Bibliometric and Content Analysis of Articles on Artificial Intelligence in Healthcare

İbrahim TÜRKMEN[1], Arif SÖYLER[2], Seymur ALİYEV[3], Tarık SEMİZ[4]

Corresponding Author

İbrahim TÜRKMEN

DOI

https://10.48121/jihsam.1533583

Received

15.08.2024

Accepted

26.10.2024

Published Online

31.10.2024

Key Words

Healthcare, Artificial Intelligence, Machine Learning, Deep Learning

ABSTRACT

The use of artificial intelligence in the healthcare sector is becoming widespread for reasons such as analyzing digital patient data, including it in decision-making processes, improving the quality of healthcare services, and providing cost, time, and access advantages. This study aims to evaluate published articles on bibliometric indicators and the use of artificial intelligence in the healthcare sector and examine the content of the most cited articles. Articles about artificial intelligence in the health sector in the Web of Science database were included in the study using the criteria of "keyword, publication year, and publication language". The research covers 2,680 articles published in English by 14,195 authors from 106 countries in 1084 journals between 2020-2024. 4,671 different keywords were used in the published articles. The country that published the most was "USA", the journal was "Journal of Medical Internet Research", the author was "Meng Ji", and the most cited author was "Weihua Li". The 55 most cited (≥50) articles focused on themes related to "diagnosis of COVID-19 disease", "diagnosis of diseases", "detection and classification of cancerous cells", "identification of disease risk factors and disease prediction", "prediction of treatment outcomes", "prediction of disease course", "personalized treatment recommendations", "decision-making processes", "ethical considerations, risks, and responsibilities". With the COVID-19 pandemic, it is seen that the number of articles on artificial intelligence in the healthcare sector has increased exponentially. In the research, articles related to artificial intelligence in the health sector were examined, and a framework was created for researchers by revealing the most publishing countries, journals, authors, most cited authors, and keywords that were used the most.

[1] İbrahim TÜRKMEN, Lecturer, PhD., a) Vocational School of Health Services, Usak University, b) PhD Student., Graduate Education Institute, Izmir Bakircay University, İzmir. ibrahim.turkmen@usak.edu.tr

Orcid Number: https://orcid.org/0000-0002-1558-0736

[2] Arif SÖYLER, PhD Student., Graduate Education Institute, Izmir Bakircay University, İzmir. arifsoyler@gmail.com

Orcid Number: https://orcid.org/0000-0001-7699-6316

[3] Seymur ALİYEV, PhD Student., Graduate Education Institute, Izmir Bakircay University, İzmir. aliyevseymur899@gmail.com

Orcid Number: https://orcid.org/0009-0002-0224-5805

[4] Tarık SEMİZ, Assoc. Prof. Dr., Faculty of Health Science, Izmir Bakircay University, İzmir. tarik.semiz@bakircay.edu.tr

Orcid Number: https://orcid.org/0000-0002-6647-3383

Türkmen, İ., Söyler, A., Aliyev, S., Semiz, T. (2024). Bibliometric and Content Analysis of Articles on Artificial Intelligence in Healthcare. Journal of International Health Sciences and Management, 10(20): 137-148

1.INTRODUCTION

Digitalization in the health sector is increasing day by day. Digital technologies in health services allow health data to be created and stored electronically. The use of electronic health records (EHRs) is becoming essential to improve the quality of healthcare, health outcomes, and public health and reduce chronic diseases (Tekin and Emikönel, 2023). While it is important to have health data, it needs to be analyzed and used in decisions to turn it into a benefit.

Analyzing EHRs helps health professionals make rational decisions (Türkmen and Özkara, 2001). However, due to limited access to health data, reluctance and concerns of health institutions to share data, privacy and confidentiality violations, legal regulations on the confidentiality of personal information, and the lack of sufficient expert data analysts in health institutions, the potential of EHRs to improve decisions and outcomes in health services cannot be sufficiently utilized (Rankin et al., 2020). Until recently, organizing, analyzing, interpreting, and understanding large amounts of EHRs depended entirely on human knowledge, skill, and intelligence. Recently, artificial intelligence (AI) technologies have been used to analyze medical data (Srivastava et al., 2021). By analyzing big health data, AI can uncover relationships that humans cannot detect. The primary purpose of using artificial intelligence in healthcare is to analyze the relationships between disease prevention, diagnosis and diagnostic processes, treatment techniques, monitoring of the disease process, and patient outcomes (Bickman, 2020).

Kaplan and Haenlein (2019:17) define AI as “the ability of a system to accurately interpret external data, learn from such data, and use this learning to achieve specific goals and tasks through flexible adaptation”. AI refers to "the ability of a machine to imitate intelligent human behavior." AI refers to the branch of computer science that focuses on developing computer algorithms to perform tasks traditionally associated with human intelligence (Tang et al., 2018). AI includes many types of programs and algorithms. A critical type of AI is machine learning (ML). ML is “the creation of algorithms that can learn from data and make predictions based on data” (Bickman, 2020). ML can be defined as “an automated process that supports predictions and decision-making by allowing machines to analyze a large data set, recognize patterns, and learn from data” (Wang and Siau, 2019). Deep learning (DL) is a sub-branch of machine learning and is "the creation of learning algorithms using large amounts of data in a similar way to how the human brain works" (Bickman, 2020).

AI, ML, and DL have successfully discovered complex structures in large amounts and different data dimensions. For this reason, it is used in many sectors today (LeCun et al.,2015). Especially in the health sector, its use is becoming widespread. AI has the potential to make a significant contribution to healthcare by analyzing complex and large health data with its feature of “imitating human cognitive functions”. AI is used to collect and analyze data and provide useful outputs to the end user (Ye et al., 2024). Artificial intelligence is rapidly moving from the experimental stage to the applied stage in many fields, including medicine. The availability of large data sets, increased computing power, and advances in learning algorithms have provided great impetus for the development of AI applications (Tang et al., 2018). AI offers the potential to revolutionize evidence-based, cost-effective, and personalized medical practice (Dilsizian and Siegel, 2014).

AI methods are used in applications such as diagnosis and diagnostic processes, treatment protocol development, patient follow-up and care, individualized treatment strategies, and drug development (Bickman,2020). In a study conducted by Esteva et al. (2017), it was reported that AI performed equivalent to dermatologists in diagnosing dermatologic diseases. AI has been used extensively in fields such as radiology and pathology to speed up diagnostic processes and increase accuracy. The use of AI technologies in healthcare can help reduce diagnostic and treatment errors. Using EHRs and other health data, AI can help make inferences for health outcome prediction and health risk alerts. AI can improve healthcare quality and patient safety (Ye et al., 2024). The impacts of AI techniques on healthcare systems are being applied in medicine to reduce treatment costs, ensure cost-effectiveness, improve service quality, improve patient satisfaction, and reduce readmission and mortality rates (Krittanawong et al., 2017).

In the research conducted by Emikönel, Türkmen and Tekin (2024), it was concluded that artificial intelligence, machine learning and deep learning are used in the field of radiology in subjects such as "disease diagnosis", "detection and classification of cancerous cells", "disease prediction" and "personalized treatment recommendations". In the said research, attention is drawn to the concerns, difficulties and problems caused by artificial intelligence and its components in healthcare services as well as the benefits they provide.

In addition to being used by healthcare professionals in the clinical environment, AI will help manage patients' chronic conditions with smart devices. Beyond the clinical setting in AI, healthcare institutions need to allow data sharing and use to be adopted by healthcare professionals and to gain patients' trust. However, there are still concerns about data privacy, data misuse, unauthorized access, violation of patient privacy, and transparency regarding the use of AI in healthcare (Vayena et al., 2018). Countries have adopted strict protocols regarding the sharing of health data. These

regulations restrict the access of data. The stringent measures taken for the protection and privacy of patient data pose significant challenges in the usability of large data sets (Bhattacharya et al., 2021).

