

Citation Analysis of Artificial Intelligence and Machine Learning Articles Indexed In the Directory of Open Access Journal (DOAJ)

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Abstract

This study performs a comprehensive citation analysis of articles related to Artificial Intelligence (AI) and Machine Learning (ML) indexed in the Directory of Open Access Journals (DOAJ). By utilising bibliometric methods, authors analysed citation data to determine the most influential articles, authors, and journals in the field. This study also specifically concentrates on articles in the field of AI and ML and these are tailored for Bibliography, Library science, and Information resources. It focuses on articles published between 2020 and April 2024. The analysis reveals 560 indexed articles, including 260 in AI and 300 in ML articles.

Keywords: Citation Analysis, Machine Learning, Artificial Intelligence, Open Access Journals, DOAJ

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I. Introduction

The phrase "Artificial Intelligence" encompasses various information technology principles such as computation, software development, and data transfer. Nonetheless, the rise of AI aligns with a surge in cyber attacks. The objective of AI is to create machines capable of thinking and functioning akin to the human brain. Machine Learning involves instructing machines to handle data more efficiently. Sometimes, despite examining the data, we struggle to comprehend the extracted information. In such cases, machine learning comes into play. The demand for machine learning is escalating due to the abundance of available datasets. It finds applications across various industries for retrieving relevant data. The core objective of ML is to derive insights and knowledge from data.

II. Review of Literature

Mohammad (2020) explores several AI technologies and their potential to enhance productivity across diverse industries. The research aims to delve into artificial intelligence and its anticipated future applications. With its myriad benefits, AI is increasingly gaining traction across various sectors. AI-driven machinery boasts accuracy, efficiency, and multitasking capabilities while also being cost-effective compared to human labour. It serves as the foundation for numerous concepts such as data processing, software development, and computer systems. Artificial intelligence finds applications in machine learning, deep learning, robotics, speech recognition, natural language generation, and biometric identification. Industries spanning healthcare, manufacturing, corporate environments, automobile production, and assembly harness the power of AI for enhanced operations.

Bircan and Salah (2022) through bibliometric analysis of papers catalogued in the Social Sciences Citation Index (SSCI) within the Web of Science repository spanning from 2015 to 2020, this study elucidates the utilization of Big Data and computational methodologies within the social sciences. The research reveals that the application of AI and big data extends beyond computational social sciences (CSS), permeating various disciplines within the social sciences and addressing diverse primary research areas. Despite this, the anticipated convergence between CSS and expertise in Social Sciences & AI has yet to materialize fully. Additionally, the influence of computational social science studies has not diffused into broader social science citation networks.

Furthermore, the analysis indicates that articles on AI and Big Data listed under the SSCI index predominantly focus on computational studies rather than addressing social science concepts, challenges, and nuances.

Additional pertinent articles considered for the current study include:

- Artificial Intelligence Related Publication Analysis Based on Citation Counting. (YANG et al., 2018).
- Machine Learning Algorithms - A Review. (Mahesh, 2020).
- Machine Learning in Artificial Intelligence: Towards a Common Understanding. (Kühl et al., 2019).
- Bibliometric analysis of Indian contribution in the research literature on artificial intelligence: a study. (Marimuthu & Tamizchelvan, 2019).

III. Objectives of the study

The study aims to:

- To identify the AI and ML ranked journals.
- To find out the Ranking list of publishers.
- To explore authorship trends.
- To examine language usage within journals.
- To analyze the year-wise publication and license used by the publisher.
- To examine the type of article access method.

IV. Methodology

The present study focused on citation analysis of AI and ML articles indexed in a DOAJ. The online survey method was used for the study, and data was collected from the DOAJ Website. It investigated the 560 Indexed articles from DOAJ on AI and ML subjects. The data is scrutinized to document author details, journal titles, language and license used for publication, Publisher, and authorship patterns. This analysis is conducted using MS Excel.

V. Scope and Limitations

By analyzing articles between AI and ML indexed in DOAJ there are 222 indexed journal articles found in ML 295 articles in AI and 43 repeated indexed journal articles are found, a total of 560 articles are examined. The study is limited to the period from 2020 to April 2024. Currently, the investigation encompasses 560 indexed articles traced from DOAJ, The study specifically concentrates on articles connected to Bibliography, Library Science, and Information Resources.

