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Chapter 1: Machine learning in education

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Abstract: This book chapter aims to review the literature on the Adoption of Machine Learning in the education sector. Better individualization of online education is made possible by computer programs, data mining, and forecasting. The days of cookie-cutter training courses that assume all students have the same skills and background knowledge are numbered. The chapter describes how ML will change the face of education worldwide. This study explores the role of ML in the classrooms of the future. Although there are still some difficulties in the education system, the findings indicate that ML helps in pedagogical techniques, assessment, evaluation, and staff training. Using ML, educational technology can adapt to students' evolving requirements. Machine learning has the potential to improve education by individualizing instruction, designing more interesting and immersive activities, and generating more accurate assessments of students' progress. Training programs can provide useful data analytics based on historical performance to anticipate student requirements, design student-focused instances, and improve learning results. This technology has only scratched the surface of what it can do for distance education in terms of student involvement, incentive, and enjoyment of the educational experience. In conclusion, machine learning is one of the most urgently required technologies in the academic world. Artificial intelligence and machine learning have the potential to revolutionize the learning process. Therefore, get ready to hop on the trend when ML permeates across every facet of education and revolutionizes educational experiences and performance.

Keywords: Artificial Intelligence, Machine Learning, Training, Technology, Education.

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1 Introduction

Machine Learning is a branch of Artificial Intelligence that allows systems and other "teaching machines" to draw conclusions and learn from all available data. The machine-learning architecture requires collecting and storing a plethora of data, which is then converted into a database of organized information with multiple applications. Adopting machine learning in education can help educators better allocate their time. ML is radically altering how we educate and conduct research. The question of whether and how algorithms for learning can be applied to teaching is, therefore, legitimate. It does this by monitoring student progress in real-time and adjusting instruction using adaptive education. Each student's education may be tailored to their needs, resulting in higher quality education. The effectiveness and quality of education are improved through ML. It helps teachers organize lessons and materials to cater to each student's strengths and weaknesses (Lyzanets, 2022). Teachers can devote more time to projects that need human judgment and creativity if they are freed from administrative duties such as class scheduling and management. Using AI tools would be a big step toward providing accessible education to all students. In addition, it will guarantee that individuals who are typically excluded from educational possibilities, such as the poor, the elderly, the disabled, the unemployed, the homeless, and the geographically dispersed, have access to quality education. Machine learning has many applications in education, including improved student progress evaluation, more dynamic and interactive lesson plans, and more individualized instruction. Hence, this chapter aims to review the literature on Machine Learning in education.

2.0 Literature

2.1.1 Machine Learning

In 1943, neurophysiologist Warren McCulloch and a mathematical genius named Walter Pitts wrote a paper that shed light on neurons and their functioning, setting the stage for the subsequent decades of research. A model based on electrical circuits was developed, giving rise to the neural network we know today. In 1950, Alan Turing devised the now-famous "Turing Test" to determine whether or not computers possessed true intelligence. To pass the test, it must convince a person that it is human and not a computer. In 1952, Arthur Samuel built the first software program that could acquire knowledge while it performed a board game of checkers. The perceptron, the first artificial neural network, was created by Frank Rosenblatt in 1957.

The practice of Machine Learning (ML), an aspect of AI that summarizes the capacity of machines to acquire knowledge autonomously through experience without having

been explicitly programmed to do so, has been considered one of the greatest advances in technology of the past three decades, especially in the realm of artificial intelligence (Mallia-Milanes & Montebello, 2017). Simply put, machine learning is the process through which a machine can acquire knowledge through observation and practice. Machine learning is an AI technique that helps computers learn from large datasets to address targeted issues. It uses computer algorithms that get better at what they do the more they do it. Machines don't write code; humans provide information into a general-purpose computer program. The machine's logic, or algorithm, is constructed from its given information. Computing science subfield that makes use of statistical methods to endow machines with the capacity to "learn." This is useful for gradually enhancing data-driven performance on a particular task. AI is a broad umbrella term for this branch of study. It's the study of allowing computers to learn and create their code, making them behave and make decisions more like humans. This is accomplished with little to no programming on the part of a person. Machines learn automatically and enhance their performance depending on their past experiences. Machine learning models are constructed using various methods and fed high-quality data for machine learning training. Which algorithm is best for automating a specific task relies on the nature of the available data.

