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A Role of Artificial Intelligence in Healthcare Data for Diabetic People Affected by COVID-19

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ABSTRACT

Artificial intelligence (AI) enables the diabetic patient's symptoms and biomarkers to be monitored. People with diabetes are weak, and if a COVID-19 infection is present, the patient must be managed optimally, with a focus on fighting the virus while simultaneously maintaining homeostasis and glycemic control. This study examines the present state of knowledge and limitations in using AI to prevent and manage individuals with diabetes and COVID-19 infection. Furthermore, patient engagement in diabetes care is improved by media and online. These innovative technological advancements have improved glycemic management by lowering fasting and by tracking postprandial glucose levels and glycosylated haemoglobin. In this pandemic period, glycemic management and the implementation of suitable interventions are crucial considerations for diabetic patients, particularly those with an active illness. More research is needed in the future to provide care for diabetic patients' psychological and nutritional well-being as well as to reduce their healthcare costs by building focused AI systems.

KEYWORDS

Artificial Intelligence (AI), Artificial Intelligence Tools, COVID-19, Data Process, Decision Support, Diabetes, Evaluation, Health Informatics and Analytics, Inflammatory, Mortality Rate, Outcome, SARS-CoV-2

1. INTRODUCTION

The applications of artificial intelligence (AI) have been interpreted in a number of ways. Understanding, learning, and reasoning are all skills that are utilised to analyze and solve problems. AI uses a number of technologies to imitate certain aspects of human intelligence. Over the last few decades, Medicine and health care in general have benefited from AI methodologies and tools. The

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objective of this study is to use AI technologies to make them easier to comprehend for diabetes health care during covid pandemic. AI medical applications include diagnosis, categorization, therapy, and robotics, among others. To date, neural networks and fuzzy logic (FL) are the most widely utilised AI technologies. Other methods and technologies, on the other extreme, were chosen and included in this evaluation due to their significance.

Artificial intelligence (AI) is a rapidly evolving science, and its applications to diabetes, a global epidemic, have the potential to revolutionise the way diabetes is diagnosed and managed. Machine learning principles have been utilised to generate algorithms to support predictive models for the risk of diabetes and its complications. In the management of diabetes, digital therapies have proven to be a reliable intervention for lifestyle therapy. Patients are more empowered to manage their diabetes on their own, and clinical decision support benefits both patients and health care providers. The use of artificial intelligence enables for continuous and painless remote monitoring of a patient's symptoms and biomarkers. In the case of diabetes, technological advancements have aided in resource optimization. AI will usher in a paradigm shift in diabetes care, moving away from traditional management tactics and toward data-driven precision care (Ellahham, 2020).

Corona viruses are a type of single-stranded RNA genome enclosed virion. The Corona virus Disease (COVID-19) initially emerged in December 2019 in Wuhan, China. It was swiftly detected as a rapidly spreading infectious disease, and by March 2020, it had spread around the globe, causing the WHO to declare it a pandemic (Muniyappa and Gubbi, 2020). In this global health calamity, the healthcare system is looking for innovative technologies to direct and manage the spreading of the COVID-19 (Coronavirus) outbreak (Hu-Ge, et al., 2010).

The severe acute respiratory syndrome virus 2 (SARS-CoV-2)-caused Coronavirus Disease 2019 (COVID-19) was initially detected in December 2019 and quickly spread to most cities and countries throughout the world. SARS-CoV-2 is mostly spread through respiratory droplets during face-to-face contact. Mild upper respiratory tract infection symptoms, as well as potentially severe sepsis and shock, may be caused by the infection. In vulnerable populations, such as the elderly with comorbidities, it may cause serious and deadly consequences. SARS-CoV-2 has infected over 200 countries and caused massive losses, with over 120 million confirmed cases and 2.6 million deaths as of March 16, 2021. COVID-19's escalating incidence and large casualties put a strain on already stretched hospital resources. To improve the clinical efficiency of healthcare systems and streamline the diagnosis, treatment, and surveillance of COVID-19, effective technologies are required. Artificial intelligence is a promising technology, according to recent studies, because it can achieve better scale-up, accelerate processing power, and even surpass people in some healthcare activities.

Artificial intelligence (AI) is an area of algorithm-based applications that enable machines to solve knowledge issues and employ algorithms to replicate human decision-making, all while continuously improving performance by applying inputted data to specified tasks. High sensitivity and specificity in detecting the object, speed of reporting, and consistency of outcomes are all advantages of AI. AI has made great progress in recent years, particularly in predictive machine learning models for medical care. Deep learning is a machine learning technique that is based on the intricate topologies of Artificial Neural Networks (ANN). Deep learning demonstrates strong discriminative performance if adequate training data sets are provided, and it is required for prediction. Artificial intelligence and machine learning (AI/ML) technologies in medicine attempt to improve the quality of medical care, boost diagnostic accuracy, reduce potential errors, and forecast outcomes by uncovering new insights from massive amounts of data generated by many patients' experiences.

