ADOPTION OF MACHINE LEARNING IN DIAGNOSIS AND TREATMENT IN HEALTHCARE; A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

The utilization of machine learning (ML) has the capacity to greatly influence the examination of intricate data sources within the field of medical practice. Machine learning algorithms are presently utilized in the medical domain to identify patterns and make predictions concerning possible outcomes. The healthcare sector has made notable advancements in utilizing machine learning (ML) technology, particularly in areas such as diagnosis, predicting clinical events, and forecasting mortality trends. We employed a methodical approach to locate and examine scholarly articles that were published between the years 2015 and 2022. A total of 26 articles were identified and reviewed. The findings suggest that machine learning has the capability to improve the accessibility and efficiency of service provision. Despite the considerable potential of machine learning in the healthcare industry, there has been a surprising lack of research in this area. The study indicates that most research in this area has primarily focused on subjects such as diagnosing and predicting risks, suggesting treatments, and creating medications.

Key Words: Machine learning, Predictive modelling, Patient outcomes, Disease detection, Risk assessment

INTRODUCTION

Machine learning (ML) has the potential to greatly change how doctors analyze various data sets in clinical settings. Machine learning (ML) has great potential in the healthcare industry to revolutionize healthcare delivery and improve the precision of diagnoses and prognoses (Aldahiri et al., 2021). Machine learning algorithms are currently employed in the field of medicine to detect patterns and make predictions regarding potential outcomes (Kourou et al., 2015). This system is capable of handling both structured and unstructured data inputs. Worksheets and datasets are highly regarded as efficient instruments for their respective functions when dealing with organized data. However, unstructured data does not possess any identifiable pattern or established framework. Different modes of communication, such as written text, spoken language, visual images, and audio recordings, pose unique challenges when it comes to understanding them. People with high cognitive abilities have consistently demonstrated the capacity to effectively interact with unstructured information. Natural language processing (NLP) and other forms of artificial intelligence (AI) can be employed to understand and make effective use of the given data. Machine learning (ML) is a discipline in the field of artificial intelligence (AI) and computer science. Its primary objective is to create models that imitate human learning by utilizing statistical methods and computational frameworks. The main objective of this replication study, as described by El Naqa and Murphy (2015), is to improve the accuracy over a prolonged duration.

In traditional medicine, the main factors considered when choosing treatment methods have historically been the recognition and assessment of a patient's condition and the related clinical symptoms. The development of genome sequencing and pharmacogenomics in recent times has presented considerable difficulties to traditional ways of thinking (Coronato et al., 2020). These significant findings have led to the development of a new field of medicine known as personalized medicine. Instead of solely relying on a patient's diagnosis, personalized medicine takes into account their individual circumstances when determining their treatment. Healthcare professionals can improve their ability to treat patients with hypertension by utilizing genetic and demographic information to anticipate how each patient will respond to a specific medication. The idea of a paradigm shift towards personalized therapy is intellectually stimulating. However, its implementation necessitates a thorough evaluation of the genetic makeup of each patient. However, the financial consequences of this study could potentially impede the widespread acceptance of personalized medicine as a convenient method of delivering healthcare.

Machine learning has become increasingly common in the healthcare industry due to its capacity to quickly and accurately detect diseases. Machine learning has the capacity to be employed in the medical field to aid in the task of disease diagnosis. Breast cancer diagnosis is commonly aided by the use of ultrasound or X-ray imaging techniques. Supervised learning classification is suitable for this scenario as it aims to identify the presence or absence of cancer, which can be represented by a discrete binary label (Saxena, 2021). Moreover, the algorithm possesses the ability to provide health practitioners with valuable information by elucidating the reasoning behind its classification of a picture. Machine learning has been used in the healthcare field to predict the progression of Alzheimer's disease (Tanveer et al., 2020). The machine learning model employed in this case seeks to detect patterns in the speech of individuals affected by this particular condition, utilizing a dataset of audio recordings.

Machine learning (ML) offers numerous benefits compared to traditional classification and prediction models like logistic regression. Allan et al. (2022) state that machine learning (ML) can effectively identify relevant elements by analyzing information, thereby eliminating the requirement for pre-determined selection. Therefore, in comparison to traditional methods, the user spends significantly less time and effort in creating a proficient machine learning model. In addition, machine learning provides a wider array of choices for integrating predictors in comparison to logistic regression. Awada et al. (2021) suggest that employing machine learning's adaptability can improve the handling of large and complex datasets in modern times. In addition, machine learning can detect complex and non-linear connections within datasets. This presents a difficulty for logistic regression models in accurately capturing and accommodating these complexities. The progress of artificial intelligence (AI) and machine learning (ML) is anticipated to have a substantial influence on the application of personalised medicine, owing to the numerous advantages they offer.

