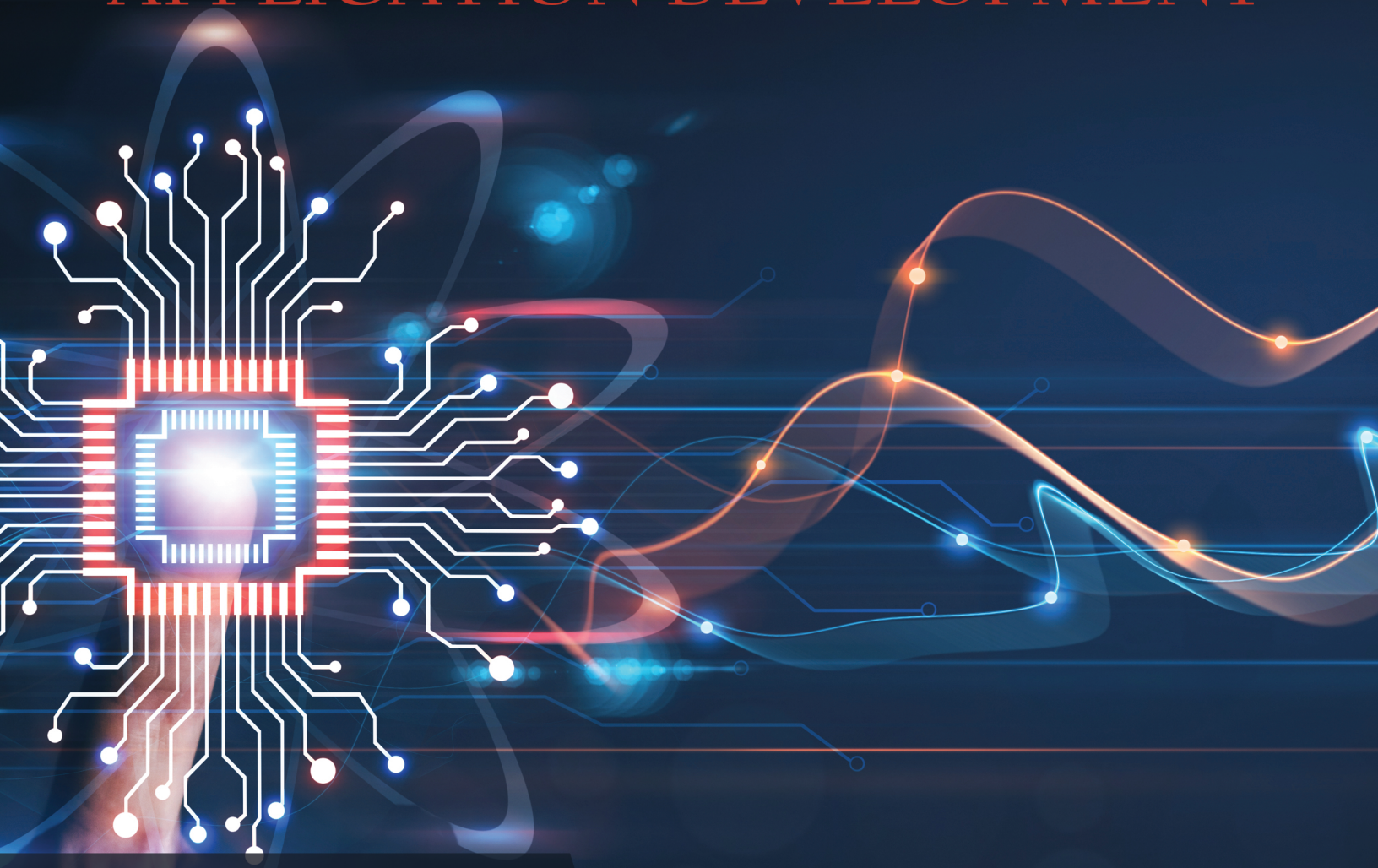
MACHINE LEARNING METHODS FOR ENGINEERING APPLICATION DEVELOPMENT



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Machine Learning Methods for Engineering Application Development

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FOREWORD

As I reviewed the manuscript prior to writing this Foreword, I was fascinated by many unique features that I would like to share with you. The book can best be described as concise yet detailed. There is more useful information packed into its 12 chapters than seen in most books twice its size. Therefore, it gives me great pleasure to contribute to this foreword.

This book is an enthusiastic celebration of many Machine Learning Techniques for Engineering Applications. It is also a unique tribute to many academicians and researchers who were involved in their study and contributed to society. Still another element is provided by many interesting technical details and an abundance of illustrations in the form of figures and tables. On top of that, there are innumerable machine learning algorithms for Intelligent Systems, Computational Linguistics, Natural Language Processing, Information Retrieval, Neural Networks, Social Networks, Recommender Systems, *etc*., indeed, to anyone with a fascination with the world of machine learning. This book can be read on two different levels. First, it may be read by ordinary people with a limited, if any, scientific background. Throughout, the book has been written with this audience in mind. The second group of readers will be represented by professionals from academia, government agencies and researchers. I do feel that everybody in the scientific community agrees with the content and ideas put forth in this book, and I hope that the information and knowledge presented will become a useful guideline for the research community and scholars.

This book contains so much useful information, and the chapters contain many pearls. I hope that this book will become a primer for teachers, teacher educators, and professional developers, helping teachers across the world to learn, teach, and practice machine learning techniques for various applications.

Sangeeta Sonania
Software Developer
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Australia

PREFACE

Machine learning deals with the issue of how to build programs that improve their performance at some tasks through experience. Machine learning (ML) plays a major role in the fourth industrial revolution, and we see a lot of evolution in various machine learning methodologies. AI techniques are widely used by practicing engineers to solve real-world problems. Industry 4.0 refers to the introduction of digital technologies and the development of skills, resources, and high-tech for the evolution of Industrial Factories. The concepts of Artificial Intelligence (AI), Machine Learning, and its applications in Industry 4.0 are popular among researchers. Several industrial applications are being designed and deployed. Herein, we share a few examples of machine learning that we use every day and perhaps have no idea that they are driven by ML-like Virtual Personal Assistants, Predictions, Videos Surveillance, Social Media Services, Email Spam and Malware Filtering, Online Customer Support, Search Engine Result Refining, Product Recommendations, and Online Fraud Detection. Besides, numerous researchers from diversified domains are working towards the amalgamation of these technologies.

The chapters of this book are organized into five parts, Machine Learning Essentials, Applied Machine Learning, Surveillance Systems, Machine Learning in IoT and Cyber Security, and Intelligent Systems. Machine learning algorithms have proven to be of great practical value in a variety of application domains. Not surprisingly, the field of software engineering turns out to be a fertile ground where many software development and maintenance tasks could be formulated as learning problems and approached in terms of learning algorithms. This book deals with the subject of applying machine learning methods and engineering. In these books, we first provide the characteristics and applicability of some frequently utilized machine learning algorithms. We then summarize and analyze the existing work and discuss some general issues in this niche area. Finally, we offer some guidelines on applying machine learning methods to software engineering tasks.

This book describes the most common Artificial Intelligence (AI), Machine Learning and its applications in Industry 4.0, including Bayesian models, support vector machines, decision tree induction, regression analysis, and recurrent and convolutional neural networks. It first introduces the principles of machine learning; it then covers the basic methods, including the mathematical foundations. The biggest part of the book provides common machine learning algorithms and their applications. Finally, the book gives an outlook into some of the future developments and possibly new research areas of machine learning and artificial intelligence in general.

This book is meant to be an introduction to Artificial Intelligence (AI), Machine Learning, and its applications in Industry 4.0. It does not require prior knowledge in this area. It covers some of the basic mathematical principles but intends to be understandable even without a background in mathematics. It can be read chapter-wise and intends to be comprehensible, even when not starting in the beginning. Finally, it also intends to be a reference book.

Key Features

• Describes real-world problems that can be solved using Machine Learning.

• Provides methods for directly applying Machine Learning techniques to concrete real-world problems.

• Research outputs require working in Industry 4.0 platforms, including the use and integration of AI, ML, Big Data, NLP, and the Internet of Things (IoT).

• We welcome new developments in statistics, mathematics, and computing that are relevant to the machine learning perspective, including foundations, systems, innovative applications, and other research contributions related to the overall design of machine learning and models and algorithms that are relevant for AI.

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CHAPTER 1

Cutting Edge Techniques of Adaptive Machine Learning for Image Processing and Computer Vision

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Abstract: Computers, systems, applications, and technology, in general, are becoming more commonly used, advanced, scalable, and thus effective in modern times. Because of its widespread use, it undergoes various advancements on a regular basis. A fast-paced life is also associated with modern times. This way of life necessitates that our systems behave similarly. Adaptive Machine Learning (AML) can do things that conventional machine learning cannot. It will easily adjust to new information and determine the significance of that information. Adaptive machine learning uses a variety of data collection, grouping, and analysis methods due to its single-channeled structure. It gathers, analyses, and learns from the information. That is why it is adaptive: as long as new data is presented, the system can learn and update. This single-channeled device acts on any piece of input it receives in order to improve potential forecasts and outcomes. Furthermore, since the entire process happens in real-time, it can immediately adjust to new actions. High efficiency and impeccably precise accuracy are two of AML's main advantages. The system does not become outdated or redundant because it is constantly running in real-time. So, incorporating the three core concepts of agility, strength, and efficiency better explains AML.

Agility helps systems to respond rapidly and without hesitation. The systems achieve new levels of proficiency and accuracy as a result of their power, and they can find new ways to operate flawlessly at lower costs as a result of their performance. This chapter covers the preparation, regularisation, and structure of deep neural networks such as convolutional and generative adversarial networks. New information in the reinforcement learning chapter includes a description of t-SNE, a standard dimensionality reduction approach, as well as multilayer perceptrons on auto encoders and the word2vec network. As a consequence, these suggestions will assist readers in applying what they have learned.

