WILEY | Hindawi

Retraction

Retracted: Investigation of Diabetes Care in Elder Individuals Using Artificial Intelligence

Journal of Food Quality

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] S. Vyas, S. Gupta, S. Tarar et al., "Investigation of Diabetes Care in Elder Individuals Using Artificial Intelligence," *Journal of Food Quality*, vol. 2022, Article ID 8760032, 7 pages, 2022.

WILEY | Hindawi

Research Article

Investigation of Diabetes Care in Elder Individuals Using Artificial Intelligence

Sonali Vyas [iD],[1] Sachin Gupta [iD],[2] Sandhya Tarar [iD],[3] Batyrkhan Omarov [iD],[4] Bhasker Pant [iD],[5] Jyoti L. Bangare [iD],[6] and Tapas Bhowmik [iD][7]

[1]*School of Computer Science, UPES, Dehradun, Uttrakhand, India*
[2]*School of Engineering and Technology, MVN University, Haryana, India*
[3]*Computer Science and Engineering, Gautam Buddha University, Greater Noida, India*
[4]*Universiti Tenaga Nasional, Kajang, Malaysia*
[5]*Department of Computer Science & Engineering, Graphic Era Deemed to be University, Dehradun, Uttarakhand, India*
[6]*Department of Computer Engineering, MKSSS's, Cummins College of Engineering for Women, Savitribai Phule Pune University, Pune, India*
[7]*Canadian University of Bangladesh, Dhaka, Bangladesh*

Correspondence should be addressed to Tapas Bhowmik; tapas.bhowmik@cub.edu.bd

The term blockchain is mainly regarded as the distributed transaction which is mainly comprised of different blocks, and each set tends to represent the data that are being associated with the previous blocks. The blockchain is mainly managed through peer-to-peer networks which comparatively involves in adhering to the protocol of authenticating various blocks to form the blockchain. The usage of blockchain technology has been increasingly used in different fields, and healthcare services are now using blockchain for better patient delivery, detecting disease, and other aspects. The scope of the proposed study is that this study has exploited the function of a blockchain-enabled big data network to support medical professionals in giving better treatment modalities and delivering better patient care. The application of a new generation of smart block chains such as Ethereum and NEM is now offering better services and features in creating blockchain-based healthcare data management and hence support healthcare centers, medical practitioners, nurses, radiologists, and patients for better healthcare management. The application of blockchain technology in big data networks supports adding more value as it results in enhanced data quality, accessibility, and support in creating better security and safety of data and information, which is highly essential in the medical industry. Blockchain technology enables big data technologies enabled in supporting medical practitioners in addressing various healthcare ailments; one of the major diseases impacting many people around the world is diabetes. Patients with such ailments tend to generate more data and information related to the disease and health-related aspects. Hence, this information requires being maintained and analyzed, so that superior healthcare services can be provided. This study is more involved in the investigation of blockchain technology through a big data network enabled in offering better care for elderly individuals who have been affected due to diabetes, the researchers propose to choose a questionnaire method to collect the data from nearly 169 respondents, and these data were then analyzed using SPSS data package. The analyst used percentage analysis, correlation analysis, and chi-square test to analyze the data which has been collated by the researchers. The results and discussion show in detail the major aspects of blockchain technology in supporting healthcare professionals for better diabetes care management for elderly individuals.

1. Introduction

In the current world scenario, many individuals are being affected by different types of diseases like cancer, hypertension, and cardiac arrest. Diabetes is a major chronic disease that involves and impacts many others apart from patients. Diabetes is considered the main disease which occurs when individual blood glucose is more than the

permissible limit. It has been widely stated that obesity and inactive lifestyle are considered the main reasons for type 2 diabetes [1]. The proposed research plays a crucial role to explore the role of blockchain technology enabling big data technologies in diabetes care for elderly individuals who have effected due to diabetes. Moreover, individuals who possess these issues tend to consult other medical practitioners like endocrinologists, general medical practitioners, nurses, radiologists, and others to keep their health in check and to maintain their blood sugar level at appropriate levels. Now, individuals need to take proper insulin injections and prescribed tablets to maintain a proper lifestyle. Hence, patients who possess these diseases tend to generate more amount of information which are related to the disease, the type of medications currently taken in medical records, insurance, measurement of blood glucose, home measures of other critical vitals, blood pressure monitoring, and other key metrics [2]. These information are highly critical and need to be stored in a safe place, so that it can be retrieved as and when required by patients, medical practitioners, nurses, and healthcare centers for making better healthcare decisions. Through the sharing of vital data, the patient' health conditions can be monitored on a real-time basis, and it leads to enhanced clinical effectiveness and is also supported by better clinical analysis and research.