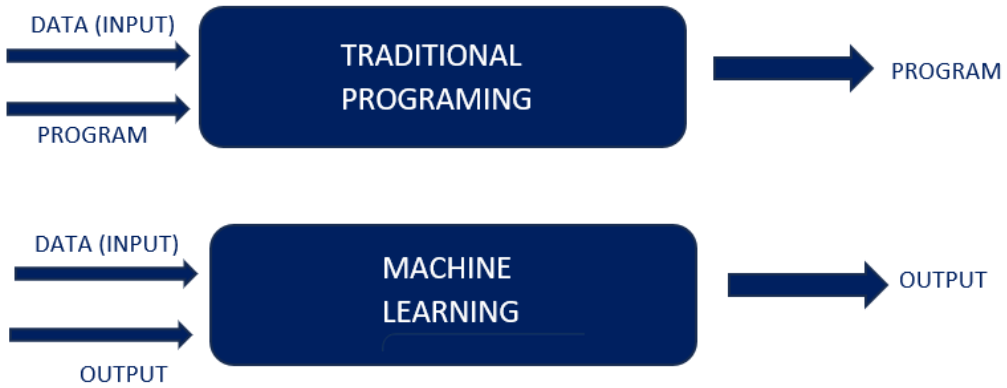

Figure 1: ML Models

2.1.2 Types of Machine Learning

Almost every industry now finds some use for machine learning. In machine learning, you can use a variety of techniques to construct intricate models. There is a place for each of these ML algorithms, and they all have names. Figure 1 displays the many forms.

2.1.3 Supervised Machine Learning

To train ML models, supervised learning makes use of labelled data. The results can be predicted with labelled data. The only thing the model has to do is connect the dots between the inputs and the results. In supervised instruction, a model is used to discover a relationship between training samples and a target variable (Great Learning Team, 2023) to solve a certain type of problem. Training a system to recognize an animal in a picture is an application of supervised learning. Predictions are made on test sets when just the inputs are provided, and the model's performance is estimated by comparing its predicted values to those of the withheld target variables. The training data consists of inputs and outputs. In supervised learning, ML algorithms are taught by being fed examples of inputs and expected outputs from the past. After each input-output pair is processed, the algorithm modifies the model to provide an output close to the target value (Rimo, 2020).

An algorithm supervises and corrects models to better anticipate the expected target outputs in the training dataset. These algorithms are "supervised"; they learn by generating predictions based on input data instances. The instructor's or teacher's perspective on the objective y gives rise to the phrase "supervised learning" (Goodfellow et al., 2016). Rimo (2020) predicts that through 2022, supervised learning will continue to be the most popular form of ML used by enterprise IT directors. Fraud detection, sales forecasting, and inventory management are just some of the numerous commercial applications where supervised learning shines.

Historical data, simulations, and human data labelling are all viable options for generating input and output data. It is possible to use particular properties or classifications as output data when dealing with unstructured data like photos, video, audio, or text. Thanks to human instructors, supervised learning makes predictions, recognition, and classification possible (Great Learning Team, 2023). When it comes to supervised learning, unlike other forms of machine learning, both the desired outcome (or target) and the training data for the computer are known in advance. Because of this, the computer may "learn" to get a good outcome by tweaking its settings until they're just right.

2.1.4 Semi-Supervised Machine Learning

This method was developed by considering the advantages and disadvantages of both supervised and unsupervised learning. During the training phase, machines are prepared using labelled and unlabelled datasets. The majority of real-world input datasets, however, are unlabelled. The efficiency of this approach is enhanced by the fact that it makes use of unlabelled as well as labelled data. To begin with, groups of related

information are grouped. An unsupervised learning algorithm is used for this purpose. Thus, the unlabelled data may be properly categorized. Since it takes the expertise of humans, the cost to label the data is high. Both labelled and unlabelled data are used as input. The model predicts future outcomes after automatically learning the underlying patterns. It combines aspects of classification with those of clustering. The training data for semi-supervised learning consists of a small number of labelled examples and many unlabelled samples. In contrast to supervised learning, where only labelled data is used, semi-supervised learning models aim to maximize the use of all accessible data.

