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A BIBLIOMETRIC ANALYSIS OF RESEARCH ON ARTIFICIAL INTELLIGENCE IN VETERINARY MEDICINE

Hakan SERİN1*, Muslu Kazım KÖREZ2

[1] *Selcuk University, Faculty of Veterinary, Department of Biostatistics, 42150, Konya, Türkiye*
[2] *Selcuk University, Faculty of Medicine, Department of Biostatistics, 42150, Konya, Türkiye*

Abstract: The use of artificial intelligence in veterinary sciences has placed studies on this subject in a significant position in the literature. The increasing number of studies using artificial intelligence algorithms in the current literature shows that knowledge discovery in this field is increasing rapidly. This study aims to provide a general map of the literature on the utilization of artificial intelligence in veterinary medicine science and identify its application areas using bibliometric analysis. Web of Science database was used to reveal the current literature about artificial intelligence in veterinary medicine. The data were analyzed using the "Bibliometrix" package in the R statistical programming language and the VOSviewer program. Various research elements, including journals, article-citation counts, authors, institutes, and countries, were examined using bibliometric metrics. The number of studies on artificial intelligence in veterinary medicine from increased dramatically since 2019. According to the findings, the most influential countries identified were the USA, China, and Türkiye. Animals and Preventive Veterinary Medicine were determined as the most influential journals in the field. The findings indicated that artificial intelligence in veterinary medicine is a trending topic. The topics "deep learning", "active learning", and "computer-aided diagnosis" were estimated to be increasingly utilized soon. Rapid developments in artificial intelligence will likely attract more researchers to the field. This article, the first bibliometric study about the utilization of artificial intelligence in animal sciences, will offer researchers valuable information about the intellectual structure of the field.

Keywords: Artificial intelligence, Bibliometric analysis, Classification problem, Machine learning, Veterinary sciences

***Corresponding author:** Selcuk University, Faculty of Veterinary, Department of Biostatistics, 42150, Konya, Türkiye
E mail: hakan.461995@gmail.com (H. SERİN)
Hakan SERİN https://orcid.org/0000-0002-1290-4547
Muslu Kazım KÖREZ https://orcid.org/0000-0001-9524-6115

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1. Introduction

Artificial intelligence, driven by highly advanced computer systems and technology, is extensively employed across various areas and continues to evolve rapidly. Due to technological advancements, it is estimated that numerous professions can be performed through artificial intelligence shortly. Artificial intelligence is defined as software capable of executing high cognitive functions, including perception, learning, thinking, reasoning, problem-solving, communication, inference, and decision-making (Russell, 2010). The term artificial intelligence was first introduced by John McCarthy in 1956. However, despite theoretical studies on this subject, practical application only became feasible in the 2000s with the advancement of computer and software technologies (Kaul et al., 2020). Today, artificial intelligence has become a common method frequently utilized in medical and veterinary sciences. For example, in the field of veterinary medicine, the utilization of artificial intelligence for the development of diagnostic and treatment methods in animal health is becoming increasingly widespread. However, due to the recent increase in the utilization of artificial intelligence, there is only a limited number of studies in the literature (Appleby and Basran, 2022). Bibliometrics is an analytical approach aimed at reviewing, evaluating, and uncovering scientific interactions within a specific field of literature. Bibliometric analysis can be utilized for any research field to gain a general insight into the field before conducting a comprehensive study. Accordingly, popular topics in a field can be identified and potential emerging topics can be predicted (Yu et al., 2020). Bibliometrics examines the interaction between certain research elements (institutes, authors, journals, keywords, etc.) to evaluate bibliometric indicators such as h-index, g-index, m-index, citation count, and publication count (Wang et al., 2020). Thanks to recent academic journals, conferences, and other publication opportunities, the annual influx of academic materials, including articles, theses, dissertations, reports, case studies, etc., into the literature has reached millions, and this number continues to increase exponentially. This situation necessitates researchers to invest considerable time and effort in accessing the existing literature related to research on any topic. However, bibliometric analysis offers significant advantages in swiftly and easily obtaining the required information from a vast amount of

knowledge (Fırat et al., 2018).

A literature review revealed that bibliometric analysis in the veterinary field particularly focused on multidisciplinary studies as well as animal welfare and diseases. Cui et al. (2023) conducted a bibliometric analysis of the literature on farm animal welfare in China. They reported that most China-centered studies mostly focused on pig and chicken species, but the collaboration index between institutes and authors was low. Chen et al. (2022) conducted a bibliometric analysis of the publications from Veterinary Communication Education Research from 1 January 2000 to 31 December 2021 on Web of Science. They found that the highest number of publications in this field was from Guelph University and the Journal of Veterinary Medical Education. Furthermore, Yardibi et al. (2021) employed a bibliometric analysis to identify trending topics in animal science over the last five years (2015 – 2019). They identified "Genomic prediction" as the most trending topic, whereas, "Growth performance" and "Staphylococcus aureus" were identified as potential popular topics in the future. The current study aims to provide a general map of the literature on the utilization of artificial intelligence in veterinary medicine and to identify the most common application areas of artificial intelligence through bibliometric analysis. To the best of our knowledge, no study has yet conducted a bibliometric analysis on artificial intelligence studies in veterinary medicine. In this regard, this paper presents the first bibliometric analysis of articles about the use of artificial intelligence methods in veterinary sciences. The most influential journals, authors, countries, and popular topics were identified. The findings are believed to provide useful information for the researchers about the intellectual structure of the field and current research topics.

