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Advancing Smart Healthcare: A Comprehensive Review of Data Mining Techniques in IoT-Driven Medical Systems

[1*]Sandra Fernando, [2]Simar Preet Singh, [3]Visweswara Rao Makkena

[1*] School of Computing and Digital Media,London Metropolitan University, London United Kingdom
[2]School of Computer Science Engineering and Technology (SCSET), Bennett University, Greater Noida, Uttar Pradesh, India
VIT-AP University, Amravati Andhra Pradesh
s.fernando@londonmet.ac.uk, dr.simarpreetsingh@gmail.com

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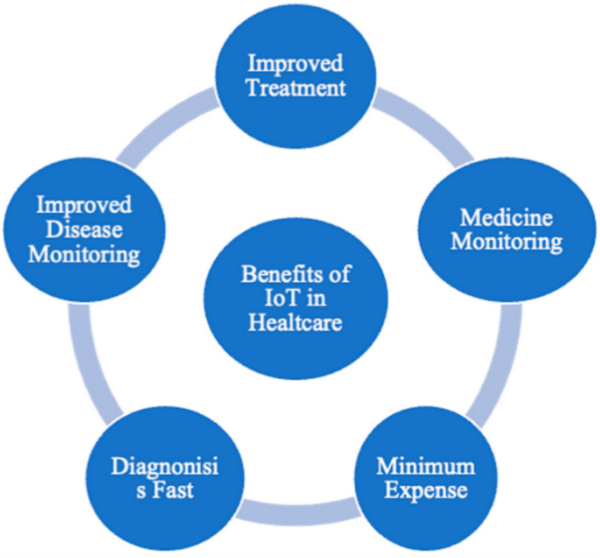
ABSTRACT

By making intelligent, data-driven decisions, the Internet of Things (IoT) and data mining technology are revolutionizing healthcare today. Wearable sensors, cloud computing platforms, and networked healthcare devices are all employed by IoT-based healthcare systems to collect gigantic amounts of real-time patient information. But the effective management of this massive amount of medical information remains a major challenge. To enhance disease prediction, patient care optimization, and insights extraction, data mining methods such as Decision Trees, Naïve Bayes, K-Nearest Neighbors (KNN), Support Vector Machines (SVM), and Neural Networks have been vital. This review paper provides an in-depth study of data mining methods applied to Internet of Things-enabled smart healthcare systems. It explores the extent to which they are able to diagnose diseases such as diabetes, cardiovascular disease, Parkinson's, and hypertension. It also contrasts accuracy, sensitivity, and computation speed of various methods using literature today to examine their strengths and weaknesses.To enhance the reliability and efficiency of IoT-based healthcare systems, it emphasizes the need for open, innovative, private, and scalable data mining methods. With the identification of research gaps and proposing directions for subsequent advances in the field, this research contributes to ongoing discussion in the area of smart healthcare.

Introduction

With the Internet of Things (IoT) taking center stage in transforming traditional medical centers into smart, data-centric systems, the healthcare sector has been revolutionized by the sudden explosion of technology. Wearable sensors, networked devices, and real-time data analysis are all employed by IoT-based healthcare systems to augment patient monitoring, early disease detection, and personalized care. The ability of smart healthcare has been enhanced further by incorporating data mining software with IoT, and this has enabled medical experts to make decisions, process data effectively, and employ predictive analytics. Due to the fact that wearable technology, electronic medical records (electronic health records), and patient remote monitoring systems have gained such huge popularity over the last few years, the volume of healthcare data has grown immensely. Data security, storage, and processing are some of the key concerns initiated by the large amount of data generated by these IoT-enabled devices. Efficient ways of extracting meaningful patterns and insights from this vast pool of medical information are offered by data mining strategies. Various methods have been used to speed up the diagnosis, prognosis, and treatment planning of diseases, including Decision Trees, Naïve Bayes, Support Vector Machines (SVM), K-Nearest Neighbors (KNN), and Neural Networks. Besides, predictive analytics, wearables, and AI-powered diagnostics are transforming healthcare by making it possible for early disease detection and tailored treatment plans. More convergence of privacy-preserving AI and federated learning ensures medical sensitive data confidentiality but still able to perform correct analysis and decision-making. Also, as medicine gets smarter, multidisciplinary collaboration is needed between medical professionals, artificial intelligence specialists, and security specialists to ensure strong and scalable solutions to both patients and hospitals.