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Keywords: Autoencoders, Automatic Learning, Contourlet and orthogonal transforms, Disparity, Domain Methods, Stereo Face Images.

INTRODUCTION

One of the technologies that will flourish in the next years is adaptive machine learning, also known as adaptive automated learning. Using online machine learning models, this technology allows for continuous learning in real-time. This capability enables machine learning models to adapt to the ever-changing environment. This technology is particularly useful for autonomous car training because of its high adaptability. These vehicles must be capable of integrating new data in real-time, analysing it, and making decisions based on it. However, the technology's use is not limited to self-driving vehicles (which Gartner expects to see in the next 10 years or so). Real-time adaptive autonomous learning necessitates efficient reinforcement learning, or how an algorithm must continuously communicate with its environment in order to maximise its reward. Agriculture, web marketing, smart cities, financial institutions, and any other industry that uses the Internet of Things could benefit from these algorithms [1]. Since it must be retrained and make decisions in real-time, it is difficult to gather all produced data, organise and calculate it, and train a “traditional” machine learning model in these changing environments.

Extraction of relevant functionality from massive, potentially heterogeneous images is a critical challenge for many end-user communities. Picture segmentation is the method of partitioning a digital image into several newline segments based on sets of pixels in computer vision. Researchers may use collection platforms that run in a wide range of spectral bands. With modern delivery systems and data formats making data distribution increasingly cheaper and simpler, the availability of appropriate analysis tools is now more than ever the bottleneck to effective data exploitation. Image processing is a computationally expensive undertaking since it involves multiple low-level (pixel-level) operations on an image to complete a task, such as edge detection, edge connecting, noise reduction, dilation, erosion, and filtering. In this sense, machine vision has been successfully applied to a number of tasks such as sorting and assembling a group of machined parts, inspecting an automobile door panel for microscopic defects, and so on. Machine vision applications in manufacturing have been the subject of extensive study, as they provide the advantages of being non-contact and quicker than contact methods. Machine Vision (information gathered using an array of sensors) may be used to calculate and analyse [2] the area of a surface, allowing the user to make application-specific intelligent decisions. (Fig. **1**) shows how conventional computer vision compares to modern computer vision. The benefit of using computer vision to grab photos from the

internet is that it ignores factors such as machine tool noise and vibrations. Computer vision systems must be able to capture images, collect data using vision sensors, and make educated decisions. Image denoising is the process of manipulating image data in order to create a visually high-quality image. The filtering process [3] has been found to be the most effective when the image is corrupted. Quality control and output testing have been critical components of the operation. Surface finish is crucial in a number of engineering applications, such as the surface quality of any machined component. By simply looking at a 2D image, the human brain unconsciously and automatically perceives its 3D form. However, using a computer to reconstruct 3D face from 2D images is a difficult and time-consuming process. Face recognition is one of the most basic ways for humans to communicate with one another.

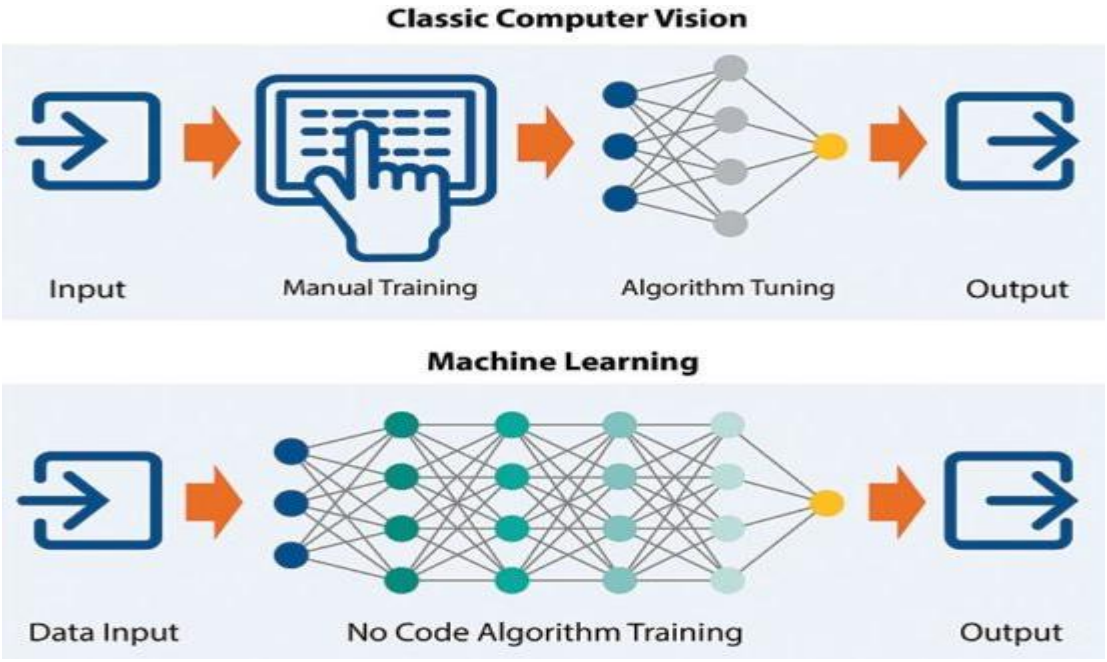

Fig. (1). Classic CV *vs* Machine Learning [18]

Law enforcement, civil applications, and security systems are only a few of the applications for face recognition. Since the human face is highly deformable and its appearance changes dramatically, face recognition is a difficult issue [4].

CHAPTER 2

Algorithm For Intelligent Systems

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Abstract: In the 21st-century, machines are becoming more and more intelligent. Terms like artificial intelligence, automation, robotics, *etc.*, are becoming the new normal in today's tech-savvy world. All of this is made possible because of complex programs (algorithms) which are able to perform such difficult tasks.

Intelligent systems are self-taught machines intended for a particular task. Intelligence is the ability to learn and use new information and skills. As the person learns from past data, the system can be programmed using various algorithms to make it intelligent.

In this chapter, we will be discussing some of the algorithms in brief, like- Reinforcement learning, Game theory, Machine Learning, Decision Tree, Artificial Neural Networks, Swarm Intelligence, and Natural Language Processing and its applications.

Keywords: Algorithm, Clustering, Game Theory, Machine Learning, Neural Network, Regression, Reinforcement Learning, Swarm Intelligent, Swarm Robots.

INTRODUCTION

Intelligent systems (IS) give a normalized methodological way to tackle significant and fairly unpredictable issues and acquire steady and solid outcomes. Obtaining from different word references, intelligence implies the potential to grasp, comprehend and benefit from the experience. As a matter of fact, there are, obviously, different meanings like the capacity to gain and hold the information, mental capacity, the capacity to react rapidly and effectively to a new circumstance, and so on.

The meaning of intelligent systems is a troublesome issue and is dependent upon a lot of discussions. From the point of view of calculation, the insight of a

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framework can be described by its adaptability, versatility, learning, memory, thinking, temporal dynamics and the capacity to oversee imprecise and uncertain data.

The rapid growth of the internet and other technologies generates a lot of data. Domo, Inc. is a cloud software company that works on business intelligence tools and data visualization. It released a report stating that "Over 2.5 quintillion bytes of data is generated every single day, and it is only going to grow from there. By 2020, it is estimated that 1.7MB of data will be created every second for every person on earth" [1].

This data can be put to use by creating different kinds of algorithms in various domains, which could later be used in designing an algorithm to create a powerful, intelligent system to help tackle a real-world problem.

Reinforcement Learning

Learning is a subset of machine learning that uses trial and error techniques to learn in an interactive environment by using feedback from its own experiences and actions. It examines the prediction and control of events of perceptual importance with regards to psychological and neural rules for adaptation. These RL models are given a set of actions they can perform in a specific environment, and a goal to pursue. One of the algorithms in reinforcement learning is-

Q-Learning

Q learning is a straightforward method of learning with the help of an agent which learns in a controlled environment [2]. Agents get rewarded whenever the action is correct. The Q-learning basic structure shown in Fig. (**1**) solves problem by trial and error method having two agents.

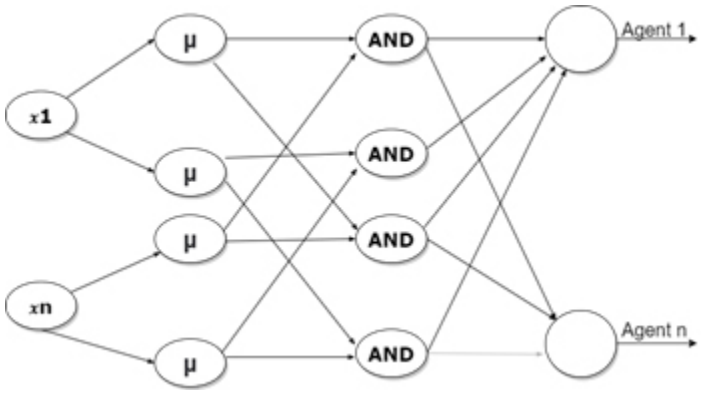

Fig. (1). Q-Learning: agents solve the problem using the trial-and-error method [3]

Game Theory

The practical applications of the Game theory are in statistical decision making, linear programming, and operation re-search.

Game theory lessens the intricacy of variations in calculations in enormous networks. It answers to decentralized cross-functional frameworks, like the players of the game, under fractional recognisability suspicions. Games can be competitive or cooperative. In a competitive game, each player is fundamentally worried regarding their own result, and due to this reason, every one of its choices is made seriously. In cooperative games, every player is worried regarding their complete advantages, while not being extremely stressed over their very own advantage.

Here, Bayesian analysis can be utilized to justify the cost dependent on perceptions of steps being undertaken. Moreover, on the ac-count of a non-zer--sum game, equilibrium may occur. It is likewise restricted by the number of players that the game has, considering the investigation of the strategies of the game ends up being more and more complex. Quite possibly, the central constraint here is that everyone should recognize the cost function of their fellow players.

