JACoIT
Journal of Applied Computer and Information Technology

Review

Evolution, hotspots, and prospects of AI-powered telehealth: A bibliometric study

Bingxin Jin [1, 2, *], Hapini Awang [1] and Nur Suhaili Mansor [1]

[1]Institute for Advanced and Smart Digital Opportunities (IASDO), School of Computing, Universiti Utara Malaysia, Malaysia; jin_gxin@gsgsg.uum.edu.my; hapini.awang@uum.edu.my; nursuhaili@uum.edu.my
[2]Northwest A&F University, Shaanxi, China; jin_gxin@gsgsg.uum.edu.my

[*]Corresponding Author: jin_gxin@gsgsg.uum.edu.my

Received: 16 December 2025
Revised: 7 March 2026
Accepted: 18 March 2026
Published: 2 April 2026

Abstract

The integration of artificial intelligence (AI) and telehealth has become a key enabler of smart healthcare, improving accessibility and efficiency in medical services. However, comprehensive reviews focusing on the evolution, knowledge structure, and future directions of AI-powered telehealth remain limited. This study addresses this gap by conducting a bibliometric analysis of 427 publications indexed in the Scopus database from 2010 to 2025. The analysis examines publication trends, citation patterns, influential studies, and keyword co-occurrence networks. The findings reveal a two-phase development pattern characterized by "scale expansion" followed by "quality improvement", with 2020 identified as a critical turning point. The results further highlight three major clusters of influential research focusing on AI-based diagnosis, specialized healthcare applications, and technological integration. In addition, four primary research themes are identified: AI-based telehealth applications, enabling technologies, research methodologies, and precision telehealth. Emerging research directions include the development of mobile health solutions, explainable AI, mixed-method approaches, and improvements in system capacity and reliability. This study provides a comprehensive knowledge framework and offers theoretical and practical insights to support the sustainable and high-quality development of AI-powered telehealth.

Keywords: smart telehealth; bibliometric analysis; publication trends; key topics; future directions

1. Introduction

Industry 4.0 is grounded on the application of smart technologies. These are AI, big data, and Internet of Things. They aim at making smarter industrial development. The digital transformation of healthcare is one of the essential components of the given process. This change refers to the abandonment of offline services and paper records. It trends to smart diagnosis, distance cooperation and management through data [1]. Alternatively, in the current health care systems, AI is altering the provision of services. Such technologies as deep learning, wearable devices, cloud computing, and natural language processing keep on advancing. Consequently, the application of AI has increased. AI no longer provides tasks such as diagnosis support or image analysis. It is currently deployed for real-time monitoring, remote consultations, management, and health intervention [2]-[3]. Simultaneously, telehealth is developing rapidly. This is elevated by the usage of mobile devices, increased network infrastructure and the increasing health demands of the people. Following the COVID-19 pandemic, the usefulness of telehealth has been brought into the limelight. It has a significant role in managing chronic illnesses, population health as well as in healthcare provision in rural locations [4]-[5].

In this context, the combination of AI and telehealth is regarded as a viable solution to the enhancement of access to healthcare and efficiency in service delivery. It also contributes to health equality. Intelligent consultation systems, wearable monitoring devices, and personalized intervention models, are some of the tools used in AI-based telehealth. The purpose of these tools is to ensure the continuous and cost-effective health care delivery to various groups of people [6]-[8]. AI-based diagnostic instruments in telehealth environments can help generate real-time decisions and more precise health care in rural and underserved environments. This trend could favor the long-term evolution of the healthcare systems in the world [7].

As related technologies and applications continue to develop rapidly, a systematic understanding of this area of related research has become essential. This encompasses its knowledge base, development process, and prospects. Although the body of research on AI in healthcare continues to grow, existing bibliometric studies rarely examine this topic in the context of telehealth. As shown in Table 1, previous core bibliometric studies have different focuses on research focus, data coverage, and analysis dimensions, but all have significant limitations, such as neglecting telehealth as an independent application scenario [9], being confined to single specialties [11], outdated data coverage [10], and narrow research scope [12], highlighting the necessity of this study. Specifically, some analyses covering studies related to multimodal data fusion in the Web of Science database from 2014 to 2025 [9], while including dimensions such as publication trends and collaboration networks, mainly focus on technical-level integration in smart healthcare and do not define telehealth as an independent application scenario, resulting in the concealment of the practical characteristics of telehealth across services and populations and failing to reflect the practical value of technology in remote diagnosis and treatment scenarios; another study including 1,035 articles (2004-2024) [11] is confined to digital health in the single specialty of vascular surgery, and even though it analyzes research distribution and topic changes, it is difficult to reflect the interdisciplinary and cross-clinical integration characteristics of AI and telehealth, failing to present the overall development trend of the field; a further study integrating three major databases [10] has data only up to 2020, failing to cover the critical stage of rapid telehealth development after the COVID-19 pandemic (2021-2024), and its analysis focus is on topic grouping and trend identification of information fusion technology, with insufficient attention to practical dimensions such as clinical application processes and user demand adaptation of telehealth, resulting in limited timeliness and practical guiding value of the research; additionally, a study focusing on machine learning applications oriented to disease diagnosis [12] has a data range only covering 2012-2021, and its analysis dimensions are mostly concentrated on basic attributes such as subject distribution and citation characteristics, without extending to broader telehealth fields such as remote monitoring and rehabilitation intervention, making it difficult for the research scope and analysis depth to support a systematic understanding of this interdisciplinary field.

Table 1. Summary of previous studies

Author	Research focus	Data Source & Scope	TDE[1]	Bibliometric Attributes Examined	Ref.
Chen et al.	AI & multimodal data fusion (Smart Healthcare)	Web of Science (2014-2025)	105	- Publication trend - Top studies - Journal analysis - Top countries/regions, institutions, and authors - Collaboration analysis - Top frequently used term and phrases - Topic identification and trend analysis	[9]
Li et al.	AI & digital health (Vascular Surgery)	Web of Science (2004-2024)	1,035	- Distribution of publications - Scientific cooperation - Variation of the most active topics - New trends and developments	[11]
Chen et al.	AI & Information fusion (Smart Healthcare)	Web of Science PubMed Scopus (-2020)	351	- Publication trend - Top studies - Source analysis - Leading countries/regions, institutions, and authors - Most used terms, phrases, and keywords - Identification of topics and trend analysis - Grouping of topics	[10]
Ahsan et al.	Machine learning & disease diagnosis (Smart Healthcare)	Web of Science Scopus (2012-2021)	102	- Subject Area - Co-Occurrence Network - Publication by Year - Publication by Journal - Publication by citation - Publication by country - Publication by author	[12]

[1]TDE=Total documents examined

To fill these gaps, the study conducts a bibliometric analysis and constructs an interdisciplinary knowledge framework of AI and telehealth to systematically identify the current state of research, academic influence, thematic structure, research gaps, and future trends in this field. Specifically, this research seeks to address the following questions (RQs):

RQ1: What are the publication counts and citation counts of research on AI-powered telehealth?

