

Artificial Intelligence and Blockchain Technology in Healthcare System : A Systematic Review

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ARTICLE INFO

Article History:

Accepted: 01 Aug 2023

Published: 10 Aug 2023

Publication Issue

Volume 9, Issue 4

July-August-2023

Page Number

301-313

ABSTRACT

Blockchain technology considers a decentralized system in which a focal authority is pointless. As a result of the work of cryptographic standards, monetary dealings can be relied upon while likewise being totally protected. To a great extent because of the ascent in worth of digital currencies, blockchain technology has as of late become in vogue and spread to different regions. The healthcare business is one that could benefit extraordinarily from blockchain technology on account of the developing accentuation on patient-focused care, the need to coordinate siloed systems, and the longing to work on the unwavering quality of EHRs. In this thorough review, we look at the latest discoveries from blockchain concentrates on in the clinical calling. The objective is to reveal insight into the technology's possible advantages and cause to notice the hardships and likely future improvements of blockchain research in the healthcare area. The paper starts with some initial material prior to jumping into an itemized clarification of the techniques utilized here. A synopsis of the bibliometrics, an assessment of the data and its credits, and the discoveries of a writing quality evaluation follow. Eventually, the investigation results are examined. Data sharing, wellbeing record the executives, and authorization the board are where blockchain technology sparkles in this field of study. The option is an uncommon event. Most investigations have as their objective the presentation of a few new systems, designs, or models into the field. The outcomes likewise show that the majority of the review uncovers no model execution or execution subtleties, and that specialized insights regarding the utilized blockchain parts are not given in a large portion of the dissected papers. Indeed, even with a functioning model, information in regards to the Blockchains parts is frequently held back.

Keywords : Blockchain, Healthcare, Systematic Review, Artificial Intelligence, Healthcare, Patient Data

I. INTRODUCTION

Ongoing years have seen a transient ascent in the execution and usage of blockchain technology across all spaces of ICT. The dramatic enthusiasm for digital money values and the gigantic flood of funding into blockchain new companies have been essential drivers of premium and improvement here. The blockchain market is supposed to expand until 2021 [1]. In the brief a long time since Bitcoin's presentation, there have been north of 1500 new crypto coins created [2]. Bitcoin was the very first digital money made. It ensures that dealings are made in a decentralized style without depending on any one solid power. While utilizing public keys, uncovering anybody's actual personality is pointless. In return for their figuring exertion confirming and putting away Bitcoin exchanges (installments) in the Bitcoin blockchain, excavators are a fundamental piece of the Bitcoin organization and acquire Bitcoins. If you have any desire to get familiar with Bitcoin, you can do as such by counselling [3].

Blockchain technology has numerous expected applications past cryptographic money. with a nutshell, with a digital currency [4-6], you really want to separate between the blockchain, the convention, and the actual cash. An autonomous digital money and convention can be carried out on top of the blockchain of a current digital currency like Bitcoin or Ethereum. The blockchain is the decentralized database that monitors all digital currency exchanges. As an ever increasing number of blocks are added to the chain, it expands endlessly. The blockchains for by far most of digital currencies are available to the general population, and their exchanges might be questioned on sites like blockchain.com.

Blockchain dispenses with the requirement for a (trusted) mediator in monetary exchanges. It utilizes validators (frequently diggers) to approve exchanges in a decentralized way rather than depending on outsiders. Conveyed agreement takes into account this, as it considers individuals that have little to no

faith in another to agree on anything. This computational issue is connected with the twofold spending issue in the domain of cryptographic forms of money, for example step by step instructions to check that a given amount of a computerized coin has not as of now been spent without the confirmation of a confided in outsider (ordinarily a bank) that monitors all exchanges and client adjusts[7-8].

There are recently distributed outlines [9] of blockchain's expected purposes in a few enterprises. Blockchain technology's engineering and numerous strategies are reviewed by Zheng et al. [10-11]. Large data and modern applications are featured in the outlines of blockchain technology presented by Karafiloski and Mishev [12] and Ahram et al. [13]. Two late systematic examinations, by Conoscenti et al. [14] and Yli-Huumo et al. [15], look at the different use cases for blockchain technology and related research regions. While there are studies talking about blockchain's potential utility in the healthcare area [16-20], no reviews the region exhaustively.

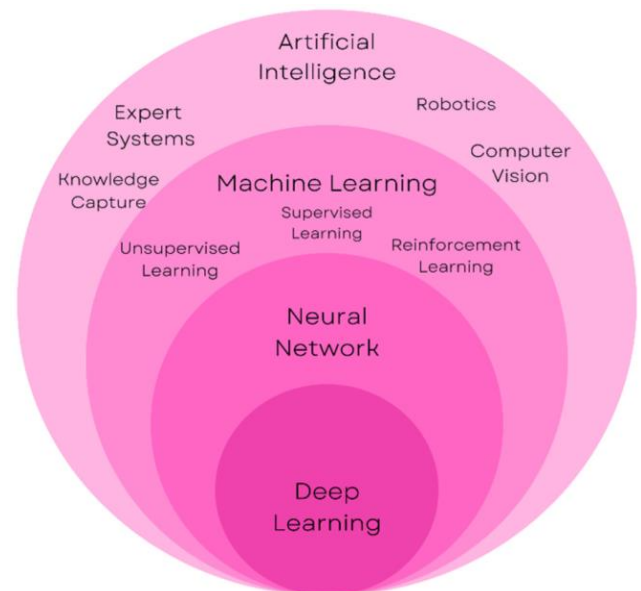


Figure 1 : Integrating Blockchain and AI to Improve Public Health

II. LITERATURE SURVEY

In this segment, we lay the basis for this article by making sense of the essentials of blockchain technology. A blockchain can be considered a common record that is open to all clients in a decentralized organization [21-23]. It was presented close by Bitcoin and tended to the well established issue of twofold spending. This happens in Bitcoin when most of "mining hubs" settle on a bunch of substantial exchanges and add them to the blockchain. Blockchain was at first carried out for use with computerized monetary standards. To utilize blockchain and make decentralized applications, be that as it may, it isn't fundamental to present a digital currency [24-25]. To assist the peruser with understanding the idea of the blockchain, its major elements and constituent parts will be framed underneath.