AI systems need to be sensitive in their use in a sector such as healthcare, where vital and life-changing decisions are made. Biased algorithms may cause inequalities in access to healthcare services and treatment processes for some groups. Biases and prejudices in AI algorithms should be prevented from leading to discriminatory and unfair behavior towards certain groups (Mehrabi et al., 2021). In a study conducted by Seyyed-Kalantari et al. (2021), it was determined that biased results can be achieved in the interpretation of chest X-ray images with artificial intelligence. Biased AI algorithms can incorrectly label a person with a disease as healthy, delaying access to care or causing under diagnosis. This raises ethical concerns about the use of AI models in the clinic. With the use of AI systems in healthcare, the need for more transparency in decision-making processes likely creates serious problems regarding accountability and responsibility. In particular, there are uncertainties about who should be held accountable for errors caused by algorithms (Novelli et al., 2023).

This wide-ranging review of AI applications in the healthcare sector reveals the technology's potential benefits and challenges. In this context, our study's methods and materials section will describe in detail the scientific methodology and data collection process on which our research is based.

2. MATERIALS AND METHOD

Research Method

This study used bibliometric analysis, which has become a critical research methodology in recent years (Ellegaard and Wallin, 2015). Bibliometrics is "a field of research that examines publications in the literature using quantitative methods" (Broadus, 1987). Bibliometric methods "identify general trends in terms of publications, citations, authors, keywords, countries, and journals and provide a general framework for the relevant topic" (Martinez-Lopez et al., 2018).

Purpose of the Research

The use and benefits of AI and its components in healthcare services are increasing. In this context, this study aims to conduct a bibliometric analysis of articles focusing on the use of AI in healthcare based on the Web of Science (WOS) Database and to analyze the most cited articles in terms of content. In line with the purpose of the study, 8 research questions were identified.

Research question 1: What is the distribution of articles on the subject according to years?

Research question 2: What is the distribution of relevant articles by country?

Research question 3: Which authors have published the most articles?

Research question 4: Which authors are the most cited on the topic?

Research question 5: Which journals publish the most articles on the topic?

Research question 6: What are the most commonly used keywords in articles on the topic?

Research question 7: Which articles on the topic are the most cited?

Research question 8: What are the research findings of the most cited articles on the topic?

Inclusion and Exclusion Criteria

Research data were obtained from the WOS database. Keywords at the subject and title level, article, publication year, and publication language were used as inclusion criteria. The search criteria are given in Table 1.

Table 1. Research Inclusion and Exclusion Criteria

Search steps	Number
Key Words Topic: "health" Title: "Artificial Intelligence" or "machine learning" or "deep learning" and "diagnosis" or "treatment" or "disease" or "illness" or "sickness" or "health" or "patient monitoring" or "medical care" or "health care"	4.846 Document
Document Types: Article	3.063
Publication Years: 2020-2024	2.701
Publication Languages: English	2.680

On 20.03.2024, 4,846 publications were accessed by using the keywords "health" at the subject level and "Artificial Intelligence" or "machine learning" or "deep learning" and "diagnosis" or "treatment" or "disease" or "illness" or "sickness" or "health" or "patient monitoring" or "medical care" or "health care" at the title level among the publications in the WOS database. Within the inclusion and exclusion criteria framework, 2,680 articles published in English in 2020-2024 were included in the study.

Data Analysis

The data collected from the WOS database, including the year of publication, country, journal, author, and citation numbers of the articles, was subjected to a comprehensive analysis. This analysis, which was carried out using Excel and VOSviewer software,

provided a detailed and accurate understanding of the trends and patterns in the field. Additionally, 61 articles with 50 or more citations were subjected to rigorous content analysis, further enhancing the depth of our findings.

3. RESULTS

Bibliometric Results

As of 20.03.2024, the WOS database contained 2,773 articles on AI in health. The number of articles published on the subject has increased in the last ten years, especially during and after the COVID-19 pandemic. The most articles were published in 2023 (790, 28.49%).

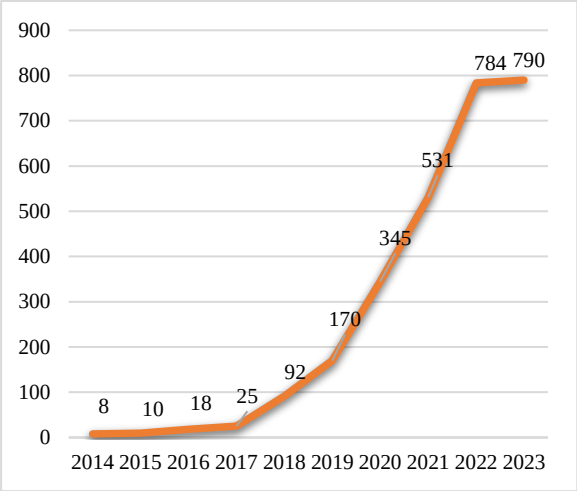

Figure 1. Last 10-Year Distribution of AI Related Articles in Healthcare (2014-2023)

When the published articles are analyzed in terms of countries, 14,195 authors from 106 countries contributed to the field. It was determined that most articles on artificial intelligence in health were written by researchers working in the United States (776), China (617), India (334), the United Kingdom (224), Saudi Arabia (182) and South Korea (158). Turkey ranks 16th with 57 articles (Figure 2 and Figure 3).

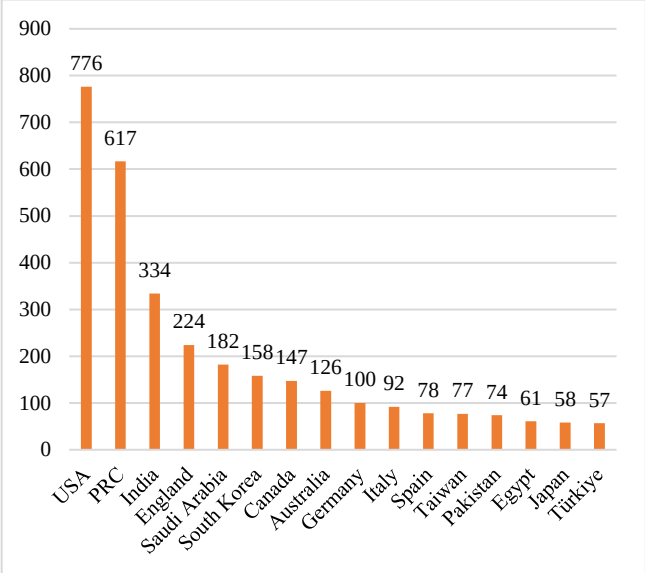

Figure 2. Distribution of Articles on AI in Healthcare by Countries (number of articles≥50)