2.1.5 Unsupervised Machine Learning

An unsupervised learning challenge aims for the model to learn independently by identifying patterns in the data and drawing conclusions about the links between them. Similar to unsupervised learning, no human instructor is present to guide the model's development. The focus of unsupervised learning is entirely on the data that is provided. There are no learning objectives (Great Learning Team, 2023) to direct the process. Understanding the underlying patterns in the data will help you master the data more easily. Therefore, this information can be mined for less obvious categories and trends. Clustering (the process of grouping related objects) and dimensionality reduction (the process of lowering the number of dimensions in a data collection) are two examples of applications for unsupervised learning techniques. Clustering, which aims to identify subsets within a dataset, is one of two basic types of unsupervised learning. (2) Density estimation aims to normalize data spread across multiple locations. These procedures are used to recognize trends in the data. Since they both aim to reveal hidden patterns in the data, visualization and projection could also be classified as unsupervised. Data dimensionality reduction is at the heart of projection, whereas plotting and graphing the data is at the heart of visualization. The input data is unlabelled and unlabelled. The input data is analyzed for patterns, which are then used to prepare the model. Clustering, dimensionality reduction, and learning associations are all examples of this challenge. The Apriori algorithm, K-Means, and Association Rules are just a few of the methods available for these situations. Unsupervised learning aims to classify data into manageable groups based on similarities and show the data in a compact format. With this information, organizations may better plan their future moves. In contrast to supervised and reinforcement learning, in unsupervised learning, the computer is not instructed to find a specific pattern. Instead, it is up to it to determine how to get the desired outcome. The computer will be able to learn more about the data, but this can be a more challenging process.

2.1.6 Reinforcement Machine Learning

In reinforcement learning, an agent learns how to best interact with its environment by maximizing the amount of positive reinforcement it receives from that environment. The benefits may be negative. Rewarding good behaviour and punishing bad is at the heart of reinforcement learning (RL). Instead of a single result from a single input, the algorithm generates multiple results and is taught to choose the most appropriate one based on criteria. The agent then advances in the environment based on the incentives received (Great Learning Team, 2023). The procedure for accomplishing a job is decided by the agent that provides reinforcement. In this case, there is no predefined training dataset, and the computer is left to learn independently. Games, market trading, and robot control are just some of the many applications of reinforcement learning algorithms. Unlike the other two forms of machine learning, reinforcement learning does not seek to forecast but to optimize a desired outcome (reward). This makes it useful for ambiguous situations regarding the best course of action.

2.1.7 Self-Supervised Machine Learning

An unsupervised learning issue can be self-supervised if it is recast as a supervised learning problem and supervised learning techniques are applied. An alternative or pretext task is solved using supervised learning methods, yielding a model or representation that can be applied to the solution of the primary modelling problem.

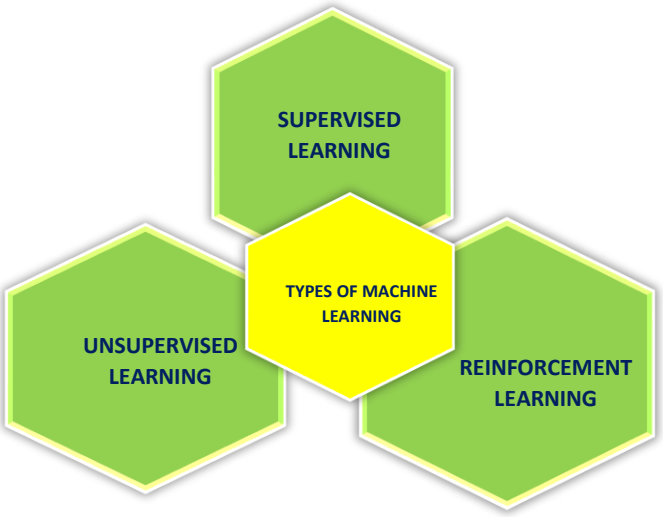

Figure 2: Types of Machine Learning Source: Valihura (2023). https://light-it.net/blog/machine-learning-in-education-explanation-benefits-cases/