RQ2: Which articles in AI-powered telehealth research have the strongest influence?

RQ3: What are the main research topics in AI-powered telehealth?

RQ4: Which application areas of AI-powered telehealth show the most potential?

By answering the above research questions, this study supplements the scenario-based analysis dimension missing in existing bibliometric frameworks and offers actionable insights for key stakeholders: for scholars, it clarifies under-explored research gaps to avoid homogeneous studies; for medical institutions, it provides service layout and resource allocation references to optimize telehealth implementation; for healthcare practitioners, it deepens the understanding of core application scenarios to deliver more targeted patient-centered services; for policymakers, it provides evidence-based data to optimize telehealth promotion strategies; for system designers, it identifies core technical priorities to align research and development with clinical and public health needs.

2. Materials and Methods

This study employs a bibliometric approach to systematically analyze the evolution and knowledge structure of research on AI-powered telehealth. Bibliometric analysis is a well-established quantitative method for examining scientific literature based on publication and citation data, enabling the identification of research trends, influential studies, and intellectual structures [13]–[17]. In this study, the analysis is conducted from two perspectives: (1) performance analysis, which evaluates publication output and citation impact, and (2) science mapping, which explores research themes, knowledge domains, and application areas. Compared with traditional narrative or thematic reviews, bibliometric analysis provides a more objective and reproducible framework for understanding the development of a research field [18]. The methodological procedure follows the four-step framework proposed by Donthu et al. (2021), including: (1) defining the research objectives and scope, (2) selecting analytical techniques, (3) data collection and screening, and (4) data analysis and visualization [19].

2.1. Establishing Research Objectives and Scope

The objective of this study is to systematically examine the research landscape of AI-powered telehealth by developing a comprehensive bibliometric and knowledge structure framework. Specifically, the study aims to analyze publication trends, identify influential studies, and map the key research themes and application domains within the field. Given the interdisciplinary nature of AI and telehealth, the scope of this study encompasses a wide range of topics, including technological development, clinical applications, and healthcare service integration.

2.2. Choice of Analytical Techniques

This study applies two main bibliometric techniques: performance analysis and science mapping. Performance analysis is conducted to evaluate research productivity and impact based on publication output and citation metrics. In addition, science mapping is employed to explore the intellectual structure of the field through keyword co-occurrence analysis, enabling the identification of major research themes and topic clusters.

2.3. Data Collection and Analysis

This section describes the procedures for data collection, screening, and analysis in this bibliometric study. Data were retrieved from the Scopus database, selected for its comprehensive coverage of peer-reviewed literature and compatibility with bibliometric analysis tools. The literature selection process was conducted following the PRISMA guidelines to ensure transparency and reproducibility in the identification, screening, eligibility, and inclusion of relevant studies. The overall process and search parameters are illustrated in Figure 1.

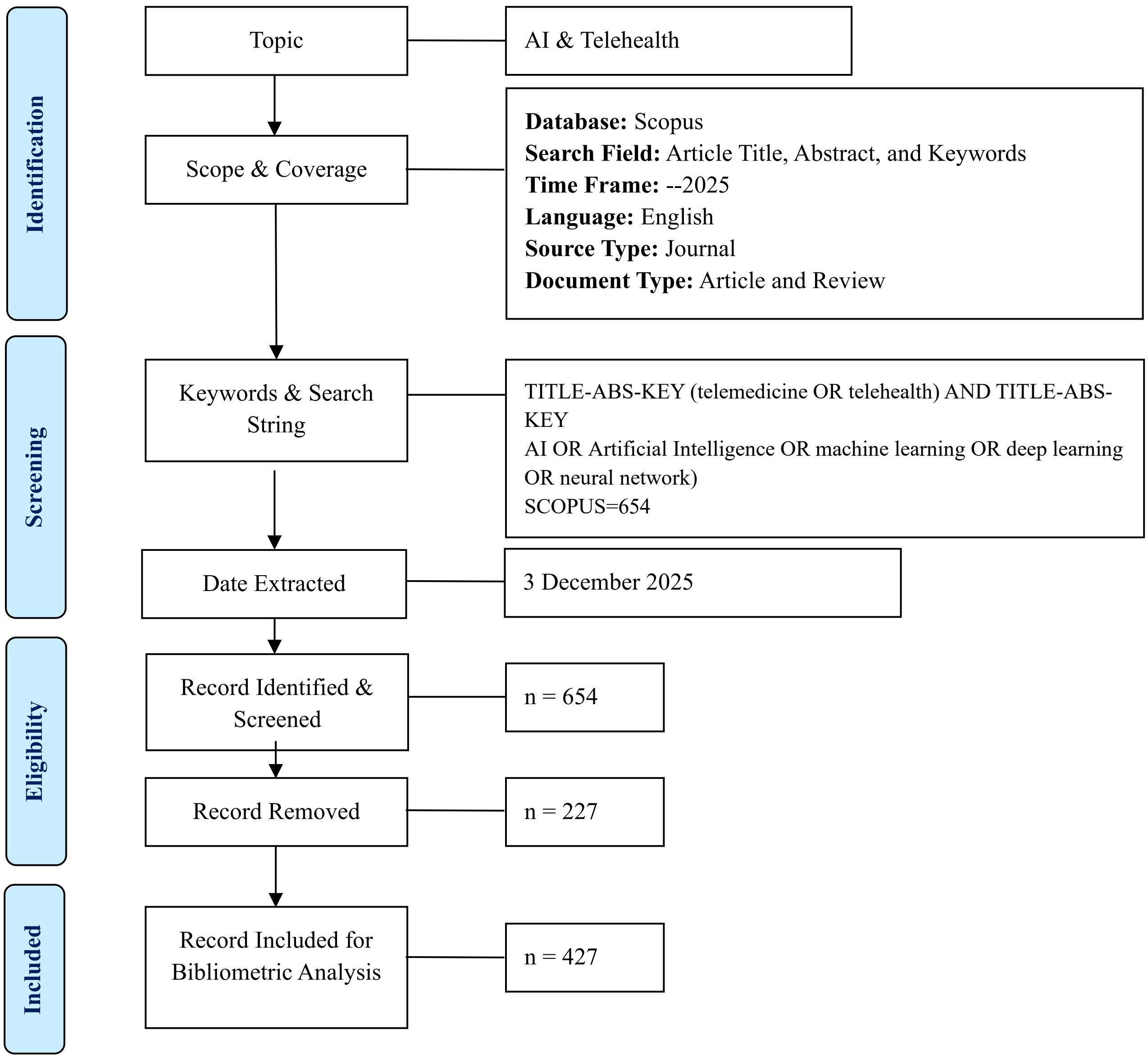

Figure 1. Flow diagram of the search strategy [20]

Inclusion Criteria: Literature was included if it addressed the application of Artificial Intelligence (AI)-related technologies in the medical field (including but not limited to machine learning, deep learning, convolutional neural networks, federated learning, computer vision, and natural language processing); or focused on the scope of telehealth/telemedicine (covering mobile health, remote patient monitoring, remote screening and diagnosis, remote rehabilitation, the Internet of Medical Things (IoMT), digital health and other related fields); or explored the application, development, efficacy, or challenges of AI technologies in telehealth-related contexts.