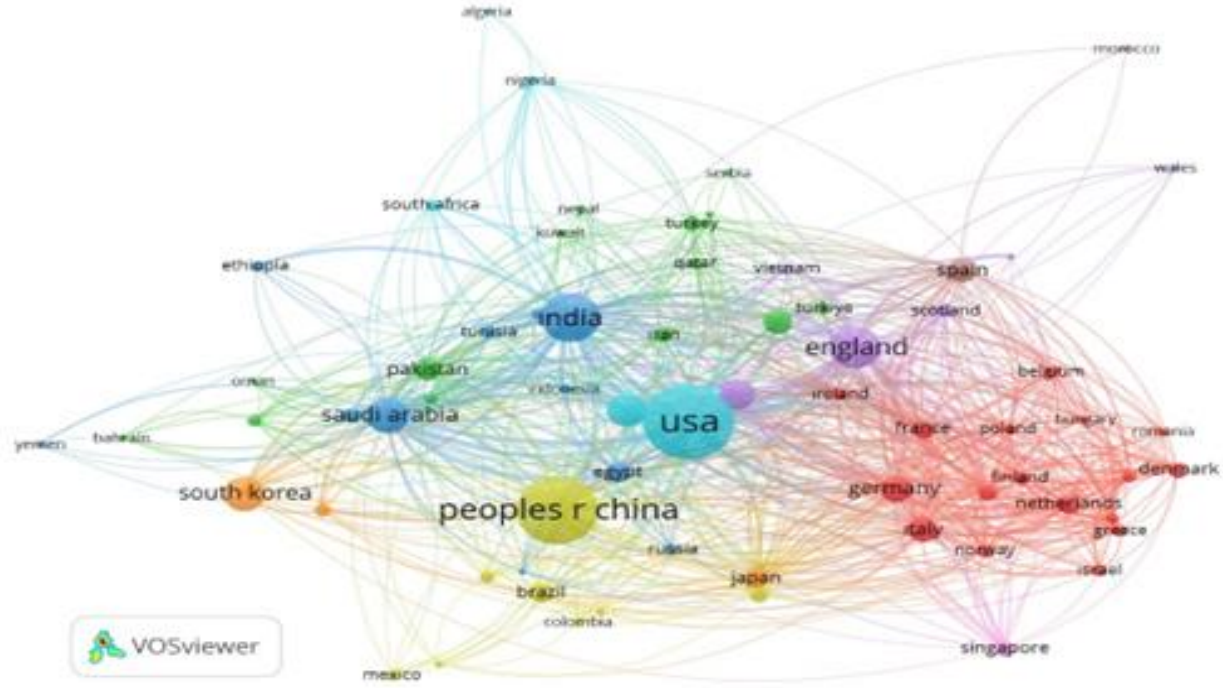

Figure 3. Number of Articles on AI in Health by Country (number of articles≥5)

Articles on the subject were published in 1084 journals. The journals that published the most articles were the Journal of Medical Internet Research (64), IEEE Access (59), Scientific Reports (57), Plos One (50), JMIR Medical Informatics (44) and Sensors (43) (Figure 4).

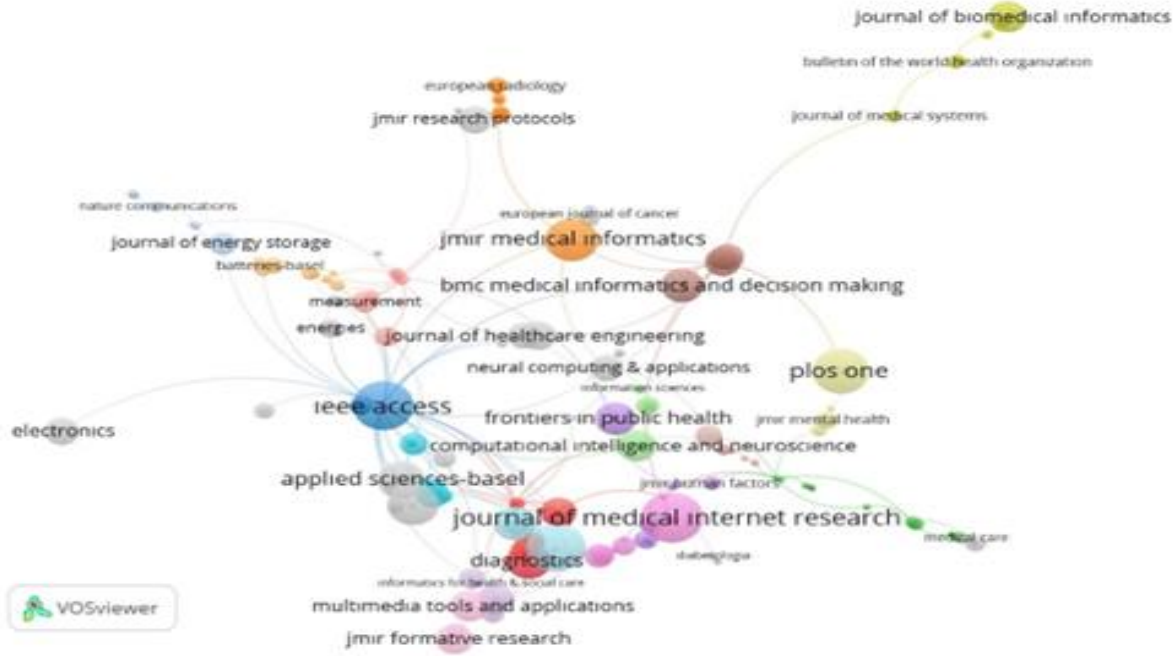

Figure 4. Number of Articles on AI in Healthcare by Journals (number of articles≥5)

Meng Ji (11), Tina Hernandez-Boussard (8), Kwang-sig Lee (8), Fei Wang (8) and Wenxiu Xie (8) wrote the most articles on artificial intelligence in healthcare (Table 2).

Table 2. Authors Who Published the Most Articles on AI in Health (n > 5)

	Auhor	Documents
1	Meng Ji	11
2	Tina Hernandez-Boussard	8
3	Kwang-sig Lee	8
4	Fei Wang	8
5	Wenxiu Xie	8
6	Tianyong Hao	7
7	Jie Xu	7
8	Ki Hoon Ahn	6
9	Chi-yin Chow	6
10	Aixia Guo	6
11	Deepak Gupta	6
12	Jong-myon Kim	6
13	Girish N. Nadkarni	6
14	Wentao Wang	6

Li (404), Shen (389), Li and Zha (382), Zhang (375) and Chen et al. (367) were the most cited authors on AI in healthcare (Table 3).

Table 3. Most Cited Authors on AI in Health (n ≥ 250)

	Author	Documents	Citations
1	W. Li	2	404
2	J. Shen	2	389
3	L. Li and Y. Zha	2	382
4	X. Zhang	2	375
5	Chen et al.	1	367
6	Brunese et al.	1	308
7	S. S. Gill	1	291
8	Arya et al.	1	275
9	Z. Allam and D. S. Jones	2	268
10	Nima et al., (23)	1	258
11	Mohsen et al.	1	257
12	A. Altan and S. Karasu	1	252

In the articles published on AI in health, 6,241 different keywords were used. Notably, the most commonly used keywords were machine learning (936), artificial intelligence (430), and deep learning (419), indicating the prevalence of these topics in the field. Other frequently used keywords included COVID-19 (105) and electronic health records (102) (Figure 5).

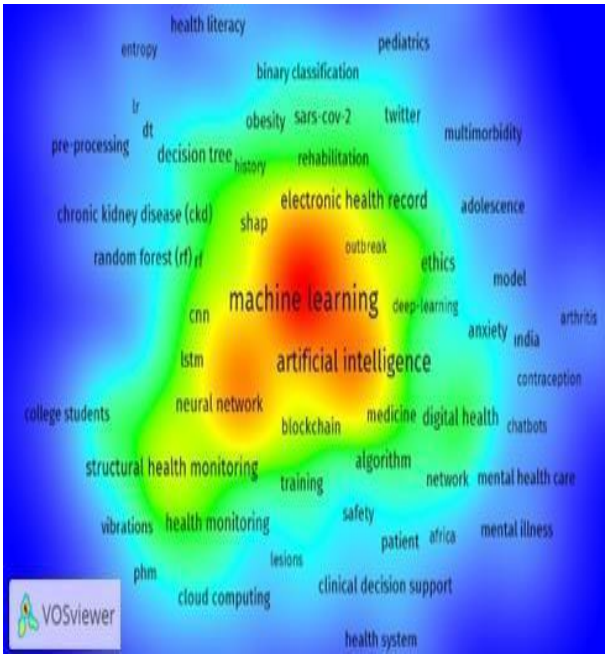

Figure 5. Most Used Keywords Content Analysis Results of the Most Cited Articles on AI in Healthcare

Fifty-five articles with 50 or more citations were analyzed regarding AI type, data used and research findings. The articles examined in terms of content were found to focus on themes related to "diagnosis of COVID-19 disease", "diagnosis of diseases", "detection and classification of cancerous cells", "identification of disease risk factors and disease prediction", "prediction of treatment outcomes", "prediction of disease course", "personalized treatment recommendations", "decision-making processes", "ethical issues, risks and responsibilities".