Thus, in addition to labeled training data, game theory needs a prior understanding of the system. The players require information on various specifications like SINR, base station costs, and powering. (Fig. **2**) shows an illustration of rock paper scissors.

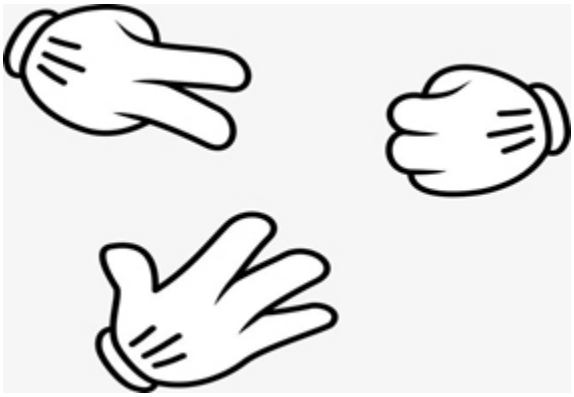

Fig. (2). Game Theory- image depicting the game of rock-paper-scissors [4]

CHAPTER 3

Clinical Decision Support System for Early Prediction of Congenital Heart Disease using Machine learning Techniques

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Abstract: One of the main reasons for deaths in children or low-age kids is congenital heart disease detected by CDSS (clinical decision support system). If it's diagnosed at an early stage, the significant results can be obtained for life-saving. The practitioners are not equally qualified and skilled so the detection of the disease and the proper diagnosis is delayed. The best prevention is the early detection of the symptoms of this disease. An automated medical diagnosis system is made to improve the accuracy and diagnose the disease. CHD expands the heart deformation as in newborn babies. Early detection of CHD is necessary to detect and diagnose this disease. Due to this, the life of a newborn child is in danger. By different detection methods, CHD could be accomplished by its clinical information using CDSS and it is also detected by its non-clinical data. In pregnant ladies, CHD is diagnosed by their non-clinical data by applying it to the newborn baby that is in their womb. Due to this, different machine learning algorithms, including K-NN and MLP, are explored. For CHD detection, dataset selection is a big issue, and it is utilized by the Support Vector Machine and random forest, K-NN, and MLP algorithms. This proposed work develops a decision support system to detect congenital heart disease. In this proposed work, the data mining techniques and the machine learning algorithms are used to gain insight into the system for their accuracy rate. This proposed work is designed and developed by the Python jupyter notebook to implement MLP. This paper presents an analysis using the machine learning algorithm to develop an accurate and efficient model for heart disease prediction. The MLP models have a high accuracy of 97%.

Keywords: CHD (Congenital heart disease), DSS (decision support system), K-NN (K-nearest neighbor), Machine learning, MLP (Multilayer Perception), SVM (support vector machine).

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INTRODUCTION

Clinical theory in heart detection using DSS (Decision Support System) is a set of tools that are based on computerized information programs based on discernment, resolution, and the action of courses in the organization or

business [1]. DSS helps in identifying what actions should be taken if a particular condition is satisfied. DSS provides the capability to solve problems by providing specific information. DSS can also provide suggestions based on information stored in it [2]. Suggestions were given by DSS to help the people to make decisions. It is useful for solving unstructured and semi-structured problems. It analyzes the huge amount of data for comprehensive data preprocessing, which is used to solve problems that help decision-making [3]. Mostly DSS used information such as E-government, health care, marketing, and inventory operation-related data [4]. It solves different queries and must be easy to interact with DSS. DSS can retrieve required information, perform analysis, make decisions, produce reports, and estimate the effects of decisions [5]. ADSS represents information graphically and an expert system or artificial intelligence (AI). It works together with knowledge workers and business executives [6, 7]. Typical information that a decision support application might gather and present would be:

(a) Accessing all information assets, including legacy and relational data sources;

(b) Comparative data figures;

(c) Projected figures based on new data or assumptions;

(d) Consequences of different decision alternatives, given experience in a specific context.

DSS is suitable for semi-structured problems and man/machine systems. DSS is very important for any manager to solve problems andmake decisions accordingly. If a CBIS is used, then we need a large database with some criteria that is given below [8].

1. Data manipulation means a large amount of computation.

2. Relationships between complex information systems [9].

3. At the different stages, analysis and judgment are required.

4. Communication *via* DSS tools [10].

The problem with DSS is that it is not suitable for unstructured problems, and it works on structured problems because it is based on CBIS. DSS needs to manage these problems and requires a large database. Examples are spreadsheets, Analysis packages, Expert systems, and Modeling [11]. It acts as a goal seeker for managers to complete a certain goal [12]. DSS is an individual or group of individuals that use decision-making called GDSS, which supports a group of decisions. GDSS is a well-integrated system, which is interactive, and a support group facilitator for decision making [13]. Antenatal decency is the major reason for increasing the rate of newborn decency [14] such as underweight Childs, contagious diseases, undernourishment, and congenital birth defects. The defects due to the congenital birth are common in newborns. In china, the newborns are widely affected by this disease. The estimated range is 2 to 5 which means 2 out of the 5 children are suffering from congenital birth defects. The Antenatal defect due to CHD is higher as compared to other diseases [15]. If these symptoms are recognized earlier, these diseases could be treated very well .Sometimes the medical practitioners have a lack of knowledge and experience as comapred to subject specialists [16]. These diseases could be reduced by diagnosing it at an earlier stage by developing the predictive model for congenital heart disease using a decision support system . This model predicts the CHD during the pregnancy and is treated based on some non-clinical data. Without clinical data, it’s difficult to identify congenital heart disease in a woman's womb.

RELATED WORK

In his study, Liu s *et al.* [13] projected univariate and multivariate examinations to distinguish ecological danger factors that advance the odds of CHD on medical clinic-based information containing records of 164 patients affacted with CHD. Components like infant's physiological state, the scope of earlier pregnancies, higher parcel disease in anticipating moms, B-mode USG assessment, and mental pressure all through early maternity were investigated. Detrano *et al.* [20] proposed the machine learning classifier based on DSS that is used for heart disease prediction and classification. By using this classifier, he achieved an accuracy of 77%. B.Vanishree *et al.* [24] proposed a model to predict the newly conceived infantwho has an CHD from her mom in her womb. In this paper, predicting congenital heart diseases by 3 unique classifiers such as WSVM, Logit, and WRF was done on unequal information. In this proposed work, Edmonds *et al.* [26] used the Cleveland dataset and achieved higher precision in terms of accuracy rate. It highlights the feature section techniques for selecting the relevant features from the dataset. Gudadhe *et al.* [27]. utilized multilayer perceptron (MLP) and backing vector machine calculations for coronary illness order and proposed arrangement framework and acquired exactness of 80.41%. Kahramanli and Allahverdi *et al.* [28] planned a coronary illness characterization framework

CHAPTER 4

A Review on Covid-19 Pandemic and Role of Multilingual Information Retrieval and Machine Translation for Managing its Effect

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Abstract: Novel Coronavirus disease 2019 (COVID-19) was initiated in the town of Wuhan, Hubei Province, Central China, and has multiplied speedily to 215 nations to date. Around 178,837,204 confirmed cases and 3880450 deaths had been reported across the globe till 23 June 2021. The exceptional outburst of the 2019 novel coronavirus called COVID-19 around the world has placed numerous governments in a precarious position. Most of the governments found no solution except imposing fractional or full lockdown. The laboratories grew rapidly across the globe to test and confirm the rate of disease spread. The disease had adverse effects on the global economy. This chapter focuses on using technology on languages such as NLP, Multilingual Information Retrieval Systems, and Machine Translation to evaluate the impact of covid-19 outbreaks and manage it.

Keywords: Covid 19 Pandemic, Information Retrieval, Multilingual Information Retrieval, Machine Translation, Natural Language Processing.

INTRODUCTION

Orthocoronavirinae, Order Nidovirale, is the the family of novel coronavirus. There are four types of viruses in this group *i.e*., Alpha (α-CoV) Coronavirus, Beta (β-CoV) Coronavirus, Gamma (γ –CoV) Coronavirus and Delta (δ-CoV) Coronavirus. COVID-19 is an abbreviation for "Coronavirus-Disease-2019". This is a respiratory illness disease initiated by severe-acute-respiratory-syndr-me-coronavirus-2 (SARS-CoV-2). [1] Similar to virus influenza SARS-CoV-2 damage the human body's breathing function and causes illnesses like cough, fatigue, and fever. SARS-CoV-2 belongs to the β-CoV coronavirus family, although exact initiation of the virus is still mysterious and it derives its gene sources from rodents and bats, according to scientists. [1].

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In December 2019, the COVID-19 infection appeared in the city of Wuhan in China and spread to 215 countries of the world. The worst affected countries of the world by COVID-19 are shown in Fig. (**1**) . This article brings the basic analysis of COVID-19 disease and the role of current technologies such as information retrieval, machine translation, and multilingual information retrieval. How efficiently these technologies could help in providing the correct pandemic information, awareness among the people, knowledge of safety precaution, treatment, and diagnosis is the basic purpose of this article, This information would be available in native language of the user to moderate the pandemic adverse effect and save lives.

