

Comparison between Expert Systems, Machine Learning, and Big Data: An Overview

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ABSTRACT— *Today, the science of artificial intelligence has become one of the most important sciences in creating intelligent computer programs that simulate the human mind. The goal of artificial intelligence in the medical field is to assist doctors and health care workers in diagnosing diseases and clinical treatment, reducing the rate of medical error, and saving lives of citizens. The main and widely used technologies are expert systems, machine learning and big data. In the article, a brief overview of the three mentioned techniques will be provided to make it easier for readers to understand these techniques and their importance.*

Keywords— Artificial Intelligence, Expert Systems, Machine learning, Big Data, COVID-19.

1. INTRODUCTION

Artificial intelligence [1-3] is a computer-based system that simulates and understands human users' thoughts and behaviours [4]. In the modern era, many studies are being conducted on the similarity between the mind of the computer and the mind of humans and how to transform the mind of a human being into a machine to be employed in many fields [5]. In other words, the science of artificial intelligence tries to make an intelligent system and expand the fields of science and scientific research to make the machine work in the place of the human in making accurate decisions [6][7]. Moreover, it has become essential to expand and develop artificial intelligence and convey its ideas to all societies and how to benefit from it in any field. One of the most influential parts of artificial intelligence is machine learning [8], which continues to shape learning systems for devices. In addition, artificial intelligence endeavours to solve a problem intuitively within its mathematical and logical techniques [9][10]. For instance, artificial intelligence with learning technology allows the user to understand to play an online game on their own, realise the error the technology has made in the system every time a player loses the game, and move forward without repeating it in the next round, allowing this to solve the game entirely. The point is that computers and artificial intelligence have a place in human life to develop the skill of thinking and achieving daily tasks. Artificial intelligence is characterised by not repeating its mistakes in the following situation by recognising its mistakes like humans [11][12]. Still, it differs in terms of interactive features and access to the required solution. Fortunately, artificial intelligence techniques have human-like reactions to every situation [13].

The main contribution of this article is to provide a short and general overview of the three techniques (expert systems, machine learning and bigdata) so that readers can understand these techniques and how they are utilised in research work using these techniques. In Section 2, the three techniques will be discussed, and Section 3 concludes the article.

2. THE TECHNIQUES

2.1 Expert systems

Since time immemorial, humanity has attempted to understand the universe and nature. However, people continue to discover new intelligent and effortless ways to make their lives easier to do their jobs. Artificial intelligence is one of the critical concepts increasingly employed in various fields today, appears due to the increasing need of humans for its technologies [14][15]. Expert System is a sub-branch of artificial intelligence [16][17]. Also, it is a computer system that utilises the ability and skills of one or more professionals to solve a specific concern [18][19]. Moreover, these systems are consulting computer programs that seek to simulate the mind of experts in solving some specialised problems related to the field they are dealing with, which always leads to information-based operations [20-22]. In short, they are computer programs that can solve any concern in a particular field in the same way that experts do. In fact, the origin of expert systems is the method implemented to automatically carry out the process of processing the information of human intelligence by the machine [23]. To do this, the knowledge and experience of experts must be transferred to the computer and kept by the computer. Thus, these systems utilise the information in the knowledge base to solve the concern that is handled with a structure similar to the human decision-making process. Expert systems also supply information about the 'how' and 'why' they came to the judgment they obtained while solving the concern. In addition, expert systems take a hierarchical approach to problem-solving [24][25]. These systems are characterised by combining a minimum level of knowledge and experience from different decisions. Thus, combining information from different decisions expands the expertise available to solve the concern under thinking. Expert systems are first designed as a sub-branch of artificial intelligence in the 1960s for use in disease diagnosis problems in medicine in order to deal with complex concerns [26][27]. Today, expert systems are applied in diagnosing, monitoring, analysing, counselling, planning, explaining, learning, narrating, giving ideas and many more. In addition, in the absence of experts, it is aimed at quickly and accurately solving problems by increasing the efficiency of work and the quality of decisions made. The main components of expert systems are: knowledge base, user interface and inference engine.