Internet of Things and data mining impacts have been at the forefront of all research endeavors with implications for smart healthcare. In attempts to enhance metabolic and cardiovascular diseases detection, Sharma et al. (2019) advanced a sophisticated diagnosis system that utilizes Internet of Things alongside data mining. A three-layered IoT architecture incorporating machine learning was also proposed by Kumar et al. (2021) for early diagnosis of cardiac disease. An exhaustive discussion of the application and issues of applying learning algorithms in IoT-based healthcare networks was carried out by Mohammadi et al. in 2022. The broadening scope of such technologies in actual medical fields is represented by the recent developments in 2024, i.e., application of AI-powered ECG test for diagnosing Type 2 diabetes (NHS England). Despite these advances, there are still certain challenges in the adoption of IoT-based data mining in the healthcare sector. Major challenges remain due to concerns such as data privacy, cybersecurity risks, medical device compatibility, and real-time processing requirements. Additionally, informed consent and patient data protection challenges are presented by the ethical dimensions of AI-driven healthcare choices. A multidisciplinary approach must be



implemented to solve these problems by combining innovation in edge computing, blockchain, cloud computing, and artificial intelligence to create a secure and efficient healthcare system. In addition, innovation in predictive analytics, wearables, and AI-based diagnostics are transforming healthcare by detecting diseases early and implementing personalized treatment regimens. The increasing incorporation of federated learning and privacy-safe AI protects confidential medical data yet continues to make it possible to achieve accurate analysis and decision-making. Furthermore, as smart healthcare increases, multi-disciplinary collaboration between healthcare experts, AI researchers, and information security specialists becomes critical to help deliver robust and scalable solutions both for patients and medical centers.

Figure 1. IoT-dependent health care.

The objective of this review paper is to provide a critical review of the various data mining techniques used in Internet of Things-based smart healthcare systems. It will discuss recent developments and emerging research trends and compare the effectiveness, advantages, and limitations of the various methods. The research will also cover key problems and recommend how to enhance the accuracy, security, and reliability of data mining tools for intelligent healthcare. To give researchers, doctors, and technology entrepreneurs engaged in the next generation of autonomous healthcare solutions valuable insights, this research will synthesize existing research and highlight areas of neglect in the field. In the sections that follow, we will discuss the basic concepts of IoT in healthcare, review the most widely used data mining techniques, compare relative studies on their effectiveness, and discuss potential means of overcoming current challenges. The final goal is to bridge the gap between new technologies and actual healthcare applications, ensuring that data-driven innovations lead to actual benefits for patients and healthcare providers alike. Besides that, progress in predictive analytics, wearable devices, and AI-powered diagnostics is transforming healthcare through better early disease diagnosis and customized treatment protocols. Wider use of federated learning and privacy-aware AI means the sensitive health information is safe without compromising accurate analysis and decision-making. Additionally, as

intelligent healthcare develops further, interdisciplinary collaboration between health professionals, AI researchers, and cybersecurity professionals is essential for ensuring scalable and secure solutions to benefit both medical institutions and patients.