2. Materials and Methods

2.1. Research Methods

The studies incorporating artificial intelligence in the veterinary medicine field were examined using bibliometric analysis. Bibliometric analysis typically includes 2 stages, namely, performance analysis and mapping techniques. Performance analysis provides statistical metrics, whereas, mapping techniques allow visual examination of the interactions between research elements (Donthu et al., 2021). Certain indicators such as h-index, g-index, m-index, citation count, publication count, Journal Impact Factor (JIF), and JIF Quartile were used in the performance analysis. Addition-ally, Lotka's and Bradford's Laws were employed as bibliometric laws. The h-index is a performance index introduced by Jorge E. Hirsch that takes into account the number of studies and citations. Today, the h-index is one of the most prominent impact measures. However, it faces criticism for being influenced by time and having lower value for researchers with high citation and article counts (Bornmann and Daniel, 2007). As a result of the criticisms received by the h-index, the g-index was introduced by Leo Egghe. The g-index prioritizes publications with a high citation count, whereas the h-index does not (Egghe, 2006). The h-index may not be an effective measure for young researchers, as they may not have had sufficient time to receive citations. To address this issue, the m-index, calculated by dividing the h-index by the active years of the researcher, has been introduced (Harzing, 2012). Bradford's law, one of bibliometric laws, is used to determine a small group of journals covering an important section (one-third) of the literature on a given topic (Garfield, 1980). Lotka's law, on the other hand, determines the distribution of the contributions of authors to a particular field and measures scientific productivity. According to Lotka's law, 60% of the authors are expected to contribute to the field with one article, 15% with two articles, and 7% with three articles (Sudhier, 2013).

2.2. Data Sources and Statistical Analysis

To discover the current literature about artificial intelligence in the veterinary medicine field, Clarivate Analytics' database Web of Science (WoS) was employed. WoS and Elsevier's Scopus are the biggest databases. Both databases cover studies in compliance with publication ethics (Merigó and Yang, 2017). A search for artificial intelligence in the veterinary medicine field in these databases resulted in 212 and 467 results with filtering in Scopus and WoS, respectively. Accordingly, WoS was preferred since it allows for reaching a wider literature. The data query was performed on 10 November 2023. A search in WoS for the keywords "veterinary" OR "veterinary sciences" OR "animal sciences" AND "machine learning" OR "deep learning" OR "artificial intelligence" OR "data mining" resulted in 601 studies. After filtering by document type (research article) and language (English), a total of 467 open access and non-open access studies were listed. A review of these 467 articles revealed that 70 articles were included in the search results due to word similarity and did not incorporate artificial intelligence and the veterinary medicine field. Consequently, the bibliographic dataset included a total of 397 research articles that fulfilled the required criteria (Figure 1). For bibliometrics analysis, the "Bibliometrix" package in R programming language and VOSviewer with Biblioshiny interface were employed (Aria and Cuccurullo, 2017; Van Eck and Waltman, 2017). The performance analyses of academicians, journals, institutes, and countries were conducted through the package Bibliometrix. On the other hand, co-citation analyses, bibliographic matching, a network map of institutes, and keyword network analyses were performed using VOSviewer.

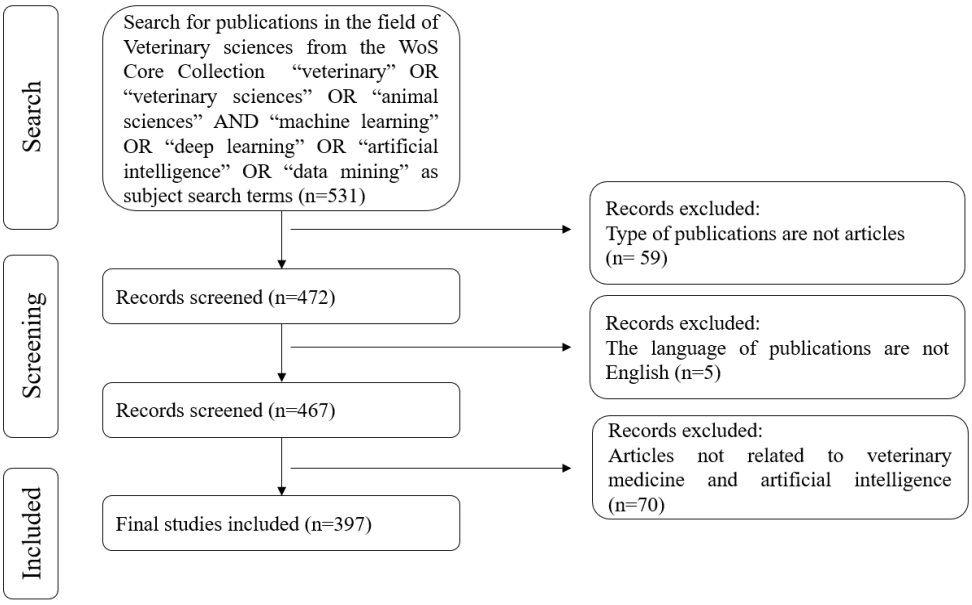

Figure 1. The publications selection process for this bibliometric analysis study.