Significant progress has been made in applying machine learning (ML) methods in healthcare, specifically in areas such as diagnostics, predicting clinical events, and forecasting mortality trends. Previous academic studies on the application of machine learning (ML) in healthcare have observed a significant increase in healthcare data following the implementation of electronic health records. Recent studies have shown that there is a significant rise in the demand for healthcare information technology (IT) and applications (Carriere et al., 2021; Char et al., 2018; Elfiky et al., 2018; Char et al., 2018). In addition, it is crucial to utilize diagnostic data collected from a large group of patients in order to effectively apply clinical machine learning. Therefore, it is crucial to have access to precise and ample data in order to offer appropriate medical guidance. It is important to recognize and understand the increasing amount of academic research in this specific field. In order to fully comprehend the application of machine learning in healthcare, particularly in the areas of diagnosis and treatment, it is essential to combine and integrate various researched topics.

Motivated by the knowledge gained from prior research and with the aim of encouraging academic inquiry and providing enhanced guidance, this study provides a comprehensive systematic literature review on the adoption of ML in personalized patient treatment. In this regard, this research attempts to address the following research objectives:

1. To conduct a comprehensive analysis of the extant literature pertaining to adoption of machine learning in diagnosis and treatment.
2. To identify future research agenda on ML in diagnosis and treatment.

This study aims to explore the existing understanding of the utilization of machine learning in diagnosis and treatment. The review offers valuable insights into academic theory and research by summarizing the latest evidence.

RESEARCH MATERIALS AND METHODS

This section provides an explanation of the procedures that were followed in order to gather data, analyze it, and report on it. First, the criteria that would be used to choose the articles were developed. In addition to that, a wide variety of information sources were investigated in order to bolster the original quantity of papers. In addition, the papers and other materials were organized according to the extent to which they were relevant to the topic of the study. The chosen papers underwent a thorough analysis, during which time a number of aspects, including the year of publication, the research methodology used, and the overall scope of the studies, were taken into consideration. A summary of the progress achieved in the research for this study may be found in the next sections.

Search criteria

A systematic approach was used to perform a literature review on the application of machine learning in personalized patient treatments from 2015 to 2022. We utilized several search databases, including the PubMed, National Library of Medicine and Google Scholar, to locate the relevant articles. The Boolean operators were utilized in conjunction with the following search strings to obtain pertinent literature:

Str1: “Artificial intelligence" OR "Machine learning") AND ("Healthcare diagnosis" OR “Medical diagnosis “OR” Disease diagnosis")

Str2: “Machine Learning” AND (Adoption OR Application*) AND (Health OR “Health Sector*”) AND (Patient outcomes OR “Patient treatment”)

Screening

The following inclusion and exclusion criteria were used:

- Studies centred on the adoption of ML in diagnosis and treatments in the health sector.
- Peer-reviewed journal articles and book chapters
- Language – English
- Publication Timeframe – 2015 - 2022

Figure 1 provides a summary of the process used for the selection and identification of the relevant articles used in this study.