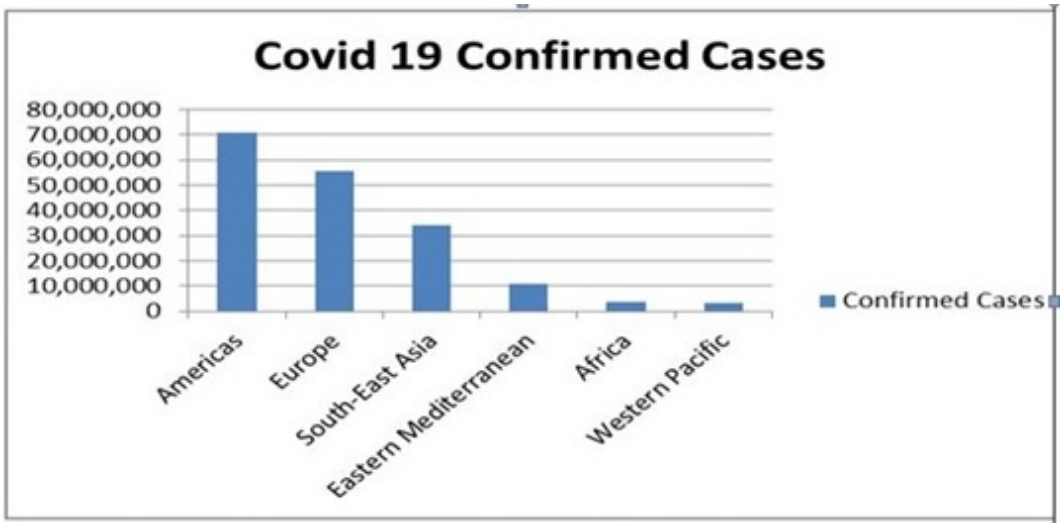

Fig. (1). Top regions affected by Covid-19 WHO Report – (23 June 2021).

This paper is organized into five sections; first section is the introduction. In section II, existing work on COVID-19 pandemic is discussed. In section III, we discuss various stages of transmission of COVID-19 disease. Section IV includes disease mechanism, the current method of diagnosis, safety precautions, treatment and preventive measures, while section V lists the progressing tools and technologies for moderating the influence of COVID-19 pandemic effectively. Finally, section 6 concludes the paper.

RELATED WORK

Viral infections, especially caused by various coronaviruses, have become a severe community health problem, according to WHO [2]. Coronaviruses are positive sense spherical RNA viruses having a diameter of 600Å-1400 Å [3], with proteins like spikes protruding structures on their surfaces. In the last two

decades, we have witnessed the appearance of various viral outbreaks like coronavirus, such as the SARS-CoV outbreak in 2002-2004 [4], and in 2012 infection of (MERS-CoV) respiratory syndrome coronavirus. SARS-CoV and MERS-CoV outbreaks originated in China and Saudi Arabia, respectively. 31 December 2019, the COVID-19 outbreak occurred when 27 cases of unknown etiology pneumonia were presented at China's WHO office. The outbreak epicenter was connected to the wholesale market of exotic animals like bats, snakes, and marmots as well as other seafood of Wuhan in China [5].

A novel twists of extremely contagious SARS-CoV-2, β-coronavirus has been reasoned accountable for the quick epidemic of COVID-19. Unique distinctiveness of the virus consists of its exceptionally infectious character and comparatively extensive (1-14 days) incubation time. A human being can be contaminated by the disease without having a single symptom at all. And hence people contaminated by the disease may silently transmit the disease unknowingly. Substantial epidemic of COVID-19 has provoked a range of laboratories, researchers, scientists and organizations around the world to carry out a huge levels of investigation to come up with vaccines and other protocols to treat patients. To search out the treatment protocol for COVID-19 disease, the medical history of 138 infected patients, their demographics, signs and symptoms are assessed carefully by the scientist and the author mentioned in the paper [6]. In the paper [7], Author has published a case study of 99 patients affected by COVID-19 in Wuhan, China. In this study, the patient's clinical, epidemiological and radiological characteristics of the disease have been mentioned. Their study mentioned that 17% developed acute respiratory syndromes and 11% died due to multiple organ dysfunction syndromes. In the paper [8] author Fang *et al*. have presented treatment and outline of clinical features of COVID-19. In paper [9] author reviewed the Google scholar, PubMed and Elsevier platform for tomography characteristics of COVID-19. Paper [10 - 13] provide transitory outline of clinical aspects, diagnosis and treatment of COVID-19 outbreak. Paper [14] presents an adaptive immune reaction against SARS-CoV-2 virus. Also, the author studied the generation of monoclonal antibodies by antibody generating cells while caring for and after acute infection. Author Vinay Chamola at el. in paper [1] present the role of Artificial Intelligence, Drones, Internet of Things, Block chain, and 5G technologies in managing the COVID-19 pandemic.

OUTBREAK STAGE OF COVID 19

At the time of writing this research paper, a huge amount of research in the domain of COVID-19 disease has been published worldwide. But no effort in the present works attempts to review the role of emerging skills such as information retrieval, multilingual information retrieval, and machine translation for managing

CHAPTER 5

An Empirical View of Genetic Machine Learning based on Evolutionary Learning Computations

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Abstract: The only prerequisite in the past era was human intelligence, but today's world is full of artificial intelligence and its obstacles, which must still be overcome. It could be said that anything from cars to household items must be artificially intelligent. Everyone needs smartphones, vehicles, and machines. Some kind of intelligence is required by all at all times. Since computers have become such an integral part of our lives, it has become essential to develop new methods of human-computer interaction. Finding an intelligent way of machine and user interaction is one of the most crucial steps in meeting the requirement. The motivations for developing artificial intelligence and artificial life can be traced back to the dawn of the computer era. As always, evolution is a case of shifting phenomena. Adaptive computer systems are explicitly designed to search for problem-specific solutions in the face of changing circumstances. It has been said before that evolution is a massively parallel quest method that never works on a single species or a single solution at any given time. Many organisms are subjected to experiments and modifications. As a result, this write-up aims to create Artificial Intelligence, superior to machine learning that can master these problems, ranging from traditional methods of automatic reasoning to interaction strategies with evolutionary algorithms. The result is evaluated with a piece of code for predicting optimal test value after learning.

Keywords: Evolutionary computation, Evolutionary algorithms, Fitness stage, Genetic and Heredity, Population, Stochastic.

INTRODUCTION

Evolutionary algorithms (EAs) are a type of optimization algorithm that uses a meta heuristics approach to solve problems. Selection, mutation, and crossover are all genetic operators it goes through [1]. It iteratively expands candidate solutions set based on the survival of the fittest theorem. The methodology of the "black box"character distinguishes evolutionary algorithms from other approaches

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that are often referred to as evolutionary optimization methods. It also relies on very few conclusions regarding the objective functions that underpin it. Even the concept of an objective function is simple since it excludes systemic problems from the problem at hand and allows for the creation of an admissible heuristic by individuals. These features improve the efficiency of evolutionary algorithms across a wide variety of problem domains. (Fig. **1**) illustrates the fundamental steps to be followed while applying the evolutionary-based algorithms for the applications [2]. This chapter will cover the fundamental concepts and properties of evolutionary algorithms, as well as probability theory and stochastic processes. Before reading this novel, it is presumed that the reader has taken a simple probability and statistics course. As a result, the aim is to assist the reader in refreshing their memory and establishing a common language and set of notations through the evolutionary procedure in deep learning. Random processes will be briefly analyzed [3], and some basic principles will be stated, in addition to probability and random variables. Finally, basic concepts and properties relevant to knowledge theory will be summarized at the end of the chapter. This chapter can be skipped by readers who are familiar with all of these concepts.

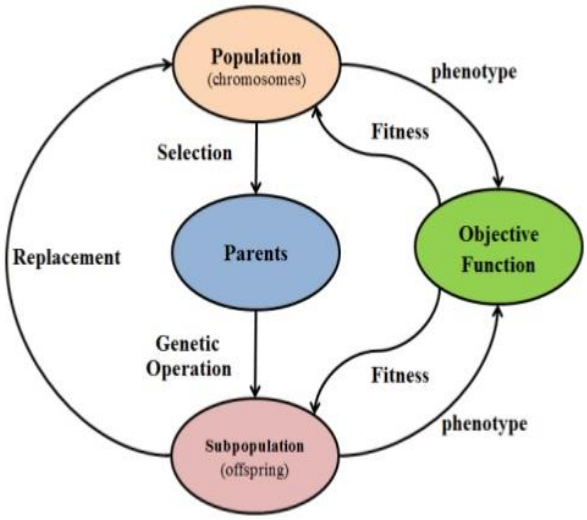

Fig. (1). Basic notions of evolutionary algorithms

Preamble of Evolutionary Algorithms (EA)

Evolutionary Algorithms (EA) are heuristic search techniques focused on artificial reproduction of the processes that underpin living organism evolution. Natural selection and genetics are the two primary pillars. In his book "Origin of Species by Means of Natural Selection," Charles Darwin describes natural selection for the first time in his own words, " [4]... if variations useful to any organic being

occur, individuals thus characterized will almost certainly have the best chance of surviving in the fight for life; and, due to the strong theory of inheritance, they will almost certainly produce offspring similarly characterized. For the sake of brevity, I've dubbed this preservation theory Natural Selection."

Biological evolution has created autonomous, highly complex living beings capable of solving difficult problems such as continuous adaptation to an unpredictable and ever-changing world. The wide variety of settings in which life achieves integration demonstrates that the evolutionary process is resilient and capable of solving complex problems. Indeed, EA has been used to solve difficult problems where other optimization algorithms [5] have failed to deliver satisfactory results. Three core ideas underpin all evolutionary algorithms: Individuals with differences that better match them to the world are more likely to have more offspring.

Heredity: Children mimic their parents but are never identical to them.

Variability: Minor differences in offspring can have a major impact on survival chances.

Both evolutionary algorithms adopt the working structure depicted in Fig. (**2**) and advance in the following manner:

1. First, a population Pop of individuals p is generated with a random genome p g.

2. For each candidate solution p. x in Pop, the values of the fitness functions f are computed. This assessment can include complex simulations and calculations.

3. The utility of the different features of the solution candidates has been determined using the fitness functions, and a fitness value v (p) has been measured.

4. A subsequent screening procedure eliminates solution candidates in poor physical condition, allowing those in good physical condition to reach the mating pool with a higher probability. Since fitness can be enhanced, the lower the v (p. x)-values are, the higher the (relative) utility of the person to whom they belong [6].