Researchers have made major contributions to the fight against COVID-19, and new COVID-19-related AI models are rapidly appearing in the literature. Artificial intelligence models that have been properly trained can ensure accurate and quick diagnosis or assist clinicians in streamlining the diagnosis and reducing manual work. By using training data, AI models could discover individuals at increased risk early, characterise the epidemiology of COVID-19, and model disease transmission. Artificial intelligence-based methods could help in the creation of new treatments and vaccines by repurposing existing drugs, screening targets as vaccines based on the probable mutation model for SARS-CoV-2, and screening compounds as vaccine adjuvants. AI-powered chatbots have proven to be effective in clinical contexts, advising far more people than a person call centre and reducing the load placed on medical hotlines. By utilising thermal imaging to monitor public locations for persons who may be affected and enforcing social separation and lockdown measures, AI could help manage the epidemic.

Diagnoses, public health, clinical decision making, social control, medicines, vaccine research, monitoring, big data integration, operation of other essential healthcare services, and treatment of COVID-19 patients have all benefited from artificial intelligence. Rapid diagnosis, accurate prognosis, better monitoring, and efficient therapies are the most crucial strategies to stop the spread of the pandemic and relieve the considerable strain on limited medical resources produced by the COVID-19 pandemic. There have been a slew of similar review articles published. However, the findings of these studies are uneven, and there is little research systematically evaluating the application of AI for COVID-19 in accordance with PRISMA, with the majority of them focusing on elements such as diagnosis or treatment. As a result, we undertook this evaluation to comprehensively examine AI performance for COVID-19, as well as to define the main areas of AI application, prospective benefits and constraints, and AI's future possibilities.

AI is a technology that might be used to track the virus's spread, identify high-risk individuals, and assist in real-time infection control. By thoroughly assessing the patients' history data, it may also anticipate mortality risk (Gozes, 2020). By offering population screening, medical support, notification, and infection management suggestions, AI can help in the fight against this virus (Pirouz -Shaffiee Haghshenas, et al., 2020). As a consequence of the rapid and considerable increase in the number of patients during the COVID-19 pandemic, healthcare workers are overworked which can be reduced by AI technologies (Ting- Carin, et al., 2020).

Diabetes is a chronic condition in which insulin action or secretion is impaired, resulting in elevated blood sugar levels (Erener, 2020). More than 425 million diabetics are believed to exist worldwide, and the number continues to rise on a regular basis. Type 1 Diabetes Mellitus (T1DM), which is an autoimmune illness, and Type 2 Diabetes Mellitus (T2DM) are the two forms of diabetes. Furthermore, nearly 90% of diabetic patients develop or have a concomitant disease such as hypertension, hyperlipidemia, and other conditions. This, combined with the fact that they are immune weakened as a result of the disease's patho-physiological influence on the immune system, renders them more likely to develop and catch infections than other healthy people. The reason why diabetics have a more severe course of the disease has been connected to Angiotensin Converting Enzyme – 2 (ACE2), which the Coronavirus uses on the surfaces of epithelial cells to deceive them into entering and infecting them. Because many diabetics also have hypertension, angiotensin-converting enzyme inhibitors (ACEIs) are frequently administered to boost ACE2 expression in cells. As a result in (Ma- Holt, et al., 2020), the viral's chances of binding to cells are increased. To date, however, no study has found that diabetics are more susceptible to infection than elderly or hypertensive patients.

High blood sugar levels in the body can have a negative impact on the immune system; however, lowering glucose levels in the body along with antiviral treatments can help to reduce the risk of COVID-19 severe complications; however, there are some limitations to their use and potential interactions with COVID-19 treatment that must be carefully considered. Adverse acute respiratory syndrome coronavirus 2 infections (Hartmann-Boyce, et al., 2020), in fact, may be a worsening factor for diabetics, as they can induce significant metabolic difficulties through direct negative effects on -cell function.

Intensive therapy successfully delays the start and decreases the progression of diabetes-related problems such as retinopathy, nephropathy, and neuropathy, according to decades of well-designed trials. Despite this, a recent study of 300,000 people with type 2 diabetes who were started on medical therapy discovered that after three months, 31% of patients had stopped taking their diabetes drugs completely, rising to 44% after six months and 58 percent after a year. Only 40% of those with diabetes were able to resume their medication after a period of time. The absence of real-time, critical health information required to make educated decisions related with rigorous therapy and tight diabetes control often obstructs optimal diabetes care for people with diabetes (PWDs).

Although technological advancements provide unprecedented and low-cost access to critical information for many people in many domains, their impact on diabetes management appears to be limited. The challenges of real-time diabetic care information are exacerbated by medical knowledge's rapid increase. As of June 2018, the biomedical literature index has over 28 million articles and is expanding at a rate of over 850,000 additional citations each year. In his or her lifetime, each person will generate more than 1 million terabytes of health-related data, the equivalent of nearly 300 million books.

Unstructured data makes up about 80% of all health data. Nonclinical data sources include device and sensor data (often referred to as Internet of Things data), genomic data, and social determinants of health data, as well as clinician notes, clinical trials, hospital records and discharge summaries, imaging and laboratory reports, and nonclinical data sources such as genomic data and social determinants of health data. Ninety percent of a person's health outcomes can be related to genetics and external data, highlighting the necessity of PWDs and their clinicians gathering and utilising this information to make informed health decisions.