Using AI in the Diagnosis of COVID-19 Disease

Diagnosing the COVID-19 disease, which started in China and affected the whole world, was among the most critical health issues in 2019 and 2020. During this period, it was shown that COVID-19 disease can be diagnosed with AI using chest X-ray images (Almalki et al., 2021). It has been proven that DL (Altan and Karasu,2020; Brunese et al., 2020; Al-antari, et al., 2021; El et al., 2021; Karar et al., 2021; Dansana et al., 2023) and ML (Elaziz et al., 2020; Mohammed et al., 2020) can be used to diagnose COVID-19 disease from chest X-ray images. COVID-19 disease can be diagnosed by DL from CT images (Song et al., 2021), ML from plasma samples (Delafiori et al., 2020) and symptoms (Zoabi et al., 2021). In the research conducted by Wang et al. (2020), it was determined that the use of DL and ML together from chest X-ray images for the diagnosis of COVID-19 disease yielded more accurate results. Kwekha-Rashid et al. (2021) concluded that ML could be used to evaluate and classify COVID-19 cases.

Using AI to Diagnose Diseases

In addition to diagnosing COVID-19, DL and ML can diagnose different diseases. Lung and respiratory diseases can be diagnosed using DL from chest X-ray images (Brunese et al., 2020; Khan et al., 2020; Al-Ansari et al., 2021; Karar et al., 2021). Lauritsen et al. (2020a) showed that early diagnosis of sepsis from EHRs is possible with DL. Tuli et al. (2020) concluded that heart diseases could be diagnosed from data obtained from medical sensors with DL methods. Srivastava et al. (2021) proved that chronic obstructive pulmonary disease (COPD) can be diagnosed using medical respiratory sound data with DL methods. Kim et al. (2020) showed that DL methods can be used to diagnose mental illnesses from user content on social media. ML can be used to diagnose chronic kidney disease (Gin, 2020) and major depressive disorder (Nemesure et al., 2020) using EHRs. Javed et al. (2021) determined that cognitive disorders (Dementia) can be diagnosed with ML methods using data obtained from the Internet of Things.

Using AI in the Detection and Classification of Cancerous Cells

Research results show that cancerous cells can be detected and classified using DL. It is possible to detect and classify cervical cancer (Khamparia et al., 2020) and skin cancer (Khamparia et al., 2021) with the DL method. In the study conducted by Liu et al. (2020a), it was concluded that the DL method can detect and classify 7 different dental diseases.

Using AI to Identify and Predict Disease Risk Factors

Using EHRs, AI and ML are used to identify risk factors and predict diseases. With ML, it is possible to identify and predict risk factors for cardiovascular diseases (Ghosh et al., 2021), diabetes (Maniruzzaman et al., 2020), suicide risk (Gradus et al., 2020), heart disease (Ahmed et al., 2020), atrial fibrillation (Tiwari et al., 2020), Alzheimer's disease (Park et al., 2020) and acute critical illness (Lauritsen et al., 2021).

Use of AI in Predicting Treatment Outcomes

ML can accurately predict disease treatment outcomes (Bica et al., 2021). It has been used to predict treatment outcomes in psychiatry (Chekroud et al., 2021), oncology (Manz et al., 2020), endovascular (Brugnara et al., 2020), and COVID-19 (Vaid et al., 2021) diseases.

Using AI to Predict the Course of Disease

AI, ML, and DL play a crucial role in predicting the development, progression, spread, and course of diseases. In a study by Liu et al. (2020b), the DL method accurately predicted the future development of brain disease. ML can be used to predict biological and behavioral changes in individuals (Souri et al., 2020), the future incidence of Alzheimer's disease (Park et al., 2020), and the progression of diabetic kidney disease (Chan et al., 2021). Importantly, Allam et al. (2020) demonstrated that the spread of COVID-19 can be accurately predicted using AI, highlighting its potential in disease control.

Using AI in Personalized Treatment Recommendations

ML can be used to make personalized treatment recommendations to patients with depression and anxiety in psychiatry (Chekroud et al., 2021), online therapies (Chien et al., 2020), and generalizing EHRs (Bica et al., 2021).

Use of AI in Decision Making Processes

DL can be used to evaluate the patient's condition using patient data and to help clinicians in their decision-making processes (Chan et al., 2020). Alanazi (2020) showed that ML can provide authorities with comparative scenario recommendations to mitigate the continuous spread of COVID-19 disease successfully. Roma et al. (2020) used ML to predict the likelihood of individuals to comply with COVID-19 protective measures. Zhao et al. (2021) proved that ML can prevent the spread of false health information on social media.

Ethical Considerations, Risks and Responsibilities in the Use of AI in Healthcare Services

In addition to the many benefits of using AI, ML and DL in healthcare, there are concerns about ethical issues, risks and responsibilities. Hernandez-Boussard et al. (2020) state that reporting standards, transparency, validity and reliability should be ensured when reporting medical AI. According to Murdoch (2021), using AI involves privacy and security risks related to health data. Jacobs et al. (2021) point out incorrect ML recommendations can negatively affect clinicians' treatment choices. Fletcher et al. (2021) suggests that three critical criteria (appropriateness, fairness and bias) should be followed when using ML and AI in healthcare. Markus et al. (2021) provide a roadmap for developing trusted AI systems in healthcare. Habli et al. (2020) consider that AI

developers should also be responsible for patient harm caused by clinical AI used for decision-making.

Perceptions and Attitudes Towards the Use of AI in Healthcare Services

The three articles in the content analysis examine perceptions and attitudes towards using AI in healthcare services. According to Vellido (2020), to develop positive attitudes towards the use of AI in healthcare, the proactive involvement of medical professionals in the development and use of ML is necessary. Fan et al. (2020b) investigated the factors affecting healthcare professionals' adoption of an AI-based medical diagnosis support system. As a result, this research found that factors such as "performance expectation, ease of use, behavioral intention, social influence, trust in AI, personal innovativeness, task complexity, technology features, perceived substitution crisis" are influential in adopting AI. On the other hand, Abdullah and Fakieh (2020) concluded in their research that healthcare workers fear that AI technologies will replace employees and that there is a general lack of knowledge about AI.

4. DISCUSSION AND CONCLUSIONS

This study analyzed articles on using AI in healthcare services in the WOS database bibliometrically and content-wise. According to the findings obtained from the bibliometric analysis, it is seen that articles on the use of AI in healthcare services increased during and after the COVID-19 pandemic. In terms of productivity, it was determined that the most articles were published by "USA, China, and India" as countries, "Journal of Medical Internet Research, IEEE Access, Scientific Reports, Plos One" as journals, and "Meng Ji, Tina Hernandez-Boussard, Kwang-sig Lee, Fei Wang and Wenxiu Xie" as authors. When analyzed in terms of the effectiveness of the published articles, it is seen that authors such as "W. Li, J. Shen, L. Li and Y. Zha, X. Zhang, Chen et al. and Brunese et al." received the most citations. The most commonly used keywords in the related articles are "machine learning, artificial intelligence, deep learning, covid-19 and electronic health records". This bibliometric analysis highlights the ever-increasing use and significant impact of AI, ML, and DL in healthcare.

