Deep Learning Applications and Their Worth: A Short Review

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ABSTRACT— *Deep learning has become a favoured trend in many applications serving humanity in the past few years. Since deep learning seeks useful investigation and can learn and train huge amounts of unlabelled data, deep learning has been applied in many fields including the medical field. In this article, the most noteworthy applications of deep learning are presented shortly and positively, they are image recognition, automatic speech recognition, natural language processing, drug discovery and toxicology, customer relationship management, recommendation systems and bioinformatics. The report concluded that these applications have a significant and vital role in all areas of life.*

Keywords—Deep learning, Machine Learning, Applications, Artificial intelligence, Analysis.

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1. INTRODUCTION

Deep learning or otherwise known as deep structured learning or hierarchical learning, is a section of machine learning that relies on a pack of techniques that skillfully seek to design high-level abstract models in data and perform many functions, including prediction, diagnosis, null value analysis and giving effects that support experts take the judgment [1-7]. Figure 1 illustrates the difference between machine learning and deep learning in object analysis. The architecture of deep learning is inspired by artificial intelligence that simulates the deep learning process and sensory layers of the human brain in learning from past experiences and making the decision to solve a specific problem that may encounter a machine [8-12]. In addition, deep learning techniques aim to automatically extract features from data and abstractions and identify the most critical data required [13-16]. These techniques are practical when it comes to dealing with large amounts of unsupervised data, learning to represent data naturally, and pursuing goals in data classification and decision-making with high accuracy [17-20].

In recent decades, many researchers have been able to apply deep learning techniques in many activities, including its application in the classification of medical images [22-24]. The major objective of this article is to design a simple review of the most vital applications of deep learning and what role they play in the scientific community.
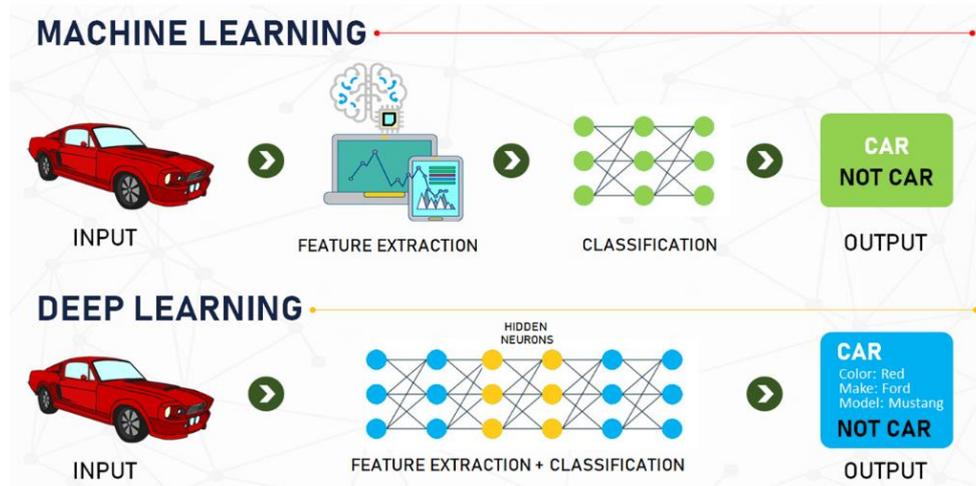
Figure 1: The difference between machine learning and deep learning in object analysis [21].