2.2 Machine Learning in Education

Using machine learning in the classroom can potentially tailor lessons to each learner as tailored instruction. ML in educational settings today ensures that all students, regardless of their financial resources, have access to high-quality learning materials. That is the original thought that drives today's developments. Machine learning can be at everyone's disposal when developing online courses and programs for the educational sector. Learning and improvement through data analysis are at the heart of machine learning (ML). Based on "knowledge" acquired through processing (training) datasets relating to certain tasks, approaches based on machine learning (ML) techniques can make judgments autonomously. The field of machine learning is rapidly expanding into the traditional academic territory. Machine learning is one of the most powerful emerging technologies, and it controls the roost regarding AI and human interaction. Cancer, global warming, as well as terrorists are being fought with the help of machine learning. It's becoming the standard application support system (Lv & Li, 2015). Therefore, ML enables computers to uncover previously unseen insights without being explicitly instructed. It helps teachers tailor their lessons to the specific needs of their students by revealing where individual students are struggling and allowing them to adapt the pace of their instruction accordingly. It's a powerful facilitator of development that opens the door to a world of digital helpers, streamlined onboarding, engaging individualized curriculum, and advanced education. Using ML in the classroom is likely to keep students engaged. On the other hand, using ML and AI during the learning process can improve long-term memory retention.

2.2.1 Advantages of ML in Education

2.2.2 Analyzing the Content as a whole

The application of machine learning to education has the potential to revolutionize the online learning business by providing users with content that is both timely and tailored to their specific needs. How? The educational material of e-learning programs is analyzed by ML innovations, which helps to determine if the standard of the given knowledge fulfils the relevant criteria. It also reveals how users view the data and if they grasp what is taught. As a result, users obtain knowledge based on their unique requirements and skill sets, vastly enhancing the quality of education.

2.2.3 Widespread Interest

Large e-learning platforms with various courses and materials no longer present an issue. Machine learning can potentially expand the market by providing accurate translations and transcriptions. The business owner shouldn't pay expensive consultants to make the training materials available to all employees. Machine learning and artificial intelligence can get the job done quickly, cheaply, and accurately. People with disabilities can be included in the learning process through ML because of the many forms in which content can be delivered (text, audio, video, and presentation, for example).

2.2.4 Educators' Textbooks are Being Digitized

Artificial intelligence and machine learning (ML) can convert paperback textbooks into digital books, videos, forums, and scholarly papers. The algorithm may also return results similar to what the student is looking for based on the topic they are currently studying. Conveniently, ML/AI can compile a list of the most relevant sources for pupils (Kvartalnyi, 2022). This advantage is particularly helpful in online classrooms, where instructors typically assign tasks simply, and students are responsible for conducting their research.

2.2.5 Automation

This is very important for educators to know. Boring paperwork that needs careful attention might take up valuable time that could be used for personal growth. Artificial intelligence solves this issue by allowing teachers to focus on creating engaging lessons while handling administrative tasks more efficiently than ever before (Kvartalnyi, 2022).

2.2.6 Modern Methods of Grading and Evaluation

Educational professionals have reported a biased grading system in schools. This occurs because teachers might consider elements apart from students' knowledge (Lyzanets, 2022). Thus, education experts think ML and AI can substantially contribute to creating a more reliable assessment system. This is helpful since teachers overlook more underlying issues in favour of attendance and overall performance. The system estimates the essay's style, organization, and content.

ML has also been used to improve the grading and scoring processes in the classroom. New assessment forms can grade on elements such as style, structure, language proficiency, narrative depth, and plagiarism detection. With ML technologies,

evaluating a student's academic prowess may be done in a matter of seconds, with more precision and no room for error. They have extensive expertise in grading online courses, reflecting many students' knowledge and skills. Machine learning can eliminate human bias in grading, making the process of assigning grades much faster than it used to be. However, AI has already replaced human graders for several multiple-choice tests. Machines can't take the role of human educators everywhere, but they can assist in refining how we evaluate and grade students' work. Teachers' subjective perspectives, biases, and illogical reasoning are sometimes put to use while assigning grades in the classroom. This ML/AI is advantageous since it eliminates the possibility of bias and preconceived notions about students. Students can see how they are doing academically without any biases getting in the way (Kvartalnyi, 2022). Here, not only will all the relevant grade-related data be processed by ML and AI, but they will also recommend grades for the students. Without the instructor's intervention, this will help level the playing field for the students.