Exclusion Criteria: Literature was excluded if it had no relevance to either AI or telehealth, including basic technical studies without medical application scenarios such as pure network algorithms, pure encryption protocols, and pure sensor material research; non-core academic literature including conference abstracts, patents, news reports, popular science articles, and short commentaries lacking substantial research content; duplicate articles; articles with missing or incomplete key bibliographic information; as well as literature in other disciplines completely unrelated to the research theme of AI-powered telehealth.

Search Strategy: To ensure comprehensive and targeted retrieval, a standardized Boolean search string was constructed, with the search restricted to the TITLE-ABS-KEY field (Article Title, Abstract, and Keywords) in the Scopus database. The complete and definitive search string is as follows:

TITLE-ABS-KEY (telemedicine OR telehealth) AND TITLE-ABS-KEY (AI OR Artificial Intelligence OR machine learning OR deep learning OR neural network).

Search Constraints: Strict retrieval constraints were applied to guarantee academic quality and consistency. The document type was limited to articles and reviews; source type was restricted to journals; language was limited to English; and the publication time frame was set to cover all available records up to 2025. Literature retrieval was executed and data were extracted on 3 December 2025. The data for this study were obtained from the Scopus database, recognized as the largest repository of peer-reviewed scientific publications [21], which facilitates the efficient identification of research patterns and connections using widely used bibliometric tools (e.g., VOSviewer) [22].

Literature Screening Process: Based on the predefined search strategy and constraints, a total of 654 publications were initially retrieved from the Scopus database. During the screening process, 227 records were removed based on the established inclusion and exclusion criteria, including irrelevant studies and records that did not meet the research scope. The remaining 427 publications were retained for the final analysis. No duplicate records or articles with missing or incomplete bibliographic information were identified. Accordingly, the final dataset consists of 427 publications, which were used for subsequent data extraction, analysis, and discussion.

2.4. Conducting Analysis and Reporting Results

Bibliometric analysis was conducted using VOSviewer (version 1.6.20) [23], Scopus analytical tools, and Microsoft Excel. The analysis includes performance analysis, focusing on publication and citation trends, and science mapping techniques, particularly keyword co-occurrence analysis. Network visualization was applied to identify relationships among research topics and to reveal the thematic structure of the field. The results of the analysis are presented in the following section.

3. Results

This study presents the research results based on bibliometric content analysis and explains their relationship to the research questions. Specifically, the research results regarding the number of published papers, influential articles, and prominent themes correspond separately to the first three questions.

3.1. Publication Trends

To address **RQ1**, which focuses on publication volume and citation patterns in AI-powered telehealth research, this study analyzes the annual trends of both publications and citations based on data retrieved from the Scopus database. The bibliometric dataset includes key information such as publication year, document metadata, and citation counts, which provide a comprehensive basis for evaluating research development and academic impact [19].

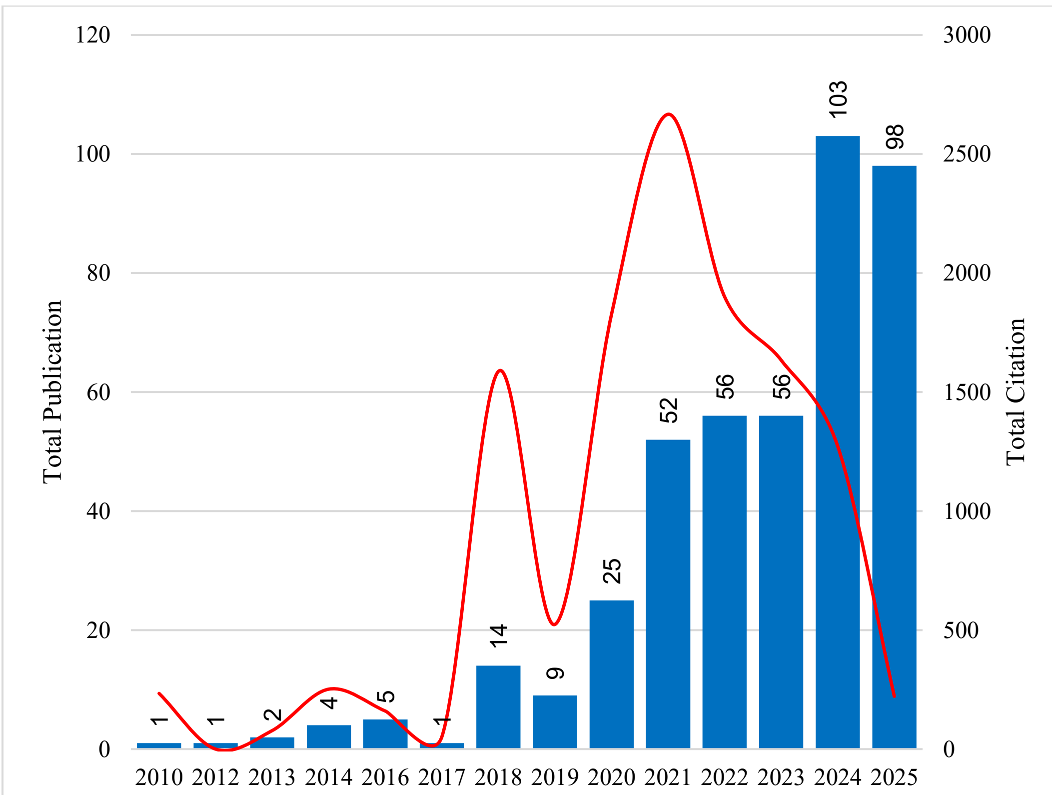

Figure 2. Total Publications and Citations by Year

Figure 2 presents the annual publication output and citation trends in the field from 2010 to 2025. Overall, the results indicate a clear upward trajectory in research productivity, accompanied by dynamic fluctuations in citation patterns. The development of the field can be broadly divided into two phases. The initial phase (2010–2019) is characterized by relatively low and stable publication activity, reflecting the early stage of exploration in integrating AI with telehealth. In contrast, the period from 2020 onward demonstrates a rapid increase in publication output, indicating accelerated research expansion and growing scholarly interest. Notably, the number of publications rose sharply after 2020 and reached a peak in 2024, highlighting the transition toward large-scale development.