2. APPLICATIONS AND EXPLANATION

In this section, the most noteworthy applications of deep learning will be discussed with a straightforward discussion of the significance of these applications and how they are utilised in the service of humans. Figure 2 illustrates the work of deep learning in classifying a medical image and determining whether a person has a benign or malignant disease.
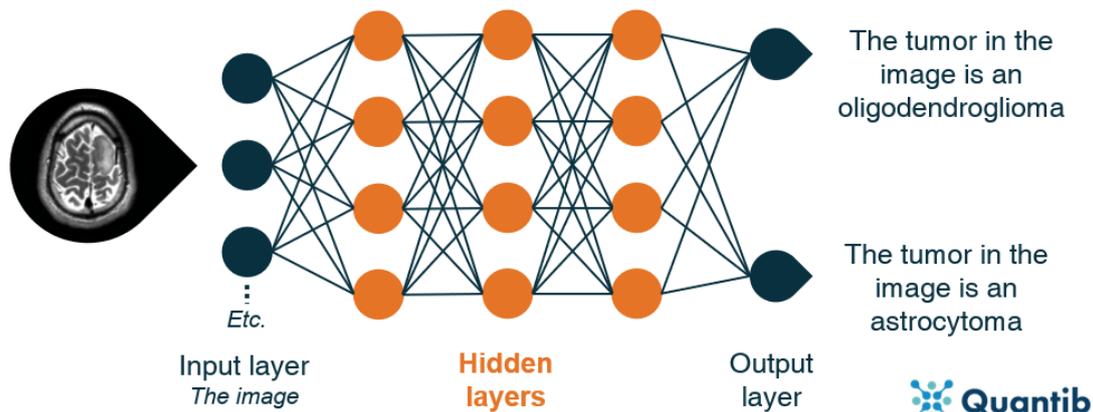
Figure 2: The work of deep learning in classifying a medical image [25].

2.1 Automatic Speech Recognition

Moreover, it has the ability to manipulate the voice, recognise the meaning of words in all languages of the world and follow accordingly, for instance, executing commands to perform a predetermined operation through the voice. This technology is seen in many devices, including the most popular smartphones. This simple explanation of technology contains complex challenges that have required major technological advances. In order for a machine to truly "understand" what a person is saying, there are phonemic, linguistic, and arithmetic issues involved that are implemented in the devices.

We can point out four basic phases in the operation process of a voice recognition system:
- Audio capture: the system detects voice activity, the difference between silence and noise, and converts it into ones and zeros.
- Analysis and parameterization: the system differentiates units of meaning (phonetic, lexical, semantic).
- Identification: In a retroactive process, the system identifies those units and produces a result (executes an order).
- Response: The system is capable of giving a response based on its programming and machine learning.

2.2 Image Recognition

Image recognition is a process performed by an artificial intelligence program capable of recognising images using complex mathematical algorithms. Artificial intelligence is able to identify, analyse and compare the arrays of bits that make up the digital image, with the aim of performing specific actions based on the information obtained. Thanks to image recognition, it is possible to automate some tasks that require a significant investment of time and resources for humans. Moreover, it is able to identify people, places, objects and any other element present within the image. The number of its applications is increasing over time, and it is expected that it will continue to do so in the future, thanks to the continuous development of artificial intelligence. Image recognition is also supported by machine learning and deep learning, two aspects of artificial intelligence that allow machines to learn while analysing images. The more images they process, the more they refine their results and get better results.

2.3 Natural Language Processing

Natural language processing is an application of deep learning that deals with communication whereby a computer can be programmed to understand and generate language like a human being. In short, it is the ability of computer systems to read and translate words into the language of the person using the computer. This technology can generate a natural language, such as the language used by humans; for example, if the person's mother tongue is Arabic and the website is in English, then this technology plays a major role in transforming the language of the website into Arabic directly without human intervention in that. In addition, this technology can understand vocabulary, pronunciation errors, misspellings, and other language variables. Newly, deep learning methods have been successfully involved to a variety of language and information retrieval applications. By exploiting deep structures, deep learning techniques can discover from the training data the structures and features hidden at various levels of abstraction that are proper for any task [26-28].

2.4 Drug Discovery and Toxicology

A deep learning model quickly predicts the three-dimensional shapes of drug-like molecules, which could speed up the drug discovery process. In their quest to discover effective new drugs, scientists are looking for drug-like molecules that can bind to disease-causing proteins and change their functionality. In the recent period, the pharmaceutical industry market witnessed significant development and companies began to turn to artificial intelligence techniques to help them in the search for new medicines that serve humanity. The goal is to use modern supercomputers and learning systems to predict the behaviour of molecules and how likely they are to make valuable drugs, saving time, money and testing. Also, deep learning has proven its ability to turn anything that appears on computer screens into reality, as the process of creating drugs and vaccines has become an important issue for healthcare workers and doctors. For illustration, as happened in the production of COVID-19 vaccines [29], which saved many inhabitants of this universe, where machine learning and deep learning techniques had a significant role in achieving proper vaccines and saving many lives.