3. Results

3.1. General Publication Trends

An overall examination of the bibliometric data showed that articles from 65 different journals in the period 1995 - 2023 were included in the analysis. Over this 28-year period, a total of 397 articles meeting the search criteria were published. The total number of researchers was 1758 with 9 single-authored articles. The citation count per article was 6.25 with a total citation count of 13958. The bibliographic data included 1127 keywords plus and 1437 author keywords. According to the analysis of author collaboration statistics, the number of articles per author was 0.23, the number of authors per article was 4.42, the number of co-authors per article was 5.45, the international co-authorship rate was 27.46% and the collaboration index was 4.53. A total of 1758 authors contributed to these studies, and their names were mentioned 2.163 times. A great portion of the articles (97.22%) was multi-authored. The author footprint index was calculated as 0.18 (see also Table 1). The trend analysis of publications on artificial intelligence in the veterinary medicine field indicates a significant increase in the number of articles from 1995 to 2023. The annual growth rate was found to be 17.88%. However, this growth did not follow a linear pattern. The publication count remained steady until 2018 but displayed a dramatic increase thereafter, and this upward trend is still ongoing. In 2018, only 7 articles were published in this field. However, this number reached to 27 in 2019, to 36 in 2020, to 70 in 2021, and increased to 105 in 2022. As of November 2023, 100 articles were published during 2023.

Table 1. Main statistics on artificial intelligence

Description	Results
Main Information About Data	
Timespan	1995:2023
Sources (journals, books, etc.)	65
Documents	397
Annual growth rate %	17.88
Document average age	2.71
Average citations per doc	6.254
References	13958
Document Types	
Article	378
Article; early access	8
Article; proceedings paper	11
Document Contents	
Keywords Plus (ID)	1127
Author's Keywords (DE)	1437
Authors	
Authors	1758
Author appearances	2163
Authors of single-authored documents	9
Authors of multi-authored documents	1749
Authors Collaboration	
Single-authored documents	11
Multi-authored documents	386
Documents per author	0.23
Authors per document	4.42
Co-Authors per documents	5.45
Collaboration index	4.53
Author footprint index	0.18
International co-authorships %	27.46

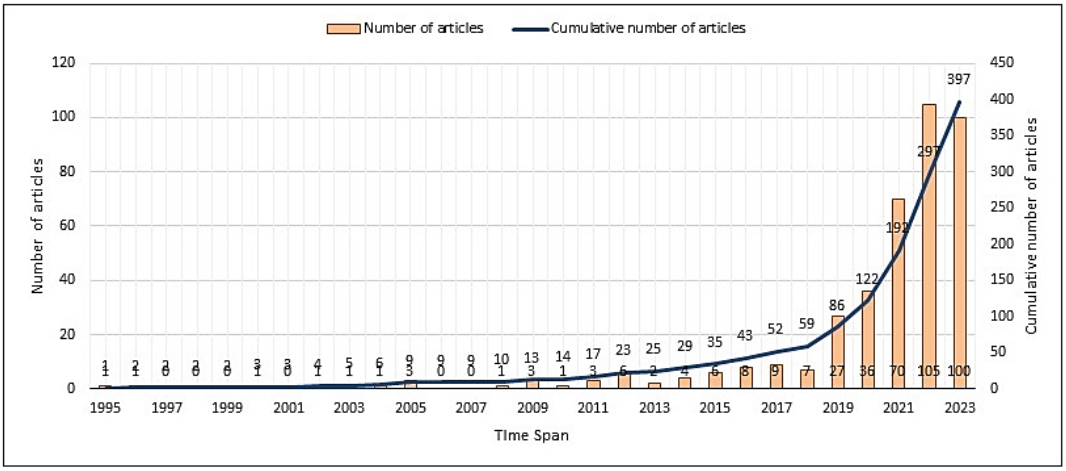

Figure 2. Annual scientific production on artificial intelligence in veterinary medicine.

The interactions between prominent sources (SO), authors (AU), and keywords (DE) are il-lustrated in Figure 3. The Animals and Frontiers in Veterinary Science journals were identified as the most influential sources. Jayon Kim and Guoming Li were the most influential authors. The most influential authors frequently used "deep learning" and "artificial intelligence" terms as keywords.

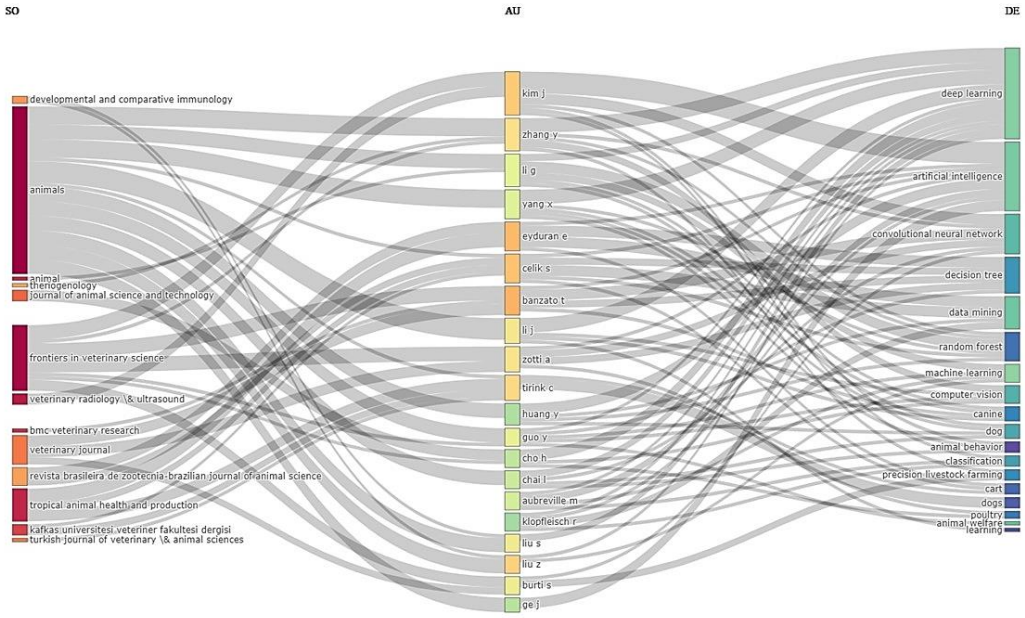

Figure 3. Artificial Intelligence three area graph, sources (left), authors (middle) and keywords (right).