5. Offspring are generated in the reproduction process by adjusting or combining the genotypes p. g of the selected individuals' p Mate using the search algorithm. Search Op $\in$ Op (which are called reproduction operations in the context of EAs).

CHAPTER 6

High-Performance Computing for Satellite Image Processing Using Apache Spark

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Abstract: High-Performance Computing is the aggregate computing application that solves computational problems that are either huge or time-consuming for traditional computers. This technology is used for processing satellite images and analysing massive data sets quickly and efficiently. Parallel processing and distributed computing methods are very important to process satellite images quickly and efficiently. Parallel Computing is a computation type in which multiple processors execute multiple tasks simultaneously to rapidly process data using shared memory. In this, we process satellite image parallel in a single computer. In distributed computing, we use multiple systems to process satellite images quickly. With the help of VMware, we are creating a different operating system (like Linux, windows *etc*.) as a worker. In this project we are using cluster formation for connecting master and slave: apache spark is one of the important concepts in this project. Apache spark is one of the frameworks and Resilient Distributed Datasets are one of the concepts in the spark, we are using RDD for dividing dataset on the different node of the cluster.

Keywords: Satellite images, Apache spark, python, Image processing, VMware, Parallel Computing, Distributed Computing.

INTRODUCTION

Remote sensing is one of the important concepts in this project. With the support of high-performance computing and apache spark, we can process and display satellite information quickly [1]. Satellite sensors capture images of the earth: in these images, we can see the population on the earth, the water on the earth, the greenery and the land on the earth.

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High Performance Computing is the aggregate computing framework that solves computational problems that are either huge or time consuming for traditional computers. This technology is used for processing satellite images and analysing massive data sets quickly and efficiently [1]. This technology concentrates on executing and performing parallel and distributive methods parallelly and distributedly for solving difficulties. Parallel processing and distributed computing methods are very important to process satellite images quickly and efficiently. Parallel Computing is a computation type in which multiple processors execute multiple tasks simultaneously for rapid execution of data using shared memory. In this, we process satellite images parallelly in a single computer. In distributed computing, we use multiple systems to process satellite images quickly [1].

Apache spark supports multiple languages like scala, python and java. With the help of spark, we can develop a project in different languages. HPC technology is used for processing satellite images and analysing massive data sets quickly and efficiently. HPC provides high computation Power that's why we can process a large number of data quickly, and HPC improves the computational speed: in this project, we are using apache spark with HPC [1]. . Apache spark is a framework Resilient Distributed Datasets is one of the concepts in the spark we are using RDD for dividing dataset on the different node of the cluster it may be computed. We are using python for programming purposes [3].

RDD have the capacity to divide a large number of data into small pieces based on the key, in previous projects, a large amount of data took additional time to display and execute, but now we are using RDD for executing large data fastly: multiple nodes are available in RDD to execute a large number of data. In RDD, multiple executors are present. Each executor executes different jobs.VMware is one of the useful software in this project which is used for creating multiple operating systems that we are using as workers in this project; we are performing cluster formation: and in the cluster formation we are connecting servers and clients. Each worker communicates with each other: if we enter any command from the server, the worker performs the task, and it processes the image fastly. We create a server in our main machine, and workers in a virtual machine.

Parallel Computing

Parallel processing is one of the important parts of high performance computing. Parallel computing is one of the computation types in which the number of processors execute multiple tasks simultaneously to rapidly process data using shared memory. In this, we process satellite images parallelly in a single computer. With the help of parallel processing, we can display and process

satellite images quickly. We can process satellite images in parallel shown in Fig. (**1**).

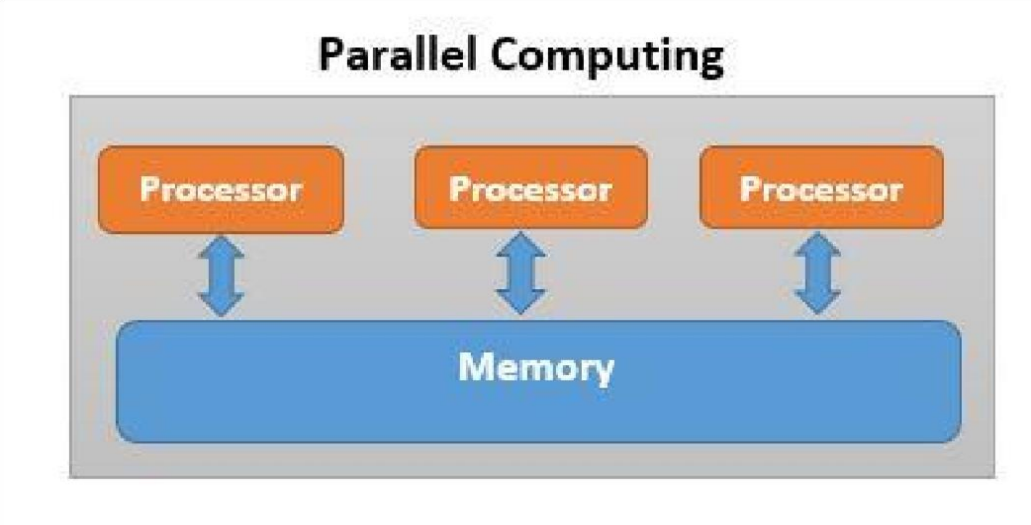

Fig. (1). Parallel Computing.

In parallel processing, multiple processors perform the task with a single computer. To perform any task, we required multiple processors.

(https://subscription.packtpub.com/book/application_development/9781787126992/1/ch01lvl1sec10/parallel-versus-distributed-computing)

Benefits Of Parallel Computing

1. It saves money and time than other methods.
2. Taking care of bigger issues on sequential computing it can be unfeasible.
3. When the local resources are finite, it can exploit non-neighbourhood assets.
4. It solves large problems in a short time.
5. It executes multiple tasks simultaneously.

Distributed Computing

Distributed Computing is one of the important parts of high performance computing. Distributed computing uses multiple systems to quickly process satellite images, as shown in Fig. (**2**).

CHAPTER 7

Artificial Intelligence and Covid-19: A Practical Approach

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Abstract: An unprecedented outbreak of unknown aetiology pneumonia occurred in Wuhan of Hubei, China, in December 2019. The WHO reported a novel coronavirus causative agent outbreak with limited evidence of COVID-19. SARS-CoV-2 embodies the ssRNA genome containing 29891 nucleotides to encode 9860 amino acids and shows different types of mutations, such as D614G. The epidemic of this virus officially declared an emergency of International Concern by the WHO in January 2020. In the first week of April 2021, a new strain of coronavirus named N-440 was reported in Chandigarh, India. The number of cases of laboratory-confirmed coronavirus has risen at an unprecedented pace worldwide, with more than 132,573,231 cases currently confirmed, including 2,876,411 deaths as of April 06th 2021. The lack of funding to survive the epidemic of this virus, coupled with the concern of overloaded healthcare systems, has driven a lot of countries into a partial/total lockout situation. This epidemic has caused chaos, and a rapid therapy of the disease would be a therapeutic medication with experience of use in patients to overcome the current pandemic. In the recent global emergency, researchers, clinicians and public health care experts around the world continue to search for emerging technologies to help tackle the pandemic of this virus. In this chapter, we rely on numerous reputable sources to provide a detailed analysis of all the main pandemic relevant aspects. This research illustrates not only the immediate safety effects connected with the COVID-19 epidemic but also its impact on the global socio-economy, education, social life and employment. Artificial Intelligence (AI) plays a significant supporting capacity in countering COVID-19 and may prompt arrangements quicker than we can, in any case, achieve in different zones and applications. With technological developments in AI combined with improved computing capacity, the repurposing of AI-enhanced medications may be useful in the cases of this virus. Artificial intelligence has gotten one of those advances which can undoubtedly distin-

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guish the transmission of this virus; exceptionally hazardous victims are recognized and are significant for constant control of that contamination. Artificial intelligence could genuinely assist us in battling against this infection through network testing, clinical administrations and advice on controlling diseases. This chapter addresses recent applications of AI in fighting the pandemics of this virus, e.g., monitoring of the epidemic, forecast of hazards, screening and diagnosis, improvement of medical treatment, fake news breaks, strengthening lockdowns, preventing cyber-attacks and finally, effective online education. This chapter will provide a clear definition and general understanding of the field of this virus pandemic and the role of AI to readers and researchers.

Keywords: Artificial Intelligence, Coronavirus, Corona App, Contact tracing, COVID-19 Pandemic, Cyber Threats, Drugs and Vaccines, Global Economy, Social Life Impact, AI applications, Monitoring, Projection.

INTRODUCTION

COVID-19 or "Coronavirus Disease-2019" is one of the respiratory ailments caused by SARS-CoV-2 (Fig. **1**). SARS-CoV-2 is an encompassed infectious novel virus of order: Nidovirales, family: Coronaviridae of ss(+)RNA viruses and group: Betacorona virus. The shape of RNA is either helical or rounded in this virus. The virus may be L or S type with little contrasts at two spots. It is accounted that L type was more common in an early episode. Its non-segmented genome is comprised of 26-33.5kb encoded four structural (Nucleocapsid or N, membrane or M of ~25-30kDa, spike or S of ~150kDa and envelope or E of ~8.12kDa) proteins and few non-structural proteins. The club-like tip in the envelope gives the crown-like appearance of this virus. The protein groupings of the spike of ~80virus have been adjusted and taken a gander phylogenetically. The exact source of the virus, however, is unclear, and its gene sources are usually derived from bats and rodents [1]. It is reported that the spike of SARS-CoV-2 is stated to be 10-20 times bound to bind angiotensin-converting enzyme 2 (ACE2) in cells of human. ACE2 is produced by the gene SLC6A20 present on the 3rd chromosome of man. As indicated by one report, coronaviruses may be divided into four subgroups as α,, and . Six zoonotic coronaviruses, HCoV229E(α), Nl63(α), OC43(), HKU1(), SARS-CoV() and MERS-CoV(), are competent to cause either mild or severe and acute respiratory diseases. SARS-CoV-2 is also renowned for its D614G mutation in spike. In this mutation, D and G stand for aspartate and glycine, respectively. Therefore, the underlying D614 is now the G614 variant. Results indicated that patients tainted with G614 variants have a more viral load in comparison to D614. But S-G614 difficultly binds ACE2 more than S-D614. These findings derive more stability of S-G614 contrasted with S-D614. An average of 15 days is required for its mutation. SARS-CoV-2 multiplies

with the help of its copy machine, sometimes known as coronavirus polymerase [2].