The term blockchain is mainly stated as the distributed ledger which is mainly comprised of blocks, each category tends to represent key information that is linked to previous blocks, and the layers tend to get more complex; hence, they are highly secured and can be accessed by the users. Blockchain technology is most important in healthcare, especially for diabetics. This technology has been widely used in several areas, and healthcare professionals are now using the blockchain for enhanced patient delivery, illness detection, and other features. Blockchain technology is extremely unchanged because all blocks are fragmented and it is very difficult to find the original source.

There is a growing importance of keeping the data in a safer location so that they are free from any cyber-attacks or malware; hence, the application of blockchain is highly immutable since each block tends to possess a hash, and it is highly difficult to track to the original source [3]. Furthermore, it has been stated that the changes made to a single block tend to change the historical chain and the overall contents of the other blocks; hence, the data and information stores will be highly secured.

Through the application of blockchain technology, enabled big data networks are highly applied in healthcare, mainly for diabetes patients, the information will be saved more safely, and the patients possess full access to all data and control over the healthcare centers, medical practitioners, or others with whom the data were shared. Blockchain technology has more benefits and very less limitations in healthcare. It is more costly. There is no causal relationship between allowing medical practitioners to make informed decisions and the use of the blockchain in diabetes treatment for older people.

The application of big data supports in gathering the required information which is critical in the healthcare industry and supports the specialist in making quick decisions. The patient possesses all rights to provide permissions and designate individuals who can read and take information related to the healthcare data; access control management is also used to use on-off chain-based apps. These data will enable individuals to analyze different entities that possess access to critical data and will also allow medical practitioners to take quick and better decisions to enhance the health and wellbeing of the individuals [4]. Moreover, the patient can provide more flexibility in providing permission to access data, the nature of the data which can be accessed, and the time frame. This concept enables enhancing transparency and allows the individual to make more information decisions related to the health and wellbeing of the patients.

The work aimed to use blockchain technology and a big data network to help healthcare professionals provide better patient care and better potential treatments. These data allow individuals to explore different entities to determine who has access to important data and help doctors make quicker, more informed decisions that will improve patient health and wellbeing. Additionally, the patient can have more flexibility in selecting how to obtain data that are available for a limited time frame. Big data technology enabled by blockchain help health professional address a range of healthcare concerns. Big data are used to help specialists make quick judgments and get the requisite qualifications, which are significant in the healthcare industry. This concept promotes greater openness and encourages individuals to make better-informed decisions regarding the health and welfare of their patients.

The main goal of this study is to examine the evaluative characteristics that enable big data networks powered by blockchain technology to provide better diabetes care for elderly people. Key considerations include higher information security, increased transparency, and the ability of medical professionals to make well-informed decisions that will improve elderly people's health and wellness.

The intended research has been divided into five components. Section 1 introduces the idea and relevance of artificial intelligence in healthcare, while Section 2 focuses on the review literature. Section 3 provides the proposed research method. Section 4 describes the analysis and interpretation. Moreover, Section 5 depicts the suggested framework's conclusions and prospective scope.

2. Review of Literature

The researchers have identified that the healthcare industry possesses various personal data and information which need to be protected effectively ; the individuals possessing access to these data need to use them with utmost care and in good faith for rendering medical services. Hence, it has been suggested that the patient needs to possess the right to set access and rights and decide the medical practitioners, radiologists, and others in reading information and use it [5]. To possess better control over the flow of information and decide the appropriate rights, the blockchain is applied in the current scenario. The usage of technology will enable the

patient to own full rights and access to the information, enable updating the data with ease, and decide to whom this information can be shared. It has been noted that the patient at any point in time can grant or revoke any nature of access.