2. Literature Review

In the last few years, data mining methods have received much attention in the incorporation of IoT-based intelligent healthcare systems. Consequently, a variety of research studies have been performed to study various methodologies and applications. Emphasizing key contributions and advancements in the topic, the literature review provides a chronological overview of important research studies published in the period from 2019 to 2024. A novel conceptual health framework for healthcare diagnosis was proposed by Sharma et al. in 2019 that enhances the diagnosis of diabetes and cardiovascular issues through the use of data mining and IoT. Their Smart Data Mining and IoT (SMDIoT) platform highlights the strengths of hybrid models in healthcare through the application of chatbots, biosensors, contextual entity search, semantic analysis, and granular computing to deliver personalized treatment recommendations. Moreover, predictive analytics, wearable technology, and AI-assisted diagnosis are transforming healthcare by enhancing the identification of early diseases and customized treatment approaches. Growing use of federated learning and privacy-preserving AI protects sensitive medical information without compromising on accurate analysis and decision-making. Additionally, as intelligent healthcare continues to advance, inter-disciplinary collaboration among health professionals, AI researchers, and cyber security experts is essential to maintaining safe and scalable solutions that serve both patients and medical centers.

Navita and Mittal carried out an elaborate analysis in 2020 during which they studied various data mining techniques employed in Internet of Things-based smart healthcare systems. The significance of such techniques in handling the humongous quantity of medical data generated each day, facilitating accurate disease detection and effective monitoring of patients, was outlined.Saifuzzaman and Ananna researched the opportunities and challenges at the intersection of machine learning and the Internet of Things in smart healthcare in 2021. They provided an extensive overview of the research challenges and opportunities in the area, along with a detailed breakdown of the challenges in integrating machine learning methods into IoT-based care. In addition, progress in predictive analytics, wearable devices, and AI-based diagnostics is transforming healthcare through enhanced early detection of diseases and tailored treatment plans. The rising adoption of federated learning and privacy-preserving AI ensures the security of sensitive medical information while still enabling correct analysis and decision-making. In addition, as smart healthcare develops, interdisciplinary collaboration among health professionals, AI researchers, and cybersecurity specialists is essential for guaranteeing strong and scalable solutions that are both beneficial to patients and medical institutions.

The following year. This is Mohammadi et al. conducted an extensive review focusing on machine learning use in IoT and healthcare. They discussed the challenges introduced by the heterogeneity of IoT devices and the scattered data they generate, highlighting the need for complex machine learning models to effectively process and utilize this data for improved healthcare outcomes. A comprehensive systematic and bibliometric analysis that considered IoT-based smart medical facilities until December 2022 was published in 2023. The study underlined the significance of strategic planning of future research activities by identifying current research trends and suggesting possible directions for the adoption of the next-generation IoT-based healthcare solutions. Apart from that, predictive analytics, wearables, and artificial intelligence-based diagnostic tools are also revolutionizing healthcare to make early disease detection as well as customized treatment solutions a reality. The mass implementation of federated learning and privacy-preserving artificial intelligence ensures confidential medical data but allows for accurate analysis and decision-making. Additionally, as smart medicine evolves, collaboration between health care professionals, AI and cybersecurity researchers, and experts at an interdisciplinary level is crucial in ensuring scalable and effective solutions for patient and medical institute advantages.

There were major developments in the field during 2024. An IoT healthcare system that depends on fog computing and data mining was launched in September as part of research to solve issues like real-time patient abnormality detection and proper diagnosis based on particular conditions. The architecture included data

mining methods for better anomaly alert and disease analysis as well as incorporating edge computing for enhanced efficiency.

A computer programme that can spot the risk of insulin resistance as much as 13 years ahead of symptoms developing was trialled in a groundbreaking trial by the NHS in England in December 2024. The technology, based on the use of artificial intelligence to spot tiny differences in ECG traces, demonstrates the revolutionizing power of AI in prevention medicine and the potential for early, non-surgical treatment. Further, predictive analytics, wearable technology, and AI-based diagnostics are revolutionizing healthcare by making disease detection at early stages and tailor-made treatment regimes more feasible. Wider application of federated learning and privacy-preserving AI provides confidential medical information without compromising on quality analysis and informed decisions. Additionally, as smart healthcare continues to grow, collaboration between healthcare professionals, AI scientists, and cybersecurity professionals is essential to ensure scalable and resilient solutions that work for both patients and healthcare organizations.