Artificial intelligence (AI) technologies are rapidly advancing, promising to make real-time structured and unstructured health data available for the care of PWDs. "The science of making computers do things that require intellect when done by humans," according to the Turing Archive for the History of Computing. AI refers to a variety of methods for emulating human intelligence and performing various reasoning tasks, including visual perception, speech recognition, analytics, decision-making, and language translation. Cognitive systems use a variety of AI technologies to help humans extend and scale their knowledge and expertise by allowing them to quickly access enormous information sources to solve challenges.

AI is already being used to harness vast volumes of important data to meet customer demand in every industry, including health care. According to a survey, 68 percent of mobile health app developers and publishers believe diabetes will continue to be the most important health care field with the best market potential for digital health solutions in the near future, and 61 percent believe AI will be the most disruptive technology shaping the digital health sector in the near future. Despite the fact that breakthroughs in AI for health care are being documented in the literature and new AI-powered devices for diabetes treatment are being approved, a systematic assessment of clinically relevant diabetes AI applications is lacking.

The COVID-19 outbreak has put many people's lives at risk, especially those who are immuno-compromised, such as diabetics. Because of the impact of COVID-19, a diabetic may be exposed to a variety of pandemic-related risks (Asiedu-Danso, et al., 2021). As a result, it's critical to understand how the COVID-19 epidemic impacted diabetics' mortality, nutritional, and psychological well-being.

This paper organized as follows: The introduction of research topic was discussed in the previous section. The literature review of the relevant studies is defined in Section 2. Section 3 describes about AI methodologies. Section 4 shows the results of AI applications in diabetic field during Covid. Section 5 and 6 concludes with limitations and future implications.

To combat and anticipate new diseases, healthcare delivery involves the use of new technologies such as artificial intelligence (AI), the internet of things (IoT), big data, and machine learning. We want to look at AI's position as a critical technology for analysing, preparing for, and combating COVID-19 (Coronavirus) and other pandemics.

Artificial Intelligence (AI) is a cutting-edge technology that can aid in the fight against the COVID-19 pandemic. This technology can be used to properly screen, track, and anticipate present and future patients. The main uses of this AI are for early infection detection and diagnosis. AI is employed in the development of medications and vaccines, as well as the reduction of healthcare staff' burden.

2. RELATED STUDIES

The applications of artificial intelligence (AI) in medical field is becoming more widespread and has resulted in significant improvements. Recently, pushed clinical innovation, improved living conditions, and enhanced overall welfare have incrementally increased the population's future. As a result, we are now dealing with an increasing number of patients who are constantly infected. AI can be defined as strategies for computers to perform tasks that would normally require human insight explored by K.H. Yu, et.al, in (Yu-Beam, et al., 2018). Diabetes mellitus is an unending, unavoidable condition with a wealth of knowledge and a wide range of outcomes. M. Rigla, et.al, described Diabetes is a fertile ground for merging synthetic intelligence in this fashion (García-Sáez, 2017). Clinical decision-making, robotized retinal screening, predictive population hazard definition, and patient self-administration equipment are all examples of computerised reasoning in diabetes treatment proved by I. Dankwa-Mullan, et.al, in (Dankwa-Mullan, 2019).

The COVID-19 pandemic has wreaked havoc on health-care systems, both directly as a result of the infectious disease outbreak and indirectly as a result of public-health initiatives to prevent transmission. Demand, capacity, and even contextual factors of health care have all experienced significant dynamic variations as a result of this disruption. As a result, in many countries, the traditional face-to-face patient–physician care model has had to be re-examined, with digital technology and new models of care being rapidly adopted to meet the pandemic's varied difficulties. This Viewpoint focuses on modern ophthalmic models that have adapted to include digital health solutions including telemedicine, artificial intelligence decision support for triaging and clinical treatment, and home monitoring (Gunasekeran-Tham, et al., 2021).

People with diabetes appear being more susceptible to covid infection, based on existing data. This is because diabetic people are more vulnerable to infections in general due to a lack of immune function that impacts phagocytosis, neutrophil chemotaxis, and cell-mediated immunity investigated by S.R. Bornstein, et.al, in (Bornstein-Rubino, 2020). Diabetes is known to produce coagulation system and fibrinolytic cascade homeostasis problems, as well as hyperactive inflammation. These two components appear in the more severe stages of SARS-CoV-2 infection as well.

The major problems in the most severe phases of infection are a broad hyperactive inflammatory state and coagulative dysfunction, which can lead to thrombosis and lung injury. Diabetes was shown to have a greater concentration of inflammatory markers and a higher prevalence of coagulopathy associated with worse mortality in a study of 174, COVID-19 patients in Wuhan, China (Guo-Li, et al., 2020). Controlling glucose homeostasis and the pathophysiology of diabetes is something that must be done all of the time. Due to the COVID-19 pandemic's lockdown in many countries, it may be difficult for diabetic patients to receive all of the medical help they need to better manage their disease.