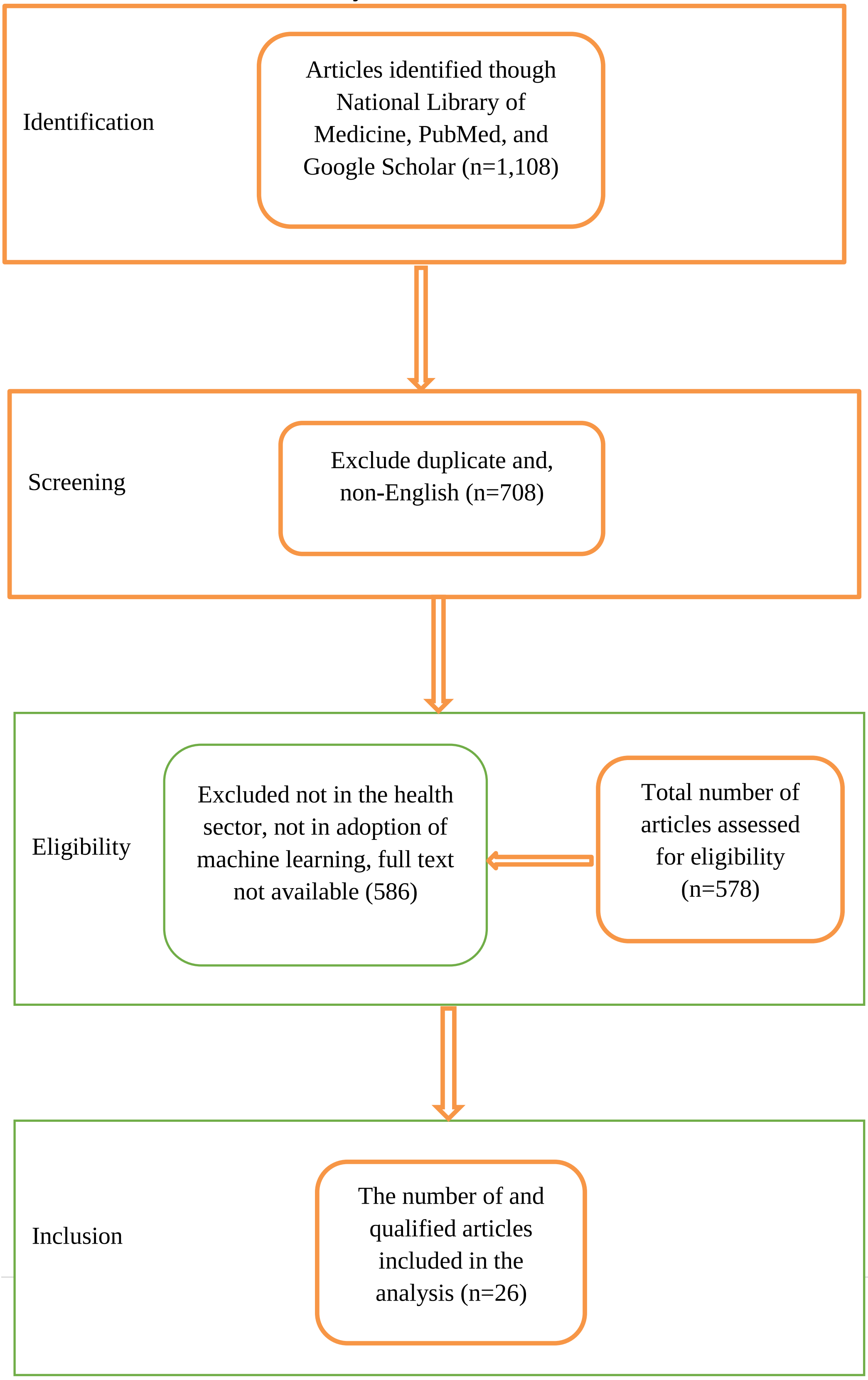

Figure 1 Review Process
Source: Author (2023)

Data Extraction Process

A comprehensive qualitative study was conducted on the selected publications. A coding framework was created to facilitate the data extraction procedure. The study's research goals led to the utilization of two classification categories;

- Thematic issues/study focus area
- Journal, author(s)
- Year of publication

The output of the search process in terms of the number of works published by year is shown in Figure 2.

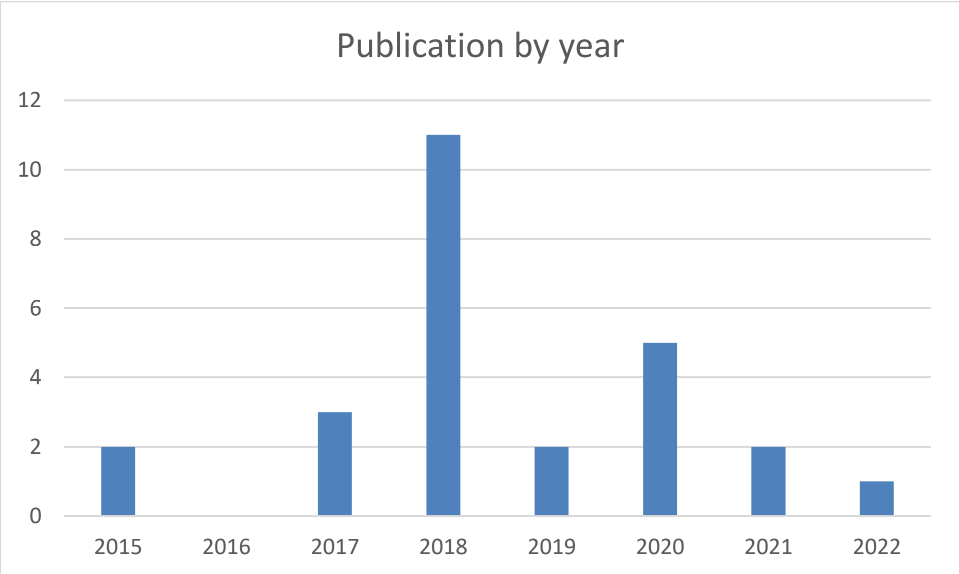

Figure 2 Publication by year
Source: Researcher (2023)

The period under examination witnessed sporadic progress. Given the immense potential of machine learning (ML) in the healthcare sector, it appears that researchers have not given this area as much focus as they could have. Moreover, based on a survey of the literature, it appears that the majority of authors have shown a preference for publishing their work in prestigious scientific journals. The 26 articles included in this review are displayed in Table 1.