Concerns about the potential for human bias in grading are a common source of anxiety for students. Teachers, for their part, stress the need to use reliable and consistent grading criteria. Smart assessments that can instantly analyze multiple forms, including written tasks like papers, essays, and presentations, are now possible thanks to the integration of machine learning into the educational process. Modern grading schemes might examine plot complexity, writing style, structure, and originality. We can use ML technology to assess students' academic abilities with pinpoint accuracy and in seconds, all while eliminating the room for human error.

2.2.7 The Greater Return on Investment in E-learning

When the technology is implemented, users can receive individualized assistance from the machine learning software and spend less time scouring the web in vain. There are several advantages for students while using modern learning systems. When discussing the benefits of machine learning in online education, it's important to highlight predictive analysis's role in monitoring students' development. E-learning businesses can use this data as a precise guide for creating the appropriate content and allocating their eLearning resources at the right time and location. This benefit is especially important for the business world, where limited time and money are major concerns.

2.2.8 Enhanced Inspiration to Study

One of the most discouraging aspects of regular classes is the monotony of the curriculum. Machine learning can completely transform the educational system. By tracking student performance, machine learning algorithms can improve the curriculum

and provide more individualized feedback to each student. Online learning environments equip students with all the tools they need to quickly close any knowledge gaps and gain necessary skills. Using gamification and chatbots can boost engagement and retention rates, and the knowledge that a course provides a personalized experience can motivate students to join.

One of the most discouraging features of generic eLearning courses is having to endure tedious and redundant portions of a program. All of that can shift with the introduction of machine learning into the classroom. By tracking student performance, machine learning algorithms can improve lessons and deliver more relevant material. Online platforms help students close knowledge gaps and develop critical skills by providing the necessary resources to succeed. Using gamification and chatbots can increase students' interest and retention if they know the course will be tailored to their specific needs.

2.2.9 Analysis of Learning Data

Like the student, the educator may experience difficulty at some point. This prevents students from grasping the essential ideas and concepts. Teachers can use learning analytics to dig deeper into the data. The person in question can sift through millions of pieces of content, interpret them, and draw meaningful conclusions. D'Angelo (2023) argues that this can potentially improve classroom instruction.

2.3.0 E-Learning Enhanced by Constructive Critique

Teachers can include student comments in their online courses in various ways. Student performance and activity can be better managed with the support of individual perspectives on the quality of the course and ways in which the material could be improved. Thus, AI and ML analyze the comments made, improve with practice, and quickly alert the teacher (Kvartalnyi, 2022).

2.3.1 Extensive Personalization

Machine Learning in the classroom today affords every student an excellent education, independent of their financial situation (Lyzanets, 2022). As a sort of personalized learning, machine learning in the classroom can potentially tailor lessons to each student. Here, students are given choices regarding what, when, and how they study (D'Angelo, 2023) and are directed in their learning. Collecting and analyzing learner data to create profiles and understand student actions is the goal of learning analytics. Machine

learning algorithms generate these profiles, tailoring individual students' educational experiences. The term "adaptive learning" describes this procedure. Individual students can proceed through the lessons at their own pace. These suggestions and potential avenues for growth are founded on past achievements and missteps. Teachers can then utilize this data to adjust the tempo at which they present the lesson. Learning analytics can be used to keep track of students' presence and performance in class and subsequently deliver individual progress reports (Huebner, 2022). That is the original thought that drives today's developments. Machine learning can be at everyone's disposal when developing online courses and programs for the educational sector. It helps teachers tailor their lessons to the specific needs of their students by revealing where individual students are struggling and allowing them to adapt the pace of their instruction accordingly. It's a powerful facilitator of development that opens the door to a world of digital helpers, streamlined onboarding, engaging individualized curriculum, and advanced education. Using machine learning in the classroom is likely to keep students engaged.

On the other hand, using ML and AI during the learning process can improve long-term memory retention. These days, customers don't care if the product they're consuming costs a dollar or is provided for free; they just want a premium experience tailored specifically to them. That's the conundrum of today's corporate world. On the one hand, it is an incredible driver of advancement, inspiring innovation among business owners. However, this burdens business owners heavily and inhibits them from making educational investments (Valihura, 2023). Many (though not all) of the issues associated with the lack of customization in education can be resolved using machine learning tools. There are various methods for accomplishing this.