3.2. Most Influential Journals

The most influential journals in artificial intelligence were evaluated by considering scientific metrics. Based on Bradford's law, the Animals and Frontiers in Veterinary Science journals were identified as the most influential and fundamental journals. According to the h-index, g-index, total publication count, and citation count, the first two journals were Animals and Preventive Veterinary Medicine. A thorough review of the purpose and scope of Animals, the top-ranking journal in the field, indicates that the journal encompasses significant studies in any field related to animals, with a particular focus on animal ethics. The review of artificial intelligence studies published in this journal indicated that studies mostly focus on animal behaviour, animal welfare, and animal tracking systems. The examination of Preventive Veterinary Medicine journal revealed that the published studies covered topics related to animal health, veterinary epidemiology, and disease control. The review of artificial intelligence studies published by this journal showed that articles mostly focus on the utilization of machine learning and deep learning in disease classification, disease detection, and out-break prediction. The journals with the highest m-index were Animals and Frontiers in Veterinary Science. According to the citation index (CI), the top two journals with the highest CI were Trans-boundary and Emerging Diseases and Veterinary Journal. Eight of the top ten most

influential journals in the field of artificial intelligence had a Category Normalized Citation Impact (CNCI) of above 1 (world average, (Gray and Price, 2020)). The analysis of the international collaboration percentages of the journals showed that the Transboundary and Emerging Diseases and Preventive Veterinary Medicine journals had the highest collaboration rates.

Table 2. The *h*-index, *g*-index, *m*-index and other scientific indices of the journals (top 10)

Source	*h* index	*g* index	*m* index	TC	NP	CI	CNCI	IC(%)	JIF	JIF Quartile	Country
Animals	11	15	2.2	405	106	3.82	1.37	32.36	3	Q1	Switzerland
Preventive Veterinary Medicine	9	14	0.474	236	32	7.38	1.38	40.89	2.6	Q1	Netherlands
Animal	6	10	0.429	109	12	9.08	1.68	38.73	3.6	Q1	United Kingdom
Frontiers in Veterinary Science	6	11	0.667	178	49	3.63	1.41	34.41	3.2	Q1	Switzerland
BMC Veterinary Research	5	10	0.313	110	10	11.00	1.33	29.52	2.6	Q1	United Kingdom
Veterinary Journal	5	6	0.227	85	6	14.17	1.13	33.22	2.2	Q2	United Kingdom
Veterinary Radiology & Ultrasound	5	9	0.455	92	16	5.75	0.86	20	1.7	Q2	USA
Journal of Veterinary Internal Medicine	4	6	0.8	37	7	5.29	1.28	29.62	2.6	Q1	USA
Kafkas University Journal of Veterinary Faculty	4	6	0.4	41	9	4.56	0.39	10.62	0.7	Q3	Türkiye
Transboundary and Emerging Diseases	4	4	0.308	58	4	14.50	1.82	43.54	4.3	Q1	Germany

NP= number of publications, TC= total citations, CI= citation impact, CNCI= category normalized citation impact, JNCI= journal normalized citation impact, IC= international collaborations, JIF= journal impact factor

3.3. Analysis of Prolific Authors

The h-index, g-index, m-index, collaborations, and other metrics of the top ten most influential authors in studies on the utilization of artificial intelligence in the veterinary medicine field (in some countries, several fields of science are integrated) according to their contribution to the literature are shown in Table 3. The authors with the highest scores for the h-index and g-index were Tommaso Banzato (Italy), Ecevit Eyduran (Türkiye), and Alessandro Zotti (Italy). On the other hand, the author with the highest scores for the m-index was Jayon Kim (South Korea) followed by Tommaso Banzato (Italy). The authors with the highest publication and citation count in this field were Ecevit Eyduran in the first place, Tommaso Banzato in the second place, and Alessandro Zotti in the third place. Regarding citation impact, the first 3 authors were Ecevit Eyduran, Lilong Chai, and Tommaso Ban-zato. According to CNCI values, 7 of the top ten authors had a CNCI value above 1. Ecevit Eyduran, Guoming Li, and Lilong Chai were identified as the most influential authors in terms of international collaboration. The only author without international collaboration was Jayon Kim. Conformity of the dataset to Lotka's law was examined accordingly, 85.7% of the authors contributed to the field with one article, 9.2% with two articles, and 3.2% with three articles. This distribution was found not to comply with Lotka's law. The reason for this result is that 85% of the articles were from the last 5 years, even though the selected period starts from 1995. With the developments in computer and software technologies, this distribution will probably change as the number of articles in this field increases in the following years. However, there may be deviations in the distribution since the studies in this field require specific fields such as veterinary medicine, software, and statistics. However, it can be argued that authors with more than 5 articles have delved deeper into the field of artificial intelligence and can be considered core authors.