In terms of citation trends, the pattern differs from publication growth. Citations remained relatively stable during the early years, followed by a noticeable increase starting in 2017 and reaching an initial peak in 2018. After a temporary decline in 2019, citation counts surged again during 2020–2021, likely driven by heightened global attention to telehealth during the COVID-19 pandemic. Although citation counts declined after 2021, the continued growth in publication volume suggests that the field is still expanding, with recent studies requiring time to accumulate citations. Overall, the findings indicate a shift from early-stage exploration to rapid expansion and increasing research maturity in AI-powered telehealth.

3.2. Highly Cited Publications

To address **RQ2**, this study identifies the most influential publications in AI-powered telehealth based on citation counts, which serve as a widely accepted indicator of scholarly impact [24]. A total of 427 articles were analyzed, and the top 20 most cited documents are presented in Table 2. The results indicate that the most highly cited studies are primarily associated with key research areas, including AI-based disease diagnosis, specialized healthcare applications, and the integration of advanced technologies in telehealth systems. These studies have significantly contributed to shaping the research direction and intellectual foundation of the field. Notably, a considerable proportion of highly cited documents were published after 2020, reflecting the rapid expansion of research activity and increased academic attention in recent years. Furthermore, most of these influential studies were published in high-impact interdisciplinary journals, highlighting the cross-disciplinary nature of AI-powered telehealth research.

Table 2. Top 20 highly cited publications

No.	Authors	Year	Title	Journal	Citations	Ref.
1	Yıldırım et al	2018	“Arrhythmia detection using deep convolutional neural network with long duration ECG signals”	Computers in Biology and Medicine	727	[25]
2	Al Kuwaiti et al.	2023	“A Review of the Role of Artificial Intelligence in Healthcare”	Journal of Personalized Medicine	470	[26]
3	Li et al.	2021	“Digital technology, tele-medicine and artificial intelligence in ophthalmology: A global perspective”	Progress in Retinal and Eye Research	462	[27]
4	Guo et al.	2020	“Artificial intelligence in health care: Bibliometric analysis”	Journal of Medical Internet Research	317	[28]
5	Ellahham	2020	“Artificial Intelligence: The Future for Diabetes Care”	American Journal of Medicine	262	[29]
6	Bansal et al.	2022	“Healthcare in Metaverse: A Survey on Current Metaverse Applications in Healthcare”	IEEE Access	261	[30]
7	da Costa et al.	2018	“Internet of Health Things: Toward intelligent vital signs monitoring in hospital wards”	Artificial Intelligence in Medicine	236	[31]
8	Chua et al.	2010	“Application of higher order statistics/spectra in biomedical signals-A review”	Medical Engineering and Physics	234	[32]

9	Sujith et al.	2022	"Systematic review of smart health monitoring using deep learning and Artificial intelligence"	Neuroscience Informatics	218	[33]
10	Bokolo	2021	"Application of telemedicine and eHealth technology for clinical services in response to COVID-19 pandemic"	Health and Technology	173	[34]
11	Lahoura et al.	2021	"Cloud computing-based framework for breast cancer diagnosis using extreme learning machine"	Diagnostics	169	[35]
12	Hwang et al.	2019	"Artificial intelligence-based decision-making for age-related macular degeneration"	Theranostics	167	[36]
13	Tan et al.	2022	"Metaverse and Virtual Health Care in Ophthalmology: Opportunities and Challenges"	Asia-Pacific Journal of Ophthalmology	166	[37]
14	Young et al	2020	"Artificial Intelligence in Dermatology: A Primer"	Journal of Investigative Dermatology	164	[38]
15	Aminizadeh et al.	2024	"Opportunities and challenges of artificial intelligence and distributed systems to improve the quality of healthcare service"	Artificial Intelligence in Medicine	161	[39]
16	Ting et al.	2021	"Artificial intelligence for anterior segment diseases: Emerging applications in ophthalmology"	British Journal of Ophthalmology	157	[40]
17	Kapoor et al.	2019	"The current state of artificial intelligence in ophthalmology"	Survey of Ophthalmology	145	[41]
18	Guidi et al.	2014	"A machine learning system to improve heart failure patient assistance"	IEEE Journal of Biomedical and Health Informatics	143	[42]
19	Liu et al.	2020	"A Smart Dental Health-IoT Platform Based on Intelligent Hardware, Deep Learning, and Mobile Terminal"	IEEE Journal of Biomedical and Health Informatics	139	[43]
20	Bibi et al.	2020	"IOMT-based automated detection and classification of leukemia using deep learning"	Journal of Healthcare Engineering	134	[44]

3.3. Key Research Topics

To address **RQ3**, this study identifies the major research topics in AI-powered telehealth through keyword co-occurrence analysis. Author keywords are widely recognized as indicators of thematic focus, while their co-occurrence reflects the intellectual structure and evolving trends within a research field [45]. The network visualization is presented in Figure 3.