Table 1 Papers in the review

Author	Title	Journal	Citation Index
Battineni et al. (2020)	Applications of machine learning predictive models in the chronic disease diagnosis	Journal of personalized medicine	5
Coronato et al. (2020)	Reinforcement learning for intelligent healthcare applications: A survey.	Artificial Intelligence in Medicine	171
Bray et al. (2018)	Global cancer statistics	Cancer Journal for Clinicians	17378
Dercle et al. (2021)	Reinventing radiation therapy with machine learning and imaging bio-markers (radiomics): State-of-the-art, challenges and perspectives	Methods	78
Bica et al. (2021)	From real-world patient data to individualized treatment effects using machine learning: current and future methods to address underlying challenges	Clinical Pharmacology & Therapeutics	171
Chien et al. (2020)	A machine learning approach to understanding patterns of engagement with internet-delivered mental health interventions	JAMA network open	2
Loftus, et al. (2020)	Decision analysis and reinforcement learning in surgical decision-making.	Surgery	15
Davatzikos, et al. (2019)	Precision diagnostics based on machine learning-derived imaging signatures.	Magnetic resonance imaging	141
Ahmed et al. (2020)	Artificial intelligence with multi-functional machine learning platform development for better healthcare and precision medicine	Database	0
Chew & Achananuparp, (2022)	Perceptions and needs of artificial intelligence in health care to increase adoption: scoping review.	Journal of medical Internet research	142
Zhang et al. (2018)	Learning for personalized medicine: a comprehensive review from a deep learning perspective	IEEE reviews in biomedical engineering	15

Naylor, (2018)	On the prospects for a (deep) learning health care system	Jama	1367
Liu et al. (2017)	Deep reinforcement learning for dynamic treatment regimens on medical registry data	IEEE international conference on healthcare informatics	12
Delahanty et al. (2018)	Development and evaluation of an automated machine learning algorithm for in-hospital mortality risk adjustment among critical care patients.	Critical care medicine	299
Ahamed & Farid, (2018)	Applying internet of things and machine-learning for personalized healthcare: Issues and challenges.	International Conference on Machine Learning and Data Engineering	463
An, et al. (2018)	Predicting drug-resistant epilepsy—A machine learning approach based on administrative claims data	Epilepsy & Behavior	8
Bzdok, & Meyer-Lindenberg, (2018)	Machine learning for precision psychiatry: opportunities and challenges.	Biological Psychiatry: Cognitive Neuroscience and Neuroimaging	16
Istepanian & Al-Anzi, (2018)	m-Health 2.0: new perspectives on mobile health, machine learning and big data analytics.	Methods	2
Tseng et al. (2017)	Deep reinforcement learning for automated radiation adaptation in lung cancer	Medical physics	8
Donsa et al. (2015)	Towards personalization of diabetes therapy using computerized decision support and machine learning: some open problems and challenges.	Smart Health: Open Problems and Future Challenges	265
Huang et al. (2018)	Machine learning predicts individual cancer patient responses to therapeutic drugs with high accuracy	Scientific reports	52
Stead, (2018)	Clinical implications and challenges of artificial intelligence and deep learning.	Jama	95
Tsoukalas et al. (2015)	From data to optimal decision making: a data-driven, probabilistic machine learning approach to	JMIR medical informatics	30

	decision support for patients with sepsis.		
Tizhoosh, & Pantanowitz (2018)	Artificial intelligence and digital pathology: challenges and opportunities	Journal of pathology informatics	12
Bhardwaj (2022)	Promise and provisos of artificial intelligence and machine learning in healthcare	Journal of Healthcare Leadership	14
Salto-Tellez, Maxwell, & Hamilton, (2019)	Artificial intelligence-the third revolution in pathology	Histopathology	9

RESEARCH RESULTS

In this section, the research objectives are addressed.

To conduct a comprehensive analysis of the extant literature pertaining to adoption of machine learning in diagnosis and patient treatment.

The increasing use of digital technology is impacting the daily routines of nearly everyone, both personally and professionally. The integration of health information technologies (HITs) in health care, such as electronic health records or clinical decision support systems, has led to notable advancements in processes like emergency medical care, diagnostics, and therapy (Mohammadi et al., 2022). Nevertheless, the incorporation of Health Information Technologies (HITs) is not a universal solution, as it presents significant difficulties in healthcare settings. These technologies contribute to an increasing amount of patient data and the intricate nature of interconnected systems, posing significant challenges for physicians (Bhardwaj, 2022). In this study, the following themes are prominent in the works that were reviewed:

Clinical Diagnosis and risk forecasting

The availability of accurate and robust predictive models is essential for estimating overall survival and relapse rates. Machine learning techniques possess remarkable capabilities in analyzing extensive datasets and uncovering concealed patterns and correlations among seemingly disparate variables. Using this innovative approach, it is possible to accurately forecast the future outcomes of various neoplastic disease presentations. Recent scientific studies, including those conducted by Tseng et al. (2017), Huang et al. (2018), and Kourou et al. (2015), have shown an increasing interest in utilizing machine learning (ML) techniques for the purpose of cancer prognosis and prediction. In a significant study conducted by Huang et al. (2018), it was discovered that the utilization of machine learning (ML) methods has the ability to greatly enhance the accuracy of cancer prognoses related to susceptibility, recurrence, and mortality. The improvement observed was substantial, ranging from 15% to 25%.