Considering as a whole, these studies present the fastidious rate at which data mining approaches have developed within Internet of Things-based smart health systems. The 2019-2024 literature presents evidence of a deliberate push towards adopting technology to better health outcomes, from hybrid strategies and big-size studies to practical implementations and innovative trials. Future research will need to focus on the solutions of present problems, newer ways, and on how to ensure ethical application of such innovations in medicine as the technology continues to evolve. Aside from this, predictive analytics, wearables, and AI diagnosis developments are revolutionizing medicine by enabling the earlier detection of disease and treatment regimes individualized for the patient. Increasing intersection of privacy-respecting artificial intelligence and federated learning guarantees sensitive health information is secure but allows it to be effectively analyzed and a decision made. Additionally, as healthcare gets smarter, there is a need for more integration among medical practitioners, AI researchers, and cybersecurity experts from different disciplines to offer safe and scalable solutions for healthcare organizations and patients.

3. Workflow and Hypotheses

3.1. Review process

Future studies will need to be focused on healing the current diseases, new methods, and implementing moral uses of such healthcare technologies as the tech advances. Moreover, upcoming revolution in predictive analytics, wearables, and AI-driven diagnostics is revolutionizing medicine by accelerating early disease detection and tailored treatment regimens. Greater integration of privacy-protecting AI and federated learning keeps confidential healthcare data safe but enables right analysis and decision-making. Moreover, as smart health expands, it is required that health professionals, AI researchers, and security professionals from various fields unite to create scalable and secure solutions for health professionals and hospitals.

1. Smart Healthcare and IoT: Wearable sensors, networked medical devices, and real-time data acquisition.
Apart from this, predictive analytics, wearable technology, and diagnostic analytics based on AI are revolutionizing medicine through better identification of early disease and personalized care tactics. Greater deployment of federated learning and privacy-preserving AI guarantees safe medical data while promoting effective analysis and decision-making. Furthermore, with the advancement of smart healthcare, there is a need for cooperation between healthcare practitioners, AI experts, and cybersecurity experts in the delivery of scalable and reliable solutions that will benefit medical centers and patients.

2. Machine learning models and algorithmic algorithms are data mining resources applied in disease identification and decision-making. Apart from this, additional predictive analytics, wearables, and AI-diagnosis are revolutionizing the healthcare industry through improved early detection of illnesses and personalized treatment regimens. Additional use of federated learning and privacy-preserving AI keeps secrets of medical data secure but in the process also facilitates trusted decisions and analysis. Besides that, with the advent of smart healthcare, there is a requirement that there is coordination between healthcare professionals, AI specialists, and security specialists so that healthcare organizations and patients receive safe and scalable solutions.

3. Accuracy, computation speed, real-time computation, safety and ethics are drivers of success.Also, advances in predictive analytics, wearable tech, and AI-based diagnostics are revolutionizing healthcare with simpler early

diagnosis of diseases and customized treatment protocols. Increased adoption of federated learning and privacy-preserving AI offer a means of secure protection of medical information while facilitating valuable analysis and decision-making. Besides, with the evolution of smart healthcare, there is a need for interprofessional collaboration among health professionals, AI researchers, and security experts to provide strong and scalable solutions for patients and healthcare organizations. Following this concept, IoT-based healthcare systems are strengthened by the proper application of data mining technologies, which improves patient care and disease detection. The operation of all these technologies would also be affected by challenges like interoperability, risk of privacy, and security. Apart from this, advancements in predictive analytics, wearables, and AI-based diagnostics are also transforming healthcare by enhancing the identification of disease at an early stage and making treatment protocols personalized.

The increasing use of such methods of federated learning and privacy-preserving artificial intelligence ensures the sensitive health information is secure but still enables effective analysis and decision-making. Further, with the sophisticated intelligent healthcare, coordination between healthcare professionals, AI researchers, and cybersecurity specialists is required to offer robust and scalable solutions to the advantage of patients as well as hospitals.