1.1. Block chain—Distributed Ledger Technology

The expression "block chain" alludes to a progression of time-stepped, cryptographically-connected blocks. These blocks are airtight fixed with the goal that they can't be adjusted [26]. Each new block has a reference (i.e., a hash worth) to the substance of the past block, so the chain is continually expanding and new blocks are being attached to the end. Investors, who are otherwise called hubs in the block chain, structure a decentralized P2P structure. Each organization hub has two keys [27]: a public key utilized for encoding messages communicated to it and a confidential key used to interpret those messages so it might understand them.

Block chains should be steady, irreversible, and unrepudiable, consequently the public key encryption process is used to accomplish these objectives. Messages encoded with a particular public key can be unscrambled with the going with private key. Topsy-turvy cryptography is the term for this method of safety. Since a total clarification is past the extent of this review, if it's not too much trouble, allude to for additional information. The supposed hash, which is

made by a cryptographic one-way hash capability (like SHA256), associates every one of the blocks in the block chain. It ensures the block's protection, permanence, and little size [28].

Before a hub communicates an exchange to the organization for affirmation, it signs it. Confidential key confirmation and exchange trustworthiness are made conceivable through carefully marking an exchange. The first is that main a client with a specific confidential key can sign the exchange, and the second is that decoding (i.e., affirming a computerized signature) is unthinkable assuming there was a blunder during transmission of the data. In networks that utilization agreement procedures like verification of-work or evidence of-stake, particular hubs known as excavators are answerable for sorting out and pressing legitimate organization exchanges into time-stepped blocks. The excavators and the information contained in the block are chosen by the agreement method (a more careful meaning of an agreement convention is given beneath).

After the blocks have been made, they are communicated to the organization, where approval hubs really look at the blocks against a hash of the first block in the chain to guarantee they contain genuine exchanges. Assuming the two circumstances are met, the hubs will remember the block for the blockchain. On the off chance that the circumstances are not met, the block isn't utilized. Presently we might talk about how network hubs capability. Considering that the blockchain network is decentralized and in view of shared cooperations, a hub that joins the organization and starts trading data with different hubs is known as a companion hub. For the wellbeing of effortlessness, we'll allude to it as a "hub" from here on out. A full hub is a machine that runs a total duplicate of the blockchain record [29-33] and has the center blockchain client introduced.

To take part in the blockchain, you need to join the organization by joining a hub [34]. All diggers are likewise expected to run a completely functional hub, subsequently the recently recorded excavators are a

subset of hubs. Hence, all excavators are hubs, however not all hubs mine. Confirmation of-work (PoW) agreement public blockchains are know what is happening (more on this beneath). Other blockchain networks, like those in light of PoS (confirmation of-stake), don't require mining.

The basic tasks of a blockchain node are [35]:

- establishing a link to the blockchain,
- maintaining a current accounting record,
- Paying attention to business,
- including: forwarding legitimate transactions to the network,
- keeping an ear out for recently resealed masonry
- verifying transactions by validating newly sealed blocks,
- Making and sharing brand new building blocks.

III.ARTIFICIAL INTELEGENCE IN HEALTHCARE

The specialists will utilize the effective dendrogram to construct a development model in light of four significant measures [36-40]. With regards to clinical consideration, computer based intelligence has demonstrated a unique advantage [41-43]. Wellbeing information systems, geocoding wellbeing data, pandemic and syndromic reconnaissance, predictive displaying and choice help, and clinical imaging are only not many of the areas where simulated intelligence has helped specialists and clinical experts. Moreover, the creators utilized the discoveries of the bibliometric examination to decide the four most significant large scale factors in the field. Accordingly, the accompanying subsections will endeavor to explain the contention about involving artificial intelligence in healthcare[44-48].

1.2. Health Services Management

Perhaps of the most intriguing thing about computer based intelligence is the likelihood that it might assist with overseeing medical care overall. Clinical experts,

medical attendants, and leaders can all profit from these applications. For example, computer based intelligence systems may ceaselessly, and possibly progressively, update wellbeing specialists with the most recent clinical information from a large number of sources such diaries, course books, and clinical practices [38, 40]. During the Coronavirus period, when steady correspondence is expected for viable worldwide pandemic administration [49], the adequacy of these applications is of principal significance. The coordination of patient information apparatuses and the help of reasonable ends for wellbeing risk cautions and wellbeing result prediction are two further instances of uses [50-53].