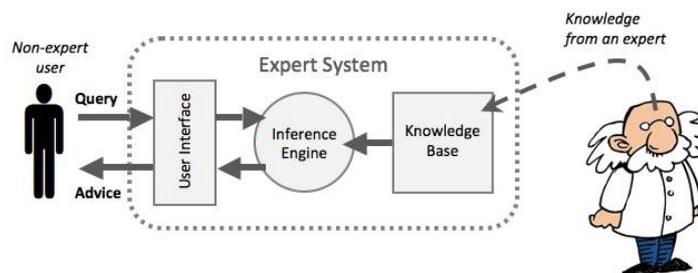


Figure 1. General structure of expert systems [downloaded from Google].

From Figure 1, it is exhibited that expert systems can describe and keep information in a particular way and form. The knowledge base contains information that is already known. In order for expert systems to transfer the acquired experience to the computer, the information provided must be written in the required format. At the same time, a user interface consists of a database and a database of rules. It takes advantage of the rules in the rule base to present expert knowledge to the user using the available data. The third part is the inference engine is the station in which the appropriate answers to the question posed by the user are generated employing the information in the knowledge base. Indeed, expert systems have the adequate ability to communicate closely with the user and only receive information about the actual situation from the user. This mechanism is accomplished through the user interface. In addition, the information is processed in the inference engine and the extracted results are transmitted to the user through the user interface. Moreover, expert systems can also have self-development features if they are correctly designed.

2.2 Machine learning

Machine learning is a set of techniques designed to solve a specific issue according to the evidence got from the problem environment [28-30]. By glancing at a large collection of articles, machine learning can be known as a system that allows the machine to work better again, either when the same task is repeated or in a different mission in another field. Some methods and algorithms are capable of predicting, estimating, and some of them are capable of classification [31-34]. In other words, these methods and algorithms help solve problems and make decisions. In addition, prediction is noteworthy in machine learning [35]. Also, these techniques have the potential to assist experts in achieving data analysis, especially in the medical and many other fields. Some think that machine learning and statistics work on the same principle [36], but this is incorrect. Machine learning is concerned with how accurate the prediction of training data is, while statistics are concerned with both correct prediction and how models and methods are interpreted, as well as the quality of these models and methods. Machine learning and statistics are not against each other, but they are complementary fields.

Types of Machine Learning

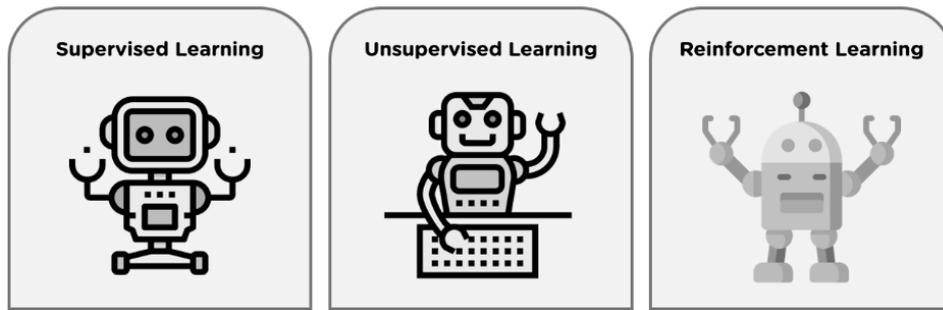


Figure 2. Types of machine learning [downloaded from Google].