Public health is a critical concern for safeguarding and avoiding illness outbreaks in the community. Governments invest a significant portion of their gross domestic product (GDP) on public welfare, and measures such as immunisation have increased people's life expectancy. However, chronic and hereditary disorders have become more prevalent in recent years, posing a public health threat. Diabetes mellitus is one of the most deadly diseases since it causes damage to the heart, kidneys, and nerves, among other things (Butt, U. M., 2021).

Diabetes is a metabolic illness in which the body's ability to process blood glucose, often known as blood sugar, is impaired. Hyperglycemia is a symptom of this condition, which is caused by a deficiency in insulin secretion, insulin action, or both. Type 1 diabetes is caused by a total lack of insulin secretion (T1D). Diabetes spreads rapidly due to the patient's inability to utilise the insulin generated. Type 2 diabetes is the name given to this condition (T2D). Both types of diabetes are on the rise, although T2D has a greater rate of growth than T1D. T2D accounts for 90 to 95 percent of all diabetes cases.

Diabetes management that isn't properly monitored can lead to strokes, hypertension, and cardiovascular disease. A monitoring method of BG level plays a significant role in avoiding and reducing diabetic complications. Using a portable SMBG (self-monitoring of blood glucose) device, a combination of biosensors and sophisticated information and communication technology (ICT) provides an efficient real-time monitoring management solution for the health state of diabetic patients. The changes in glucose levels in a patient's blood can be checked by the patient himself. CGM (continuous glucose monitoring) sensors help users better grasp BG fluctuations.

In this study, we offer an approach for the classification, early-stage identification, and prediction of diabetes that takes advantage of advances in modern sensor technology, IoT, and machine learning approaches. The fundamental goal of this research is twofold. To begin, we used three widely used classifiers to divide diabetes into preset categories: random forest, multilayer perceptron, and logistic regression. Second, long short-term memory (LSTM), moving averages (MA), and linear regression (LR) are used in the predictive analysis of diabetes. PIMA Indian Diabetes is utilised for experimental evaluation to demonstrate the efficacy of the proposed treatment. In comparison to the other classifiers, MLP achieved an accuracy of 86.083 percent in diabetes classification in experimental assessment, while LSTM earned an accuracy of 87.26 percent in diabetes prediction. In addition, we conducted a comparison of the suggested approach with existing state-of-the-art approaches. Our proposed approach's accuracy results illustrate its flexibility in a variety of healthcare applications.

A. Ghosh et.al, introduced Telemedicine that can be helpful in the care of patients with chronic conditions like diabetes during this time. The name "telemedicine" literally means "healing at a distance" (Ghosh, Gupta, and Misra, 2020). Diabetes also enhanced the risk of complications in patients with influenza A (H1N1) defined by R. Allard, et.al, in 2009 (Allard-Leclerc, et al., 2010). B. Lopez, et.al, in (López-Martin, 2018) revealed the special section on artificial intelligence for diabetes.

3. AI METHODOLOGIES

AI has largely been concentrated on a few areas of medical operations and medical research. System vision, or the application of artificial intelligence to visual activities, has captivated the therapeutic community's interest. Wearables, mobile phones, and other gadgets with specialised features have been developed to track and monitor infection status of covid diabetic patients (Reyana-Krishnaprasath, 2020).

3.1 Expert Systems in Medicine

Expert Systems (ES) of AI are defined as "systems that can capture expert knowledge, facts, and strategic competence to support caretakers in their regular tasks." ES seeks to emulate physician knowledge by employing inference methods to engage in strategic planning or issue resolution. ES is able to organise facts and make well-informed decisions. ES has a number of capabilities, including image interpretation, diagnosis assistance, and alert generation. Table 1 shows some useful terms of AI.

3.2 AI Technologies and Diabetes With Covid-19

All of the aforementioned AI technologies have been applied to various aspects of diabetes management, and will be useful throughout the covid-19 pandemic. Some examples of the AI applications will be summarised as follows (Rudra and Kautish, 2021).

3.2.1 CBR-Based Decision Support

Imperial College London researchers conducted among the most significant studies on the use of ES to assist diabetic patients in making decisions. They implemented and tested a CBR-based bolus calculator algorithm. This device is used to monitor glucose level in covid patient's by tracking through patients smartphone. It is feasible to evaluate the tool's positive advantages over standard bolus calculators (Juneja-Dhiman, 2021).

Table 1. Useful Terms of AI based approach

CIG	Clinical practise guidelines established in a computer-based system are referred to as computer interpretable guidelines (CIGs)..
Data Mining	A computational method for extracting knowledge and information from a huge database and transforming it into an interpretable structure.
Fuzzification	The process of mapping numerical inputs into fuzzy inputs, i.e. the degree whereby the input data correspond to the corresponding fuzzy sets based on a membership function, is referred as fuzzification in FL.
Supervised learning	A mathematical algorithm that can learn from a dataset that already contains the desired output. It is a generalisation of a function that transfers the available inputs to the intended outputs. Techniques for classification and prediction are supervised learning algorithms.
Unsupervised learning	The purpose of this algorithm is to find correlations or structures in a dataset. The output that is desired is unknown. Clustering and association are examples of unsupervised algorithms.
Stochastic	In order to solve issues, a stochastic programme uses probabilistic methods.