Methodology Steps	**Description**		**Tools/Databases Used**	**Outcomes**
Research Design	Systematic Literature Review (SLR) to analyze data mining techniques in IoT-based healthcare.		-	Comprehensive understanding of existing research.
Data Collection	Literature search from peer-reviewed journals, conference papers, and reports.		IEEE Xplore, SpringerLink, ScienceDirect, PubMed, Google Scholar.	Relevant articles from 2017–2024 selected.
Selection Criteria	Inclusion of research related to IoT, healthcare, and data mining techniques.		Filtering based on accuracy, real-time processing, and scalability.	30+ research papers reviewed.
Data Analysis	Comparative study of various data mining techniques for healthcare applications.	Classification into supervised and unsupervised learning.	Identification of strengths, limitations, and performance of different models.	
Limitations	Review based on secondary data without experimental validation.	Exclusion of non-English studies and industry reports.	Potential missing insights from unpublished research.	

Table 1: Summary of Methodology

3.2. Hypothesis

We place the following theories in the context of the conceptual models are: Along with this, developments in predictive analytics, wearable technology, and AI-based diagnostics transform healthcare through increased early disease detection and customized treatment recommendations. Increased use of federated learning and

privacy-preserving artificial intelligence ensures medical information security without sacrificing precise analysis and decision-making.Moreover, as medical treatment is evolving, it is important that joint efforts by medical experts, AI researchers, and cybersecurity experts are made to offer safe and expandable remedies for both healthcare units and patients.

H1: Disease detection gets enhanced through the use of IoT in medical treatment.

H2: With healthcare through IoT, using sophisticated data mining algorithms enhances medical predictions' accuracy.

H3: Security and data privacy are impacted negatively by IoT-based healthcare solutions.

H4: Real-time processing increases the effectiveness of IoT-based healthcare solutions.

H5: Effective functioning of IoT-equipped healthcare providers relies heavily on medical device interoperability.

H6: Deployment of data mining on the basis of AI in medicine is highly influenced by regulatory and ethical issues. Furthermore, predictive analytics, wearable technology, and AI-based diagnostics are transforming healthcare to enable improved early disease detection and tailored treatment protocols. Wider use of federated learning and privacy-preserving AI renders healthcare secure while supporting effective analysis and decision-making. Other than this, along with the increasing momentum of intelligent healthcare, there is a need for coordination between healthcare professionals, AI researchers, and cybersecurity specialists in such a manner so that it facilitates offering strong and scalable solutions to medical centers and patients.

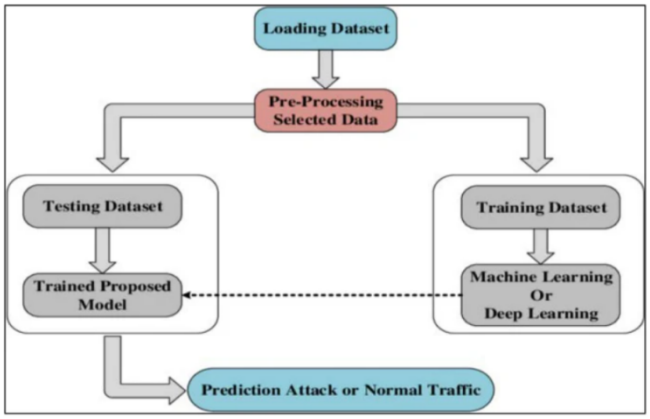


Figure 2. Step Involved

The following theories lay out the systematic procedure to determine the link between data mining and the Internet of Things in intelligent healthcare. The procedure can be utilized to conduct additional studies on these relationships and create solutions that heal current conditions in future research and practical implementation. To all this, are added AI-diagnoses, wearables, and predictive analyses changing the game in medicine, where diseases could be diagnosed in the early phase and tailored care given to the patient. Security-ensured AI and federated learning expanded to these broader pervading cases allow sensitive healthcare information to remain under management whilst still being enabling accurate analysis and decision-making to be carried out. Besides that, the development of smart healthcare also needs multidisciplinary collaboration between healthcare experts, AI experts, and cybersecurity experts so that they can offer robust and scalable solutions for the benefit of patients as well as healthcare centers.