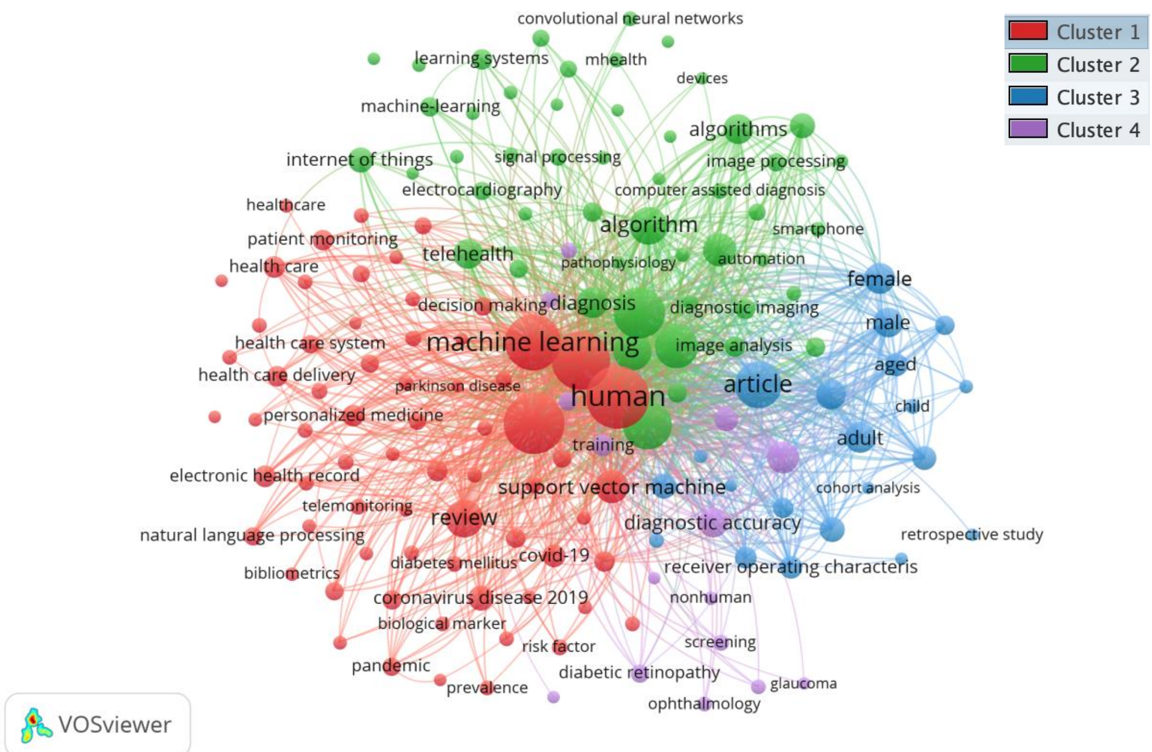

Figure 3. Network visualization mapping with keyword co-occurrence

Using VOSviewer, a total of 5,262 keywords were extracted from the Scopus dataset. After applying a minimum occurrence threshold of 14, 154 keywords were retained, forming four major clusters with 9,403 links. These clusters represent the core thematic structure of AI-powered telehealth research. Keywords with larger node sizes indicate higher frequency, while the links between nodes reflect the strength of their relationships. The analysis reveals several dominant keywords, including “artificial intelligence,” “telemedicine,” and “machine learning,” which serve as central nodes connecting multiple research topics. Their high frequency and strong link strength indicate that they form the conceptual backbone of the field.

The four clusters can be interpreted as follows. **Cluster 1 (red)** represents AI-powered telehealth applications, focusing on the practical implementation of AI techniques in healthcare services, including patient monitoring, healthcare delivery, and decision-making systems. This cluster also reflects the strong influence of the COVID-19 pandemic, as indicated by the presence of related keywords.

Cluster 2 (green) highlights AI-powered telehealth technologies, emphasizing the development and application of advanced computational methods such as deep learning, neural networks, and Internet of Things (IoT). This cluster represents the technological foundation that enables intelligent healthcare systems.

Cluster 3 (blue) corresponds to research methodologies, including study design, statistical evaluation, and predictive modeling approaches. The presence of terms such as “diagnostic accuracy,” “predictive value,” and “receiver operating characteristic” indicates a strong focus on validating the performance of AI models in clinical contexts.

Cluster 4 (purple) reflects precision telehealth, focusing on specialized applications such as disease-specific diagnosis and screening, particularly in areas like ophthalmology and diabetic retinopathy. This cluster highlights the movement toward personalized and high-accuracy healthcare solutions.

Overall, the results demonstrate that AI-powered telehealth research is structured around four interconnected themes: application, technology, methodology, and precision healthcare. These themes collectively illustrate the transition of the field from technological exploration to clinically oriented and data-driven healthcare innovation. In addition, emerging directions such as mobile health applications, explainable AI, hybrid research methods, and system scalability suggest promising avenues for future research.

3.4. Future Research Directions

Based on the bibliometric and thematic analyses, several emerging directions can be identified for future research in AI-powered telehealth. These directions reflect both technological advancements and evolving healthcare demands, indicating the continued expansion and maturation of the field.

First, the development of AI-powered mobile health (mHealth) applications is expected to become a major research focus. With the increasing availability of smartphones and wearable devices, future studies may explore how AI can enhance real-time health monitoring, personalized interventions, and remote patient management in diverse healthcare settings.

Second, the growing importance of explainable artificial intelligence (XAI) represents a critical direction. As AI systems are increasingly applied in clinical decision-making, ensuring transparency, interpretability, and trustworthiness becomes essential. Future research should focus on developing models that not only achieve high accuracy but also provide clear and interpretable outcomes for healthcare professionals.

Third, the integration of mixed research methods is likely to gain more attention. While quantitative approaches dominate current studies, combining them with qualitative methods can provide deeper insights into user experience, system usability, and implementation challenges in real-world healthcare environments.

Fourth, the scalability and reliability of AI-powered telehealth systems remain important challenges. Future research should address issues related to system robustness, data security, interoperability, and large-scale deployment across different healthcare infrastructures.

Finally, the expansion of AI applications into specialized and precision healthcare domains is expected to continue. This includes disease-specific diagnosis, personalized treatment planning, and predictive analytics, which can further enhance the effectiveness and efficiency of telehealth services.

Overall, these directions highlight a shift from technology-driven exploration toward patient-centered, reliable, and scalable healthcare solutions, emphasizing the need for interdisciplinary collaboration in advancing AI-powered telehealth.

4. Discussion

This study provides a comprehensive bibliometric analysis of AI-powered telehealth research, highlighting its rapid development, evolving intellectual structure, and expanding application domains. The integration of artificial intelligence and telehealth has significantly enhanced healthcare accessibility, optimized resource distribution, and improved clinical decision-making, particularly in remote and underserved regions. Compared with traditional review approaches, the bibliometric method adopted in this study enables a more objective and systematic examination of publication trends, citation patterns, and thematic structures, thereby offering a clearer understanding of the field's knowledge landscape [48].

From a diffusion of innovation perspective, AI-powered telehealth can be conceptualized as a complex innovation that evolves across multiple stages of adoption and diverse user groups. Unlike prior bibliometric studies that often treat AI in healthcare as a homogeneous technological advancement [9,10,12], this study emphasizes telehealth as a distinct service context with unique adoption barriers, organizational characteristics, and user needs. Previous research has largely focused on technical integration or single-specialty applications, thereby overlooking the cross-disciplinary and service-oriented nature of telehealth. As a result, such approaches provide limited explanatory power for understanding variations in the adoption and diffusion of AI-powered telehealth across different healthcare settings.

The findings of this study reveal that the development of AI-powered telehealth follows a non-linear and multi-phase trajectory rather than a simple technology-driven growth pattern. The significant increase in publications after 2020 reflects a transition from early-stage technological exploration to broader implementation and integration within clinical workflows. This shift corresponds to the movement from early adopters to early majority users, where research focus expands from proof-of-concept studies to issues related to system integration, scalability, and practical deployment. At the same time, the observed divergence between rapid publication growth and slower citation accumulation suggests that while exploratory research is expanding quickly, the development of practice-changing evidence requires longer-term validation through real-world implementation and multi-center studies.

This study also highlights several limitations in existing bibliometric frameworks. First, by not treating telehealth as an independent service scenario, prior studies tend to underestimate the influence of contextual factors such as digital literacy, interoperability, and policy support, which play a critical role in technology adoption [50]. Second, the exclusion of post-2020 data in earlier analyses results in an incomplete understanding of the rapid acceleration phase driven by global healthcare disruptions and policy changes. The COVID-19 pandemic, in particular, acted as a major catalyst by reshaping healthcare delivery models and accelerating the adoption of telehealth technologies. Third, studies focusing on single clinical specialties fail to capture the integrative nature of telehealth across multiple domains, including ophthalmology, dermatology, chronic disease management, and dentistry. Finally, technology-centered analyses often prioritize performance metrics while overlooking key diffusion attributes such as compatibility, complexity, and observability, which are essential for translating technological innovation into routine clinical practice.