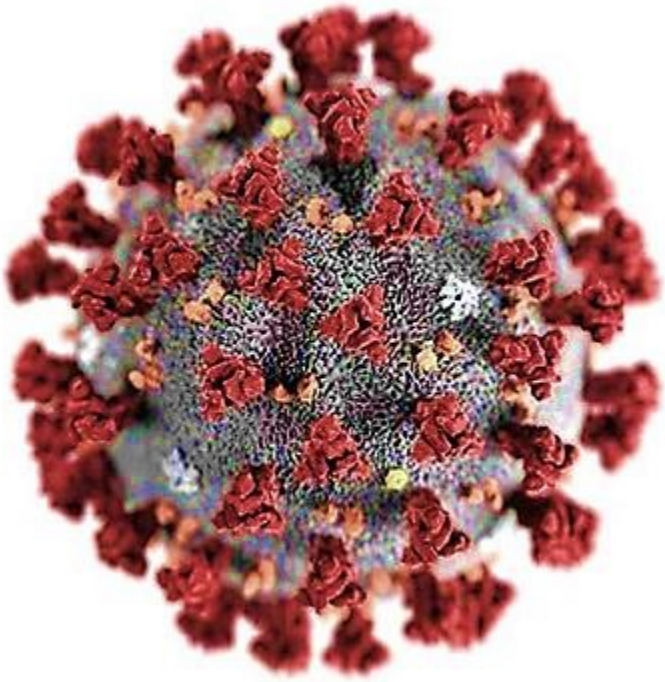

Fig. (1). SARS-CoV-2 version [3].

Like the flu infection, SARS-CoV-2 attacks respiratory frameworks and leads to burdens, for example, hack, fever, weariness and windedness. The virus was initially found to influence human existence in Wuhan of Hubei, China, in Dec. 2019. From that point forward, it has spread more stunning throughout the remainder of the world, signifying its essence in 213 countries and autonomous regions. As per the WHO, the current overall tally of affirmed Covid cases remains at 27,205,275, while the loss of life has arrived at 8,92,880 as on September 8 2020 [4]. The snappy in amount of these virus scenes on a global scale has actuated the necessity for sure-fire countermeasures to check the cataclysmic effects of the virus flare-up. To this end, the present chapter assesses the application of various advancements. Be that as it might, before exploring the possible inventive responses to the viral pandemic affect the executives, we give an exhaustive review of this virus, embracing its clinical symptoms, assurance, therapy, and its impact on its scene the overall economy.

The entire world is by and by under the most extreme threat inferable from COVID-19 spread by contamination of Covid. Most countries of the world have

CHAPTER 8

Intelligent Personalized E-Learning Platform using Machine Learning Algorithms

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Abstract: Personalized learning is a teaching method that allows the content and course of online training to be adapted according to the individual profile of learners. The main task of adaptability is the selection of the most appropriate content for the student in accordance with his digital footprint. In this work, we build a machine learning model to recommend the appropriate learning resources according to the student profile. To this end, we use Sequential forward selection (SFS) as a feature selection technique with AdaBoost as a classifier. The obtained results prove the efficiency of the proposed model with 91.33% of accuracy rate and 91.43% of precision rate.

Keywords: Boosting algorithm, Feature selection, Machine learning, Personalized e-learning.

INTRODUCTION

ONLINE education has become ubiquitous and important in our society. Hence, to improve the educational process, one of the most recommended solutions is E-learning personalization which considers individual's profile for adapting courses and learning scenarios. According to the National Academy of Engineering [1] institution, E-learning personalization is one of the most interesting challenges of the 21st Century. Personalized E-learning focuses on learners' differences in adapting learning scenarios and courses according to the learners' characteristics (such as learner's media preferences, level of knowledge, learning outcomes, learning resource type, *etc.*).

The scale of the eLearning industry was $176 billion in 2017 and is projected to hit $398 billion by 2026 [2]. Over the past 12 months, almost 50% of students have participated in at least one online course [3].

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As per a survey, 94% of students are satisfied with online learning and they suggest that it has or will have a positive return on investment (ROI) [4].

In the first quarter of 2020, the COVID-19 pandemic spread around the world fast. Because of this pandemic, all aspects of life, including education, were affected severely. The pandemic has led to the closure of schools and colleges, resulting in an alarming situation for institutions to provide education. To continue the learning process in a safe and secure manner, most of the countries have announced online classes. This major, sudden transition from conventional classroom learning to an entirely online learning framework has changed the way of delivering education and assessment activities to their students [5].

Due to the pandemic, most of the schools worldwide, started to conduct classes through e-learning tools and video telephony software. As of a recent study, around 89% of the world's student population is out of school due to the pandemic. This represents 1.5 billion students learning through online education platforms. This sudden change in the learning method leads to some challenges across countries. For example, 95% of students have a computer to do their homework in Switzerland, Austria and Norway, whereas 34% of students only have a computer in Indonesia. Also, schools use different software across the world to provide online education.

Nowadays, students want to gain maximum results in minimum time. To meet students' expectations, a personalized learning platform is most recommended. According to United States National Education Technology Plan 2017, adaptive e-learning recommendations, such as instructional approaches, learning objectives, and instructional contents, may all vary based on student's needs. Moreover, learning tasks should be more relevant and meaningful based on student interests [6].

Personalized learning is a learner-centric approach designed to meet the individual needs, desires, and goals of the learner. In terms of e-Learning, personalization is a technical approach that deals with the system to provide a learning experience for each user [7]. It is one of the wildly important techniques to improve the quality of teaching-learning methods by proposing an intelligent E-learning system that can confirm high-quality interaction for all learners [8]. In fact, the personalized course represents an efficient solution to increase the learner's motivation, and to reduce the time required to achieve his/her learning outcomes. In addition, customization of learning scenarios helps the learner to understand the learning objects efficiently.

However, it is difficult to consider all learners' preferences at the same time in the personalization process. First, the course may include many learning objects to

match a set of learner's characteristics. Thus, an instructor may spend more effort and a lot of time preparing his/her course with different learning materials in various ways for learners having distinct characteristics. Second, collecting the learner's preferences manually is a tedious and time-consuming task. Also, there is no consent about the most interesting preference to use in the personalization process. To address this issue, we will study in this project how to use artificial intelligence methods to implement a new E-learning personalization process.

In this context, we propose an automatic E-learning personalization method based on the artificial intelligence algorithms on Learning Objective Metadata (LOM) standard defined in (IEEE 1484.12.1, 2002) and (IEEE 1484.12.3, 2020). The aim of this standard is to facilitate both learner and teacher to explore, assess and use learning objects by defining a common conceptual data schema. The idea is to use machine learning and evolutionary algorithms to personalize the course and the learning scenarios according to the learner's characteristics.

The objective of this work is to provide the learner with suitable learning resources (slides, narrative text, simulation, *etc.*) according to their user profile (age, level of study, motivation, *etc.*)

In summary, our main contributions are as follows:

• To review the recent development on E-learning personalization.

• To propose a model for course personalization.

RELATED WORK

Several approaches have been proposed in the literature about E-learning personalization. We classify existing personalized e-learning approaches into two broad categories 1) machine learning approaches, 2) rule-based classification approaches.

Machine Learning Approach

Several machine learning techniques have been used for E-learning personalization. Most of the work used information related to the learner, and/or an assessment of contextual information to discover the interests and preferences of the learners [9]. In particular, some authors in their study [10] exploited data mining techniques to group students into clusters based on the similarity of their behavior with respect to the Felder–Silverman learning styles model (FSLSM).

CHAPTER 9

Automated Systems using AI in the Internet of Robotic Things: A New Paradigm for Robotics

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Abstract: The Internet of Things (IoT) allows a huge number of "things" with unique addresses to connect and exchange data through the current internet or suitable network protocols. This chapter proposes a new framework for controlling and monitoring activities at deployment sites and industrial automation systems, in which intelligent objects may follow peripheral occurrences, induce sensor data from a variety of sources, and apply ad hoc, local, and distributed "machine intelligence" to choose the optimal course of action, and then to act in a seamless manner to monitor or disseminate static or dynamic location conscious robotic things in the real world by giving the means to employ them as the Internet of robotic things (IoRT). While multi-robotic systems have progressed, and robots are continuously being enriched by vertical robotic service, and simpler developing functionalities. For the constant and seamless support for which they were created, centric divisions are insufficient. The important aspects of IoRT are highlighted in this article, which includes efficient Coordination Algorithms for Multi Robot Systems, optimization of multi robot task allocation, and modelling and simulation of robot manipulators. The purpose of this chapter is to obtain a better knowledge of IoRT architectural assimilation and to identify key research goals in this field.

Keywords: Geometric pattern, Internet of robotic-things, Multi-robot, Synchronization, Tardiness and coordination algorithms.

INTRODUCTION

During the last two decades, multirobot systems (MRS) that work together to complete a complex task have raised a great deal of interest. The technical community's curiosity in this path is justified due to MRS's numerous advantages. The key reason for using MRS is that they can improve the efficiency and effectiveness of a solution for a specific task, *i.e.*, a team of robots can perform a

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task more efficiently and effectively by using distributed sensing and actuation. Multiple industrial manipulators, tactical aircraft, or autonomous networked transport vehicles, for example, can be divided into various groups depending on their implementations. The robot's agility has increased, allowing it to travel around the world and complete the different tasks assigned to it. Robots now have autonomous capabilities thanks to the tireless efforts of artificial intelligence researchers. Autonomous Robots are capable of completing tasks without the need for human interaction. Some tasks necessitate the use of multiple autonomous robots rather than a single robot [1]. When compared to a single robot, the use of multiple robots can provide more benefits.