3.2.2 Computer Interpretable Guidelines (CIGs)

Clinical guidelines are valuable tools for improving the quality of care. Decision-support tools can be constructed by formalising them as CIGs and using a complicated RBR framework (Kautish, 2021). Medical experience with diabetes mellitus CIGs used for covid diabetic patients and physicians advanced analytics with performance and greater compliance for blood glucose monitoring in comparison to conventional treatment based on direct consultations during this pandemic.

3.2.3 ANN for Retinopathy Detection

Deep learning ANN has recently been found to detect diabetic retinopathy in retinal images with sensitive and specific during this pandemic (Adinolfi, 2021). The researchers developed an algorithm that uses the luminance of pixels in a fundus picture to determine the severity of diabetic retinopathy. The function was trained on a large number of photos before being put to the test at two different operating points, one for higher sensitivity and the other for great specificity, with extraordinarily high results.

3.2.4 Diabetes Patient Monitoring and Remote Management

Numerous manufacturers offer wearable technologies that recognise activity, pulse, and other useful or physiological factors (for example, Fitbit®, Apple Watch®, Samsung Galaxy®, etc). The wearable device assists covid diabetic patients in keeping track of calories consumed. Because wearable insulin estimation gadgets are now widely available, the next level could be the computerization of insulin administration with minimal human intervention (Gupta, 2021).

3.2.5 Clinical Decision Support

Intelligence-based clinical assistance devices have been found to be able to predict short- and long-term HbA1c responses in type 2 diabetic patients after insulin initiation (Lehmann-Deutsch, et al., 1994). The customizable net regularization-set up combined an instantaneous approach following standard HbA1c with a glomerular filtration rate evaluation to accurately estimate the HbA1c reaction (Bhattad and Jain, 2020). Computer-based intelligence has been used to create a unique technique for altering treatment adherence interventions and anticipating the risk of hospitalisation in diabetic patients infected with the corona virus.

3.2.6 Self-Treatment of Diabetes by Covid Patient

Covid individuals with diabetes can make daily food and action decisions due to computer-based intelligence. Patients have been able to assess the quality of their food and estimate their calorie intake using apps (Buch, Varughese and Maruthappu, 2018). When covid patients catch their own image food and analyse what they consume, their responsibility for diabetes treatment improves.

3.2.7 Exactness Dosing in Diabetes

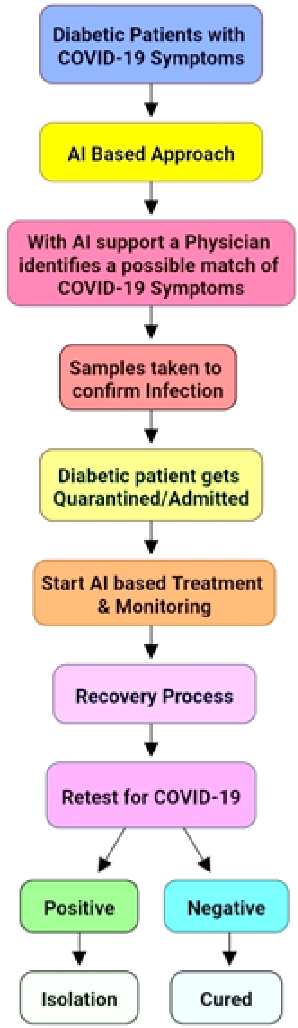
AI will help diabetic patients with covid remember to take their medication on time. Apps from the mobile have been used to allow patients to survey information in order to select a date for the medical admission, which will then send a reminder to covid patients on that date, ensuring that they do not forget to take their medication (López, Martin, and Viñas, 2018).

4. RESULTS

4.1 Main Applications of AI in Diabetes Infected by Covid-19 Pandemic

- The infection should be detected and diagnosed as soon as possible. AI can detect odd ailments and other “red flags” promptly, alerting covid diabetic patients and healthcare providers. It allows for faster decision-making, which helps in cost-effective decision-making.
- AI could be utilised to create an intelligent platform for self-monitoring and forecasting viral epidemics. ANN might be constructed to detect the visual aspects of this sickness, allowing for more accurate diagnosis and treatment of affected people. It can give diabetic patients with information and updates, as well as treatment options for the COVID-19 outbreak. The main approach of AI-based applications that assist general practitioners in identifying COVID-19 symptoms in diabetic patients is depicted in Figure 1.
- AI can help with determining the virus’s infection level, identifying clustering and ‘problem areas,’ and effectively tracing and monitoring individual interactions. In covid diabetic individuals, it can predict the virus’s future outcome and chance of recurrence.
- This system can track and estimate the characteristics of the virus, including the transmission of infectious diseases and its expected spread among diabetic patients, using current data, social networking and media sites. It can also predict how many confirmed cases and deaths will occur in a certain region. AI can help identify the most vulnerable locations, people, and countries so that proper measures can be taken.
- AI is used in drug research by analysing current information on COVID-19. It could contribute in the development of effective COVID-19 diabetic medicines. It has transformed into a valuable tool for the development of diagnostic tests and vaccinations. AI speeds up the creation of vaccines and therapeutics, as well as clinical studies throughout vaccine research.
- AI can assist predict future virus and communicable diseases by using previously trained data that is prevalent at different times. It pinpoints the qualities, causes, and motivations that lead to the spread of illness. This technique will be critical in fighting against other diseases and pandemics in the future. It’s being used as a prophylactic measure as well as a therapy for a number of ailments. In future, AI will play a significant role in providing more preventive and predictive healthcare.