Machine learning is of three types (see Figure 2). The first type is supervised learning [37], where the data consists of pairs of inputs and outputs, and the training data is categorised. Furthermore, the output data obtained as a result of the information is included in the training data as these inputs are categorized by external work. In addition, this type has many outputs, which are the outputs of binary classification for the results of a binary class. Differential learning is the name for multiclass classification, and it occurs when the outputs are limited. Still, if the outputs are of real value, this is known as regression or functional learning. Examples of this type of learning include handwriting [38], predicting stock market values, forecasting weather, and rating news in a news agency. The second type is unsupervised learning [39][40], where the data consists of inputs only, and there are no outputs. In this learning, models and structures appear in the data automatically. For illustration, suppose the task is only to separate films in a particular database by age. In that case, films with the same characteristics can be grouped with unsupervised learning, and a category can be created, and that category has no name. The third type is reinforcement learning [41]. There are no outputs for each input in the training data in this type. Instead, it gives several potential outputs of that output rather than the actual output, along with a measure of how sound that output is. This type is characterised by having a few inputs and a small number of outputs and results for these outputs. As for supervised learning, there are confirmed inputs and outputs. In addition, reinforcement learning is helpful in learning how to play a game, such as backgammon, as it helps games decide to make the best move against several moves. In supervised learning, there is a problematic mechanism in making the decision to choose the best action. In short, reinforcement learning makes making decisions much more accessible.

2.3 Big data

After surveying a set of literature on the topic of big data, it can be outlined as a set of mathematical procedures enforced to transfer large amounts of data in many fields in order to extract useful information that displays certain patterns, relationships and connections related to an organisation. Bigdata is exploited in many different fields and has future trends in the coming years [42][43] and interacts with the Internet of things in a civilised and industrial environment [44]. For instance, air quality data, relative temperature and humidity, dealing with biometric systems and surveillance cameras that seek to assist health workers by studying the health status of people in a particular place using sensors and thermal cameras, as well as early identification of possible infection Through the use of biosensors and nanosensors strategically placed in the city or anywhere [45-47]. In addition, big data is five defining characteristics for developing a research project: size, diversity, speed, suitability, and value. Size requires extensive data processing and storage resources represented in a set that can be structured or unstructured. As for speed, it refers to the amount of data that is represented periodically and requires advanced and modern devices and technologies. Moreover, the stored data must be correct; otherwise, valuable computational resources will be wasted on unreliable or unhelpful information, leading to incorrect results and incorrect decision-making related to suitability. As for value, it is understood as the extraction of relevant information for determining strategies and decision-making. In the time of COVID-19 [48-50], it requires making an extensive database that includes massive data to distinguish between virus families, treatments and risks and analysing this data using artificial intelligence techniques and its purpose to diagnose and treat the patient and save lives. In other words, the five characteristics must be attending, reliable, and beneficial so that artificial intelligence, deep learning, and machine learning systems can analyse them and reach correct and accurate decisions. Using big data [51-53], COVID-19 data can be analysed by predicting the spread of the virus and monitoring patients, and this is what artificial intelligence techniques do [54][55]. From the above, it is clear that big data is part of the statistical and mathematical techniques distinguished in the study variables that allow the expansion of techniques and models represented as groups through patterns or data correlations, which in turn can be combined with artificial intelligence to improve results. In the study of structured and unstructured databases, frequent correlations are searched to arrive at a reasonable solution that anticipates an event, such as the case of COVID-19. That is, it can be determined the spread of the virus in a particular area under climatic parameters, demographic density factors, mobility patterns, and phenotypic characteristics of the virus in relation to its other family and environment. In short, big data uses artificial intelligence techniques found in machine learning and deep learning to analyse it and reach a correct and reasonable decision.

3. CONCLUSIONS

Artificial intelligence is one of the most progressive sciences at the present time, and it is expected that this development will grow more and more in the future. Today, it has a significant role in many areas, multiple tasks, speed in completing tasks and assisting in making decisions. The critical question is, is there an unethical role for artificial intelligence, or in other words, does moral responsibility fall on the machine or the human being for the errors committed by the machines?. In other words, it likes to build artificial intelligence systems correctly and not use them in unethical ways because this science is intended to help humans complete their work and not against them. Therefore, it is necessary to evaluate AI as an ethical component and establish international ethical rules.

4. REFERENCES

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