When the articles included in the scope of the research were examined in terms of content, it was found that AI, ML, and DL were used in "diagnosis of COVID-19 disease", "diagnosis of diseases", "detection and classification of cancerous cells", "determination of disease risk factors and disease prediction", "prediction of treatment results", "prediction of disease course", "personalized treatment recommendations", "decision-making processes", "ethical issues, risks, and responsibilities".

With the DL method using chest x-ray images of COVID-19 disease (Brunese et al., 2020; Altan and Karasu, 2020; Dansana et al., 2023; El Asnaoui and Chawki, 2021; Karar et al., 2021; Al-antari, et al., 2021) can be diagnosed. Elaziz et al. (2020) and Mohammed et al. (2020) proved that COVID-19 disease could be diagnosed by ML using chest X-ray images. Apart from COVID-19 disease, lung and respiratory diseases (Brunese et al., 2020; Khan et al., 2020; Al-antari et al., 2021; Karar et al., 2021), sepsis (Lauritsen et al., 2020a), heart diseases (Tuli et al., 2020), COPD (Srivastava et al., 2021), mental illness (Kim et al., 2020), major depressive disorder (Nemesure et al., 2020) and dementia (Javed et al., 2021). Research shows deep learning can detect and classify cancer cells (Khamparia et al., 2020; Khamparia et al., 2021).

ML is not only used to diagnose diseases but also to identify risk factors and predict diseases (Ahmed et al., 2020; Gradus et al., 2020; Maniruzzaman et al., 2020; Park et al., 2020; Tiwari et al., 2020; Ghosh et al., 2021), provide personalized treatment recommendations to patients (Chekroud et al., 2021; Chien et al., 2020; Bica et al., 2021), predicting treatment outcomes of diseases (Brugnaraet al., 2020; Manz et al., 2020; Bica et al., 2021; Chekroud et al., 2021; Vaid et al., 2021) and predicting disease course (Souri et al., 2020; Park et al., 2020; Chan et al., 2021). It is also possible to use DL to predict the future development of the disease (Liu et al., (2020b) and AI to predict the spread of epidemics (Allam et al., 2020). DL has been proposed as an aid to clinical decisions (Chan et al., 2020) and ML as an aid to managerial decisions (Alanazi, 2020; Roma et al., 2020; Zhao et al., 2021). However, in addition to the many benefits of using AI, ML, and DL in health, there are also concerns such as setting reporting standards, ensuring transparency, validity and reliability (Hernandez-Boussard et al., 2020), privacy and security risks related to health data (Murdoch, 2021), the effects of inaccurate, biased and erroneous recommendations of ML (Jacobs et al., (2021). Some studies (Fletcher et al., 2021; Markus et al., 2021; Habli et al., 2020) have tried to develop recommendations to address concerns about the use of AI in healthcare. However, more research is needed in this area.

Although scientific research articles on the use of AI, ML, and DL in healthcare have positive results, clinicians' expectations, attitudes and behaviors are as crucial as the system's success. In particular, healthcare professionals' fears, prejudices and lack of knowledge about AI technologies may cause a decrease in the benefits to be obtained (Abdullah & Fakieh, 2020). Factors such as "performance expectation, ease of use, behavioral intention, social influence, trust in AI, personal innovativeness, task complexity, technology features, perceived substitution crisis" come to the fore in reducing the prejudices of healthcare professionals towards AI-based medical diagnosis support system and adoption (Fan et al., 2020b). In addition, to develop positive attitudes towards the use of AI in healthcare services, medical experts should be proactively

involved in developing and using ML (Vellido, 2020). AI offers excellent potential in the delivery of healthcare services. However, realizing this potential requires careful consideration of ethical issues and positive attitudes and behaviors of healthcare professionals. The findings from this bibliometric and content analysis provide a foundation for future research and policy-making in the field of AI, ML, and DL in healthcare.

Acknowledgments:
No

Conflict of Interest:
The authors declared there is no conflict of interest

Ethical Approval:
The data used in the research are publicly available secondary data and ethics committee approval is not required.

Funding:
There is no funding support.

REFERENCES

Abdullah, R., & Fakieh, B. (2020). HealthCare Employees' Perceptions of the Use of Artificial Intelligence Applications: Survey Study. Journal of medical Internet research, 22(5), e17620. https://doi.org/10.2196/17620

Ahmed, H., Younis, E.M., Hendawi, A.M., & Ali, A.A. (2020). Heart disease identification from patients social posts, machine learning solutions on Spark. Future Gener.Comput. Syst., 111,714-722.

Al-Antari, M. A., Hua, C. H., Bang, J., & Lee, S. (2021). "Fast deep learning computer-aided diagnosis of COVID-19 based on digital chest x-ray images".Applied intelligence (Dordrecht, Netherlands), 51(5),2890-2907. https://doi.org/10.1007/s10489-020-02076-6

Alanazi, S. A., Kamruzzaman, M. M., Alruwaili, M., Alshammari, N., Alqahtani, S. A., & Karime, A. (2020). Measuring and Preventing COVID-19 Using the SIR Model and Machine Learning in Smart Health Care. Journal of Healthcare Engineering, 2020,8857346. https://doi.org/10.1155/2020/8857346

Allam, Z.; Dey, Gourav; Jones, David (2020). Artificial Intelligence (AI) Provided Early Detection of the Coronavirus (COVID-19) in China and Will Influence Future Urban Health Policy Internationally. Deakin University. Journal contribution. https://hdl.handle.net/10779/DRO/DU:20709592.v2

Almalki, Y. E., Qayyum, A., Irfan, M., Haider, N., Glowacz, A., Alshehri, F. M., Alduraibi, S.K., Alshamrani, K., Alkhalik Basha, M. A., Alduraibi, A., Saeed, M. K., & Rahman, S. (2021).A Novel Method for COVID-19 Diagnosis Using Artificial Intelligence in Chest X-ray Images. Healthcare (Basel, Switzerland), 9(5), 522. https://doi.org/10.3390/healthcare9050522

Almalki, Y. E., Qayyum, A., Irfan, M., Haider, N., Glowacz, A., Alshehri, F. M., Alduraibi, S.K., Alshamrani, K., Alkhalik Basha, M. A., Alduraibi, A., Saeed, M. K., & Rahman, S. (2021).A Novel Method for COVID-19 Diagnosis Using Artificial Intelligence in Chest X-ray Images. Healthcare (Basel, Switzerland), 9(5), 522. https://doi.org/10.3390/healthcare9050522

Alsubai, S., Alqahtani, A., Sha, M., Abbas, S., Gregus, M., & Furda, R. (2023). Automated Cognitive Health Assessment Based on Daily Life Functional Activities. Computational intelligence and neuroscience, 2023, 5684914. https://doi.org/10.1155/2023/5684914

Altan, A., & Karasu, S. (2020). Recognition of COVID-19 disease from X-ray images by hybrid model consisting of 2D curvelet transform, chaotic salp swarm algorithm and deep learning technique. Chaos, solitons,and fractals, 140, 110071. https://doi.org/10.1016/j.chaos.2020.110071

Bhattacharya, S., Maddikunta, P. K., Pham, Q.-V., Gadekallu, T. R., Krishnan, S. S., Chowdhary, C. L., . . . Piran, M. J. (2021). Deep learning and medical image processing for coronavirus (COVID-19) pandemic: A survey. Sustainable Cities and Society, 65, 102589. https://doi.org/10.1016/j.scs.2020.102589

Bica, I., Alaa, A. M., Lambert, C., & van der Schaar, M. (2021). From Real-World PatientData to Individualized Treatment Effects Using Machine Learning: Current and Future Methods to Address Underlying Challenges. Clinical pharmacology and therapeutics, 109(1), 87-100. https://doi.org/10.1002/cpt.1907

Bickman, L. (2020). Improving Mental Health Services: A 50-Year Journey from Randomized Experiments to Artificial Intelligence and Precision MentalHealth. Administration and Policy in Mental Health and Mental Health Services Research, 47(5), 795–843. https://doi.org/10.1007/s10488-020-01065-8

Broadus, R. N. (1987). Toward A Definition of "Bibliometrics". Scientometrics, 12(5-6), pp. 373–379.