The analysis of publication and citation trends further confirms the staged evolution of the field. Early research was characterized by slow growth and limited impact, followed by a period of rapid expansion and increased scholarly attention in recent years. While publication output has grown significantly, citation patterns indicate a lag in the consolidation of influential, practice-oriented research. This suggests that the field is still transitioning from experimental and exploratory studies toward more mature, standardized, and clinically validated applications.

The examination of highly cited publications indicates that the intellectual core of the field is primarily shaped by studies focusing on AI-assisted disease diagnosis, specialized healthcare applications, and the integration of advanced technologies into telehealth systems. These influential works are predominantly published in interdisciplinary journals at the intersection of computer science and medicine, reflecting the inherently cross-disciplinary nature of the field. Their emphasis on practical applications and clinical relevance suggests that future research will continue to prioritize real-world problem solving and translational impact.

Furthermore, the thematic analysis reveals that AI-powered telehealth research is structured around four interconnected domains: applications, technologies, methodologies, and precision healthcare. These domains collectively illustrate a shift from technology-oriented exploration toward more patient-centered, data-driven, and clinically integrated healthcare solutions. Despite these advances, important gaps remain, particularly in areas related to ethical considerations, data privacy, and healthcare equity, which have not yet received sufficient attention in the existing literature. Addressing these challenges will be essential for ensuring the sustainable and responsible development of AI-powered telehealth systems.

5. Conclusions

This study presents a comprehensive bibliometric analysis of AI-powered telehealth research based on 427 publications indexed in the Scopus database from 2010 to 2025. The findings reveal a clear evolutionary pattern characterized by a transition from early-stage exploration to rapid expansion, with 2020 identified as a critical turning point. While publication output has increased significantly in recent years, citation patterns indicate a lag in the consolidation of practice-oriented and high-impact research. The analysis of highly cited publications shows that the field is primarily driven by studies focusing on AI-assisted disease diagnosis, specialized healthcare applications, and technology integration. In addition, keyword co-occurrence analysis identifies four core thematic domains, applications, technologies, research methodologies, and precision telehealth, reflecting the multidimensional structure of the field.

The main contribution of this study lies in developing a structured and interdisciplinary knowledge framework for AI-powered telehealth. By incorporating a scenario-based perspective, this study extends existing bibliometric approaches and provides a more nuanced understanding of how AI technologies are applied across diverse healthcare contexts. The findings also highlight the shift of the field toward patient-centered, data-driven, and clinically integrated healthcare solutions.

From a practical perspective, this study offers valuable insights for multiple stakeholders. For healthcare institutions, it provides guidance for resource allocation and service design; for practitioners, it enhances understanding of key application scenarios; for policymakers, it supports evidence-based decision-making to promote equitable access to telehealth services; for system developers, it identifies priorities for designing accessible and scalable solutions; and for researchers, it highlights underexplored areas such as ethics, data privacy, and healthcare equity.

Despite its contributions, this study has several limitations. First, the analysis is based solely on the Scopus database, which may limit the coverage of relevant studies from other sources such as Web of Science and PubMed. Second, the rapid evolution of AI technologies and emerging telehealth applications may not be fully captured within the selected time frame. Future research is encouraged to incorporate multiple databases and explore emerging topics, including generative AI and advanced clinical applications, to provide a more comprehensive and up-to-date understanding of the field.

Overall, this study offers a systematic and forward-looking overview of AI-powered telehealth research, providing both theoretical insights and practical guidance for advancing the development of intelligent and inclusive healthcare systems.

Author Contributions: Bingxin, Jin: Writing review and editing, writing original draft preparation, methodology, software, data curation, visualization, formal analysis, conceptualization; **Hapini, Awang**: Validation, supervision; **Nur Suhaili, Mansor**: Validation, supervision.

Funding: This research received no external funding.

Data Availability Statement: Data will be made available on request.

Acknowledgments: The authors would like to express their sincere gratitude to Universiti Utara Malaysia (UUM) for providing access to the latest information from Scopus data sources. We also extend our thanks to Elgamar and Mohamad Fadli for their support in publishing this article.

Conflicts of Interest: The authors declare no conflicts of interest.

References

[1] M. Osama et al., Internet of medical things and healthcare 4.0: Trends, requirements, challenges, and research directions, *Sensors (Basel)*, vol. 23, no. 17, p. 7435, Sep. 2023, doi: 10.3390/s23177435.

[2] S. A. Alowais et al., Revolutionizing healthcare: The role of artificial intelligence in clinical practice, *BMC Med Educ*, vol. 23, no. 1, p. 689, Dec. 2023, doi: 10.1186/s12909-023-04698-z.

[3] P. Manickam et al., Artificial Intelligence and Internet of Medical Things assisted biomedical systems for intelligent healthcare, *Biosensors (Basel)*, vol. 12, no. 8, p. 562, Aug. 2022, doi: 10.3390/bios12080562.

[4] D. M. Mann et al., COVID-19 transforms health care through telemedicine: Evidence from the field, *J Am Med Inform Assoc*, vol. 27, no. 7, pp. 1132-1135, Jul. 2020, doi: 10.1093/jamia/ocaa072.

[5] R. K. Sahu et al., Advancing public health: A comprehensive analysis of telemedicine in chronic disease management, access improvement, and health promotion programs, *Int J Health Sci Res,* vol. 14, no. 2, pp. 125-136, Feb. 2024, doi: 10.52403/ijhsr.20240216.

[6] G. Huang et al., AI-driven wearable bioelectronics in digital healthcare, *Biosensors (Basel)*, vol. 15, no. 7, p. 410, Jul. 2025, doi: 10.3390/bios15070410.

[7] R. Baron and H. Haick, Mobile diagnostic clinics, *ACS Sens*, vol. 9, no. 6, pp. 2777-2792, Jun. 2024, doi: 10.1021/acssensors.4c00636.

[8] Y. H. Li et al., Innovation and challenges of artificial intelligence technology in personalized healthcare, *Sci Rep*, vol. 14, no. 1, pp. 1-9, Aug. 2024, doi: 10.1038/S41598-024-70073-7.

[9] X. Chen et al., Artificial intelligence and multimodal data fusion for smart healthcare: Topic modeling and bibliometrics, *Artificial Intelligence Review*, vol. 57, no. 4, p. 91, Mar. 2024, doi: 10.1007/s10462-024-10712-7.

[10] X. Chen et al., Information fusion and artificial intelligence for smart healthcare: A bibliometric study, *Inf Process Manag*, vol. 60, no. 1, p. 103113, Jan. 2023, doi: 10.1016/j. ipm.2022.103113.