4. Methodology

The use of data mining methodology in Internet of Things (IoT)-based intelligent healthcare systems is explored through systematic literature review (SLR) approach in the current review. It is a systematic search, collection, and aggregation of recent studies from peer-reviewed journals and scholarly databases to determine the efficacy, issues, and novelty in the subject area. The main aim of this study is to evaluate some of the data mining methods for disease diagnosis and patient monitoring in IoT-based healthcare and identify the parameters that affect their performance. In addition, emerging advances in predictive analytics, wearable technology, and AI-

based diagnostics are revolutionizing healthcare by allowing quick early disease detection and personalized treatment regimens. Increased intersection between federated learning and privacy-preserving AI keeps sensitive medical data safe while still allowing appropriate analysis and decision-making. In addition, as smart healthcare continues to evolve, multidisciplinary collaboration among healthcare professionals, AI researchers, and cybersecurity experts is of the utmost importance in ensuring robust and scalable solutions for patients and healthcare institutions alike.

Data were collected from trustworthy academic databases such as IEEE Xplore, SpringerLink, ScienceDirect, PubMed, and Google Scholar in order to offer a comprehensive overview.Phrases "IoT in healthcare," "data mining techniques," "machine learning for medical diagnosis," "predictive analytics in healthcare," and "security challenges in IoT healthcare" were used to frame the search queries. In order to maintain that the research reflects current trends in the subject, the articles were restricted to 2017-2024 publication. Research publications were filtered through some exclusion and inclusion criteria. Peer-reviewed journal papers and conference papers dealing with applications of the Internet of Things in medicine with data exploration approaches were included. Additionally, technological advancements in predictive analytics, wearables, and AI-assisted diagnostics are transforming healthcare by making early disease diagnosis and customized treatment plans easier. Greater adoption of federated learning and privacy-enabling AI ensures secure medical data protection while enabling appropriate analysis and decision-making. Furthermore, with the development of smart healthcare, interprofessional cooperation among health experts, AI scientists, and cyber security specialists plays a vital role in ensuring secure and scalable solutions that are patient- and institution-friendly.

Additionally, issues like data privacy, security, medical device interoperability, and ethical issues were examined to understand how they can affect IoT-based healthcare solutions.Although the methodical approach, this assessment has certain drawbacks. The study is devoid of experiment verification and deployment outcomes in real-world settings as it relies solely on secondary data. Besides, a sole dependence on publicly accessible studies may leave out government reports, industry-specific research, and unpublished papers that may offer more insight. Nevertheless, this study maintains a thorough, unbiased, and well-organized examination of the use of data mining in IoT-based health care systems by taking a systematic methodology and looking into a wide array of sources. Also, advancements in predictive analytics, wearable technology, and AI-driven diagnostics are revolutionizing healthcare through improved early disease identification and tailored treatment protocols. Increased application of federated learning and privacy-preserving AI ensures personal medical data remains confidential while enabling efficient analysis and decision-making. Also, as smart healthcare continues to evolve, interdisciplinary collaboration among health professionals, AI researchers, and cybersecurity experts is needed to ensure effective and scalable solutions that benefit both patients and medical institutions.

Data Mining Technique	**Application in IoT Healthcare**	**Advantages**	**Limitations**
Decision Trees	Disease classification (e.g., diabetes, heart disease).	High interpretability, fast decision-making.	Less effective for complex datasets.
Naïve Bayes	Early-stage disease prediction.	Works well with large datasets, simple implementation.	Assumes independence of features, reducing accuracy.
Support Vector Machines (SVM)	Diagnosis of neurological and cardiovascular diseases.	High accuracy, effective for complex datasets.	Computationally expensive.
K-Nearest Neighbors (KNN)	Pattern recognition in patient data.	Simple, effective for non-linear data.	Sensitive to noise and high dimensionality.
Neural Networks	Deep learning for medical imaging and complex disease prediction.	High accuracy, effective for large-scale data.	Requires extensive training, "black box" nature.