2.3.2 Analytic Prediction

Understanding students' perspectives and requirements is the focus of predictive analytics in the classroom. It's useful for drawing inferences about potential outcomes. Student's strengths and weaknesses on the exam could be predicted based on their performance on the class assessments and midterm scores. The school staff and parents can be highly alert and take necessary action. D'Angelo (2023) explains how this can be used to assist students improve in their areas of need.

2.3.3 Enhancement to the User Interface

The educational sector is not immune to the trend of automating routine jobs because of the superiority of machines over humans (Valihura, 2023). Staff members have to deal with numerous administrative tasks, such as making plans, taking attendance, and

collecting homework. ML alleviates this burden and economizes the customer's time. The users' mundane tasks are completed successfully, and they are pleased. In the classroom, ML is the "magic tool" that eliminates tedious tasks while keeping the audience engaged in the learning process. The user-interface technology (LMS, translation tool, spelling checker, etc.) provides the most convenient delivery, guaranteeing a pleasant experience at all times.

2.3.4 Constant Upgrading

Machine learning's capacity for ongoing learning and adaptation benefits the academic world. This is because there is a constant expectation of change in education. The ML algorithm can swiftly adapt to new circumstances and improve (Agarwal, 2021). Machine learning is superior to other methods of prediction-making because of how quickly it generates results.

2.3.5 Analytics for Foresight

ML's predictive abilities and ability to identify students' intentions and triggers make it useful in the classroom. Insights like this are invaluable to teachers because they allow them to avoid potential disasters. They can understand who plans to drop out, why some students are unmotivated, and whether or not a consumer wants to take another course (Lyzanets, 2022). The most significant benefit of machine learning in education is its capacity to monitor student development and modify curriculum in response to individual requirements, thereby boosting motivation and improving the quality of instruction. Teachers can better know their students' strengths and areas for improvement thanks to ML algorithms' feedback on their lessons.

2.3.6 The Computerization of Bureaucratic Duties

Machine learning and AI also have the intriguing potential to automate the boring but necessary administrative duties teachers must do. Homework, quizzes, and tests take significant time to grade (Huebner, 2022). Multiple-choice and yes/no questions can now be answered automatically with the help of machine learning. Essays and short answers will soon be able to be graded automatically by machine learning. This application of machine learning can free up classroom instructors' schedules so that they can spend more time with students or develop new lessons (Huebner, 2022). By incorporating machine learning education technology into an eLearning course, trainers can free up more time to focus on tasks that demand human judgment and creativity. Tasks like organizing curriculum, onboarding, providing instructions, scheduling classes,

delivering information, and grading may all be automated using machine learning. Machine learning technology frees teachers to guide students more and create relevant, interesting, and timely lessons.

2.3.7 Recognizing Images

Facial recognition is the most widely used application; the iPhone is a great example. It has several applications, most of which relate to safety and security, such as detecting criminals, locating missing persons, assisting forensic investigators, etc. Other applications include intelligent marketing, sickness diagnosis, and student attendance monitoring (Great Learning Team, 2023).

2.3.8 Improved Usability

Machines are superior to humans in finishing repetitive jobs. These tasks include scheduling, tracking attendance, and handling assignments. Machine learning helps teachers reduce their time on mundane tasks while providing engaging material to the intended audience. While errors are practically unavoidable, they can be mitigated with machine learning (Lyzanets, 2022).

2.3.9 Learner-Specific Comments and Critiques

Teachers cannot monitor all students in advanced online courses and provide each one with individual comments. However, this issue will be resolved via machine learning. The system can monitor how well each pupil is doing and provide feedback accordingly. It has the potential to inspire students, help them chart a course to academic success, and improve their overall learning experience. In addition, machine learning can address students' concerns or inquiries. However, enhancements to this form of support are necessary so that questions from students can be answered with NLP (Lyzanets, 2022).

2.4.0 Widespread Interest and a Welcoming Atmosphere

Large e-learning platforms with various courses and materials no longer present an issue. Machine learning can potentially expand the market by providing accurate translations and transcriptions. The business owner should not pay expensive consultants to make the training materials available to all employees. Machine learning and artificial intelligence can get the job done quickly, cheaply, and accurately. Additionally, ML can provide content in various formats, including text, audio, video, and presentation,

allowing students with varied learning differences to participate in class (Lyzanets, 2022).