Table 3. The *h*-index, *g*-index, *m*-index, and other scientific indices of the authors (top 10)

Author	h-index	g-index	m-index	TC	NP	CI	CNCI	Academic-Corporate collaboration(%)	IC(%)	Country
Banzato, Tommaso	5	8	0.833	85	8	10.63	1.32	12.2	20	Italy
Eyduran, Ecevit	4	8	0.5	96	8	12.00	1.22	0	77.78	Türkiye
Zotti, Alessandro	4	7	0.667	58	7	8.29	1.28	10.6	20.83	Italy
Brunton Lucy, A.	3	3	0.75	26	3	8.67	1.55	7.7	37.50	United Kingdom
Celik, Senol	3	7	0.375	64	7	9.14	0.87	0	25	Türkiye
Chai, Lilong	3	4	0.75	45	4	11.25	2.26	5.8	56.52	USA
Chang, Yu-Mei Ruby	3	3	0.75	26	3	8.67	0.95	7.7	25	United Kingdom
Drewe, Julian Ashley	3	3	0.75	26	3	8.67	1.64	4.2	40	United Kingdom
Kim, Jayon	3	3	1.000	13	7	1.85	0.68	0	0	South Korea
Li, Guoming	3	5	0.750	25	5	5	1.37	0	60.87	USA

NP = number of publications, TC = total citations, CI = citation impact, CNCI = category normalized citation impact, JNCI = journal normalized citation impact, IC = international collaborations

Figure 4 visualizes collaborations between the most influential authors in the field without any publication count limit. The analysis of links between authors revealed 46 authors distributed across 4 groups, with a total of 385 links. The authors with the highest citation count were Ecevit Eyduran with 96 citations, Andres Martin Perez with 78 citations, and Zhanjiang Liu with 66 citations.

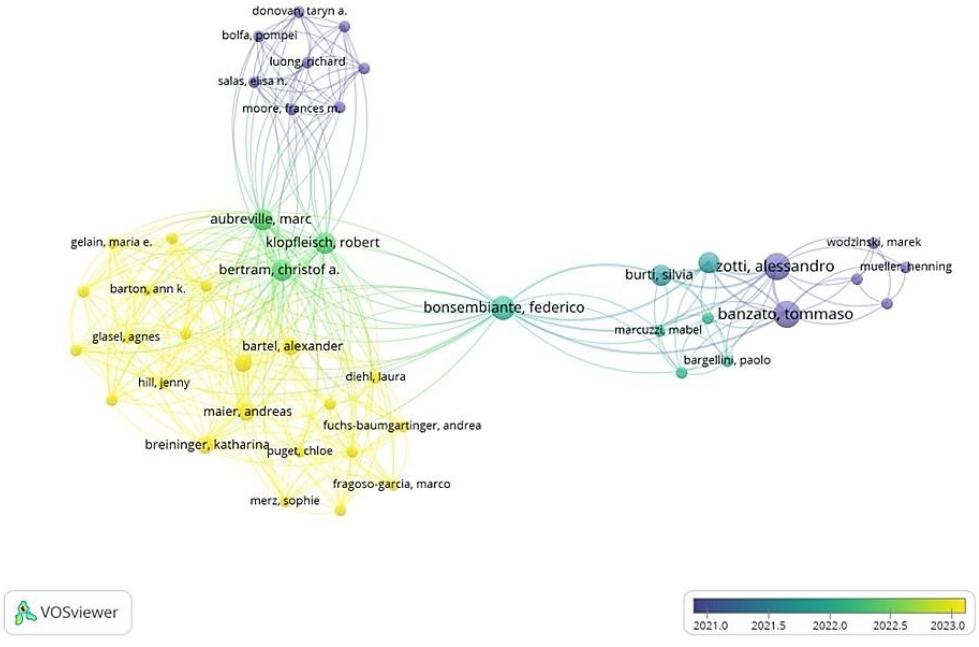

Figure 4. The network map of co-authorship related to artificial intelligence.

3.4. Contribution of Institutions

A total of 397 institutes associated with 663 articles were identified. The higher number of institutes than the number of articles can be explained by the high collaboration ratio in the field. The examination of the productivity of institutes on artificial intelligence in the veterinary medicine field showed that the institutes with the highest number of publications were UC Davis (USA), University of Padua (Italy), and China Agricultural University (China). Additionally, these institutes also held the top three positions for h-index scores. According to the CNCI values of institutes, 8 of the top 10 institutes

displayed a productivity value above 1. The examination of the international collaborations of institutes revealed that the University of Bern held the first place, the University of Padua in the second place, and the University of Guelph in the third place (Table 4).

Table 4. The *h*-index and other scientific indices of Affiliations (top 10)

Affiliation	Articles	h-index	CNCI	IC(%)	Country
University of California Davis	37	213	1.55	42.14	USA
University of Padua	32	222	1.57	52.20	Italy
China Agricultural University	30	132	1.42	31.75	China
University of Guelph	26	116	1.21	49.16	Canada
Igdir University	24	38	0.87	20.67	Türkiye
University of Georgia	19	133	1.21	32.27	USA
University of Tennessee Knoxville	17	169	1.36	41.70	USA
Kangwon National University	16	83	0.85	26.71	South Korea
University of Bern	16	233	1.74	68.26	Switzerland
University of Minnesota Duluth	16	57	1.23	38.82	USA

CNCI= category normalized citation impact, IC= international collaborations.