Artificial Intelligence	Machine Learning	Artificial Intelligence & Machine Learning	Total
222	295	43	560

VI. Discussion

Table 1: Ranking of Journals

SL. No.	Journal Name	AI	ML	Total	%	Rank
1	Data	37	104	141	25.17	1
2	Journal of Information Technology Management	21	35	56	10	2
3	Nongye Tushu Qingbao Xuebao	31	11	42	7.5	3
4	Journal of Data Mining and Digital Humanities	9	31	40	7.14	4
5	Frontiers in Research Metrics and Analytics	19	16	35	6.25	5
6	Frontiers in Health Informatics	7	20	27	4.82	6
7	Informatică Economică	14	11	25	4.46	7
8	Journal of Escience Librarianship	17	4	21	3.75	8
9	Iranian Journal of Information Processing & Management	7	9	16	2.85	9
10	Publications	2	8	10	1.78	10
11	Journal of Information Science Theory And Practice	5	3	8	1.42	12
12	International Journal of Information Science And Management	3	4	7	1.25	13
13	Liber Quarterly: The Journal of European Research Libraries	3	4	7	1.25	13
14	کتابداری و اطلاع‌رسانی	5	2	7	1.25	13
15	Jlis.It	4	2	6	1.07	14
16	The International Journal of Information, Diversity, & Inclusion	4	2	6	1.07	14
17	بازیابی دانش و نظام‌های معنایی	3	3	6	1.07	14

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SL. No.	Journal Name	AI	ML	Total	%	Rank
18	Acta Informatica Malaysia	4	1	5	0.89	15
19	International Journal of Digital Content Management	5	0	5	0.89	15
20	Journal of the Medical Library Association	4	1	5	0.89	15
21	Open Information Science	4	1	5	0.89	15
22	Zhishi Guanli Luntan	1	4	5	0.89	15
23	Aib Studi	2	2	4	0.71	16
24	Canadian Journal of Academic Librarianship	3	1	4	0.71	16
25	Code4lib Journal	2	2	4	0.71	16
26	Gms Medizin – Bibliothek – Information	3	1	4	0.71	16
27	Knowledge Engineering and Data Science	3	1	4	0.71	16
28	Восточная Азия: Факты И Аналитика	2	2	4	0.71	16
29	Vaca: Jurnal Dokumentasi Dan Informasi	2	1	3	0.53	17
30	Journal of Library and Information Studies	2	1	3	0.53	17
31	مجله علمی کاسپین	2	1	3	0.53	17
32	Цифрова Платформа: Інформаційні Технології В Соціокультурній Сфері	3	0	3	0.53	17
33	Insights: The Uksg Journal	2	0	2	0.35	18
34	International Journal of Knowledge Content Development and Technology	1	1	2	0.35	18
35	International Journal of Digital Curation	1	1	2	0.35	18
36	International Journal of Librarianship (Ijol)	2	0	2	0.35	18
37	Journal of Information Sciences	2	0	2	0.35	18
38	Kula	1	1	2	0.35	18
39	Transinformação	1	1	2	0.35	18
40	Berkala Ilmu Perpustakaan Dan Informasi	0	1	1	0.17	19
41	Bibliotečnijski Visnik	2	0	1	0.17	19
42	Bibliothecae.It	1	0	1	0.17	19
43	Em Questão	0	1	1	0.17	19
44	European Science Editing	2	0	1	0.17	19
45	Evidence Based Library and Information Practice	2	0	1	0.17	19
46	Folia Toruniensia	1	0	1	0.17	19
47	Forum Bibliotek Medycznych	1	0	1	0.17	19
48	Fronteiras Da Representação Do Conhecimento	1	0	1	0.17	19
49	Investigación Bibliotecológica: Archivonomía, Bibliotecología E Información	0	1	1	0.17	19
50	Jiàoyù Zīliào Yǔ Tūshūguǎn Xué	1	0	1	0.17	19
51	Journal of New Librarianship	1	0	1	0.17	19
52	Journal of The Canadian Health Libraries Association	0	1	1	0.17	19
53	Library Ideas	1	0	1	0.17	19
54	O-Bib. Das Offene Bibliotheks journal	0	1	1	0.17	19
55	Pakistan Journal of Information Management & Libraries	1	0	1	0.17	19
56	Pennsylvania Libraries: Research & Practice	1	0	1	0.17	19
57	Tecnociencia Chihuahua	0	1	1	0.17	19
58	Tūzī Yǔ Dàng'ān Xuékān	1	0	1	0.17	19
59	Вісник Харківської Державної Академії Культури	1	0	1	0.17	19
60	Наука И Научная Информация	1	0	1	0.17	19
61	Наукові Праці Національної Бібліотеки України Імені В.І. Вернадського	1	0	1	0.17	19
62	اطلاع رسانی کتابداری و تحقیقات کتابداری و اطلاع رسانی دانشگاهی	1	0	1	0.17	19
63	تحقیقات کتابداری و اطلاع رسانی دانشگاهی	1	0	1	0.17	19
64	تحقیقات کتابداری و اطلاع رسانی دانشگاهی	0	1	1	0.17	19
	Total	264	296	560	100	

Table 1 shows that out of 64 journals, the “Data” journal got the first rank (25.17%) based on the number of publications. Simultaneously the Journal of Information Technology Management got 2nd rank (10%). 13th rank group contains 3 journals and the 19th rank group contains 25 journals.