2.4.1 Automation of Administrative Duties

Machine learning takes over time-consuming routine tasks, such as teaching, curriculum development, content distribution, paperwork, and material management. This frees up teachers' time to focus on effectively instructing students (Lyzanets, 2022).

2.4.2 Helps Pupils Feel More Secure

According to psychological research, students will perform a simple activity more quickly in front of their peers than when working alone. However, when faced with a challenging assignment, individuals tend to perform poorly out of fear of being evaluated. The term for this phenomenon is "the mere presence effect" (Hughey, 2022). With the help of AI-powered educational software, each student may receive individualized attention and constructive criticism. It allows the teacher to focus solely on the individual student's needs. Students who struggle to speak up in class benefit greatly from this setting (Hughey, 2022).

2.4.3 Changeable Instruction

Adaptive learning the term pretty much says it all. It monitors a student's real-time progress and adjusts lessons and assignments accordingly. To improve learning, it is beneficial to tailor the experience to each student (D'Angelo, 2023) and encourage active participation. The software provides guidance on potential avenues of study for the student. The program provides the students with suggested readings and pedagogical approaches.

2.4.4 Disabled and Gifted Students

Students who require more support are reaping significant benefits from ML's enhanced availability of services. Thanks to AI-powered education platforms, the lives of students with disabilities have vastly improved in recent years. They can now participate in challenging yet supportive, individualized coursework. For kids who have trouble reading or writing, speech recognition software can be a lifesaver (Hughey, 2022). Students with mobility impairments can also benefit from AI-supported study tools that

facilitate individualized instruction. Teachers can use these tools to monitor their student's progress from afar.

2.4.5 Potential for Job Automation

In addition to benefiting children, ML helps teachers become more effective at their jobs. A teacher's day is spent grading, paperwork, and class preparation. To a large extent, these tasks could be automated by AI's support automation systems. Administrative tasks, such as grading papers, spotting learning trends, and answering queries, can be automated using ML (Hughey, 2022). This frees up more time for teachers to focus on developing their expertise and creating engaging lessons for their students. They can also develop creative strategies to pique their pupils' interest in their lessons.

2.4.6 Boosting Productivity

Machine Learning can potentially improve educational content and curricula management and organization. It's useful for delegating tasks fairly and gauging everyone's capabilities. This is useful for determining which assignments are optimal for both the instructor and the student. As a result, both educators and students feel more at ease in the classroom. This boosts interest and enthusiasm for learning and participation (D'Angelo, 2023) among the students. As a result, educational effectiveness is enhanced. It could also help teachers save time on administrative responsibilities like scheduling and management. As a result, teachers have more time to devote to activities that can't be automated and benefit from a personal touch.

3.0 Drawbacks of Machine Learning in Education

3.1.1 The Goodness of the Data

Algorithm predictions can be flawed if they are based on low-quality data. Enhancing computational methods takes a lot of time, and the performance of the algorithms is affected by the quality of the data used (Lyzanets, 2022). The best course of action is to optimize the data preparation procedure. Achieving excellent data quality requires thorough evaluations and analyses, removing irrelevant information, and identifying and filling in gaps.

3.1.2 Information Gathering and Openness

The lack of privacy protections for ML remains a major worry. Parents, teachers, and kids alike need to grasp this concept. The subject of who may access ML's data and how they do so is timely. Therefore, instructors should investigate more in-depth to ensure the privacy of all parties involved in the educational process before implementing ML (Lyzanets, 2022).

3.1.3 Problems with Verification

ML predictions may be off in rare instances where validating facts not included in the previous data is hard. It could also be time-consuming to train the model or master the dataset to the point where it can make sound decisions.

3.1.4 Less-Skilled Workers

Despite its pervasive adoption and growing body of literature, machine learning is still a young field of study. Professionals with the expertise to deal with deep analytics are in short supply. It's already too expensive since workers with deep field knowledge understand their value (Lyzanets, 2022).

3.1.5 Privacy

The availability of students' curriculum data to programmers, data analysts, and data scientists raises important questions about privacy and data ownership. However, it is necessary to make decisions about learning and provide customized and tailored feedback to each student's needs. This means that the utmost care must be taken to protect the privacy and security of students' data and to prevent any disputes about who owns the information. Companies using AI should be honest and ethical in their data usage. To enable data analytics, data warehousing, and data lake systems must consider and implement privacy and security protocols for student curriculum data.