3.5. Contribution of Countries

The country with the highest number of publications and citations in our dataset was the USA, followed by China, and Türkiye. Furthermore, these 3 countries accounted for 41.1% of the studies about artificial intelligence in veterinary medicine globally. South Korea had the highest Category Normalized CI value. Australia, the only country to achieve a 50% Multiple-country Publication rate, displayed the highest international cooperation. The examination of the countries' CNCI values revealed that 8 of the top 10 countries exhibited a scientific productivity value above 1. According to the number of connections and total connection power, the USA, China, the United Kingdom, and Canada were determined as the most influential countries in the collaboration network (Table 5).

Table 5. Publication count and collaboration metrics of the countries (top 10).

Country	TC	NP	CI	Frequency	SCP	MCP	MCP Ratio	CNCI	Links	TLS
USA	537	72	7.46	0.181	45	27	0.375	1.29	33	75
China	276	63	4.38	0.159	51	12	0.19	1.14	14	24
Türkiye	242	28	8.64	0.071	25	3	0.107	0.86	3	5
South Korea	236	23	10.26	0.058	18	5	0.217	1.08	8	9
United Kingdom	167	23	7.26	0.058	18	5	0.217	1.47	19	40
Italy	124	19	6.53	0.048	16	3	0.158	1.33	12	18
Germany	101	18	5.61	0.045	11	7	0.389	1.29	20	42
Canada	74	15	4.93	0.038	8	7	0.467	1.39	18	28
Brazil	68	14	4.86	0.035	12	2	0.143	0.81	5	8
Australia	66	10	6.60	0.025	5	5	0.5	1.50	8	11

NP = number of publications, TC = total citations, CI = citation impact, CNCI = category normalized citation impact, SCP = single country publication, MCP = multiple countries publication, TLS = total link strength.

3.6. Keyword Analysis

An analysis of the tendency of keywords used in the field can reveal the changes in important concepts within artificial intelligence studies over the years as well as the current concepts. The examination of keywords revealed that "machine learning", "artificial intelligence", "deep learning", and "convolutional neural network" were the most frequently used terms. On the other hand, "image pro-cessing", "classification", "data mining algorithms", "active learning", and "computer-aided diagnosis" were frequently preferred terms in recent studies (Figure 5).

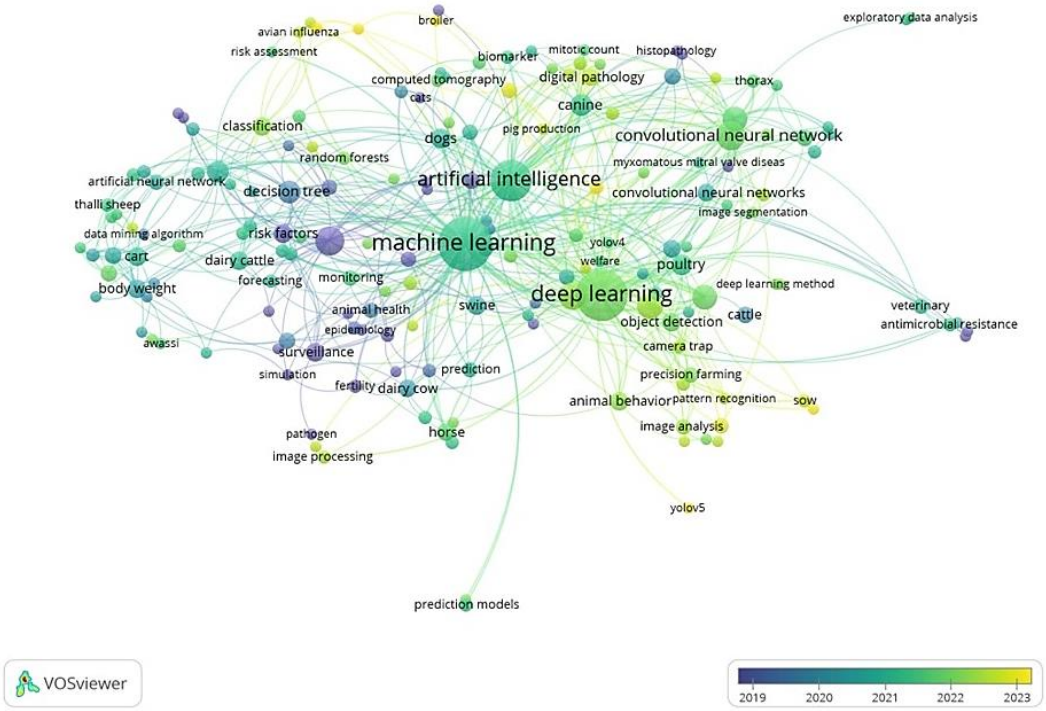

Figure 5. Network analysis of authors keywords.

3.7. Co-citation Analysis

Co-citation analysis reflects how often two documents are cited together by other sources. In the journal co-citation analysis with a minimum co-citation count of 20, 102 journals were identified. Accordingly, Computers and Electronics in Agriculture was identified as the journal with the highest co-citation count (439 co-citations, JIF 2023 = 8.3, Q1), followed by Journal of Dairy Science (412 co-citations, JIF 2023 = 3.5, Q1), and Plos One (249 co-citations, JIF 2023 = 3.7, Q2). Moreover, Scientific Reports was determined as the journal with the second highest impact factor (JIF 2023 = 4.6) and one of the most influential journals in multidisciplinary studies.