Need for MRS

There are many reasons why researchers have begun to use multiple robots rather than single robots.

• When a large number of tasks need to be completed, deploying a team of robots outperforms deploying a single robot. The design of the task itself could be difficult for a single robot at times. As a result, task completion necessitates the use of several robots. Cooperative object handling, for example, necessitates the participation of several units in order to complete the task.

• Distributed jobs, such as cleaning a large house, can be performed more effectively and in less time using several robots. The use of multiple robots aid in the completion of such tasks in a parallel manner.

• Some dangerous activities, such as military applications, have a high chance of killing the robot. The presence of redundant units will help in the completion of the remaining tasks while a team of robots engages in such a dangerous mission.

• Since the deployed robots are in multiples, the mission can be completed in a variety of ways. Even if some robots fail, others can step in to finish the job. The system's fault tolerance provides a high level of robustness [2].

Major Gaps in MRS

Before launching MRS as a full-fledged operation, researchers must address a number of issues. The following are a few current areas that need further attention:

• Simultaneous Localization and Mapping for MRS addresses the issue of initialising the robot location in the region of interest, simultaneously creating a digitally shared map among the robots, and periodically updating the position of each robot on the map for active control and decision making.

• Multi-Robot Route Preparation and Obstacle Avoidance [3] is concerned with determining the shortest robot path to each robot's destination while preventing collisions with obstacles and other robots.

• Multi-Robot Task Allocation is the issue of determining the best possible allocation of robots to complete tasks in the shortest time possible.

• Workplace Fault-Tolerance Reallocation is concerned with disaster recovery and mitigation techniques for robots that malfunction during the mission. It also covers the procedures for task reallocation in order to complete the mission.

• MRS Communication Issues are related to task coordination between robot team members through inter-robot communication. For efficient monitoring, proper communication ensures that all robots and the base station receive timely data updates.

The word MRS is used in this chapter to refer to a group of mobile robots deployed in an indoor environment and must work together to solve complex real-world problems such as geometric pattern forming, simultaneous coverage of an unknown area, task allocation, and so on. The multi-objective optimization of MRS in a static environment for foraging and nonforaging tasks with or without precedence constraints is also addressed in this research. The number of tasks to be completed and the number of robots required to complete them are both known ahead of time. Furthermore, prior to assignment, the positions of tasks and robots were identified.

EFFECTUAL COORDINATION-ALGORITHMS FOR MRS

Theoretical algorithms for geometric pattern formation have been shown to be sound and complete under a set of overly simplistic assumptions. Robots, for example, are viewed as point objects that can feel and travel with infinite precision, among other things. When developing models or solutions for robotic systems, such assumptions are popular. It is known that in practise, these assumptions would not be strictly followed. Nonetheless, approximate solutions to these hypotheses can be found. As a result, such theoretical methods cannot be comparable to other empirical approaches until they are translated into practise. In this context, the uniform circle formation (UCF) problem with a group of autonomous mobile robots has gained a lot of interest. The circle has become a standard for studies since it is one of the most fundamental forms of all geometric forms. The following is an expression of a group of autonomous mobile robots, the uniform circular formation problem: Given a collection of N-autonomous mobile robots randomly distributed on a two-dimensional plane [4], they must first agree to organise themselves on the edge of a non-degenerated circle in

CHAPTER 10

Missing Value Imputation and Estimation Methods for Arrhythmia Feature Selection Classification Using Machine Learning Algorithms

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Abstract: Electrocardiogram signal analysis is very difficult to classify cardiac arrhythmia using machine learning methods. The ECG datasets normally come with multiple missing values. The reason for the missing values is the faults or distortion. When performing data mining, missing value imputation is the biggest task for data preprocessing. This problem could arise due to incomplete medical datasets if the incomplete missing values and cases were removed from the original database. To produce a good quality dataset for better analyzing the clinical trials, the suitable missing value imputation method is used. In this paper, we explore the different machine-learning techniques for the computed missing value in the electrocardiogram dataset. To estimate the missing imputation values, the collected data contains feature dimensions with their attributes. The experiments to compute the missing values in the dataset are carried out by using the four feature selection methods and imputation methods. The implemented results are shown by combined features using IG (information gain), GA (genetic algorithm) and the different machine learning classifiers such as NB (naïve bayes), KNN (K-nearest neighbor), MLP (Multilayer perception), and RF (Random forest). The GA (genetic algorithm) and IG (information gain) are the best suitable methods for obtaining the results on lower dimensional datasets with RMSE (Root mean square error. It efficiently calculates the best results for missing values. These four classifiers are used to analyze the impact of imputation methods. The best results for missing rate 10% to 40% are obtained by NB that is 0.657, 0.6541, 0.66, 0.657, and 0.657, as computed by RMSE (Root mean Square error). It means that error will efficiently reduced by naïve bayes classifier.

Keywords: Datasets, GA (genetic algorithm), Feature selection, IG (Information gain), Missing values imputation, RMSE (Root mean square error).

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INTRODUCTION

In the medical field, many real-world problems could be detected. When data mining is employed on the dataset, it usually does not extract completely missing values and data for different kinds of diseases, such as metabolomics data, cardiovascular disease data [1], traffic data, kidney-related data, lung data, and other medical data . Many machine learning algorithms and techniques do not easily compute and analyze incomplete or missing value datasets. The different techniques and types for handling the missing values in the dataset [2].

Missing completely at random is based on the probability the responses are missing depends on the observed responses by the given dataset of missing values. The simplest solution of list-wise deletion is based on the missing values being deleted, but it could be problematic when the missing value and data are based on MNAR [3]. For the whole dataset, the missing rate is larger than a given certain value. The mean substitution is based on a variable that is used for that missing data value for the same variable. In this, no new information is added; only the size of a sample is increased [4]. In the regression imputation method, missing data is replaced with estimated values, it was not deleted dataset value, and it preserves all the missing data by replacing it. It computes the values as variables only for prediction. The model-based imputation methods were used to replace the missing values by training them and outperforming them by using statistical techniques [5]. The dataset contains the number of features that represent the data. Most of the features do not act as representatives. From the collected dataset, the irrelevant and redundant features must be filtered out [6]. The feature selection method is used for missing value imputation performed over the observed data. To filter the unrepresentative features, the feature imputation process was more efficient. In the domain of the medical field, two types of databases are available. The first dataset is for medical practitioners in which the special clinical trial data is generated. When imputation method needs a huge dataset and information, it could store it in their repository without considering for relevant research purposes. These records could be further used for the Clinical decision support system. Many records and missing values are incomplete and imbalanced regarding their corresponding label. In some of the patient's history, the medical report becomes blank because all the records that correspond to a particular disease and their test are missing or left blank [7].

When performing the feature selection over the imputation data, the main purpose of finding the missing value is to filter out the unreliable features that are not more efficient or not required for imputation. To understand the missing features for feature selection, the model should be trained for the lower-dimensional data and more efficiently estimates the values the selected features. In their research

work, two types of datasets are used, *i.e*., Cleveland and Hungarian heart disease datasets. Feature selection methods MICE [8] (Multivariate Imputation by Chained Equations), Model-based missing value imputation, Information gain and genetic algorithm, and mean mode imputation were employed by the machine learning techniques such as K-NN, MLP, and NB, Random forest. While performing the feature selection, the incomplete data and missing values are trained and tested accordingly in various domains, and then the best selected combined features are identified for the datasets using different lower and high dimensional datasets. In this paper, section 1, gives the introduction about the missing values and their method and techniques. The section 2 discusses the literature review, section 3 the Materials and methods for missing values and their imputation process, section 4 Machine learning classifier, section 5, the Experimental results, section 6 Conclusion and future scope and section 7 References.

Literature Review

Chia-HUI-HU- *et al*. [3] discussed that missing value in dataset is a very critical problem that affects the quality of data. In this study, the author used the main methods to find the missing values in the ECG data. It used the zero method, mean method, PCA method, and RPCA method. This method could successfully handle the missing value in the dataset, and it does not matter how many values are missing, it just indicates the higher classification accuracy when a large number of missing values are found in the dataset. It is used the MKDF-KNN classification algorithm to improve the performance and provide better parameters of MKDF-KNN. Fahd Saleh Alotaibi [6] researched the attributes of a clinical dataset utilizing a mix of highlight choice and order strategies to deal with missing qualities and comprehend the hidden measurable attributes of an ordinary clinical dataset. Ordinarily, when an enormous clinical dataset is introduced, it poses difficulties like missing qualities, high dimensionality, and unequal classes. This represents an inalienable issue when executing highlight choice and order calculations. With most clinical datasets, an underlying investigation of the dataset is done, and those credits with more than a specific level of missing qualities are killed from the dataset. Afterward, prognostic and analytic models are created with the assistance of missing worth attribution, including choice and order calculations. This paper has two principal ends: 1) Despite the idea of clinical datasets and their enormous size, strategies for missing worth ascription don't influence the last exhibition. What is pivotal is that the dataset is a precise portrayal of the clinical issue, and those techniques for attributing missing qualities are not basic for creating classifiers and prognostic/indicative models. 2) Supervised learning has been demonstrated to be more reasonable for mining clinical information than solo techniques. It is also shown that non-parametric

CHAPTER 11

Analysis of Abstractive Text Summarization with Deep Learning Technique

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Abstract: In today's era, data in textual format has got great importance and is used to extract useful information from this data to design various kinds of information systems such as Document Generation, Prediction systems, Report Generation, Recommendation Systems, and Language modeling, and many more. That is why such techniques are very important, which will reduce the amount of data while saving the information and various parameters concerning this information. One such technique is text summarization which retains essential and useful information. This technique is very simple and convenient as compared to other techniques of summarization. For processing data, the Apache tool of Kafka is used. This platform is useful for real-time streaming data pipelines and many applications related to it. With this, one can use APIs of native Apache Kafka to populate data lakes, stream variants to and from databases, and power machine learning and analytically carry out. The input portion in this situation is a spark base platform for analytics. For the fast development of workflows for complex machine learning systems, Tensorflow is evolved as a significant library of machine learning.