3.1.6 Data for Training purposes is Essential

It's important to create an effective machine learning model like we educate children to learn new knowledge and differentiate between items. We must ensure the model has enough information to do its tasks (Lyzanets, 2022). A baby only needs a few instances to grasp the difference between a cat and a dog, but this isn't enough for machine

learning. Our primary objective is to make ML function like a genius to categorize items based on their forms, colours, and other qualities. The number of samples needed to complete a task range from thousands for a basic activity to millions for a difficult task like object classification or speech recognition. Errors can occur if we use the wrong model or data. Therefore, we must give it everything it needs to do its job.

4.0 Future of ML in Education

Artificial intelligence and machine learning will be essential in classrooms of the future. Like any other educational technology, however, these tools can only reach their full potential when integrated into classroom settings designed to foster student growth and development. The future of machine learning is difficult to predict because it is a rapidly evolving discipline subject to many different influences. However, machine learning is expected to remain a potent influence across many sectors of the scientific and technological communities and a significant driver of technological progress. Some potential future machine learning applications include the development of intelligent assistants, tailored healthcare, and self-driving vehicles. Machine learning holds promise for tackling complex global problems like poverty and climate change. It's also likely that machine learning will continue to evolve and expand as scientists discover and implement new algorithms and methods for enhancing the field. Artificial general intelligence (AGI) refers to studying and creating machines that can learn and carry out various jobs with the same intellect as humans.

5.0 Implications

The administration and the faculty should collaborate to identify the needs of the institution that can be addressed by machine learning. Get started with a manageable, specific query. For instance, predicting who would succeed in a challenging course could be quite helpful. Is it possible to tell which pupils will succeed in calculus based on observable patterns? There are three main reasons why educational ML is so important for Edtech. (1) The future of work will be tied to technology because it is the dominant force in the world today. Improving one's digital literacy can make one more marketable in employment. The next generation is contributing to this wave of innovation in technology. (2) Technology has made content distribution more equitable. Barriers such as a lack of teachers, prohibitive tuition, or remote locations must be overcome immediately. In other words, it allows for study at any time and place. Technology promotes (3) individualized and interactive teaching and learning. Learning can continue even while not in a classroom setting.

6.0 Conclusion

Many problems in the education field, for example, the difficulty in making accurate academic forecasts, have solutions in machine learning. In addition to providing insightful and precise academic forecasts, it also helps educators better comprehend their students' growth and development for the sake of their student's success. Even though many educational institutions in underdeveloped nations do not appear to be ready to use machine learning methodologies, they will soon be forced to do so by the shifting realities in global education.

Learning patterns and performance diagnosis are two areas where machine learning and other AI solutions can alter the discourse in the education sector. Combining machine learning and AI has unleashed extraordinary potential in many areas, including the education sector and associated fields. This suggests that in the future, education will take place in highly individualized settings that will allow students to reach their full potential.

Machine learning can benefit education by tailoring lessons to each learner and detecting students' plagiarism in academia. It will gradually replace traditional approaches to solving many issues plaguing today's educational technologies. Its effects on the end user won't be noticeable or important in the beginning stages. Despite this, educators have begun recognizing the benefits of using machine learning tools to streamline and improve classroom operations.

The progress made in incorporating machine learning into the education sector has resulted in huge savings of instructors' time, both in and out of the classroom. Stakeholders are happy about this unusual perk since it makes education more accessible and enjoyable.

Offering individualized instruction in an interesting style with one-on-one support is the most competitive aspect of any educational enterprise today.

The widespread adoption and usage of machine learning in education has altered the status quo, with machines replacing teachers in many classroom settings. They can improve not only data processing but also the e-learning sector. Students now have virtual assistants to help them along the way, making the material more engaging and making time and location irrelevant. While machine learning isn't the answer to every classroom problem, it provides a much-needed technological boost to improve education overall. We are all now enjoying the fruits of big data, and there is widespread agreement that the more information we provide to our systems, the better their ability to anticipate the future. Because of traditional teaching techniques' limitations and antiquated nature, machine learning enables businesses and universities to provide services that would otherwise be inaccessible.

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