Figure 1. The basic technique of AI-based applications that assist general practitioners in detecting COVID-19 symptoms in diabetic patients



4.2 Comparison of AI and Non-AI Based Approach in Diabetes

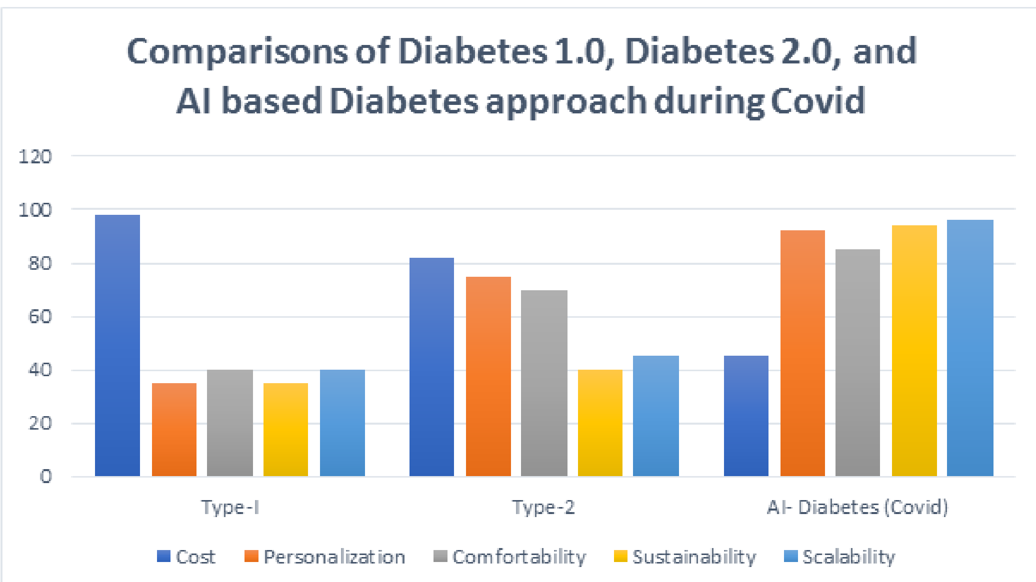
In comparison to Diabetes 1.0 and 2.0's inherent hospital-oriented features, AI Smart Diabetes achieves successful diabetes post-hospitalization and prevention treatment which was tested in 355 covid diabetic patients. Other vital physiological markers are now included in physiological monitoring, which is no longer restricted to blood glucose detection. Effective procedures are taken to track a user's real-life activities and exercise. The user's overall health is monitored in a sustainable and long-term manner. In Covid-19, Table 2 compares the benefits and drawbacks of Diabetes 1.0 and 2.0, and AI-Smart based Diabetes technology. Cost, personalization, comfort, sustainability, scalability, network support and treatment pattern are among the seven aspects compared.

In the following four characteristics, AI-Smart Diabetes outperforms Diabetes 2.0, as shown in Figure 2: AI-Smart Diabetes makes use of social networking technologies to allow relatives and friends to monitor the patient's therapy.

Table 2. Comparisons of Diabetes 1.0, Diabetes 2.0, and AI based approach in Diabetes during Covid Pandemic

Solution	Cost	Personalization	Comfortability	Sustainability	Scalability	Network support	Treatment pattern
Diabetes 1.0	High	Low	Low	Low	Low	N/A	Manual measurement, manual injection, and hospitalisation
Diabetes 2.0	Medium	High	Medium	Low	Low	Social network	Blood glucose sensing devices that are both automatic and adaptive, comparing pharmacological effects, beta cell preservation and beta cell restoration
AI-Diabetes	Low	High	High	High	High	All social networks and big data networks	Data fusion based on the needs of the user, and therapeutic intelligence based on data analytics

Figure 2. Comparison of diabetes type-1, type-2 and AI based Diabetes approach during Covid-19



LIMITATION AND FUTURE IMPLICATIONS

Diabetic consequences include metabolic, renal, ophthalmic, neurologic, and vascular issues. Nonetheless, the full extent of the lockdowns that happened in several nations as a result of COVID-19's propagation is unknown. With the use of AI, specific patient data can be easily tracked, which will aid in treatment for quarantine diabetic patients too. When it comes to diabetes during calamities and lockdowns, numerous elements are revealed in AI applications. Whenever an infection surge occurs, a large hospital-based study should be conducted to determine the level of complication experienced by diabetic patients during lockdown. It can be accomplished by employing AI technologies in a systematic manner, examining each system one at a time, and recommending a knows to diabetes patients impacted by the pandemic. AI will reduce human labour and allow them to focus on more productive tasks, such as patient mental wellness, which is critical. As the disease spread, the media became a tool that was faster than peer-reviewed articles, making such references official citation sources.