The use of endoscopic ultrasonography (EUS) is increasing as a diagnostic tool for assessing digestive system problems (Yousaf et al., 2020). The healthcare industry has recently shown increased acceptance of artificial intelligence (AI), particularly in the area of endoscopic ultrasonography (EUS). The evident benefits of artificial intelligence in this domain are increasingly apparent. The algorithms used in machine learning (ML) and deep learning (DL) are crucial components in the rapidly advancing field of artificial intelligence (AI). Endoscopic ultrasonography (EUS) is a medical procedure that combines ultrasound technology with endoscopic imaging. It allows for a detailed and real-time visualization of the luminal anatomy of the digestive tract. This method generates high-quality images of the digestive tract and its surrounding anatomy, facilitating a comprehensive assessment of tumor infiltration depth and the presence of enlarged lymph nodes (Yousaf et al., 2020).

Consequently, endoscopic ultrasonography (EUS) has emerged as a crucial instrument for the diagnosis of various gastrointestinal disorders. This technique shows great promise in enhancing the accuracy of evaluating attributes and dimensions of abnormalities, thereby improving the efficiency of their detection. The diagnostic accuracy of endoscopists using endoscopic ultrasonography (EUS) depends significantly on their knowledge, experience, and skill level. The matter under consideration is, to a certain degree, subject to individual interpretation. Battineni et al. (2020) found that relying solely on endoscopic ultrasonography (EUS) for diagnosis may pose challenges in accurately detecting certain disorders. The advancement of artificial intelligence has granted us the remarkable capability to analyze extensive amounts of data with unparalleled precision. The combination of artificial intelligence (AI) and endoscopic ultrasonography (EUS) creates an unexpected synergy, leading to a comprehensive, direct, and efficient approach to medical evaluation. Tonozuka and colleagues created a computer-aided diagnosis (CAD) system that uses endoscopic ultrasound (EUS) images to determine the effectiveness of distinguishing between patients with pancreatic ductal adenocarcinoma (PDAC), patients with chronic pancreatitis (CP), and healthy individuals.

The use of digital pathology has become an essential part of contemporary clinical practice ever since it was first implemented in pathological anatomy laboratories (Baxi et al., 2022). The advancement of information technology has significantly transformed the management and transmission of digital images used for therapeutic purposes. The use of AI techniques and specialized models enables the precise quantification of crucial data in digital histopathology pictures. Niazi and colleagues (2019) demonstrate that the novel approach surpasses conventional optical microscopy techniques in terms of both consistency and accuracy. Recent advancements in machine learning have enabled the utilization of image analysis in diagnostic applications beyond its conventional domains. Artificial intelligence and digital pathology collaborate effectively to achieve this objective. Due to the integration of digital photography, advanced algorithms, and computer-aided diagnostic procedures, pathologists can now surpass the constraints of microscopic images in the field of pathology research. Consequently, the specialist is more proficient in utilizing and integrating their diverse skills and areas of expertise (Baxi et al., 2022). Digital pathology is a pioneering field that utilizes advanced computer technology for the analysis of tissue samples. This advanced technique utilizes high-resolution photographs created in a format called Whole-Slide Imaging (WSI). In order to ensure accurate medical assessments, this complex procedure also includes meticulous storage and a comprehensive analysis of the pertinent visual representations and data. This is achieved by employing widely-accepted techniques for identifying patterns, with particular emphasis on advanced deep learning methods. Computational pathology is an emerging field that has garnered significant attention due to its innovative utilization of computer technology for the analysis of extensive image data and accompanying metadata. The main objective of this study is to develop accurate diagnoses and predictions by emphasizing important biological and clinical features and recurring patterns (Niazi et al., 2019).

The impact of artificial intelligence (AI) will be most prominently seen within the field of pathology. As an increasing number of labs adopt digital pathology, the necessary infrastructure for implementing these tools will be established, leading to their widespread adoption as a standard practice in diagnostic medicine (Salto-Tellez et al., 2019). In the field of pathology, artificial intelligence (AI) has promise in the development of image analysis technologies that may be used to aid in diagnosis or provide novel insights into disease biology that beyond the capabilities of human observers. There are now a limited but increasing number of applications that have access to diagnostic assistance. These applications include tumor detection, automated tumor grading, immunohistochemistry scoring, and mutation status prediction (Tizhoosh & Pantanowitz, 2018). There exist several challenges that need to be taken into account, with one of the significant ones being the verification and regulatory framework around these items (Niazi et al., 2019).