Brugnara, G., Neuberger, U., Mahmutoglu, M. A., Foltyn,M., Herweh, C., Nagel, S., Schönenberger, S., Heiland, S., Ulfert, C., Ringleb, P. A., Bendszus, M., Möhlenbruch,

M. A., Pfaff, J. A. R., & Vollmuth, P. (2020). Multimodal Predictive Modeling of Endovascular Treatment Outcome for Acute Ischemic StrokeUsing Machine-Learning. Stroke, 51(12), 3541-3551. https://doi.org/10.1161/STROKEAHA.120.030287

Brunese, L., Mercaldo, F., Reginelli, A., & Santone,A. (2020). Explainable Deep Learning for Pulmonary Disease and Coronavirus COVID-19 Detection from X-rays. Computer methods and programs in biomedicine, 196, 105608. https://doi.org/10.1016/j.cmpb.2020.105608

Chan, H. P., Hadjiiski, L. M., & Samala, R. K. (2020). Computer-aided diagnosis in the era of deep learning. Medical physics, 47(5), e218-e227. https://doi.org/10.1002/mp.13764

Chan, L., Nadkarni, G. N., Fleming, F., McCullough, J. R., Connolly, P., Mosoyan, G., El Salem, F., Kattan, M. W., Vassalotti, J. A., Murphy, B., Donovan, M. J., Coca, S. G., & Damrauer, S. M. (2021). Derivation and validation of a learning risk score using biomarker and electronic patientdata to predict progression of diabetic kidneydisease. Diabetologia, 64(7),1504-1515. https://doi.org/10.1007/s00125-021-05444-0

Chekroud, A. M., Bondar, J., Delgadillo, J., Doherty, G., Wasil, A., Fokkema, M., Cohen, Z., Belgrave, D., DeRubeis, R., Iniesta, R., Dwyer, D., & Choi, K. (2021). The promise of machine learning in predicting treatment outcomes in psychiatry. World Psychiatry: Official Journal of the World Psychiatric Association (WPA), 20(2), 154-170. https://doi.org/10.1002/wps.20882

Chien, I., Enrique, A., Palacios, J., Regan, T., Keegan, D., Carter, D., Tschiatschek, S., Nori, A., Thieme, A., Richards, D., Doherty, G., & Belgrave,D. (2020). A Machine Learning Approach to Understanding Patterns of Engagement With Internet-Delivered Mental Health Interventions. JAMA Network open,3(7), e2010791. https://doi.org/10.1001/jamanetworkopen.2020.10791

Dansana, D., Kumar, R., Bhattacharjee, A., Hemanth, D. J., Gupta, D., Khanna, A., & Castillo,

O. (2023). Early diagnosis of COVID-19-affected patients based on X-ray and computed tomography images using a deep learning algorithm. Soft computing, 27(5),2635-2643. https://doi.org/10.1007/s00500-020-05275-y

Delafiori, J., Navarro, L. C., Siciliano, R. F., de Melo, G. C., Busanello, E. N. B., Nicolau, J.C., Sales, ... Catharino, R. R. (2021). Covid-19 Automated Diagnosis and Risk Assessment through Metabolomics and machine learning. Analytical chemistry, 93(4), 2471–2479. https://doi.org/10.1021/acs.analchem.0c04497

Dilsizian, S. E., & Siegel, E. L. (2014). Artificial intelligence in medicine and cardiac ımaging: harnessing big data and advanced computing to provide personalized medical diagnosis and treatment. Current Cardiology Reports, 16(1), 1-8. https://doi.org/10.1007/s11886-013-0441-8

El Asnaoui, K., & Chawki, Y. (2021). Using X-ray images and deep learning for automated detection of coronavirus disease.Journal of biomolecular structure& dynamics, 39(10), 3615-3626. https://doi.org/10.1080/07391102.2020.1767212

Elaziz, M. A., Hosny, K. M., Salah, A., Darwish, M. M., Lu, S., & Sahlol, A. T. (2020). New machine learning method for image-based diagnosis of COVID-19. PloS one, 15(6), e0235187. https://doi.org/10.1371/journal.pone.0235187

Ellegaard, O., & Wallin, J. A. (2015). The Bibliometric Analysis of Scholarly Production: How Great is the Impact?Scientometrics, 105(3), 1809-1831. https://doi.org/10.1007/s11192-015-1645-z

Emikönel, S., Türkmen, İ., & Tekin, E. (2024). Use of Artificial Intelligence in Radiology: Review of the Last 10 Years (2014-2023). 6. International Mediterranean Scientific Research Congress Full Texts Book, Volume-2 (s. 141-157). Rome, Italy: IKSAD Publishing.

Esteva, A., Kuprel, B., Novoa, R. A., Ko, J., Swetter, S. M., Blau, H. M., & Thrun, S. (2017). Dermatologist-level Classification of Skin Cancer with Deep NeuralNetworks. Nature, 542, 115-118. https://doi.org/10.1038/nature21056

Fan, W., Liu, J., Zhu, S. et al. Investigating the impacting factors for healthcare professionals to adopt an artificial intelligence-based medical diagnosis support system (AIMDSS). Ann Oper Res 294, 567-592 (2020). https://doi.org/10.1007/s10479-018- 2818-y

Fletcher, R. R., Nakashima, A., & Olubeko, O. (2021). Addressing Fairness, Bias, and Appropriate Use of Artificial Intelligence and Machine Learning in Global Health. Frontiers in artificial intelligence, p. 3, 561802. https://doi.org/10.3389/frai.2020.561802

Ghosh, P., Azam, S., Jonkman, M., Karim, A., Shamrat, F.J., Ignatious, E., Shultana, S., Beeravolu, A.R., & De Boer, F. (2021). Efficient Prediction of Cardiovascular Disease Using Machine Learning Algorithms With Relief and LASSO Feature Selection Techniques. IEEE Access, p. 9, 19304–19326.

Gradus, J. L., Rosellini, A. J., Horváth-Puhó, E., Street, A. E., Galatzer-Levy, I., Jiang, T., Lash, T. L., & Sørensen, H. T. (2020). Prediction of Sex-Specific Suicide Risk Using Machine Learning and Single-Payer Health Care Registry Data From Denmark.JAMA psychiatry, 77(1),25-34. https://doi.org/10.1001/jamapsychiatry.2019.2905

Habli, I., Lawton, T., & Porter, Z. (2020). Artificial intelligence in health care: accountability and safety. Bulletin of the World Health Organization, 98(4), 251-256. https://doi.org/10.2471/BLT.19.237487

Hernandez-Boussard, T., Bozkurt, S., Ioannidis, J. P. A., & Shah, N. H. (2020). MINIMAR (MINimum Information for Medical AI Reporting): Developing reporting standards forartificial intelligence in health care.Journal of the American Medical Informatics Association: JAMIA, 27(12), 2011-2015. https://doi.org/10.1093/jamia/ocaa088

Jacobs, M., Pradier, M. F., McCoy, T. H., Jr, Perlis, R. H., Doshi-Velez, F., & Gajos, K. Z. (2021). How machine-learning recommendations influence clinician treatment selections: the example of the antidepressant selection. Translational psychiatry, 11(1), 108. https://doi.org/10.1038/s41398-021-01224-x