The major goal of this article is to use cutting-edge computing technologies such as IoT and blockchain to enhance the functionality of healthcare. Therefore, a quick explanation of the fundamental ideas behind IoT and blockchain is given at first. The use of IoT and blockchain in the medical industry is then examined in three aspects: remote patient monitoring, medicine traceability, and patient record management [6]. This investigation can offer important details regarding the function of IoT and smart health in preserving patient lifestyles. With the aid of these technologies, numerous indications are correctly maintained [7]. Authors have proposed an innovative joint knowledge filtration regime that consist of multiple connections between teaching and learning models, including instructing and extracting each other, positively affecting each other's effectiveness, and evaluating our findings on the BACH histology image set of data on breast cancer [8]. The study emphasizes a supervised learning model built on ResNet101 and using the ImageNet dataset. Our accuracy rate using the suggested framework was 99.58%. To achieve the best classification results, numerous tests and hyper parameter adjustments have been conducted. The suggested frameworks seek to be an efficient approach for all clinicians and society at large and assist the user in breast cancer early diagnosis [9]. This research emphasizes how blockchain can help prevent pandemics in the future. This report also presents other blockchain use cases that can aid in the fight against COVID-19 [10].

These technologies support in enhancing the authorization level based on the nature and type of data, and the blockchain technology ensures that the intended users can only access the information. Hence, this supports enhancing transparency and allows users to make critical decisions related to the data collection and exchange of information among the stakeholders [1]. The authors have identified that the usage of blockchain is increasing in the medical industry as it enables in protection of patient-related information effectively, and the implementation of an effective signature feature supports the users to offer critical information. The relevant data and information are necessary to make an important judgment, and blockchain technology supports accessing the information anywhere and anytime. The new technologies further use the multisignature agreement which can support creation of arbitrary values and allow the users to read the files and cannot alter any of the documents [11]. This shows that the patient possesses full authority and control over the nature of information and can process the contract based on the agreement. The healthcare units can view the data and imitate the necessary transactions based on their authorization level [12].

The new data are stored in the block as follows: the patient or a healthcare organization that is not less than one key is connected with the patient's multigeniture account and initiates a transaction, by submitting a data mosaic message that contains data. The message is encrypted, and the decryption key is sent in a separate transaction to the multisigned account. If you sign a data chip transaction manually or automatically, the transaction will go to the account associated with that data type [13]. The decryption key can only be read by devices that have access to the multiline account. In essence, the patient validates a number of accounts with a variety of signatures, each of which corresponds to a different sort of data. This nature of technology can support in allowing accessing various information available to the patients for making better healthcare decisions, and the technology will also enable enhancing the safety and security of the data and cannot be manipulated easily [14].

Medical professionals are now utilizing blockchain technology for improved patient delivery, disease detection, and other features as its application in other fields has grown. The goal of the proposed study is to support medical practitioners in providing improved treatment options and patient care by utilizing the capabilities of a big data network powered by a blockchain which is the main novelty of the approach that we have proposed. As compared to the recent investigations going on in this field, only blockchain has been employed in the healthcare system or AI techniques have been employed. But this study is more involved in the investigation of blockchain technology through a big data network enabled in offering better care for elderly individuals who have been affected due to diabetes. Healthcare facilities, medical professionals, nurses, radiologists, and patients can all benefit from enhanced services and features in building blockchain-based healthcare data management, thanks to the use of new generation of smart blockchains like Ethereum, NEM, and others.

3. Methodology

The main focus of this research is to explore the role of blockchain technology in enabling big data technologies in diabetes care for elderly individuals; the researchers are more focused on using descriptive research design for understanding the critical components of the application of blockchain in healthcare and in more specifical diabetes care for elderly patients. Diabetes is the most common disease that occurs when a person's blood glucose level exceeds the normal limits. Overweight and reduced physical activity have long been expected to be the main causes of type 2 diabetes [15]. The concept of implementing blockchain in healthcare is emerging as there is a growing need for data protection, safety of information, and to king profound actions based on the available information. Hence, the researchers intend to apply both primary and secondary sources for collating the needed information for the study, as detailed closed-ended questionnaires were prepared to gather the data, the researcher uses convenience sampling to choose the respondents, and nearly 168 respondents were considered for the study [16, 17]. Secondary data have also been used by the investigators to have a better understanding of previous research in the field and to identify crucial elements for the overall analysis.

TABLE 1: Uniform pattern of authorization.