Treatment recommendation

In this situation, it may be crucial to use sophisticated data analysis approaches, as suggested by Davatzikos et al. (2019). In the quest for improved cancer therapy, researchers have systematically investigated several chemical compounds on cell lines derived from cancerous tissues. This helps people in cultivating a deeper understanding of the connection between their genetic traits and their reaction to pharmacological therapies. Machine learning approaches have been widely used in the pursuit of this purpose (Davatzikos et al., 2019). Supervised learning techniques, such as penalized regression and recommender systems, are often used in practice. The use of reinforcement learning in a sequential fashion, wherein knowledge is obtained via the accumulation of data, has potential for augmenting production. This approach entails taking into account the unique molecular and clinical characteristics of the individual in order to ascertain the most appropriate course of therapy.

To enhance the management of diabetes, machine learning has been systematically classified into five discrete subfields. Donsa et al. (2015) have delineated a number of objectives, encompassing: (1) the expeditious detection of diabetic retinopathy; (2) facilitation of insulin therapy, with a specific emphasis on continuous glucose monitoring; (3) creation of resources to support patients in self-care; (4) classification of risk levels associated with diabetes; and (5) provision of guidance to healthcare practitioners regarding the judicious use of antihyperglycemic medications. Historically, individuals receiving medical treatment and healthcare professionals often relied on anecdotal evidence as a foundation for evaluating suitable modifications to insulin dosages. In contemporary times, there has been a notable advancement in the field of medical technology, namely the emergence of medical devices that possess the ability to transmit data from Continuous Glucose Monitoring (CGM) or Self-Monitoring of Blood Glucose (SMBG) systems to a remote server situated in the cloud. The aforementioned devices use artificial intelligence methodologies to evaluate data and determine the most suitable dose of insulin for each person (Jaiswal et al., 2021).

The study undertaken by Alloghani et al. (2019) revealed a noteworthy finding, in which an advanced automated decision support tool demonstrated similar effectiveness to the careful insulin adjustment carried out by highly regarded doctors associated with specialist academic diabetes institutions. However, the presence of severe hypoglycemia presents a substantial barrier to attaining adequate glycemic management in persons afflicted with either type 2 or type 1 diabetes mellitus. The potential for improving the accuracy of hypoglycemia diagnosis is promising via the use of machine learning techniques in integrating continuous glucose monitoring data with decision support systems. The study conducted by esteemed academics Ramesh et al. (2021) revealed a significant finding on the efficacy of machine learning algorithms in the field of hypoglycemia diagnosis. The ability of these systems to reliably identify hypoglycemia with a probability of 4.05 is a noteworthy achievement. It is crucial to realize, nonetheless, that a marginal probability of 0.26 was reported for false negatives, suggesting a limited scope for improvement. Numerous rigorous sensitivity evaluations conducted only on people diagnosed with type 1 diabetes mellitus have shown a significant level of consistency in the estimates. Based on the data given, it seems that the existing machine learning algorithms have insufficient skills in reliably detecting occurrences of hypoglycemic episodes.

The use of computational approaches to predict the response of various cell lines to medications is a crucial step in the advancement of precision medicine. The achievement is attained via the examination of the complex genetic characteristics and chemical compositions of the drugs (Ahmed et al., 2020). Comprehensive molecular profiles have been obtained by the implementation of extensive screenings on cancer cell lines. The Cancer Cell-Line Encyclopedia (CCLE) offers a comprehensive collection of molecular profiles, including many factors such as genetic mutations, gene expression patterns, and epigenetic modifications, namely DNA methylation. The primary aim of the GDSC study was to do an analysis on the effects of different medications on certain cancer cell lines. The IC50 number, also known as the half-maximal inhibitory concentration, serves as a quantitative indicator of the reaction. A medicine with a lower IC50 value may suggest a greater likelihood of effectiveness. The Genomics of Drug Sensitivity in Cancer (GDSC) offers a comprehensive collection of multi-omics resources, including whole-exome sequencing (WES), copy number variation (CNV), and DNA methylation (MET) data. Evaluating the prospective reaction of a patient to various healthcare interventions might be a formidable undertaking. To far, The Cancer Genome Atlas (TCGA) has amassed data pertaining to around 10,000 people who have successfully overcome cancer. Elfiky et al. (2018) performed a study that offers a detailed analysis of patient survival rates and recurrence outcomes after the use of various treatment strategies.