Jamshidi, M. B., Lalbakhsh, A., Talla, J., Peroutka, Z., Hadjilooei, F., Lalbakhsh, P., Jamshidi, M., Spada, L., Mirmozafari, M., Dehghani, M., Sabet, A., Roshani, S., Roshani, S., Bayat-Makou, N., Mohamadzade, B., Malek, Z., Jamshidi, A., Kiani, S., Hashemi- Dezaki, H., & Mohyuddin, W. (2020). Artificial Intelligence and COVID-19: Deep Learning Approaches for Diagnosis and Treatment. IEEE Access: practical innovations, open solutions, 8, 109581–109595. https://doi.org/10.1109/ACCESS.2020.3001973

Kaplan, A., & Haenlein, M. (2019). Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence. Business Horizons,62(1), 15-25. https://doi.org/10.1016/j.bushor.2018.08.004

Karar, M. E., Hemdan, E. E., & Shouman, M. A. (2021). Cascaded deep learning classifiers for computer-aided diagnosis of COVID-19 and pneumonia diseases in X-ray scans. Complex & intelligent systems, 7(1), 235-247. https://doi.org/10.1007/s40747-020- 00199-4

Khamparia A, Singh PK, Rani P, Samanta D, Khanna A, Bhushan B. An Internet of Health things-driven deep learning framework for detecting and classifying skin cancer using transfer learning.Trans Emerging Tel Tech.2021; 32:e3963. https://doi.org/10.1002/ett.3963

Khamparia, A., Gupta, D., de Albuquerque, V.H.C. et al. Internet of Health things-driven deep learning system for detection and classification of cervical cells using transfer learning. J Supercomput 76,8590-8608 (2020). https://doi.org/10.1007/s11227-020-03159-4

Khan, F.A., Majidulla, A., Tavaziva, G., Nazish, A., Abidi, S.K., Benedetti, A., Menzies, D., Johnston, J.C., Khan, A.J., & Saeed, S. (2020). Chest X-ray analysis with deep learning-

Based software as a triage test for pulmonary tuberculosis: a prospective study of diagnostic accuracy for culture-confirmed disease. The Lancet. Digital health, 2 11, e573-e581.

Kim, J., Lee, J., Park, E., & Han, J. (2020). A deep learning model for detecting mental illness from user content on social media. Scientific reports, 10(1),11846. https://doi.org/10.1038/s41598-020-68764-y

Krittanawong, C., Zhang, H., Wang, Z., Aydar, M., & Kitai, T. (2017). Artificial Intelligence in Precision Cardiovascular Medicine. Journal of the American College of Cardiology, 69(21), 2657–2664. https://doi.org/10.1016/j.jacc.2017.03.571

Kwekha-Rashid, A. S., Abduljabbar, H. N., & Alhayani, B. (2023). Coronavirus disease (COVID-19) cases analysis using machine-learning applications. Applied nanoscience, 13(3),2013-2025. https://doi.org/10.1007/s13204-021-01868-7

Lauritsen, S. M., Kalør, M. E., Kongsgaard, E. L., Lauritsen, K. M., Jørgensen, M. J., Lange, J., & Thiesson,B. (2020). Early

detection of sepsis utilizing deep learning on electronic health record event sequences. Artificial intelligence in medicine, 104, 101820. https://doi.org/10.1016/j.artmed.2020.101820

Lauritsen, S. M., Kristensen, M., Olsen, M. V., Larsen, M. S., Lauritsen, K. M., Jørgensen, M.J., Lange, J., & Thiesson, B. (2020). Explainable artificial intelligence model to predict acute critical illness from electronic health records. Nature communications, 11(1), 3852. https://doi.org/10.1038/s41467-020-17431-x

LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep Learning. Nature, 521(7553), 436–444. https://doi.org/10.1038/nature14539

Liu, L., Xu, J., Huan, Y., Zou, Z., Yeh, S. C., & Zheng, L. R. (2020). A Smart Dental Health- IoT Platform Based on Intelligent Hardware, Deep Learning, and Mobile Terminal. IEEE Journal of Biomedical and Health Informatics, 24(3), 898-906. https://doi.org/10.1109/JBHI.2019.2919916

Liu, M., Zhang, J., Lian, C., & Shen, D. (2020). Weakly Supervised Deep Learning for Brain Disease Prognosis Using MRI and Incomplete Clinical Scores. IEEE transactions on cybernetics, 50(7), 3381–3392. https://doi.org/10.1109/TCYB.2019.2904186

Maniruzzaman, M., Rahman,M. J., Ahammed, B., & Abedin, M. M. (2020).Classification and prediction of diabetes disease using machine learning paradigm. Health information science and systems, 8(1), 7. https://doi.org/10.1007/s13755-019-0095-z

Manz CR, Parikh RB, Small DS, et al. Effect of Integrating Machine Learning Mortality Estimates With Behavioral Nudges to Clinicians on Serious Illness Conversations Among Patients With Cancer: A Stepped-Wedge Cluster Randomized Clinical Trial. JAMA Oncol. 2020;6(12):e204759. https://doi.org/10.1001/jamaoncol.2020.4759

Markus, A.F., Kors, J.A., & Rijnbeek, P.R. (2020). The role of explainability in creating trustworthy artificial intelligence for health care: a comprehensive survey of the terminology, design choices, and evaluation strategies. Journal of biomedical informatics, 103655.

Martínez-Lopez, F. J., Merigo, J. M., Valenzuela-Fernández, L., & Nicolás,C. (2018). Fifty years of the European Journal of Marketing: A Bibliometric Analysis.European Journal of Marketing, 52(1/2), 439-468. https://doi.org/10.1108/EJM-11-2017-0853

McDermott, M. B. A., Wang, S., Marinsek, N., Ranganath, R., Foschini, L., & Ghassemi, M. (2021). Reproducibility in machine learning for health research: Still a ways to go. Science translational medicine, 13(586), eabb1655. https://doi.org/10.1126/scitranslmed.abb1655

Mehrabi, N., Morstatter, F., Saxena, N., Lerman, K., & Galstyan, A. (2021). A Survey on Biasand Fairness in Machine Learning.ACM Computing Surveys, 54(6), 1-35. https://doi.org/10.1145/3457607

Mohammed, M.A., Abdulkareem, K.H., Garcia-Zapirain, B., Mostafa, S.A., Maashi, M.S., Al-Waisy, A.S., Subhi, M.A., Mutlag, A.A., & Le, D. (2021). A Comprehensive Investigation of Machine Learning Feature Extraction and Classification Methods for Automated Diagnosis of COVID-19 Based on X-Ray Images. Computers, Materials & Continua.

Mori, Y., Kudo, S. E., East, J. E., Rastogi, A., Bretthauer, M., Misawa, M., Sekiguchi, M., Matsuda, T., Saito, Y., Ikematsu, H., Hotta, K., Ohtsuka, K., Kudo, T., & Mori, K. (2020). Cost savings in colonoscopy with artificial intelligence-aided polyp diagnosis: an add-on analysis of a clinical trial (with video). Gastrointestinal Endoscopy, 92(4),905-911.e1. https://doi.org/10.1016/j.gie.2020.03.3759

Murdoch B. (2021). Privacy and artificial intelligence: challenges for protecting health information in a new era. BMC medicalethics, 22(1),122. https://doi.org/10.1186/s12910-021-00687-3

Nemesure, M. D., Heinz, M. V., Huang, R., & Jacobson, N. C. (2021). Predictive modelling of depression and anxiety using electronic health records and a novel machine learning approach with artificial intelligence. Scientific reports, 11(1), 1980. https://doi.org/10.1038/s41598-021-81368-4

Novelli, C., Taddeo, M., & Floridi , L. (2023). Accountability in Artificial Intelligence: What it is and how it works. AI & Society, 1-12. https://doi.org/10.1007/s00146-023- 01635-y

Park, J. H., Cho, H. E., Kim, J. H., Wall, M. M., Stern, Y., Lim, H., Yoo, S., Kim, H. S., & Cha, J. (2020). Machine learning prediction of incidence of Alzheimer's disease using large-scale administrative health data. NPJ digitalmedicine, 3, 46. https://doi.org/10.1038/s41746-020-0256-0

Qin, J., Chen, L., Liu, Y., Liu, C., Feng, C., & Chen, B. (2023). A Machine Learning Methodology for Diagnosing ChronicKidney Disease. IEEE Access,8, 20991-21002.