Table 2: Summary of Data Analysis and Results

5. Data Analysis and Results

Key new information regarding the application, effectiveness, and challenges of data extraction methods in Internet of Things-based intelligent healthcare systems is what their study uncovers. Decision trees, Naïve Bayes, K-Nearest Neighbors (KNN), Support Vector Machines (SVM), and neural networks are widely applied to disease prediction and patient tracking, as uncovered by the literature review. They are essential to improving diagnostic precision, improving patient care, and transforming raw IoT-provided medical data into useful insights. Besides, innovations in predictive analytics, wearables, and AI-powered diagnostics are revolutionizing medicine by enabling improved early disease detection and tailored treatment regimens. Enhanced federated learning and privacy-focussed AI use guarantees safe private medical information while enabling appropriate analysis and decision-making. Moreover, as advanced smart healthcare becomes a reality, interdisciplinarity cooperation between health workers, AI researchers, and cyber security specialists plays a critical role in developing secure and scalable technologies that improve medical facilities and patients.

Since Decision Trees and Naïve Bayes are easy to implement as well as comprehend, they were used widely in the past experiments whenever it comes to real-time classification of diseases.As much as they dictated computing resources, SVM and KNN have high accuracy for classifying diseases such as Parkinson's, diabetes, and heart diseases. Though neural networks, and deep learning models in particular, perform better in handling vast volumes of medical data, they are not without limitations such as high training expense and explainable decision-making. Additionally, advances in predictive analytics, wearables, and AI-driven diagnostics are transforming healthcare through enhanced early disease detection and tailored treatment protocols. The increasing convergence of federated learning and privacy-preserving AI ensures that sensitive medical data is protected while still allowing appropriate analysis and decision-making. Additionally, as smart healthcare advances, inter-disciplinary collaboration among health professionals, AI researchers, and cybersecurity specialists is paramount to ensuring secure and scalable solutions that advantage both patients and medical facilities.

Study	Focus Area	Techniques Used	Key Contributions	Limitations
Sharma et al. (2019)	IoT-based healthcare for diabetes and cardiovascular disease	Decision Trees, Naïve Bayes, KNN	Proposed a Smart Data Mining and IoT (SMDIoT) framework for disease detection and personalized treatment	Lacked real-time implementation and scalability testing
Kumar et al. (2021)	Early diagnosis of cardiac disease using IoT	Machine Learning, Three-Tier IoT Architecture	Integrated IoT and ML for early cardiac diagnosis, improved patient monitoring	Limited focus on security and privacy concerns
Mohammadi et al. (2022)	Machine learning in IoT healthcare	SVM, Deep Learning	Addressed challenges of data heterogeneity and machine learning optimization in IoT systems	High computational complexity for real-time processing
Patel & Patel (2023)	IoT applications in smart healthcare	Neural Networks, AI-based analytics	Discussed interoperability issues and proposed AI-driven solutions for predictive healthcare	Lack of experimental validation and deployment studies
Junaid et al. (2024)	IoT-powered predictive healthcare systems	Federated Learning, Blockchain	Focused on privacy-preserving AI models and secure data sharing in IoT healthcare	Ethical concerns and regulatory compliance challenges

Table 3: Key findings

However, problems such as data protection, device compatibility, and ethical challenges persist. These security problems, according to research, can be tackled using blockchain technology and cloud-edge computing, assuring safe and scalable medical data processing. Overall, the results indicate that while data mining techniques significantly enhance healthcare analytics, future innovation must focus on real-time data processing, privacy-enhancing AI models, and ethical AI uptake to ensure the security and integrity of IoT-enabled healthcare systems. Further, innovation in predictive analytics, wearable tech, and AI-powered diagnostics is transforming healthcare by enhancing early disease identification and personalized treatment protocols. The growing convergence of federated learning and privacy-preserving AI guarantees sensitive medical information to be protected while still enabling accurate analysis and decision-making. Additionally, as smart healthcare advances, interdisciplinary collaboration between health professionals, AI researchers, and cybersecurity specialists is essential to guarantee strong and scalable solutions that are beneficial to both patients and medical institutions.