4. Discussion

Although studies on artificial intelligence in the veterinary medicine field began in 1995, no significant increase was observed until 2019. However, due to advancements in computer and software technology, the utilization of artificial intelligence algorithms in the veterinary medicine field has experienced a dramatic increase recently (Owens et al., 2023). The number of scientific studies in all disciplines has grown by an average of 3% over the last 30 years (Bornmann and Mutz, 2015). However, studies on artificial intelligence in the veterinary medicine field increased a 17.88% increase. The rapid growth in the field of artificial intelligence will likely attract more researchers. It is estimated that the linear increase in the number of publications on artificial intelligence will accelerate in the near future as new countries start to produce studies in this field. In addition to the theoretical results, studies in the field of artificial intelligence provide useful practical results for the prediction, prevention, and control of factors that threaten animal health (Kour et al., 2022). Furthermore, with the integration of artificial intelligence and advanced technological systems in animal husbandry science, human errors in labor are reduced and optimum efficiency is achieved from animals under existing conditions. Moreover, with effective features including image processing, decision-making, and prediction, such technologies offer minimum human intervention. The findings showed that the most frequently used terms in this field were “machine learning”, “artificial intelligence”, and “deep learning”. In a systematic review by Bouchemla et al. (2023) on artificial intelligence in medicine science, the keywords “machine learning”, “deep learning”, and “convolutional neural network” were used. This study is consistent with the findings obtained during the word analysis in the current study. A literature survey (Cavero et al., 2006; Ebrahimi et al., 2019; Rao et al., 2020) revealed that studies mostly addressed image processing, machine learning algorithms, disease prediction, and classification topics. This finding supports the keyword network obtained in the current study Furthermore, an examination of the keyword network based on species indicated that the studies were primarily focused on image processing in feline and canine veterinary medicine, as well as classification and prediction in poultry and ruminant medicine. Bibliometric analysis is a review of the literature. It does not suggest causality or a positive or negative conclusion. Therefore, the interpretation of the study results is the responsibility of the researcher. The studies on artificial intelligence in veterinary medicine mostly preferred the open-access

publication method. However, it should be noted that authors who cannot afford the open-access publication fee of popular journals in the field may face challenges in reaching a wider audience compared to those who can afford the open-access fees. This is one of the main reasons for the lower number of artificial intelligence studies in underdeveloped and developing countries. Publishing an original research article on artificial intelligence in the field of veterinary medicine necessitates expertise in various fields, including statistics and computer/software, in addition to veterinary medicine. Therefore, the authors of review and original research articles may differ significantly. This situation also explains why academic collaboration in this field is high. Identification of core re-searchers in a research area is important for understanding the perspectives within that area and per-forming effective consultations (Boyack et al., 2013). Ecevit Eyduran and Tommaso Banzato were identified as two core researchers in the field of artificial intelligence. These authors had an international collaboration rate above 20%. Furthermore, Alessandro Zotti and Tommaso Banzato, among the top ten influential authors, had co-authored many artificial intelligence studies. A great portion of the studies of these authors were on image processing. The collaboration between these two authors contributes to the reputation of both their institutions and their countries in this field (Banzato et al., 2021). In examining institutes supporting studies in this field, UC Davis and the University of Padua were identified as the primary publishers and institutes with the highest number of citations. Citations received by papers indicate the level of attention to a given field. In this regard, USA-centered papers achieved the highest citation count (537), followed by China (276), and Türkiye (242).

5. Conclusion

Artificial intelligence studies in the field of veterinary medicine are of great importance for facilitating rapid and accurate diagnosis and treatment of existing and potential diseases (Muehlematter et al., 2021). Accordingly, studies in the field of artificial intelligence have started to receive more attention. This bibliometrics study analyzed the WoS database over a 28-year period regarding the development of studies on artificial intelligence in veterinary medicine science, trends in different branches of veterinary medicine, as well as the most influential authors, countries, institutions, journals, and trending topics in this field. A total of 397 academic papers published between 1995 and 2023 were analyzed, and the results were statistically reported using mapping methods. By providing an overall map of the field, this study can serve as a guide for researchers in their future studies on artificial intelligence in veterinary medicine. While this quantitative research objectively reflects the structure of the field, it has some limitations. The WoS database has a vast collection of academic journals and is frequently used in bibliometric studies. However, as different databases such as Scopus and ScienceDirect produce different content, this reduces the reproducibility of the study and causes confusion among researchers. The fact that only one database was used in the study to eliminate this confusion can also be considered a limitation of the study. Since the data search phase in databases is done through keywords, the use of the same word in different languages causes language confusion. Therefore, only English studies were included in the analysis.

Author Contributions

The percentages of the authors' contributions are presented below. All authors reviewed and approved the final version of the manuscript.

	H.S.	M.M.K.
C	70	30
D	50	50
S	100	
DCP	60	40
DAI	40	60
L	30	70
W	50	50
CR	20	80
SR	80	20
PM	30	70
FA	30	70

C= concept, D= design, S= supervision, DCP= data collection and/or processing, DAI= data analysis and/or interpretation, L= literature search, W= writing, CR= critical review, SR= submission and revision, PM= project management, FA= funding acquisition.

Conflict of Interest

The authors declare no conflicts of interest associated with this manuscript.

