in the future. As research is a continuous process, a new architecture may also evolve.

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