Uniform pattern of authorization	Frequency	Percent
Not at all important	13	7.7
Less important	9	5.4
Neutral	25	14.9
Important	44	26.2
Highly important	77	45.8
Total	168	100

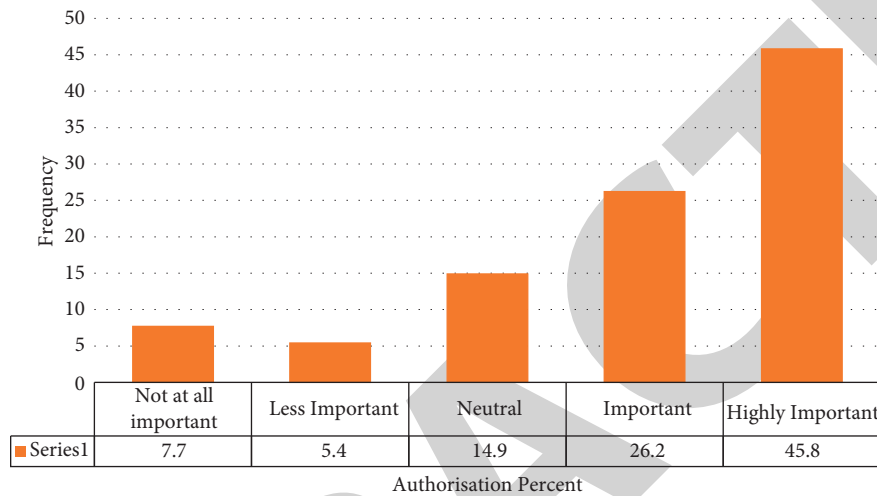FIGURE 1: Uniform pattern of authorization.

TABLE 2: Creating innovative solutions.

Creating innovative solution	Frequency	Percent
Not at all important	13	7.7
Less important	13	7.7
Neutral	27	16.1
Important	57	33.9
Highly important	58	34.5
Total	168	100
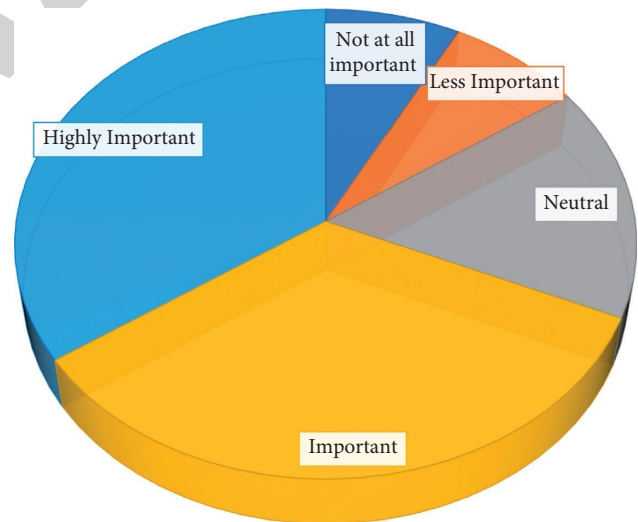
3.1. Critical Assumptions

Ho: there is no critical association between the safety of information and the usage of blockchain in diabetes care for elderly patients

Ho: there is no critical association between enhancing transparency and usage of the blockchain in diabetes care for elderly patients

Ho: there is no critical association between allowing medical practitioners in taking informed decision making and the usage of blockchain in diabetes care for elderly patients

4. Analysis and Interpretation

The section of the analysis involves performing data analysis and stating the meaningful interpretation based on the analysis. The major statistical analysis applied is frequency table, correlation analysis, and chi-square.

FIGURE 2: Creating innovative solution.

Table 1 provides that 45.8% of the respondents have mentioned that the application of blockchain supported big data technologies in creating better authorization for elderly individuals who were impacted by diabetes. Moreover, 26.2% of the respondents have mentioned that they are important, and hence, nearly 71% have strongly stated that the application of blockchain provides a uniform pattern of authorization as critical. Figure 1 shows the uniform pattern of authorization graphically.

TABLE 3: Karl Pearson's coefficient of correlation.

Karl Pearson's coefficient	Safety of information	Enhancing transparency	Informed decision making	Blockchain in diabetes care
Safety of information	1	0.893	0.832	0.827
Enhancing transparency	0.893	1	0.858	0.837
Informed decision making	0.832	0.858	1	0.765
Blockchain in diabetes care	0.827	0.837	0.765	1

TABLE 4: Chi-square test between safety of information and the usage of blockchain in diabetes care for elderly patients.