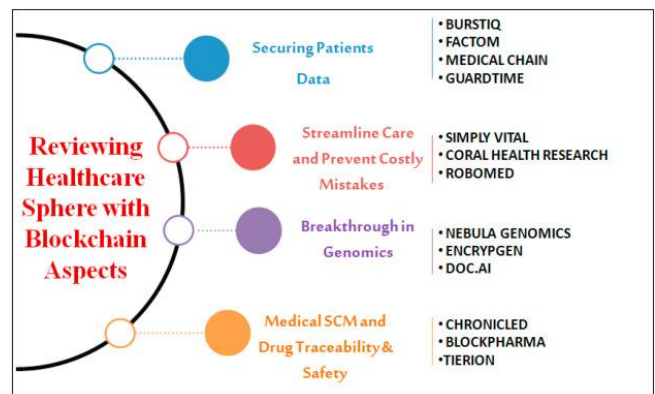


Figure 2 : Potential Medical Uses for Blockchain Technology

Health care facilities, including hospitals, can benefit from AI applications in a number of ways.

- At the point when fundamental, data is promptly accessible for clinicians.
- Attendants can work on patient wellbeing during drug organization.
- Speaking with one's clinical staff during medical clinic stays permits patients to clarify pressing issues and take part in their consideration.

Further, computer based intelligence can assist with enhancing strategic techniques, for example, the conveyance of prescriptions and clinical gadgets in an in the nick of time supply system in view of predictive calculations. Fascinating applications can likewise assist with wellbeing administration specialist schooling and advancement. This examination can possibly assist with shutting the hole among

metropolitan and provincial healthcare [54]. To wrap things up, simulated intelligence can possibly help wellbeing administrations the board utilize the wealth of information contained in electronic wellbeing records by predicting data heterogeneity among medical clinics and outpatient facilities, identifying anomalies, running clinical tests on the data, standardizing patient portrayal, improving future models' capacity to predict analytic tests and examinations, and laying out straightforwardness by giving benchmark data to surveying the nature of care gave [55-57].

1.3. Predictive Medicine

Simulated intelligence applications in sickness guess, conclusion, therapy arranging, and result/forecast assessment [58-61] are one more area of interest. Artificial intelligence's capacity to dig crude data for designs implies it can work on the exactness of clinical findings, medicines, and guesses in a great many settings [62-65]. It prepares for specialists to acknowledge avoidance as a necessary piece of patient consideration. Patient-explicit gamble factors and causes can be predicted, considering more exact and viable healthcare mediation. New prescriptions, patient observing, and individualized treatment regimens are potential because of computer based intelligence technology. At the point when specialists have additional time and clear information, they can give better consideration to their patients. Programmed gaining from computer based intelligence can possibly stir up the clinical business by empowering the improvement of prediction models for drugs and tests that track patients across their lifetimes [66-68].

1.4. Clinical Decision-making

Clinical dynamic help by man-made intelligence systems is a significant topic that rose up out of the catchphrase examination. Jiang et al. [69] guarantee that artificial intelligence can enhance or try and supplant human decisions in healthcare-related useful regions, making it simpler for specialists to settle on significant clinical choices. Clinical choices can profit

from calculations since they accelerate the interaction and how much treatment offered, which, as per [70-72], can emphatically affect the expense of wellbeing administrations. Subsequently, man-made intelligence can help specialists in their day to day work and make their undertakings simpler. At last, as [73-74] find, algorithmic stages can offer virtual guide to doctors by helping them to fathom the semantics of language and recognize empathetic answers for issues emerging in business processes.

1.5. Patient Data and Diagnostics

Patient data and diagnostics present one more troublesome area of artificial intelligence applications. Scientists in the clinical field can profit from utilizing simulated intelligence strategies to deal with the gigantic measures of patient data (clinical huge data). Data gathered from clinical undertakings like screening, analysis, and treatment assignment can be overseen by computer based intelligence systems. In this strategy, clinical staff can acquire an understanding of equal cases and the connections between unambiguous qualities of those cases and wanted results [75].

These apparatuses can survey patient data to make determinations that can be utilized in treatment. They can support determination by making it simpler for clinicians to get a general picture of the patient's condition, for example to play out a quick body check. Presently, artificial intelligence systems can recreate a patient's body in 3D. Intriguing new exploration headings are creating from the data. For example, another line of request concerning the security and organization of patient data with regards to man-made intelligence has as of late arisen [76-78].

Artificial intelligence strategies can further develop conclusion for use in exercise based recuperation and operations. Numerous robots have been created to assist with and regulate this sort of work. During engine treatment, for example, recovery robots can offer actual help and direction to a patient's appendage. Artificial intelligence can possibly decisively work on careful advanced mechanics by making instruments

that can do semi-computerized surgeries with more prominent proficiency. A definitive objective of this technology is to mechanize processes so that human blunder is wiped out yet accuracy and precision are kept up with. Telemedicine, which considers the far off observing of patients and offers doctors and attendants with help devices, has prompted an expansion in distant patient findings in the - 19 period [79-81].

IV. DISCUSSION AND RESULTS

Bookkeeping, business and the board, choice sciences, and wellbeing calling studies are the essential areas of concentration for this bibliometric assessment of computer based intelligence related healthcare writing. By adjusting Massaro et al's. [82] SLR procedure, we present a strong and repeatable review technique for future examinations around here. We additionally utilize the science planning strategy to inspect the advancement of related academic articles, as well as any unseen material, expected future roads, and consequences. Our examination uncovers novel points of view.

As per bibliometric markers, the best puts for distributing research regarding this matter are the Diary of Clinical Systems, Concentrates in Wellbeing Technology and Informatics, IEEE Diary of Biomedical and Wellbeing Informatics, and Choice Emotionally supportive networks. The essential focal point of these distributions is on subjects connected with medication and healthcare IT, including distributed computing, AI, and artificial intelligence. Moreover, The most frequently referred to work in this space is Burke et al's. [83] assessment of attendant roistering with state of the art devices like computer based intelligence. Finally, watchword co-event gives some significant setting. By looking at thousands of clinical records, encountering programmed learning with clinical cautions, effectively overseeing wellbeing administrations and spots of care, and the chance of reproducing patient history utilizing these data, specialists have found that artificial intelligence assumes a part in symptomatic

exactness and helps in the examination of wellbeing data.