The use of machine learning (ML) has promise in facilitating the shift from a reactive approach to healthcare delivery to a proactive one, by offering tailored treatment suggestions. The use of this technology has promise in supporting healthcare practitioners in providing tailored therapy to individual patients via the examination of their medical records, lifestyle choices, and presenting symptoms. As a result, the probability of patients encountering unfavorable reactions to the prescriptions provided by their healthcare providers would be reduced. Machine learning algorithms may be used by the healthcare industry to predict and track the occurrence of disease outbreaks. Bica et al. (2021) provide evidence of the potential of machine learning (ML) in mitigating the impacts of epidemics. The use of machine learning (ML) in the fields of pharmaceutical research and clinical trials holds significant promise for improving the effectiveness of these processes. The pharmaceutical industry faces a wide array of issues within its sphere. In the past, the coordination of clinical trials was marked by extended timeframes and significant financial investment owing to the many factors that needed to be taken into account. To get reliable results, it is important to comprehensively evaluate participants in clinical research across all facets. The research done by Liu et al. (2017) demonstrates that this specific technology plays a crucial role in guaranteeing the safety and efficacy of pharmaceutical goods via the ongoing monitoring and evaluation of a significant amount of data.

Medication discovery

The creation of new drugs is a process that is time-consuming and challenging owing to the intricacy and unpredictability of the undertaking. According to Vamathevan et al.'s 2019 research, the application of machine learning techniques to problems that are well outlined and that have access to high-quality data may improve the discovery and decision-making processes. The use of machine learning (ML) software might be beneficial to research in a number of subfields within the pharmaceutical industry. The scope of study covered by clinical trials is quite broad, ranging from establishing the viability of a therapy to locating prognostic biomarkers and doing digital pathology data analysis. In a diverse range of contexts and via a vast number of research approaches, it has been possible to arrive at accurate forecasts and understandings of previously unknown phenomena. According to Forest and Martin (2018), one of the challenges facing the area of machine learning (ML) is that the outcomes of ML applications might be difficult to understand and reproduce due to their complex nature. There is a dearth of high-dimensional data that is methodical and comprehensive across all fields of study. Machine learning (ML) has the ability to boost production in the pharmaceutical sector while simultaneously reducing the number of errors that occur. This will be the case, particularly if efforts to solve these hurdles continue and more people learn about the requirements for evaluating ML algorithms (Vamathevan, et al., 2019).

A deeper inclusion of machine learning (ML) is made possible by physicians' increased awareness of the molecular and genetic composition of patients and diseases, as shown by the tumor research conducted by Elfiky et al. in 2018. This study is only one example. As a result of the combination of these resources, computer simulations may now be run instead of only doing testing in the actual world. These computers are able to identify crucial individuals for pharmaceutical research and assessment by running many simulations simultaneously. With the assistance of ML, the models used in drug development may be enhanced, which would save the time needed for the design process by a number of years or perhaps decades. This might cut down on the amount of time and money spent on the development of drugs, which would ultimately be beneficial to patients (Kleczyk et al., 2021).

In traditional Chinese medicine, the treatment for infectious fever begins with the diagnosis of the underlying illness (Ma, 2016). Because the symptoms of infectious fevers are so similar to one another, traditional Chinese medicine practitioners often have a difficult time differentiating between them. The use of Deep Learning into the process of detecting infectious fever syndrome has potential as a paradigm for future use. Adding an adjustable dropout mechanism is one component of the suggested method, which also involves improving the stacked auto-encoder. The value of this study lies in the fact that it has the potential to decrease the impacts of over-fitting while also increasing the accuracy of categorisation.

The use of machine learning (ML) might be useful in a number of different subfields of pharmaceutical research. There are several instances, including as the validation of targets, the development of prognostic biomarkers, and the analysis of digital pathology data. Across all fields of study, there is a severe lack of data that is both comprehensive and well-structured, as well as high-dimensional. If machine learning (ML) is used in drug discovery models, it has the potential to significantly cut the amount of time needed for development, perhaps saving years, if not decades.

To identify future research agenda on ML in diagnosis and treatment.

The proliferation of intelligent medical devices has led to an escalation in the use of technology within the healthcare sector. The healthcare sector's receptiveness to innovation and adaptability holds promise for the integration of machine learning (ML) techniques. The use of technology enables the accomplishment of tasks such as big data analysis, the generation of credible forecasts for prospective outcomes, and several other responsibilities. This approach may be used to customize a therapeutic regimen to accommodate the distinct requirements of individuals afflicted with uncommon medical conditions. There is a strong possibility that the integration of this machine learning technique with nanotechnology might potentially enhance the efficiency of pharmaceutical administration in the future. Machine learning (ML) is a valuable tool due to its ability to address urgent issues and anticipate complex obstacles. The machine learning system has a notable ability to accurately predict worldwide pandemics as well. In contemporary times, it is essential for experts to possess the capability to effectively manage substantial volumes of data originating from diverse sources, including website analytics and live updates from social media platforms. Irrespective of the magnitude of a disease epidemic, this technique will provide enhanced precision in predicting and validating the associated figures.

The establishment of the future research agenda for machine learning (ML) in personalised patient care should be based on many critical concerns. The primary objective is to develop machine learning models capable of effectively conveying their thinking to human beings. It is essential for healthcare professionals to strike a balance between the intricacy of deep learning models and their comprehensibility in order to effectively grasp the underlying reasoning behind AI-generated suggestions. The objective should be to foster a sense of assurance among the medical community, enabling healthcare professionals to make informed judgments about patient care. The practical use of artificial intelligence discoveries will provide beneficial outcomes.