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Ethical Consideration

Ethics committee permissions for this study were obtained from Selçuk University Faculty of Veterinary Medicine, Experimental Animal Production and Research Centre Ethics Committee and the study was carried out within the scope of the permission of this committee (Approval date: March 30, 2023 and protocol code: 2023/027).

References

Appleby RB, Basran PS, 2022. Artificial intelligence in veterinary medicine. J Am Vet Med Assoc, 260(8): 819-824.

Aria M, Cuccurullo C, 2017. bibliometrix: An R-tool for comprehensive science mapping analysis. J Informetr, 11(4): 959-975.

Banzato T, Wodzinski M, Burti S, Osti VL, Rossoni V, Atzori M, Zotti A, 2021. Automatic classification of canine thoracic radiographs using deep learning. Sci Rep, 11(1): 3964.

Bornmann L, Daniel HD, 2007. What do we know about the h index? JASIST, 58(9): 1381-1385.

Bornmann L, Mutz R, 2015. Growth rates of modern science: A bibliometric analysis based on the number of publications and cited references. J Assoc Inf Sci Technol, 66(11): 2215-2222.

Bouchemla F, Akchurin SV, Akchurina IV, Dyulger GP, Latynina ES, Grecheneva AV, 2023. Artificial intelligence feasibility in veterinary medicine: A systematic review. Vet World, 16(10): 2143-2149.

Boyack KW, Klavans R, Sorensen AA, Ioannidis JPA, 2013. A list of highly influential biomedical researchers, 1996–2011. Eur J Clin Investig, 43(12): 1339-1365.

Cavero D, Tölle KH, Buxadé C, Krieter J, 2006. Mastitis detection in dairy cows by application of fuzzy logic. Livest Sci, 105(1-3): 207-13.

Chen ZF, Hsu YHE, Lee JJ, Chou CH, 2022. Bibliometric analysis of veterinary communication education research over the last two decades: Rare yet essential. Vet Sci, 9(6): 256.

Cui L, Tang W, Deng X, Jiang B, 2023. Farm animal welfare is a field of interest in China: A bibliometric analysis based on CiteSpace. Animals, 13(19): 3143.

Donthu N, Kumar S, Mukherjee D, Pandey N, Lim WM, 2021. How to conduct a bibliometric analysis: An overview and guidelines. J Bus Res, 133: 285-296.

Ebrahimi M, Mohammadi-Dehcheshmeh M, Ebrahimie E, Petrovski KR, 2019. Comprehensive analysis of machine learning models for prediction of sub-clinical mastitis: Deep learning and gradient-boosted trees outperform other models. Comput Biol Med, 114: 103456.

Egghe L, 2006. Theory and practise of the g-index. Scientometrics, 69(1): 131-152.

Garfield E, 1980. Bradford law and related statistical patterns. Curr Contents, (19): 5-12.

Gray A, Price R, 2020. Using InCites responsibly: A guide to interpretation and good practice.

Harzing AW, 2012. Reflections on the h-index. Business & Leadership, 1(9): 101-106.

Kaul V, Enslin S, Gross SA, 2020. History of artificial intelligence in medicine. Gastrointest Endosc, 92(4): 807-812.

Kour S, Agrawal R, Sharma N, Tikoo A, Pande N, Sawhney A, 2022. Artificial intelligence and its application in animal disease diagnosis. J Anim Res, 12(1): 1-10.

Fırat S, Kurutkan MN, Orhan F, 2018. Sağlık politikası konusunun bilim haritalama teknikleri ile analizi. İksad Yayınevi, Adıyaman, 28-73.

Merigó JM, Yang JB, 2017. A bibliometric analysis of operations research and management science. Omega, 73: 37-48.

Muehlematter UJ, Daniore P, Vokinger KN, 2021. Approval of artificial intelligence and machine learning-based medical devices in the USA and Europe (2015–20): A comparative analysis. Lancet Digit Health, 3(3): e195-e203.

Owens A, Vinkemeier D, Elsheikha H, 2023. A review of applications of artificial intelligence in veterinary medicine. Com Anim, 28(6): 78-85.

Rao Y, Jiang M, Wang W, Zhang W, Wang R, 2020. On-farm welfare monitoring system for goats based on Internet of Things and machine learning. Int J Distrib Sens Netw, 16(7): 1550147720944030.

Russell SJ, 2010. Artificial Intelligence: A Modern Approach. Pearson Education, Inc., Pearson, London, UK, pp: 23.

Sudhier KP, 2013. Lotka's law and pattern of author productivity in the area of physics research. DESIDOC J Libr Inf Technol, 33(6): 457-464.

Van Eck NJ, Waltman L, 2017. Citation-based clustering of publications using CitNetExplorer and VOSviewer. Scientometrics, 111: 1053-1070.

Wang C, Lim MK, Zhao L, Tseng ML, Chien CF, Lev B, 2020. The evolution of Omega-The International Journal of Management Science over the past 40 years: A bibliometric overview. Omega, 93: 102098.

Yardibi F, Fırat MZ, Teke EC, 2021. Trend topics in animal science: A bibliometric analysis using CiteSpace. Turk J Vet Anim Sci, 45(5): 833-840.

Yu Y, Li Y, Zhang Z, Gu Z, Zhong H, Zha Q, Yang L, Zhu C, Chen E, 2020. A bibliometric analysis using VOSviewer of publications on COVID-19. Ann Transl Med, 8(13): 816.