Second, the review recognizes five healthcare applications for group investigations: wellbeing administrations the board; predictive medication; patient data; diagnostics; and clinical independent direction. These developments can assist with further developing healthcare coordinated operations by working with more effective asset portion.

Third, the creators who have dissected the exploration discoveries and the difficulties within reach are a lot of for artificial intelligence's part in helping with direction. Be that as it may, instances of these purposes are given by laying out an association between data quality administration and the mechanical education of healthcare laborers [84].

Then again, there are concentrates on that attempt to sort out the adverse consequences of technology. For example, Carter [85] takes note of that the impacts of computer based intelligence length numerous ventures, yet that the progression of artificial intelligence requires measures to protect individual security. Ramifications of applying man-made intelligence to healthcare as far as morals The creators contend that the utilization of shrewd machines in healthcare brings up issues of liability, transparency, and approval, especially with regards to the utilization of mechanized contact with patients. Since our examination has not uncovered a reasonable pattern in the writing, we battle that it is urgent to have conversations on points like patient technology straightforwardness prior to pushing ahead with the making of artificial intelligence based items.

V. CONCLUSION AND FUTURE WORK

In this examination, we took a gander at where blockchain concentrates on stand right now in the clinical field. Because of the touchy idea of the data being handled and overseen in the healthcare business, the blockchain technology is viewed as having extraordinary potential for use. The examination set off

on a mission to consider where blockchain studies and applications stand in the clinical field. To achieve this, we have created research questions and, following the laid out system, have chosen a sum of 33 articles for inside and out examination. These were exposed to extra investigation. To this end, we have sifted through nine significant bibliographic databases looking for papers distributed somewhere in the range of 2008 and 2019.

Three reviewers investigated the gathering of 33 distributions for the top to bottom review. We have accumulated information in light of our examination questions and assessed the writing as per laid out standards. Our exploration shows a rising interest in investigating blockchain technology and its application in healthcare. Data sharing, wellbeing records, and access control are where blockchain research in healthcare is principally engaged right now, however different applications, for example, store network the board or medication remedy the executives, are still in their outset.

In this way, a lot of blockchain's commitment has not yet been understood. Most investigations feature the uniqueness of some construction, plan, or model for applying blockchain technology to the healthcare business. Moreover, the particular blockchain components (like the stage, agreement calculation, blockchain type, and brilliant agreements) utilized are seldom indicated. Specifically, brilliant agreements, which consider the mechanization of cycles inside a blockchain stage, could see expanded use. Most of studies could likewise introduce a model execution or discuss the useful contemplations of their proposals. Concerning future review, blockchains are as yet an arising technology in the healthcare area, so new applications for the technology are probably going to be found and researched. All in all, blockchain ought to in any case be utilized in situations where it is functional and important.

VI.REFERENCES

- [1] McKinsey & Company. Blockchain Technology in the Insurance Sector. In Proceedings of the Quarterly Meeting of the Federal Advisory Committee on Insurance (FACI), New York, NY, USA, 5 January 2017.
- [2] Dr. Abdul Hannan Abdul Mannan Shaikh, "Blockchain Technology for Beginners", 1 Nov 2022, ISBN-13 : 979-8888497654, PP 1- 218, Book Nation Press, Ltd. Chennai, Tamil Nadu, India.
- [3] Shaikh Abdul Hannan, "A Blockchain Technology and Internet of Things to Secure in Healthcare System", Journal of Advance Research in Computer Science & Engineering, Volume 9, Issue 04, pp 12-19, April 2023.
- [4] Swan, M. Blockchain: Blueprint for a New Economy; O'Reilly Media: Newton, MA, USA, 2015.
- [5] Singh, S.; Singh, N. Blockchain: Future of financial and cyber security. In Proceedings of the 2016 2nd International Conference on Contemporary Computing and Informatics (IC3I), Noida, India, 14–17 December 2016; pp. 463–467.
- [6] Shaikh Abdul Hannan, "A Blockchain Technology and Internet of Things to Secure in Healthcare System", Journal of Advance Research in Computer Science & Engineering, Volume 9, Issue 04, pp 12-19, April 2023.
- [7] Shaikh Abdul Hannan; Ms. Preeti Gupta; P. Vanitha; Rajesh Singh; Dimple Saini; Mohit Tiwari, "Analysis of blockchain technology based on digital management systems and data mining technology", IEEE Xplore, 22 March 2023, ISBN:979-8-3503-9827-4
- [8] Heena Vig, Shaikh Abdul Hannan, Asok Kumar, Rajshree Singh, Juhi Juwairiyah, Neen Kuriakose, "Gender and Age Classification Enabled Blockchain Security Mechanism for assisting Mobile Application, 2022 5th