Keywords: Abstractive Summarization, Apache Kafka, Azure ML, Extractive Summarization, MemSQL, Tensorflow, Text Summarization.

INTRODUCTION

Historical Development

Researchers in the initial days designed a faultless system contingent on the neural networks of intelligence based on human analogy.

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They grouped and mixed most of the mathematics and algorithms to create the below process (Fig. **1**).

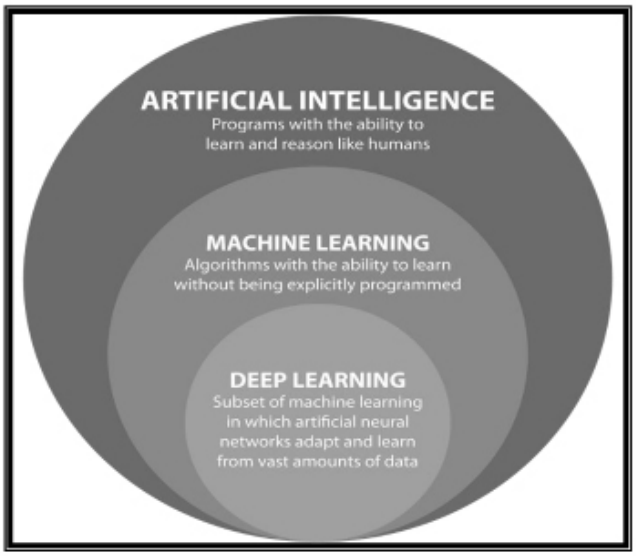

Fig. (1). History of Deep Learning.

After that, there was a great development in this process with the advent of deep learning methods. With this improvement in the techniques, there is an advancement of the Back Propagation model discovered by researchers. The first discovery in AI concentrated on the design of the neural network. They are based on the human thinking analogy in which we take input and give some output after thinking or after processing some operations on those inputs and hence machine learning becomes popular.

This process can find the different patterns in data and can go through all the data; in this way, the machine can learn information and can apply that information to the process of solving the problems or in other words, it can apply that learned information for problem-solving. Such type of AI has a great number of applications in the fields like detection of malware and can predict the future in economic software of the share market and may suggest favourable stock and trades [1].

In this way, we can say that machine learning is a very modern technique of deep learning that is very advanced, which may complete many more expectations as it is a more innovative technique. This technique is very advanced and useful in many sectors like entertainment, weather predictions, stock market and has become very popular in computational sciences too.

Area of Research and its Contribution

What is deep learning?

Deep learning is a subgroup of machine learning in artificial intelligence (AI) that has networks accomplished of learning unsupervised starting data that is unstructured or unlabeled. It is also identified as a deep neural network or learning.

A branch of machine learning that is the subfield of learning representation of data is very useful in pattern learning; such systems are very useful though the system is provided with a very large amount of information.

What is Machine Learning?

Machine learning is one such area of computer science that provides systems the capability to learn without being programmed explicitly (Fig. **2**) [2].

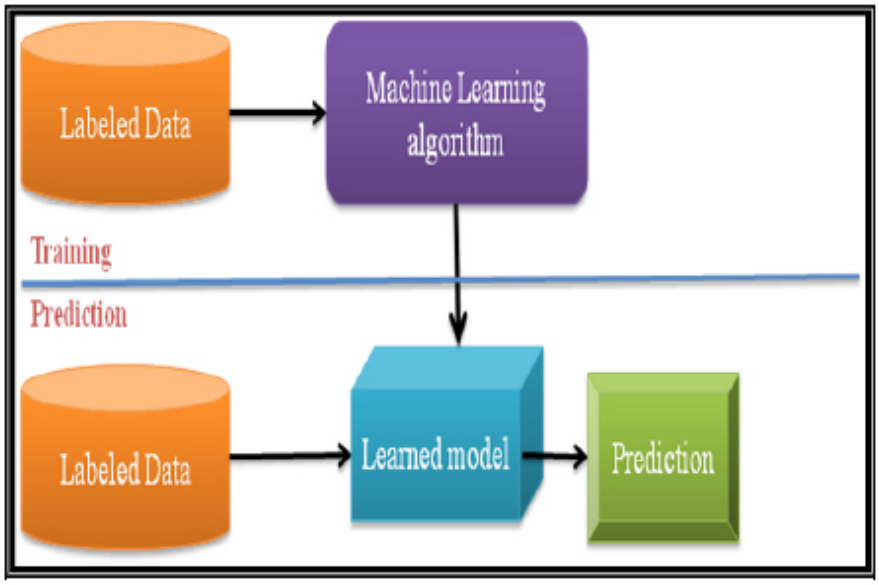

Fig. (2). Techniques of Machine Learning.

Techniques which will learn from and will make predictions on data:

Supervised: Supervised Learning can be possible using a training set that is labeled.

Example: *Classification of emails* with the help of labeled emails.

CHAPTER 12

Advanced Topics in Machine Learning

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Abstract: This chapter reveals the infancy of the striking experience near the "Internet of Things (IoT)". Machine learning technology is a part of Artificial Intelligence that grew from the training of computational learning approaches and pattern recognition of artificial intelligence. Over the last few years, Machine Learning approaches have been advanced inquisitively for various sectors such as smart city, finance, banking, education, *etc*. Today machine learning is not similar to the previous machine learning because of various new advanced computing techniques. Machine learning technique is defined as data analysis that automates the building of analytical models. The iterative factor of learning algorithms is significant as models are uncovered to new datasets; they are skilled in autonomously adjusting. The study from earlier computations generates reliable, efficient, repeatable decisions and experiment results. Therefore, Machine Learning measures have been used to protect various smart applications from any illegal activities, threats, and various attacks. Furthermore, Machine Learning provided suitable solutions for preserving the security of various advanced applications. The patent growth rate is 34% in the machine learning field from the year 2013 to 2017, according to Patent Service IFI Claims. Also, in the world, 60% of companies are using various learning algorithms for numerous purposes. In this chapter, we have discussed efficient, advanced, and revolutionary machine learning algorithms in detail.

Keywords: Algorithm of Machine Learning, KNN, Linear Regression, Machine Learning, SVM, PCA.

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INTRODUCTION

The subpart of Artificial Intelligence is Machine Learning (ML) which has been proficient in learning without code or programs. According to Arthur Samuel, the term machine learning is "a study that stretches the skill to computers to learn without any programming." While, Tom M. Mitchell gave an extensively quoted and extra formal explanation: "A computer code is called as learn that belongs from experience E corresponding to performance P and few classes' tasks T, in such a manner performance P at task T improves on behalf of experience E." This explanation is prominent for its crucial machine learning in essence working rather than cognitive. Machine learning is not a novel method, although it is strictly related to AI. Computers are able to perform numerous procedures around Machine Learning, like prediction, extraction of features, classification, regression, sorting, pattern recognition, clustering, *etc*. Such advanced machine algorithms function by structuring a model on the basis of past example inputs to make data-driven decisions or predictions. Machine learning is one of the most common applications of artificial intelligence. Through cognition of various machine learning, hardware, devices, and software have worked similarly to human beings. The various machine learning applications for computing techniques contain:

- Bioinformatics
- Computational advertising
- Affective computing
- Cheminformatics
- Information retrieval
- Recommender systems
- Speech and handwriting recognition
- Machine perception
- Sequence mining
- Structural health monitoring
- Optimization and metaheuristic
- Robot locomotion
- Computational finance
- Brain-machine interfaces
- Software engineering
- Adaptive websites
- Internet fraud detection
- Medical diagnosis
- Game playing
- Classifying DNA sequences

LITERATURE REVIEW

In the zone of Artificial intelligence, several AI-based machine learning techniques have been established to gain efficient and sustainable trades. The aim of the researcher is to analyse scientific and systematic literature reviews related to machine learning approaches, applications of machine learning and artificial intelligence in industry [1].

The comparative study of various machine learning has been performed, such as artificial neural networks (ANN), extreme learning machine (ELM), group method of data handling (GMDH), classification and regression trees (CART), *etc*., at various depths for soil temperature. The various climate variables have been considered for developing the model [2].

In the paper, the author [3] has presented a literature survey related to machine learning algorithms and various machine learning techniques for the processing of big data analytics. Firstly, the author reviewed the machine learning approaches and considered several auspicious learning approaches in their recent studies, like active learning, deep learning, transfer learning, representation learning, parallel and distributed learning, *etc*., and then performed analysis of the issues as well as probable solutions through machine learning for processing of big data [3].

For the health care system, the author [4] has proposed a deep learning-based solution that focuses on the detection of foods according to the patient's diseases. The deep learning-based datasets have also considered various features such as calories, age, weight, fat, gender, protein, *etc*.

The paper provided a summary of the machine learning application for networking and communications. The author has also classified relevant reviews dealing with the topics related to machine learning and also tried to find new possible research directions [5].

Erwin Adi1 *et al*. [6] presented a serious review study to produce data for machine learning-based IoT and the issues of IoT environment. However, the author has projected a framework to allow learning approaches with IoT applications and give a case study in real-time applications.

Tahsien *et al*. [7] presented a comparative study of IoT systems with the machine learning approach and also conferred about the probable attacks of IoT systems. In the paper, an inclusive comparison of threats and security in IoT and Machine learning-based safe IoT systems up to 2019 is discussed.

Sherali Zeadally *et al*. [8] discovered how to recover threats and security of IoT

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