2.5 Customer Relationship Management

The practice of customer relationship management activity seeks to collect, manage and apply data and support intelligent resolutions to develop long-term relationships and experience creating systems that help manage data transfers. In addition, the data brought from all contact points with clients and customers can be used, where if it is managed in a very acceptable manner, it will support organisations in creating customised marketing responses, making very cool and new ideas, and designing professional products and services. In other words, it will provide high value to customers and gain a competitive advantage that puts the organisation in the forefront [30-39].

2.6 Bioinformatics

Bioinformatics is one of the scientific specialisations that has had the most prominence and projection in recent years, something that is becoming even more seeable this year 2020 with its fundamental work in the management and interpretation of data on COVID-19. Its work consists of researching, developing and involving a computer and computational tools to allow and enhance the handling of biological data, thanks to the use of tools that gather, store, organise, analyse and will enable the interpretation of these data. In addition, the involvement of bioinformatics in the resolution of human pathologies in the clinical context has led to the emergence of a new discipline, Clinical Bioinformatics, a multidisciplinary speciality in which specialists in molecular biology, genetics, computer science, and mathematics. The explosion of Bioinformatics as a vital discipline in many domains such as Biomedicine, Agriculture, Medical and others has led to a significant increase in the demand for professionals and has led to integration into new environments. This has demonstrated the need to generate training pathways for bioinformaticians, such as the new degree in Bioinformatics or the different postgraduate training masters linked to various public and private universities throughout the national territory.

2.7 Recommendation Systems

Recommendation systems are a very necessary and valuable application in the sea of electronic commerce that constantly seeks to meet the needs of the customer in order to reduce a great effort to the customers. Engines and applications work on recommendation engines to get rid of the tyranny of choice and facilitate the way to making the appropriate decision and developing sales processes on the Internet. In addition, deep learning techniques seek to penetrate everywhere in e-commerce and create ways that make online shopping very cool, boring and time-consuming. For illustration, 80% of content watched on Netflix, and 60% of videos on YouTube are reached from recommendations (see Figure 3).
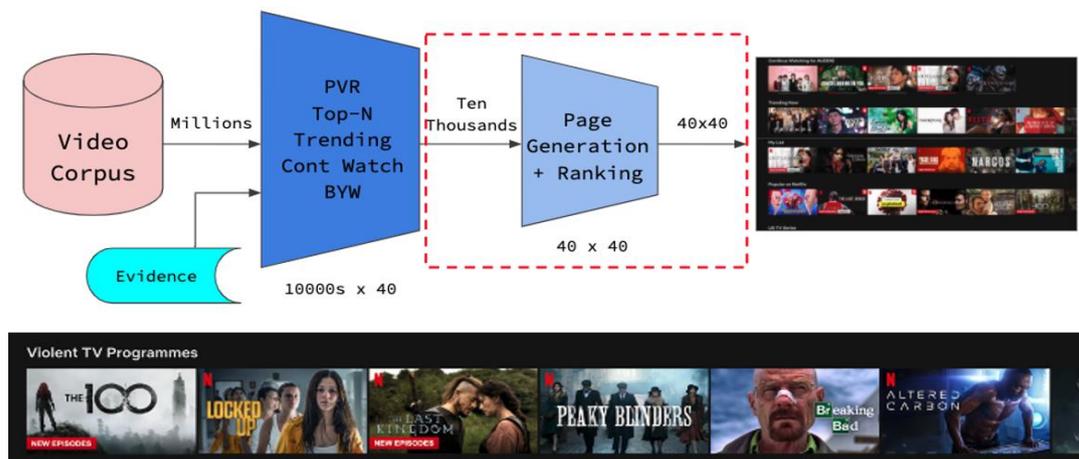
Figure 3: Netflix's model workflow [40].

3. CONCLUSIONS AND FUTURE WORK

Deep learning techniques have proven to have a significant and effective role in many areas, as they help specialists and clients to determine their choices, reduce effort and time, and help in decision-making. In addition, these techniques are still under development and improvement, and you need complete knowledge of them, so they cannot be easily applied beyond training on them. In fact, artificial intelligence is a science that is not satisfied with a certain limit of development but always likes to discover something new that can be learned and trained on: the more data, the more significant the machine's ability to think and make the right decision. The goal of this article is to present the most important applications of deep learning that have grown significantly in the recent period, and which will have a significant role in the future for readers to benefit from in conducting scientific research on them. In the future, more literature will be conducted on the importance of deep learning technologies and applications.

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