- International Conference on Contemporary Computing and Informatics (IC3I), IEEE Xplore, 22nd March 2023, pp 1123-1128, ISBN: 979-8-3503-9827-4,
DOI : 10.1109/IC3I56241.2022.10073014.
- [9] Shaikh Abdul Hannan, "A Blockchain Technology to secure electronic Health Records in Healthcare System, London Journal of Research in Computer Science and Technology, Vol 23, Issue 1, PP 1-13, London Journal Press, 10 Feb 2023, ISSN 2514-8648.
- [10] Zheng, Z.; Xie, S.; Dai, H.; Chen, X.; Wang, H. An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends. In Proceedings of the 2017 IEEE International Congress on Big Data (BigData Congress), Boston, MA, USA, 11–14 December 2017; pp. 557–564. [CrossRef]
- [11] Shaikh Abdul Hannan, "An Overview of Big Data and Hadoop", International Journal of Computer Application", Volume 154, Number 10, ISSN – 0975-887, November 2016, New York, USA.
- [12] Karafiloski, E.; Mishev, A. Blockchain solutions for big data challenges: A literature review. In Proceedings of the IEEE EUROCON 2017—17th International Conference on Smart Technologies, Ohrid, Macedonia, 6–8 July 2017; pp. 763–768. [CrossRef]
- [13] Ahram, T.; Sargolzaei, A.; Sargolzaei, S.; Daniels, J.; Amaba, B. Blockchain technology innovations. In Proceedings of the 2017 IEEE Technology Engineering Management Conference (TEMSCON), Santa Clara, CA, USA, 8 June 2017; pp. 137–141. [CrossRef]
- [14] Conoscenti, M.; Vetro, A.; Martin, J.C.D. Blockchain for the Internet of Things: A systematic literature review. In Proceedings of the 2016 IEEE/ACS 13th International Conference of Computer Systems and Applications (AICCSA), Agadir, Morocco, 29 November–2 December 2016; pp. 1–6. [CrossRef]
- [15] Yli-Huumo, J.; Ko, D.; Choi, S.; Park, S.; Smolander, K. Where Is Current Research on Blockchain Technology?—A Systematic Review. PLoS ONE 2016, 11, e0163477. [CrossRef] [PubMed]
- [16] Shaikh Abdul Hannan, "Challenges of Blockchain Technology using Artificial Intelligence in Healthcare System" International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET), Vol 12, Issue 01, page 64-74, Jan 2023.
- [17] Mettler, M. Blockchain technology in healthcare: The revolution starts here. In Proceedings of the 2016 IEEE 18th International Conference on e-Health Networking, Applications and Services (Healthcom), Munich, Germany, 14–17 September 2016; pp. 1–3. [CrossRef]
- [18] Shaikh Abdul Hannan, "Application and Scope of Blockchain in Technical Research and Higher Education" Vol 20, Issue 15, page 6185-6191, NeuroQuantology, Nov 2022.
- [19] Dubey, A., Mujoo, S., Shaikh Abdul Hannan., Satpathy, G., Arshad, M. W., & Manikandan, E., "Cancer detection using RNA sequencing and deep learning", International Journal of Health Sciences, Special Issue VIII, 27 Sept. 2022, PP 4925-4939, ISSN 2550-6978.
- [20] Shaikh Abdul Hannan, "An Examination of the Blockchain Technology: Challenges and Future Opportunities", International Journal of Engineering and Computer Science, Vol 11, Issue 11, Nov 2022.
- [21] Kuo, T.T.; Kim, H.E.; Ohno-Machado, L. Blockchain distributed ledger technologies for biomedical and health care applications. J. Am. Med. Inform. Assoc. 2017, 24, 1211–1220. [CrossRef] [PubMed]
- [22] Shaikh Abdul Hannan, Manjusha Hivre, Lata, M., Krishna, B. H., Sathyasiva, S., & Arshad, M.