Test statistics	Safety of information	Blockchain in diabetes care
Chi-square	146.821a	71.583a
Df	4	4
P value	0.001	0.001

a indicates that 0 cell has count less than 5.

TABLE 5: Chi-square test between enhancing transparency and usage of blockchain in diabetes care for elderly patients.

Test statistics	Enhancing transparency	Blockchain in diabetes care
Chi-square	229.976a	71.583a
Df	4	4
P value	0.001	0.001

a indicates that 0 cell has count less than 5.

TABLE 6: Chi-square tests allow medical practitioners to taking informed decision making and the usage of blockchain in diabetes care for elderly patients.

Test statistics	Informed decision making	Blockchain in diabetes care
Chi-square	90.452a	71.583a
Df	4	4
P value	0.001	0.001

a indicates that 0 cell has count less than 5.

Table 2 provides the application of blockchain in creating innovative solutions in the medical field.

In Table 2, it has been identified that 34.5% of the respondents have stated that the application of blockchain is essential in creating innovative solutions, and 33.9% of them have stated that blockchains are important in creating better innovative solutions. However, 16.1% of them have stated that they are neutral; the remaining stated that they are not important. The data are shown graphically in Figure 2.

4.1. Correlation Analysis. The next step is figuring out what kind of relationship exists between the dependent and independent variables. The coefficient of correlation tends to be in the range between −1 and +1.

From Table 3, the associations among the stated factors are more than +0. 700; hence, there lies a better positive correlation among the variables. Measuring the independent variables such as safety of information, enhancing transparency, and informed decision making is done with the dependent Variables. It has been noted that the correlation coefficient is high between enhancing transparency and blockchain in diabetes care with nearly 0.837; the next highest is between safety of information and blockchain in diabetes care with nearly +0.827.

4.2. Chi-square test. The next step of the study is to evaluate the essential assumptions, which will allow to determine the significance level between the observed and predicted results.

4.2.1. Hypothesis 1

Ho: there is no critical association between the safety of information and the usage of blockchain in diabetes care for elderly patients

Ha: there is a critical association between the safety of information and the usage of blockchain in diabetes care for elderly patients

From the analysis in Table 4, the value is 0.05; hence, it can be stated that there is a variable critical association between the safety of information and the usage of blockchain in diabetes care for elderly patients.

4.2.2. Hypothesis 2

Ho: there is no critical association between enhancing transparency and usage of blockchain in diabetes care for elderly patients

Ha: there is a critical association between enhancing transparency and usage of blockchain in diabetes care for elderly patients

From the analysis in Table 5, the value is 0.05; hence, it can be stated that there is a critical association between enhancing transparency and usage of blockchain in diabetes care for elderly patients.

4.2.3. Hypothesis 3

Ho: there is no critical association between allowing medical practitioners in taking informed decision making and the usage of blockchain in diabetes care for elderly patients

Ha: there is a critical association between allowing medical practitioners in taking informed decision making and the usage of blockchain in diabetes care for elderly patients

From the analysis in Table 6, the value is 0.05; hence, it can be stated that there is a critical association between

allowing medical practitioners in taking informed decision making and the usage of blockchain in diabetes care for elderly patients. The analysis results demonstrate that the accomplishment of blockchain-based big data methods assists the healthcare professional to treat diabetes successfully, and it can be stated that diabetes is the main disease that occurs when a person's blood sugar level exceeds the acceptable limit.

The term blockchain is mainly considered as a distributed transaction that consists mainly of different blocks, and each set represents data from previous blocks. The blockchain is mainly run on a peer-to-peer network, which means that you follow an authentication protocol for different blocks to create the blockchain. Blockchain technology is increasingly used in various areas, and health departments are now using blockchain to better care for patients, detect diseases, and more. The usage of blockchain now offers better services and opportunities to create blockchain-based healthcare data management and support health centers, doctors, nurses, radiologists, and patients for better healthcare [18]. The overall analysis shows that the implementation of blockchain-based big data technologies supports the healthcare professional to treat diabetes effectively , and it can be stated that diabetes is the main disease that occurs when a person's blood sugar level exceeds the permissible limit. It is widely claimed that obesity and a sedentary lifestyle are the leading causes of type 2 diabetes, and those with such problems tend to turn to other doctors, such as endocrinologists, general practitioners, nurses, radiologists, and others, to check their health and wellness. The application of big data-based technologies enables doctors to collect data effectively and analyze to take critical decision making. The application of big data plays a crucial role in gathering the required information in healthcare. These data have enabled individuals to analyse many entities that have access to crucial data, as well as healthcare professionals to make rapid and effective decisions.