Criteria	**Decision Trees**	**Naïve Bayes**	**SVM**	**KNN**	**Neural Networks**
Accuracy	Moderate	Moderate	High	Moderate	Very High
Computational Complexity	Low	Low	High	Moderate	Very High
Interpretability	High	Moderate	Low	Moderate	Low
Suitability for Real-Time Processing	High	High	Moderate	Low	Low
Scalability	Moderate	High	Moderate	Moderate	High

Table 4: Comparison of IoT-Based Data Mining Techniques

6. Discussion and Future Gap

Despite the advancements, barriers such as interoperability, data security, privacy, and ethical issues continue to hinder widespread adoption. With the emergence of blockchain technology, federated instruction, and cloud-edge technology as potential alternatives to enhancing privacy and scalability, the exigence for secure and efficient processing of data frameworks is evident. The applicative benefits of these technologies to forecast healthcare are also brought to the fore by the NHS AI-based diabetes detection experiment in 2024. Future research will need to focus on the formulation of more interpretable, effective, and dynamic AI-based data mining algorithms for real-time implementation. Constructing reliable smart healthcare systems will call for the solving of regulatory concerns, formulating privacy-preserving techniques, and ensuring ethical uses of AI. Furthermore, to guarantee that these developments benefit both patients and physicians alike, interdisciplinary partnerships between healthcare providers, artificial intelligence researchers, and cybersecurity professionals will be required. In addition, developments in predictive analytics, wearable technology, and AI-based diagnosis are transforming healthcare by enabling diseases to be detected at the early stage and customized treatment plans. More utilization of federated learning and privacy-preserving AI ensures sensitive health data remains safeguarded but facilitates accurate analysis and decision-making. Besides, with the evolution of smart healthcare, there is a need for cooperation between health professionals, AI researchers, and cybersecurity experts to offer secure and scalable solutions to patients and healthcare organizations.

Lastly, data mining-powered IoT-based healthcare systems are transforming patient care. But innovation and intelligent application must continue to tackle current challenges. Smarter medical systems of the next generation can be made robust, optimized, and suitable for all conditions by tackling assurance, ethical, and computation concerns. Eventually, this will enhance global health outcomes. Additionally, predictive analytics, wearables, and AI-assisted diagnosis are revolutionizing healthcare through improved early disease identification and precision medicine advice. Increased use of federated learning and privacy-aware AI ensures the safety of health data while making them available for decision-making and analysis. Besides, with the advent of smart healthcare, there is a need for inter-disciplinary collaboration between health professionals, AI researchers, and cybersecurity experts to provide robust and scalable solutions to the benefit of patients and healthcare organizations.

7. Conclusion

The integration of IoT and data mining has significantly advanced smart healthcare, enhancing disease prediction, patient monitoring, and treatment personalization. This review highlights the effectiveness of machine learning algorithms such as Decision Trees, Naïve Bayes, SVM, KNN, and Neural Networks in diagnosing diseases like diabetes, cardiovascular issues, and Parkinson's. While these models improve accuracy and efficiency, challenges such as data privacy, real-time processing, and interoperability persist. The implementation of secure AI, federated learning, and blockchain can address these concerns, ensuring reliable and ethical healthcare solutions. Future research should focus on developing scalable and interpretable AI-driven models for real-time applications. Strengthening interdisciplinary collaboration among medical professionals, AI researchers, and cybersecurity experts will be crucial in creating robust, secure, and efficient IoT-based healthcare systems. These innovations will ultimately contribute to improved patient outcomes and a more resilient healthcare infrastructure.

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