CONCLUSION

Artificial intelligence is an useful and practical tool for diagnosing early coronavirus outbreaks and monitoring the health of diabetic patients who have been infected. For both health care practitioners and patients, technology, particularly sensors and computer applications, has become a vital tool in diabetes management during this pandemic. While learning of insulin pumps and subsequently, glucose sensors has grown, awareness of AI and intelligent application performance is still lacking. This article presents a general introduction of the basic concepts, terminologies, and technologies often utilised in AI-related applications for diabetes patients infected by covid. Artificial intelligence will assist in reminding patients when it is time to take their medication. It can considerably improve treatment consistency and decision-making by developing helpful algorithms. AI effective not just for treating COVID-19-affected diabetic patients, but it may also be used to maintain track of their health.

REFERENCES

A, R., & Kautish, S. (2021). Corona virus-related Disease Pandemic: A Review on Machine Learning Approaches and Treatment Trials on Diagnosed Population for Future Clinical Decision Support. *Current Medical Imaging: Current Medical Imaging Reviews, 17*. 10.2174/1573405617666210414101941

Adinolfi, V. (2021). Risk of infection in diabetes before and during COVID-19: A review. *The Journal of AMD*, *24*(2), 116. doi:10.36171/jamd21.24.2.5

Allard, R., Leclerc, P., Tremblay, C., & Tannenbaum, T. N. (2010). Diabetes and the Severity of Pandemic Influenza A (H1N1) Infection. *Diabetes Care*, *33*(7), 1491–1493. doi:10.2337/dc09-2215 PMID:20587722

Artificial Intelligence (AI) applications for COVID-19 pandemic. (2020, July 1). *ScienceDirect*. https://linkinghub.elsevier.com/retrieve/pii/S1871402120300771

Bhattad, P. B., & Jain, V. (2020). *Artificial Intelligence in Modern Medicine – The Evolving Necessity of the Present and Role in Transforming the Future of Medical Care. Cureus*. doi:10.7759/cureus.8041

Bornstein, S. R., Rubino, F., Khunti, K., Mingrone, G., Hopkins, D., Birkenfeld, A. L., Boehm, B., Amiel, S., Holt, R. I., Skyler, J. S., DeVries, J. H., Renard, E., Eckel, R. H., Zimmet, P., Alberti, K. G., Vidal, J., Geloneze, B., Chan, J. C., Ji, L., & Ludwig, B. (2020). Practical recommendations for the management of diabetes in patients with COVID-19. *The Lancet. Diabetes & Endocrinology*, *8*(6), 546–550. doi:10.1016/S2213-8587(20)30152-2 PMID:32334646

Buch, V., Varughese, G., & Maruthappu, M. (2018). Artificial intelligence in diabetes care. *Diabetic Medicine*, *35*(4), 495–497. doi:10.1111/dme.13587 PMID:29368355

Butt, U. M. (2021, October 1). *Machine Learning Based Diabetes Classification and Prediction for Healthcare Applications.* Hindawi. https://www.hindawi.com/journals/jhe/2021/9930985/#experimental-studies

Dankwa-Mullan, I., Rivo, M., Sepulveda, M., Park, Y., Snowdon, J., & Rhee, K. (2019). Transforming Diabetes Care Through Artificial Intelligence: The Future Is Here. *Population Health Management*, *22*(3), 229–242. doi:10.1089/pop.2018.0129 PMID:30256722

Ellahham, S. (2020). Artificial Intelligence: The Future for Diabetes Care. *The American Journal of Medicine*, *133*(8), 895–900. doi:10.1016/j.amjmed.2020.03.033 PMID:32325045

Erener, S. (2020). Diabetes, infection risk and COVID-19. *Molecular Metabolism*, *39*, 101044. doi:10.1016/j.molmet.2020.101044 PMID:32585364

Ghosh, A., Gupta, R., & Misra, A. (2020). Telemedicine for diabetes care in India during COVID19 pandemic and national lockdown period: Guidelines for physicians. *Diabetes & Metabolic Syndrome*, *14*(4), 273–276. doi:10.1016/j.dsx.2020.04.001 PMID:32283497

Gozes, O. (2020, March 10). *Rapid AI Development Cycle for the Coronavirus (COVID-19)*. . . https://arxiv.org/abs/2003.05037

Gunasekeran, D. V., Tham, Y. C., Ting, D. S. W., Tan, G. S. W., & Wong, T. Y. (2021). Digital health during COVID-19: Lessons from operationalising new models of care in ophthalmology. *The Lancet. Digital Health*, *3*(2), e124–e134. doi:10.1016/S2589-7500(20)30287-9 PMID:33509383