The role of blockchain enables big data support in providing better control and analysis of the data; moreover, the data about patient health are increasing, and it is highly significant in analyzing the patient's condition and enable providing better medical services to the patients effectively, thereby keeping the blood sugar levels at an adequate level. Now, people can use insulin injections, prescription pills, and so on [19, 20]. Therefore, patients with these conditions tend to produce more information about the disease, the type of medication they are taking, medical records, insurance policies, blood glucose measurements, home measurements, and other important data monitoring and other key actions. It is becoming increasingly important that data are stored in a more secure location to protect it from cyber-attacks or malicious code [21, 22]. Therefore, the blockchain application is extremely unchanged because all blocks are fragmented, and it is very difficult to find the original source [23]. It has also been said that changes made in each block often change the history chain as well as the general content of other blocks, making data and information repositories extremely secure.

5. Conclusion

Through the use of blockchain technology in healthcare, especially for diabetics, information is stored more securely, and the patient has full access to all data and controls by healthcare centers, doctors, or other persons with whom he has been notified. The patient has every right to issue licenses and decide who can read and receive health data information, and access management is applied to applications outside the chain. These data enable individuals to analyze different entities about who has access to critical data and allows physicians to make faster and better decisions to improve individuals' health and wellbeing. In addition, the patient may have more flexibility to allow access to data, the nature of available data, and the time frame. This idea contributes to improved transparency and allows individuals to make more informed decisions about patients' health and wellbeing in future.

Data Availability

The data used to support this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] S. L. Cichosz, M. N. Stausholm, T. Kronborg, P. Vestergaard, and O. Hejlesen, "How to use blockchain for diabetes health care data and access management: an operational concept," *Journal of Diabetes Science Technology*, vol. 13, no. 2, pp. 248–253, 2019.

[2] M. W. Nadeem, H. G. Goh, V. Ponnusamy, I. Andonovic, M. A. Khan, and M. Hussain, "A fusion-based machine learning approach for the prediction of the onset of diabetes," *Health Care*, vol. 9, no. 10, p. 1393, 2021.

[3] M. W. Nadeem, H. G. Goh, A. Ali, M. Hussain, M. A. Khan, and V. Ponnusamy, "Bone age assessment empowered with deep learning: a survey, open research challenges and future directions," *Diagnostics*, vol. 10, p. 781, 2020.

[4] R. Ramezani, M. Maadi, and S. M. Khatami, "A novel hybrid intelligent system with missing value imputation for diabetes diagnosis," *Alexandria Engineering Journal*, vol. 57, no. 3, pp. 1883–1891, 2018.

[5] T. M. Fernández-Caramés, I. Froiz-Míguez, O. Blanco-Novoa, and P. Fraga-Lamas, "Enabling the internet of mobile crowdsourcing health things: a mobile fog computing, blockchain and IoT based continuous glucose monitoring system for diabetes mellitus research and care," *Sensors*, vol. 19, no. 15, p. 3319, 2019.

[6] P. Ratta, A. Kaur, S. Sharma, M. Shabaz, and G. Dhiman, "Application of blockchain and internet of things in healthcare and medical sector: applications, challenges, and future perspectives," *Journal of Food Quality*, vol. 2021, Article ID 7608296, 20 pages, 2021.

[7] A. Tiwari, V. Dhiman, M. A. M. Iesa, H. Alsarhan, A. Mehbodniya, and M. Shabaz, "Patient behavioral analysis with smart healthcare and IoT," *Behavioural Neurology*, vol. 2021, Article ID 4028761, 9 pages, 2021.

[8] S. Chaudhury, N. Shelke, K. Sau, B. Prasanalakshmi, and M. Shabaz, "A novel approach to classifying breast cancer histopathology biopsy images using bilateral knowledge distillation and label smoothing regularization," *Computational and Mathematical Methods in Medicine*, vol. 2021, Article ID 4019358, 11 pages, 2021.