Rankin, D., Black, M., Bond, R., Wallace, J., Mulvenna, M., & Epelde, G. (2020). Reliability of Supervised Machine Learning Using Synthetic Data in Health Care: Model to Preserve Privacy for Data Sharing. JMIR medicalinformatics, 8(7), e18910. https://doi.org/10.2196/18910

Roma, P., Monaro, M., Muzi, L., Colasanti, M., Ricci, E., Biondi, S., Napoli, C., Ferracuti, S., &Mazza, C. (2020). How to Improve Compliance with Protective Health Measures During the COVID-19 Outbreak: Testing a Moderated Mediation Model and Machine Learning Algorithms. International Journal of environmental research and public health, 17(19),7252. https://doi.org/10.3390/ijerph17197252

Seyyed-Kalantari, L., Zhang, H., McDermott, M. B., Chen, I. Y., & Ghassemi, M. (2021). Underdiagnosis bias of artificial intelligence algorithms applied to chest radiographs in under-served patient populations. Nature Medicine, 27(12), 2176- 2182. https://doi.org/10.1038/s41591-021-01595-0

Song, Y., Zheng, S., Li, L., Zhang, X., Zhang, X., Huang, Z., Chen, J., Wang, R., Zhao, H., Chong, Y., Shen, J., Zha, Y., & Yang, Y. (2021). Deep Learning Enables Accurate Diagnosis of Novel Coronavirus (COVID-19) With CT Images. IEEE/ACM transactions on computational biology and bioinformatics, 18(6), 2775–2780. https://doi.org/10.1109/TCBB.2021.3065361

Souri, A., Ghafour,M.Y., Ahmed, A.M., Safara, F., Yamini, A., & Hoseyninezhad, M. (2020). A new machine learning-based healthcare monitoring model for student's condition diagnosis in Internet of Things environment. Soft Computing, 24, 17111 - 17121.

Srivastava, A., Jain, S., Miranda,R., Patil, S., Pandya, S., & Kotecha,K. (2021). Deep learning-based respiratory sound analysis for detection of chronic obstructive pulmonary disease.PeerJ. Computer science, 7, e369. https://doi.org/10.7717/peerj-cs.369

Tang, A., Tam, R., Cadrin-Chenevert, A., Guest, W., Chong, J., Barfett, J., . . . Cicero, M. D. (2018). Canadian Association of Radiologists white paper on artificial intelligence in radiology. Canadian Association of Radiologists Journal, 69(2), 120-135. https://doi.org/10.1016/j.carj.2018.02.002.

Tekin, E., & Emiköne l, S. (2023). Comparison of Mobile Health Application Examples in Turkey and the World. In U. Akküçük, Handbook of Research on Quality and Competitiveness in the Healthcare Services Sector (pp.223-236). IGI Global. https://doi.org/10.4018/978-1-6684-8103-5.ch013

Tiwari, P., Colborn, K. L., Smith, D. E., Xing, F., Ghosh, D., & Rosenberg, M. A. (2020). Assessment of a Machine Learning Model Applied to Harmonized Electronic Health Record Data for the Prediction of Incident Atrial Fibrillation. JAMA networkopen, 3(1), e1919396. https://doi.org/10.1001/jamanetworkopen.2019.19396

Tuli, S., Basumatary, N., Gill, S. S., Kahani, M., Arya, R. C., Wander, G. S., & Buyya, R. (2020). HealthFog: An ensemble deep learning-based Smart Healthcare System for Automatic Diagnosis of Heart Diseases in Integrated IoT and Fog Computing Environments. Future Generation ComputerSystems, 104, 187-200. https://doi.org/10.1016/J.FUTURE.2019.10.043

Türkmen, İ., & Özkara, B. (2001). Evaluation of Hospital Information Management System with Information Systems Success Model. Journal of Information Technologies, 14(4), 403-410. https://doi.org/10.17671/gazibtd.830213

Vaid, A., Jaladanki,S. K., Xu, J., Teng, S., Kumar, A., Lee, S., Somani, S., Paranjpe,I., De Freitas, J. K., Wanyan, T., Johnson, K. W, Bicak, M., Klang, E., Kwon, Y. J., Costa, A., Zhao, S., Miotto, R., Charney, A. W., Böttinger, E., Fayad, Z. A., ... Glicksberg, B. S. (2021). FederatedLearning of Electronic Health Records to Improve MortalityPrediction in Hospitalized Patients with COVID-19: Machine Learning Approach. JMIR medical informatics, 9(1), e24207. https://doi.org/10.2196/24207

Vayena, E., Blasimme, A., & Cohen, I. G. (2018). Machine Learning in Medicine: Addressing Ethical Challenges. Plos Medicine,15(11), e1002689. https://doi.org/10.1371/journal.pmed.1002689

Vellido, A. Interpretability and visualization are important in machine learning for applications in medicine and health care. Neural Comput & Applic 32, 18069–18083 (2020). https://doi.org/10.1007/s00521-019-04051-w

Wang, D., Mo, J., Zhou, G., Xu, L., & Liu, Y. (2020). An efficient mixture of deep and machine learning models for COVID-19 diagnosis in chest X-ray images. PloS one, 15(11), e0242535. https://doi.org/10.1371/journal.pone.0242535

Wang, D., Mo, J., Zhou, G., Xu, L., & Liu, Y. (2020). An efficient mixture of deep and machine learning models for COVID-19 diagnosis in chest X-ray images. PloS one, 15(11), e0242535. https://doi.org/10.1371/journal.pone.0242535

Wang, W., & Siau, K. (2019). Artificial Intelligence, Machine Learning, Automation, Robotics, Future of Work and Future of Humanity. Journal of Database Management, 30(1), 61-79. https://doi.org/10.4018/jdm.2019010104

Xie, C., Zhuang, X. X., Niu, Z., Ai, R., Lautrup, S., Zheng, S., Jiang, Y., Han, R., Gupta, T. S., Cao, S., Lagartos-Donate, M. J., Cai, C. Z., Xie, L. M., Caponio,D., Wang, W. W., Schmauck-Medina, T., Zhang,J., Wang, H. L., Lou, G., Xiao,X., ... Fang, E. F. (2022). Amelioration of Alzheimer's disease pathology by mitophagy inducers identified via machine learning and a cross-species workflow. Nature Biomedical Engineering,6(1), 76-93. https://doi.org/10.1038/s41551-021-00819-5

Ye, J., Woods, D., Jordan, N., & Starren, J. (2024). The Role of Artificial Intelligence for the Application of Integrating Electronic Health Records and Patient-Generated Data in Clinical Decision Support. AMIA Jointt Summits Translational Science Proceedings, pp. 459–467.

Zhao, Y., Da, J., & Yan, J. (2021). Detecting health misinformation in online health communities: Incorporating behavioural features into machine learning-based approaches. Inf. Process.Manag., p. 58, 102390.

Zoabi, Y., Deri-Rozov, S., & Shomron, N. (2021). Machine learning-based prediction of COVID-19 diagnosis based on symptoms.NPJ digital medicine, 4(1), 3. https://doi.org/10.1038/s41746-020-00372-6