Ethical and legal issues will have significant effect on future scientific advancements. As the use of machine learning (ML) in healthcare expands, it becomes imperative to examine ethical considerations such as safeguarding patient data privacy, ensuring openness in algorithmic decision-making processes, and adhering to evolving healthcare regulations such as the Health Insurance Portability and Accountability Act (HIPAA) and the General Data Protection Regulation (GDPR). This project will investigate the subjects of data anonymization, security in federated learning, and robust auditing mechanisms. The objective is to advance the adoption of secure and morally sound use of machine learning within medical contexts.

The research should prioritize the inclusion of clinical validation and assimilation. The efficacy and safety of machine learning models are shown via comprehensive clinical validation studies. These research will evaluate the effectiveness of the models in various patient demographics and healthcare contexts. Another area that requires attention is the effective incorporation of machine learning (ML) solutions into well-established healthcare processes, such as electronic health records (EHRs) and clinical decision support systems. The facilitation of machine learning (ML) integration in the healthcare sector necessitates the establishment of standardized interfaces and protocols. This will facilitate the extensive implementation and seamless integration of machine learning technologies into healthcare protocols. Hence, it is expected that patients will enjoy more favourable healthcare encounters in general.

Limitations of the review

The presence of publishing bias poses a noteworthy constraint. Research findings that show positive or statistically significant results are more likely to be published, while studies with null or negative results may be excluded from the current body of literature. This can result in a bias in the published research. The assessment of machine learning's efficacy in creating personalized treatments for patients may have exaggerated its usefulness due to the inclusion of papers that introduced selection bias.
Another issue that emerges is the impact of time. The healthcare industry is experiencing rapid advancements in machine learning, with frequent emergence of new technology and approaches. The time gap between finishing a study and publishing it could hinder the inclusion of current information in systematic literature reviews. The review's applicability to practical healthcare environments may be compromised as a result of time limitations.

Moreover, the extensive range of research methodologies, datasets, and statistical techniques currently employed in the field could pose a significant obstacle. The field of machine learning research in healthcare encompasses a diverse range of studies, which poses challenges in consolidating data and drawing meaningful comparisons among them. It is important to acknowledge that the research quality included in this meta-analysis exhibits significant variation. The methodology of certain research studies may pose challenges that could potentially undermine the validity and reliability of their findings. It is necessary to evaluate the quality of each study and take into account its potential influence on the findings of the review.

The complexity of conducting systematic reviews in this field is exacerbated by considerations regarding privacy and ethics. Several studies in the healthcare sector focus on the utilization of private patient data in the field of machine learning. The existing literature may not always provide detailed information on data sources, patient consent processes, and other ethical issues. Hence, the assessment may encounter challenges in comprehensively evaluating the various ethical implications of the research.

Lastly, systematic reviews typically focus on articles published in academic journals, potentially excluding pertinent information from gray literature sources such as conference abstracts and unpublished studies. Insufficient understanding of the subject may result from neglecting this material, as novel concepts and preliminary investigations are frequently deliberated upon in these forums.

Conclusion

In summary, our thorough examination of the current body of research has revealed valuable findings regarding the application of machine learning in the fields of diagnosis and treatment therapy. The papers examined in this analysis emphasize the significant potential of machine learning in revolutionizing the healthcare system through the provision of personalized treatment plans for individuals. However, a significant amount of novel information and factors have emerged, and it is imperative to consider all of them.

The evaluation revealed increasing evidence supporting the utilization of machine learning applications in patient therapies. These programs can assist in various medical tasks, including diagnosis, risk assessment, therapy suggestion, and drug discovery, among others. Machine learning models have demonstrated proficiency in analyzing large amounts of data to identify significant correlations and patterns that can potentially enhance clinical decision-making and improve patient outcomes.

It is important to recognize the current constraints and obstacles within the field of study. Major obstacles that persist include ethical and privacy concerns, the necessity for interpretability in machine learning models, and challenges related to data quality and bias. Additionally, ensuring the currency, safety, and ethical integrity of machine learning systems necessitates ongoing research and adaptation in response to the swift progress in technology and the healthcare industry.

In summary, machine learning is expected to significantly impact the healthcare field, promising positive advancements in patient diagnosis and treatment. In order to tackle these challenges, it is crucial to conduct experiments with machine learning models in clinical environments and effectively integrate new technologies into healthcare procedures. This requires ongoing collaboration between data scientists, healthcare professionals, and policymakers. In order to fully comprehend the benefits of personalized medicine, it is crucial to find a middle ground that maximizes the utilization of machine learning while upholding ethical principles, privacy, and patient-focused healthcare.

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