[9] D. Chowdhury, A. Das, A. Dey et al., "ABCanDroid: a cloud integrated android app for noninvasive early breast cancer detection using transfer learning," *Sensors*, vol. 22, p. 832, 2022.

[10] K. Kaushik, S. Dahiya, R. Singh, and A. D. Dwivedi, "Role of blockchain in forestalling pandemics," in *Proceedings of the IEEE 17th International Conference on Mobile Ad Hoc and Sensor Systems (MASS)*, IEEE, Piscataway, NJ, USA, 2020.

[11] R. Bharti, A. Khamparia, M. Shabaz, G. Dhiman, S. Pande, and P. Singh, "Prediction of heart disease using a combination of machine learning and deep learning," *Computational Intelligence and Neuroscience*, vol. 2021, Article ID 8387680, 11 pages, 2021.

[12] S. Malik, S. Harous, and H. El-Sayed, "Comparative analysis of machine learning algorithms for early prediction of diabetes mellitus in women," in *Proceedings of the International Symposium on Modelling and Implementation of Complex Systems*, pp. 95–106, Springer, Batna, Algeria, 2020.

[13] S. Perveen, M. Shahbaz, T. Saba, K. Keshavjee, A. Rehman, and A. Guergachi, "Handling irregularly sampled longitudinal data and prognostic modeling of diabetes using machine learning technique," *IEEE Access*, vol. 8, pp. 21875–21885, 2020.

[14] H. Z. Almarzouki, H. Alsulami, A. Rizwan, M. S. Basingab, H. Bukhari, and M. Shabaz, "An internet of medical things-based model for real-time monitoring and averting stroke sensors," *Journal of Healthcare Engineering*, vol. 2021, Article ID 1233166, 9 pages, 2021.

[15] S. Van Cranenburgh and A. Alwosheel, "An artificial neural network based approach to investigate travellers' decision rules," *Transportation Research Part C: Emerging Technologies*, vol. 98, pp. 152–166, 2018.

[16] A. Cahn, A. Shoshan, T. Sagiv et al., "Prediction of progression from pre-diabetes to diabetes: development and validation of a machine learning model," *Diabetes Metabolism. Research. Reviews*, vol. 36, no. 2, Article ID e3252, 2020.

[17] A. Kakti, S. Kumar, N. K. John, V. V. Ratna, and S. Afzal, "Impact of patients approach towards healthcare costs on their perception towards health: an empirical study," *Tobacco Regulatory Science*, vol. 7, no. 6, pp. 7380–7390, 2021.

[18] A. Jain, A. K. Yadav, and Y. Shrivastava, "Modelling and optimization of different quality characteristics in electric discharge drilling of titanium alloy sheet" Material," *Today Proceedings*, vol. 21, pp. 1680–1684, 2019.

[19] A. Jain and A. K. Pandey, "Modeling and optimizing of different quality characteristics in electrical discharge drilling of titanium alloy (Grade-5) Sheet," *Material Today Proceedings*, vol. 18, pp. 182–191, 2019.

[20] D. Ushakov, E. Robu, O. Blagorazumnaia, and S. Kabaha, "Transnationalized tourism: hyper-advantages from global competitiveness," *Journal of Environmental Management and Tourism*, vol. 11, no. 6, p. 1316, 2020.

[21] M. Maniruzzaman, M. J. Rahman, B. Ahammed, and M. M. Abedin, "Classification and prediction of diabetes disease using machine learning paradigm," *Health Information Science and Systems*, vol. 8, no. 1, p. 7, 2020.

[22] D. S. Ushakov, O. O. Yushkevych, N. L. Ovander, H. Tkachuk, and V. H. Vyhovskyi, "The strategy of thai medical services promotion at foreign markets and development of medical tourism," *Geojournal of Tourism and Geosites*, vol. 27, no. 4, pp. 1429–1438, 2019.

[23] A. Rehman, A. Athar, M. A. Khan, S. Abbas, A. Fatima, and A. Saeed, "Modelling, simulation, and optimization of diabetes type II prediction using deep extreme learning machine," *Journal of Ambient Intelligence and Smart Environments*, pp. 1–14, Preprint, 2020.