- W.. Brain damage detection using Machine learning approach”, International Journal of Health Sciences, Special Issue VIII, 27 Sept. 2022, PP 4910-4924, ISSN 2550-6978.
- [23] Arun Prasad, Shaikh Abdul Hannan, Kavita Panjwani, Muthe Ramu, Kawaender Singh Sidhu, Nagabhusanam Tida, “Detailed Investigation of the role of Artificial Intelligence in stock market predictions, British Journal of Administrative Management, Vol 58, Issue 06, 6th Sept 2022, UK.
- [24] Dr. Abdul Hannan Abdul Mannan Shaikh, Swati Saxena, “Fundamentals of Internet of Things : A Design Perspective”, 3 Nov 2022, ISBN-13 979-8888498453, PP 1 – 336, Book Nation Press, Ltd. Chennai, Tamil Nadu, India.
- [25] Swati Saxena, Shaikh Abdul Hannan, “Women Warrior – Android Mobile Application for Women Security” International Journal of Computer Science and Information Technologies, Volume 13, Issue 3, PP 76-84, India, June 2022.
- [26] Dr. Abdul Hannan Abdul Mannan Shaikh, “Artificial Intelligence” Nov 2022, ISBN: 9789395331616, Nov 2022, RK Publication, Tamil Nadu, India.
- [27] Engelhardt, M. Hitching Healthcare to the Chain: An Introduction to Blockchain Technology in the Healthcare Sector. Technol. Innov. Manag. Rev. 2017, 7, 22–34. [CrossRef]
- [28] Dr. Abdul Hannan Abdul Mannan Shaikh, , “Data Mining for Beginners”, 16 January 2023, ISBN-13 979- 8889511588, PP 1 – 290, Book Nation Press, Ltd. Chennai, Tamil Nadu, India.
- [29] Tama, B.A.; Kweka, B.J.; Park, Y.; Rhee, K.H. A critical review of blockchain and its current applications. In Proceedings of the 2017 International Conference on Electrical Engineering and Computer Science (ICECOS), Palembang, Indonesia, 22–23 August 2017; pp. 109–113. [CrossRef]
- [30] Mohammad Salauddin Sagar, Dr. Abdul Hannan Abdul Mannan Shaikh, Prof. Saurabh Sharma, Dr. Anju Asokan, “Cloud Computing”, 28th March 2023, ISBN-10 : 9355158556, ISBN-13 : 978-9355158550, PP 1-219, Book Rivers Publication, Lucknow, Uttar Pradesh, India.
- [31] Giungato, P.; Rana, R.; Tarabella, A.; Tricase, C. Current Trends in Sustainability of Bitcoins and Related Blockchain Technology. Sustainability 2017, 9, 2214. [CrossRef]
- [32] Dr. Abdul Hannan Abdul Mannan Shaikh, Dr. Sumit Chauhan, Mrs. Suma S., Dr. Sumit Bhattacharjee, “Internet of Things”, 4 November 2022, ISBN-10 : 9355155433, ISBN-13 : 978-9355155436, PP 1- 210, Book Rivers Publication, Lucknow, Uttar Pradesh, India.
- [33] Zhang, P.; Schmidt, D.C.; White, J.; Lenz, G. Blockchain Technology Use Cases in Healthcare. In Advances in Computers; Elsevier: Amsterdam, The Netherlands, 2018. [CrossRef]
- [34] Angraal, S.; Krumholz, H.M.; Schulz, W.L. Blockchain Technology: Applications in Health Care. Circ. Cardiovasc. Qual. Outcomes 2017, 10, e003800. [CrossRef] [PubMed]
- [35] Mackey, T.K.; Nayyar, G. A review of existing and emerging digital technologies to combat the global trade in fake medicines. Expert Opin. Drug Saf. 2017, 16, 587–602. [CrossRef] [PubMed]
- [36] Prof. Nighar Rafique Sheikh, Dr. Abdul Hannan Abdul Mannan Shaikh, Prof. Jayant S. Rohankar, Prof. Firdous Sadaf M. Ismail, “Artificial Intelligence and Machine Learning”, Nov 2022, ISBN: 9789395331685, RK Publication, Tamil Nadu, India.
- [37] Dr. Abdul Hannan Abdul Mannan Shaikh “Keras for Deep Learning and Artificial Intelligence”, By, 17 October 2022, ISBN-13 : 979-8888339190, PP 1-186, Book Nation Press Ltd., Chennai, Tamil Nadu, India.
- [38] Mayank Sharma, Pramod Singh Kunwar, Dr. Abdul Hannan Abdul Mannan Shaikh, K. Sai

- Krishna, "Advanced Artificial Intelligence", 25th September 2022, ISBN-10 : 9355155190, ISBN-13 : 978-9355155191, PP 1-231, Book Rivers Publication, Lucknow, Uttar Pradesh, India.
- [39] Shaikh Abdul Hannan, "Heart Disease Diagnosis by using FFBP and GRNN algorithm of Neural Network", International Journal of Computer Science and Information Security, Vol 12, Number 6, June 2014, ISSN 1945-5500, United States of America.
- [40] Mir Arif Ali, Shaikh Abdul Hannan, "A Review on Modern and Classical Encryption Techniques", International Journal of Engineering Trends and Technology, Volume 12, Number 4, June 2014, ISSN 2231-5381, India.
- [41] Shaikh Abdul Hannan, Bharatratna P. Gaikwad, Ramesh Manza, "Brain Tumor from MRI Images : A Review". International Journal of Scientific and Engineering Research (IJSER), Volume 5, Issue 4, April-2014 ISSN 2229-5518, France.
- [42] Satish Misal, Shaikh Abdul Hannan, Santosh Lomte, "Comparative study of image processing Techniques on Geometrical shapes", International Journal of Emerging Technology & Advanced Engg., An ISO 9001:2008 Certified International Journal, Vol 2, Issue 9, New Delhi.
- [43] Aqueel Ahmed, Shaikh Abdul Hannan, "Data Mining Techniques to Find Out Heart Diseases: An Overview", International Journal of Innovative Technology and Exploring Engineering (IJITEE), An ISO 9001:2008 Certified International Journal, Volume-1, Issue-4, September 2012, ISSN: 2278-3075, New Delhi, India.
- [44] Wartena C, Brussee R. Topic detection by clustering keywords. In: 2008 19th international workshop on database and expert systems applications. 2008. p. 54–8
- [45] Shaikh Abdul Hannan, Jameel Ahmed, Naveed Ahmed, Rizwan Alam Thakur, "Data Mining and Natural Language Processing Methods for Extracting Opinions from Customer Reviews", International Journal of Computational Intelligence and Information Security, pp 52-58, Vol. 3, No. 6, July 2012. (ISSN: 1837-7823).
- [46] M. J. Baheti, A. V. Mane, Shaikh Abdul Hannan, K. V. Kale, "Comparison of PCA and SVM for a west Indian Script- Gujarati", CiiT Journal of Digital Image Processing, Vol. 3. No. 11, pp. 709-715, July 2011.
- [47] Panch T, Szolovits P, Atun R. Artificial intelligence, machine learning and health systems. J Glob Health. 2018;8(2):020303.
- [48] Shaikh Abdul Hannan, R.R. Manza and R.J. Ramteke, "Heart Disease relationship between Disease, Symptoms, Medicine and its side effects", Journal of Advance Research In Computer Engineering: An International Journal ", July to December 2009, Serials Publication, New Delhi, India, ISSN 0973-6794.
- [49] Tran BX, Vu GT, Ha GH, Vuong Q-H, Ho M-T, Vuong T-T, et al. Global evolution of research in artificial intelligence in health and medicine: a bibliometric study. J Clin Med. 2019;8(3):360.
- [50] Shaikh Abdul Hannan, V. D. Bhagile, R. R. Manza, R. J. Ramteke, "Diagnosis and Medical Prescription of Heart Disease Using Support Vector Machine and Feed forward Back propagation technique", International Journal on computer science and Information Security, – August 2010, Vol. 2, Issue 6, ISSN: 0975–3397.
- [51] Doyle OM, Leavitt N, Rigg JA. Finding undiagnosed patients with hepatitis C infection: an application of artificial intelligence to patient claims data. Sci Rep. 2020;10(1):10521.
- [52] Shaikh Abdul Hannan, Pravin Yannawar, R.R. Manza and R.J. Ramteke, "Expert System Data Collection Technique for Heart Disease", in International Journal of Innovative Research in Science and Techniques (IJIRST), Vol 1, No.1 , Jan – June 2010, PP 31-35, ISSN:2229-3116, India.