[11] X. Li et al., Artificial intelligence and digital health in vascular surgery: A 2-decade bibliometric analysis of research landscapes and evolving frontiers, *J Robot Surg*, vol. 19, no. 1, p. 453, Aug. 2025, doi: 10.1007/s11701-025-02583-z.
[12] M. M. Ahsan et al., Machine-learning-based disease diagnosis: A comprehensive review, *Healthcare*, vol. 10, no. 3, p. 541, Mar. 2022, doi: 10.3390/healthcare10030541.
[13] W. Hassan and A. E. Duarte, Bibliometric analysis: A few suggestions, *Curr Probl Cardiol*, vol. 49, no. 8, p. 102640, Aug. 2024, doi: 10.1016/j.cpcardiol.2024.102640.
[14] M. Lin et al., A bibliometric analysis of the advances of artificial intelligence in medicine, *Front Med (Lausanne)*, vol. 12, no. 5, p. 100193, Feb. 2025, doi: 10.3389/fmed.2025.1504428.
[15] Z. Z. Yuan et al., A bibliometric analysis of hydrogel research in various fields: The trends and evolution of hydrogel application, *J Nanobiotechnology*, vol. 23, no. 1, p. 70, Dec. 2025, doi: 10.1186/s12951-025-03090-x.
[16] Q. He et al., Near-infrared aggregation-induced emission materials: Bibliometric analysis and their application in biomedical field, *Aggregate*, vol. 5, no. 3, p. 70, Jun. 2024, doi: 10.1002/agt2.505.
[17] Y. Jing et al., Bibliometric mapping techniques in educational technology research: A systematic literature review, *Educ. Inf. Technol.*, vol. 29, no. 8, pp. 9283-9311, Jun. 2024, doi: 10.1007/s10639-023-12178-6.
[18] W. M. Lim et al., Advancing knowledge through literature reviews: “What”, “why”, and “how to contribute”, *Serv Ind J*, vol. 42, pp. 481-513, Jun. 2022, doi: 10.1080/02642069.2022.2047941.
[19] N. Donthu et al., How to conduct a bibliometric analysis: An overview and guidelines, *J Bus Res*, vol. 133, pp. 285-296, Sep. 2021, doi: 10.1016/j.jbusres.2021.04.070.
[20] T. Saheb and D. O. Carpenter, Mapping research strands of ethics of artificial intelligence in healthcare: A bibliometric and content analysis, *Comput Biol Med*, vol. 135, p. 104660, Aug. 2021, doi: 10.1016/j.compbiomed.2021.104660.
[21] T. Bartol et al., Assessment of research fields in Scopus and Web of Science in the view of national research evaluation in Slovenia, *Scientometrics*, vol. 98, no. 2, pp. 1491-1504, Oct. 2013, doi: 10.1007/s11192-013-1148-8.
[22] A. Al-Khoury et al., Intellectual capital history and trends: A bibliometric analysis using Scopus database, *Sustainability*, vol. 14, no. 18, p. 11615, Sep. 2022, doi: 10.3390/sU141811615.
[23] N. J. van Eck and L. Waltman, Software survey: VOSviewer, a computer program for bibliometric mapping, *Scientometrics*, vol. 84, no. 2, pp. 523-538, Dec. 2009, doi: 10.1007/s11192-009-0146-3.
[24] Y. Ding and B. Cronin, Popular and/or prestigious? Measures of scholarly esteem, *Inf Process Manag*, vol. 47, no. 1, pp. 80-96, Jan. 2011, doi: 10.1016/j.ipm.2010.01.002.
[25] Ö. Yıldırım et al., Arrhythmia detection using deep convolutional neural network with long duration ECG signals, *Comput Biol Med*, vol. 102, no. 1, pp. 411-420, Nov. 2018, doi: 10.1016/j.compbiomed.2018.09.009.
[26] A. Al Kuwaiti et al., A review of the role of artificial intelligence in healthcare, *J Pers Med*, vol. 13, no. 6, p. 951, Jun. 2023, doi: 10.3390/jpm13060951.
[27] J. P. O. Li et al., Digital technology, tele-medicine and artificial intelligence in ophthalmology: A global perspective, *Prog Retin Eye Res*, vol. 82, no. 6, p. 100900, May 2021, doi: 10.1016/j.preteyeres.2020.100900.
[28] Y. Guo et al., Artificial intelligence in health care: Bibliometric analysis, *J Med Internet Res*, vol. 22, no. 7, p. e18228, Jul. 2020, doi: 10.2196/18228.
[29] S. Ellahham, Artificial intelligence: The future for diabetes care, *Am J Med*, vol. 133, no. 8, pp. 895-900, Aug. 2020, doi: 10.1016/j.amjmed.2020.03.033.
[30] G. Bansal et al., Healthcare in metaverse: A survey on current metaverse applications in healthcare, *IEEE Access*, vol. 10, pp. 119914-119946, Nov. 2022, doi: 10.1109/access.2022.3219845.
[31] C. A. da Costa et al., Internet of Health Things: Towards intelligent vital signs monitoring in hospital wards, *Artif Intell Med*, vol. 89, pp. 61-69, Jul. 2018, doi: 10.1016/j.artmed.2018.05.005.
[32] K. C. Chua et al., Application of higher order statistics/spectra in biomedical signals-A review, *Med Eng Phys*, vol. 32, no. 7, pp. 679-689, Sep. 2010, doi: 10.1016/j.medengphy.2010.04.009.
[33] A. V. L. N. Sujith et al., Systematic review of smart health monitoring using deep learning and Artificial intelligence, *Neuroscience Informatics*, vol. 2, no. 3, p. 100028, Sep. 2022, doi: 10.1016/j.neuri.2021.100028.
[34] A. J. Bokolo, Application of telemedicine and eHealth technology for clinical services in response to COVID-19 pandemic, *Health Technol (Berl)*, vol. 11, no. 2, pp. 359-366, Mar. 2021, doi: 10.1007/s12553-020-00516-4.

[35] V. Lahoura et al., Cloud computing-based framework for breast cancer diagnosis using extreme learning machine, *Diagnostics*, vol. 11, no. 2, p. 241, Feb. 2021, doi: 10.3390/diagnostics11020241.

[36] D. K. Hwang et al., Artificial intelligence-based decision-making for age-related macular degeneration, *Theranostics*, vol. 9, no. 1, pp. 232-245, Nov. 2019, doi: 10.7150/thno.28447.

[37] T. F. Tan et al., Metaverse and virtual health care in ophthalmology: Opportunities and challenges, *Asia Pac J Ophthalmol,* vol. 11, no. 3, pp. 237-246, May 2022, doi: 10.1097/apo.0000000000000537.

[38] A. T. Young et al., Artificial intelligence in dermatology: A primer, *J Investig Dermatol*, vol. 140, no. 8, pp. 1504-1512, Aug. 2020, doi: 10.1016/j.jid.2020.02.026.

[39] S. Aminizadeh et al., Opportunities and challenges of artificial intelligence and distributed systems to improve the quality of healthcare service, *Artif Intell Med*, vol. 149, no. 2, p. 102779, Mar. 2024, doi: 10.1016/j.artmed.2024.102779.