Guo, W., Li, M., Dong, Y., Zhou, H., Zhang, Z., Tian, C., Qin, R., Wang, H., Shen, Y., Du, K., Zhao, L., Fan, H., Luo, S., & Hu, D. (2020). Diabetes is a risk factor for the progression and prognosis of COVID -19. *Diabetes/Metabolism Research and Reviews*, *36*(7). Advance online publication. doi:10.1002/dmrr.3319 PMID:32233013

Gupta, N. (2021). Transforming OMFS through Artificial Intelligence and Machine Learning. *Acta Scientific Otolaryngology*, *9–10*. Advance online publication. doi:10.31080/ASOL.2021.03.0352

Hartmann-Boyce, J., Morris, E., Goyder, C., Kinton, J., Perring, J., Nunan, D., Mahtani, K., Buse, J. B., del Prato, S., Ji, L., Roussel, R., & Khunti, K. (2020). Diabetes and COVID-19: Risks, Management, and Learnings From Other National Disasters. *Diabetes Care*, *43*(8), 1695–1703. doi:10.2337/dc20-1192 PMID:32546593

Hu, Z., Ge, Q., Li, S., & Xiong, M. (2020). Artificial Intelligence Forecasting of Covid-19 in China. *International Journal of Educational Excellence*, *6*(1), 71–94. doi:10.18562/IJEE.054

Juneja, S., Juneja, A., Dhiman, G., Behl, S., & Kautish, S. (2021). An Approach for Thoracic Syndrome Classification with Convolutional Neural Networks. *Computational and Mathematical Methods in Medicine*, *2021*, 1–10. doi:10.1155/2021/3900254 PMID:34594396

Kretchy, I. A., Asiedu-Danso, M., & Kretchy, J. P. (2021). Medication management and adherence during the COVID-19 pandemic: Perspectives and experiences from low-and middle-income countries. *Research in Social & Administrative Pharmacy*, *17*(1), 2023–2026. doi:10.1016/j.sapharm.2020.04.007 PMID:32307319

Lehmann, E., Deutsch, T., Carson, E., & Sönksen, P. (1994). Combining rule-based reasoning and mathematical modelling in diabetes care. *Artificial Intelligence in Medicine*, *6*(2), 137–160. doi:10.1016/0933-3657(94)90042-6 PMID:8049754

López, B., Martin, C., & Viñas, P. H. (2018). Special section on artificial intelligence for diabetes. *Artificial Intelligence in Medicine*, *85*, 26–27. doi:10.1016/j.artmed.2017.09.008 PMID:28943334

López, B., Martin, C., & Viñas, P. H. (2018b). Special section on artificial intelligence for diabetes. *Artificial Intelligence in Medicine*, *85*, 26–27. doi:10.1016/j.artmed.2017.09.008 PMID:28943334

Ma, R. C. W., & Holt, R. I. G. (2020). COVID-19 and diabetes. *Diabetic Medicine*, *37*(5), 723–725. doi:10.1111/dme.14300 PMID:32242990

Muniyappa, R., & Gubbi, S. (2020). COVID-19 pandemic, coronaviruses, and diabetes mellitus. *American Journal of Physiology. Endocrinology and Metabolism*, *318*(5), E736–E741. doi:10.1152/ajpendo.00124.2020 PMID:32228322

Pirouz, B., Shaffiee Haghshenas, S., Shaffiee Haghshenas, S., & Piro, P. (2020). Investigating a Serious Challenge in the Sustainable Development Process: Analysis of Confirmed cases of COVID-19 (New Type of Coronavirus) Through a Binary Classification Using Artificial Intelligence and Regression Analysis. *Sustainability*, *12*(6), 2427. doi:10.3390/su12062427

Reyana, A., Krishnaprasath, V., Kautish, S., Panigrahi, R., & Shaik, M. (2020). Decision-making on the existence of soft exudates in diabetic retinopathy. *International Journal of Computer Applications in Technology*, *64*(4), 375. doi:10.1504/IJCAT.2020.112684

Rigla, M., García-Sáez, G., Pons, B., & Hernando, M. E. (2017). Artificial Intelligence Methodologies and Their Application to Diabetes. *Journal of Diabetes Science and Technology*, *12*(2), 303–310. doi:10.1177/1932296817710475 PMID:28539087

Rudra, T., & Kautish, S. (2021). Impact of Covid-19 Infodemic on the Global Picture. *Computational Intelligence Techniques for Combating*, *COVID-19*, 333–353. doi:10.1007/978-3-030-68936-0_16

Ting, D., Carin, L., Dzau, V., & Wong, T. Y. (2020). Digital technology and COVID-19. *Nature Medicine*, *26*(4), 459–461. doi:10.1038/s41591-020-0824-5 PMID:32284618

Yu, K. H., Beam, A. L., & Kohane, I. S. (2018). Artificial intelligence in healthcare. *Nature Biomedical Engineering*, *2*(10), 719–731. doi:10.1038/s41551-018-0305-z PMID:31015651

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