- [53] Shortlife EH, Sepúlveda MJ. Clinical decision support in the era of artificial intelligence. *JAMA*. 2018;320(21):2199–200.
- [54] Shaikh Abdul Hannan, Ramesh Manza, R. J. Ramteke, "Relationship between Heart Disease and Symptoms", *International Journal of Computational Intelligent*, Vol. 3, No.2, July-December 2009, pp. 289-292, ISSN 0974-5807.
- [55] Shaikh Abdul Hannan, V. D. Bhagile, R. R. Manza, R. J. Ramteke, "Diagnosis and Medical Prescription of Heart Disease Using Support Vector Machine and Feed forward Back propagation technique", *International Journal on computer science and engineering, IJCSE – August 2010*, Vol. 2, Issue 6, ISSN: 0975–3397.
- [56] Shaikh Abdul Hannan, V.D. Bhagile, R. R. Manza and R.J. Ramteke, "Expert System for Diagnosis and Appropriate Medical Prescription of Heart Disease Using Radial Basis Function", *CiiT International Journal of Artificial Intelligent Systems and Machine Learning*, August 2010, ISSN 0974–9667 & Online: ISSN 0974–9543.
- [57] Hussain AA, Bouachir O, Al-Turjman F, Aloqaily M. *AI Techniques for COVID-19*. IEEE Access. 2020;8:128776–95.
- [58] Shaikh Abdul Hannan, R. R. Manza, R. J. Ramteke, "Generalized Regression Neural Network and Radial Basis Function for Heart Disease Diagnosis", *International Journal of Computer Applications (IJCA)* Vol. 7, No. 13, October 2010 Edition. New York, USA. ISSN: 09758887.
- [59] Agrawal A, Gans JS, Goldfarb A. Exploring the impact of artificial intelligence: prediction versus judgment. *Inf Econ Policy*. 2019;1(47):1–6.
- [60] Shaikh Abdul Hannan, V. D. Bhagile, R. R. Manza, R. J. Ramteke, "Development of an Expert System for Diagnosis and appropriate Medical Prescription of Heart Disease Using Support Vector Machine and Radial Basis Function", *International Journal of Computer Science and Information Security, (IJCSIS) August issue (Vol. 8 No. 5)*, 2010.
- [61] Mahammed Waseem, Naushad Ahmed Osmani, Shaikh Abdul Hannan, "A Survey on E-education of information and Communication Technology", *European Journal of Computer Science and Information Technology (EJCSIT)*, Vol. 4, Issue 6, ISSN 2054-0965, October 2016.
- [62] Shaikh Abdul Hannan, "Development of Digital Transformation in Higher Education Institutions", *Journal of Computer Science & Computational Mathematics*, Volume 13, Issue 01, pp 1-8, March 2023.
- [63] Atul Tiwari, Shaikh Abdul Hannan, Rajasekhar Pinnamaneni and Abdul Rahman Mohammed Al-Ansari, "Optimized Ensemble of Hybrid RNN-GAN Models for Accurate and Automated Lung Tumour Detection from CT Images" *International Journal of Advanced Computer Science and Applications(IJACSA)*, 14(7), 2023.
- [64] Shaikh Abdul Hannan, "Study and evaluation of "Se-2-Seq" model competency in AI-based educational chatbot for the Marathi language", *European Chemical Bulletin*, Volume 12, Special Issue 13, July 2023, pp 223-232.
- [65] Yogesh Rajput, Shaikh Abdul Hannan, Dnyaneshwari Patil, Ramesh Manza "Design New Wavelet Filter for Detection and Grading of Non-Proliferative Diabetic Retinopathy Lesions" *The 3rd International Conference on recent Trends in Image Processing and pattern recognition*, Springer conference, Jan 2020, Aurangabad, Maharashtra, India.
- [66] Shaikh Abdul Hannan, "Application of Neural Networks and Deep Transfer Learning Methods Transfer Learning methods for Thyroid Cancer", *European Chemical Bulletin*, Volume 12, Special Issue 9, July 2023, pp 2093-2105.
- [67] Swati Saxena, Shaikh Abdul Hannan, "A Quaitative Review on Intervention of Robotics in Medical Science", *International Journal of*