[40] D. S. J. Ting et al., Artificial intelligence for anterior segment diseases: Emerging applications in ophthalmology, *Br J Ophthalmol*, vol. 105, no. 2, pp. 158-168, Feb. 2021, doi: 10.1136/bjophthalmol-2019-315651.

[41] R. Kapoor et al., The current state of artificial intelligence in ophthalmology, *Surv Ophthalmol*, vol. 64, no. 2, pp. 233-240, Mar. 2019, doi: 10.1016/j.survophthal.2018.09.002.

[42] G. Guidi et al., A machine learning system to improve heart failure patient assistance, *IEEE J Biomed Health Inform*, vol. 18, no. 6, pp. 1750-1756, Nov. 2014, doi: 10.1109/jbhi.2014.2337752.

[43] L. Liu et al., A smart dental health-IoT platform based on intelligent hardware, deep learning, and mobile terminal, *IEEE J Biomed Health Inform*, vol. 24, no. 3, pp. 898-906, Mar. 2020, doi: 10.1109/jbhi.2019.2919916.

[44] N. Bibi et al., IOMT-based automated detection and classification of leukemia using deep learning, *J Healthc Eng*, vol. 2020, no. 2, pp. 1-12, Dec. 2020, doi: 10.1155/2020/6648574.

[45] N. Comerio and F. Strozzi, Tourism and its economic impact: A literature review using bibliometric tools, Tour Econ, vol. 25, no. 1, pp. 109-131, Feb. 2019, doi: 10.1177/1354816618793762.

[46] H. B. Vošner et al., A bibliometric retrospective of the Journal Computers in Human Behavior (1991-2015), *Comput Human Behav*, vol. 65, pp. 46-58, Dec. 2016, doi: 10.1016/j.chb.2016.08.026.

[47] I. Danvila-del-Valle et al., Human resources training: A bibliometric analysis, J Bus Res, vol. 101, pp. 627-636, Aug. 2019, doi: 10.1016/j.jbusres.2019.02.026.

[48] I. Zupic and T. Čater, Bibliometric methods in management and organization, Organ. Res. Methods, vol. 18, no. 3, pp. 429-472, Jul. 2015, doi: 10.1177/1094428114562629.

[49] J. W. Lee, Encyclopedia of Sport Management, 2nd ed., Cheltenham: Edward Elgar Publishing Ltd., pp. 266–268, Sep. 2024, doi:10.4337/9781035317189.ch157.

[50] R. van Kessel *et al.*, Mapping factors that affect the uptake of digital therapeutics within health systems: Scoping review, *J. Med. Internet Res.*, vol. 25, no. 2, p. e48000, Jul. 2023, doi: 10.2196/48000.

[51] X. Zhang et al., Artificial intelligence in telemedicine: A global perspective visualization analysis, *Telemedicine and e-Health*, vol. 30, no. 7, pp. 1909-1922, Jul. 2024, doi: 10.1089/tmj.2023.0704.

[52] R. Tang et al., Artificial intelligence in intensive care medicine: Bibliometric analysis, *J. Med. Internet Res.*, vol. 24, no. 11, p. e42185, Nov. 2022, doi: 10.2196/42185.

[53] A. Amjad et al., A review on innovation in healthcare sector telehealth through artificial intelligence, *Sustainability*, vol. 15, no. 8, p. 6655, Apr. 2023, doi: 10.3390/su15086655.

[54] M. Alhasan and M. Hasaneen, Digital imaging, technologies and artificial intelligence applications during COVID-19 pandemic, *Comput Med Imaging Graph*, vol. 91, no. 8, p. 101933, Jul. 2021, doi: 10.1016/j.compmedimag.2021.101933.

[55] S. Matsuba et al., Accuracy of ultra-wide-field fundus ophthalmoscopy-assisted deep learning, a machine-learning technology, for detecting age-related macular degeneration, *Int Ophthalmol*, vol. 39, no. 6, pp. 1269-1275, Jun. 2019, doi: 10.1007/s10792-018-0940-0.

[56] A. A. Ein Shoka et al., An efficient CNN-based epileptic seizures detection framework using encrypted EEG signals for secure telemedicine applications, *Alex Eng J*, vol. 65, pp. 399-412, Feb. 2023, doi: 10.1016/j.aej.2022.10.014.

[57] H. C. Hu et al., Deep learning application for vocal fold disease prediction through voice recognition: Preliminary development study, *J Med Internet Res*, vol. 23, no. 6, p. e25247, Jun. 2021, doi: 10.2196/25247.

[58] A. Bilal et al., A Transfer learning and U-Net-based automatic detection of diabetic retinopathy from fundus images, *Comput Methods Biomech Biomed Eng Imaging Vis*, vol. 10, no. 6, pp. 663-674, 2022, doi: 10.1080/21681163.2021.2021111.
[59] J. Pool et al., Large language models and generative AI in telehealth: a responsible use lens, *J Am Med Inform Assoc*, vol. 31, no. 9, pp. 2125-2136, Sep. 2024, doi: 10.1093/jamia/ocae035.
[60] A. Akbulut et al., Fetal health status prediction based on maternal clinical history using machine learning techniques, *Comput Methods Programs Biomed*, vol. 163, pp. 87-100, Sep. 2018, doi: 10.1016/j.cmpb.2018.06.010.
[61] V. Bellini et al., Artificial intelligence and telemedicine in anesthesia: Potential and problems, *Minerva Anestesiol*, vol. 88, no. 9, pp. 729-734, Sep. 2022, doi: 10.23736/s0375-9393.21.16241-8.
[62] N. Mugisha et al., AI-enhanced telemedicine for personalized antiretroviral therapy in HIV patients with neurological comorbidities: A narrative review, *Postgrad Med J*, vol. 101, no. 1202, pp. 1335-1343, Nov. 2025, doi: 10.1093/postmj/qgaf069.
[63] H. Alimiri Dehbaghi and K. Khoshgard, Revolutionizing emergency care: An overview of the transformative role of artificial intelligence in diagnosis, triage, and patient management, *Int J Emerg Med*, vol. 18, no. 1, p. 242, Dec. 2025, doi: 10.1186/s12245-025-01049-1.
[64] V. K. Damera et al., Enhancing remote patient monitoring with AI-driven IoMT and cloud computing technologies, *Sci Rep*, vol. 15, no. 1, p. 24088, Dec. 2025, doi: 10.1038/s41598-025-09727-z.
[65] I. Mandal and N. Sairam, Accurate telemonitoring of Parkinson's disease diagnosis using robust inference system, *Int J Med Inform*, vol. 82, no. 5, pp. 359-377, May 2013, doi: 10.1016/j.ijmedinf.2012.10.006.
[66] M. J. Ahmed et al., CardioGuard: AI-driven ECG authentication hybrid neural network for predictive health monitoring in telehealth systems, *SLAS Technol*, vol. 29, no. 5, p. 100193, Oct. 2024, doi: 10.1016/j.slast.2024.100193.