- Computer Application(IJCA), Vol. 179, Number 46, 2021, ISSN 0975-8887, USA.
- [68] Shaikh Abdul Hannan, Pushparaj Pal, “Detection and classification of kidney disease using convolutional neural networks”, *Journal of Neurology and Neurorehabilitation Research*, Vol 8, Issue 2, pp 1-7, 2023.
- [69] Jiang F, Jiang Y, Zhi H, Dong Y, Li H, Ma S, et al. Artificial intelligence in healthcare: past, present and future. *Stroke Vasc Neurol*. 2017;2(4):230–43.
- [70] Chakradhar S. Predictable response: finding optimal drugs and doses using artificial intelligence. *Nat Med*. 2017;23(11):1244–7.
- [71] Sagar Vakhare, Ramesh Manza, Abdul Hannan Shaikh and Anubha Jain, “Time Series Analysis and Forecasting of Temperatures Records in Aurangabad District of Maharashtra”, *Springer FICR International Conference on Rising Threats in Expert Applications and Solutions. 2020 at IIS University, 17-19 Jan, 2020 Jaipur*.
- [72] Anupriya Kamble, Shaikh Abdul Hannan, Yogesh Rajput and Ramesh Manza, “Prediction of Prediabetes, No Diabetes and Diabetes Mellitus-2 using Pattern Recognition”, *Springer FICR International Conference on Rising Threats in Expert Applications and Solutions. 2020 at IIS University, 17-19 Jan, 2020 Jaipur*.
- [73] Santosh Maher, Shaikh Abdul Hannan, Sumegh Tharewal, K. V. Kale " HRV based Human Heart Disease Prediction and Classification using Machine Learning " December 2019, (Vol. 17 No. 2 *International Journal of Computer Science and Information SecApplication (IJCA)*, New York, USA.
- [74] Aisyah M, Cockcroft S. A snapshot of data quality issues in Indonesian community health. *Int J Netw Virtual Organ*. 2014;14(3):280–97.
- [75] Santosh K. Maher, Sumegh Tharewal, Abdul Hannan, K. V. Kale “Review on HRV based Prediction and Detection of Heart Disease” *International Journal of Computer Application(IJCA)*, Vol. 179, Number 46, June 2018, ISSN 0975-8887, USA.
- [76] Yogesh, Abdul Hannan, Rahul Sagar, Kishor Jave, Identification and Counting Trees from Oil Palm Plantations Using Digital Image Processing Techniques, *International Journal of Engineering Research & Technology (IJERT)*, Vol. 6 Issue 05, May – 2017, ISSN: 2278-0181.
- [77] Shaikh Abdul Hannan and Mir Arif Ali, “Analysis of Polyalphabetic Transposition Cipher Techniques used for Encryption and Decryption”, *International Journal of Computer Science and Software Engineering (IJCSSE)*, Volume 6, Issue 2, February 2017, Dubai, UAE.
- [78] Yogesh, Ramesh Manza, Anupriya Kamble Shushil G., Abdul Hannan, “Novel Approach for person identification Based on Iris Statistical Features and Retinal Blood Vessels Bifurcation points, *Second International Conference on Cognitive Knowledge Engineering, 21-23 December 2016 (ICKE-2016)* , Aurangabad, Maharashtra, India. ISBN 978-93-80876-89-4.
- [79] Tarassoli SP. Artificial intelligence, regenerative surgery, robotics? What is realistic for the future of surgery? *Ann Med Surg (Lond)*. 2019;17(41):53–5.
- [80] Anupriya Kamble, Abdul Hannan, Yogesh, Dnyaneshwari, “Association Detection of Regular Insulin and NPH Insulin Using Statistical Features”, *Second International Conference on Cognitive Knowledge Engineering, 21-23 December 2016 (ICKE-2016)* , Aurangabad, Maharashtra, India ISBN 978-93-80876-89-4.
- [81] Winter JS, Davidson E. Big data governance of personal health information and challenges to contextual integrity. *Inf Soc*. 2019;35(1):36–51.
- [82] Massaro M, Dumay J, Guthrie J. On the shoulders of giants: undertaking a structured literature review in accounting. *Account Auditing Account J*. 2016;29(5):767–801.

- [83] Burke EK, De Causmaecker P, Berghe GV, Van Landeghem H. The state of the art of nurse rostering. *J Sched.* 2004;7(6):441–99.
- [84] Novak D, Riener R. Control strategies and artificial intelligence in rehabilitation robotics. *AI Mag.* 2015;36(4):23–33.
- [85] Carter D. How real is the impact of artificial intelligence? *Bus InfSurv.* 2018;35(3):99–115.
- [86] Saha SK, Fernando B, Cuadros J, Xiao D, Kanagasigam Y. Automated quality assessment of colour fundus images for diabetic retinopathy screening in telemedicine. *J Digit Imaging.* 2018;31(6):869–78.
- [87] Gu D, Li T, Wang X, Yang X, Yu Z. Visualizing the intellectual structure and evolution of electronic health and telemedicine research. *Int J Med Inform.* 2019;130:103947.
- [88] Madnick S, Wang R, Lee Y, Zhu H. Overview and framework for data and information quality research. *J Data Inf Qual.* 2009;1:1.
- [89] Chen X, Liu Z, Wei L, Yan J, Hao T, Ding R. A comparative quantitative study of utilizing artificial intelligence on electronic health records in the USA and China during 2008–2017. *BMC Med Inform DecisMak.* 2018;18(5):117.

Cite this article as :

Ali Mir Arif Asif Ali , "Artificial Intelligence and Blockchain Technology in Healthcare System : A Systematic Review ", *International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT)*, ISSN : 2456-3307, Volume 9, Issue 4, pp.301-313, July-August-2023.

Available at doi :

<https://doi.org/10.32628/CSEIT2390441>

Journal URL : <https://ijsrcseit.com/CSEIT2390441>