Table 2: Rank List of Publishers

SI No.	Publisher Name	AI	ML	Total	%	Rank
1	MDPI AG , Switzerland	40	111	151	26.96	1
2	University of Tehran , Iran, Islamic Republic of	22	34	56	10	2
3	Editorial Department of Journal of Library and Information Science in Agriculture , China	31	11	42	7.5	3
4	Frontiers Media S.A. , Switzerland	19	13	32	5.71	4
5	Nicolas Turenne , France	9	21	30	5.35	5
6	Inforec Association , Romania	14	13	27	4.82	6
7	Hamara Afzar , Iran, Islamic Republic of	7	19	26	4.64	7
8	Iranian Research Institute for Information and Technology, Iran, Islamic Republic of	8	9	17	3.03	8
9	UMass Chan Medical School, Lamar Soutter Library, United States	8	3	11	1.96	9
10	Central Library of Astan Quds Razavi , Iran, Islamic Republic of	7	2	9	1.61	10
11	Allameh Tabataba'i University Press , Iran, Islamic Republic of	7	1	8	1.45	11
12	openjournals.nl , Netherlands	4	4	8	1.45	11
13	Zibeline International , Malaysia	3	5	8	1.45	11
14	Korea Institute of Science and Technology Information , Korea, Republic of	4	3	7	1.27	12
15	University Library System, University of Pittsburgh , United States	6	1	7	1.27	12
16	Vernadsky National Library of Ukraine , Ukraine	4	3	7	1.27	12
17	Firenze University Press , Italy	4	2	6	1.07	13
18	Regional Information Center for Science and Technology (RICeST) , Iran, Islamic Republic of	3	3	6	1.07	13
19	Code4Lib , United States	2	3	5	0.89	14
20	De Gruyter , Poland	4	1	5	0.89	14
21	German Medical Science GMS Publishing House , Germany	3	2	5	0.89	14
22	LIS Press , China	1	4	5	0.89	14
23	University of Alberta , Canada	2	3	5	0.89	14
24	Associazione italiana biblioteche , Italy	2	2	4	0.71	15
25	Chinese American Librarians Association , United States	1	3	4	0.71	15
26	Pontificia Universidade Católica de Campinas , Brazil	2	2	4	0.71	15
27	The Canadian Association of Professional Academic Librarians , Canada	3	1	4	0.71	15
28	Universitas Negeri Malang , Indonesia	3	1	4	0.71	15
29	Babol University of Medical Sciences , Iran, Islamic Republic of	2	1	3	0.55	16
30	East Carolina University , United States	1	2	3	0.55	16
31	East Carolina University , United States	3	0	3	0.55	16
32	Ecole des Sciences de l'Information , Morocco	2	1	3	0.55	16
33	KNUKiM Publishing Centre , Ukraine	3	0	3	0.55	16
34	Lembaga Ilmu Pengetahuan Indonesia , Indonesia	2	1	3	0.55	16
35	National Taiwan University , Taiwan, Province of China	2	1	3	0.55	16
36	Russian Academy of Sciences, Institute of China and Contemporary Asia (ICCA RAS) , Russian Federation	3	0	3	0.55	16
37	Verein Deutscher Bibliothekarinnen und Bibliothekare (VDB) , Germany	0	3	3	0.55	16
38	Pensoft Publishers , Bulgaria	2	0	2	0.35	17
39	Research Institute for Knowledge Content Development & Technology, Korea, Republic of	1	1	2	0.35	17

SI No.	Publisher Name	AI	ML	Total	%	Rank
40	Tamkang University Press , Taiwan, Province of China	1	1	2	0.35	17
41	Ubiquity Press , United Kingdom	2	0	2	0.35	17
42	Universidad Autónoma de Chihuahua , Mexico	0	2	2	0.35	17
43	University of Edinburgh , United Kingdom	0	2	2	0.35	17
44	University of Victoria Libraries , Canada	1	1	2	0.35	17
45	Federal University of Minas Gerais , Brazil	1	0	1	0.17	18
46	Institut für Bibliothekswissenschaft Berlin , Germany	1	0	1	0.17	18
47	Iran Public Libraries Foundation , Iran, Islamic Republic of	1	0	1	0.17	18
48	Kharkiv State Academy of Culture , Ukraine	1	0	1	0.17	18
49	Medical University of Warsaw , Poland	1	0	1	0.17	18
50	National Chengchi University Libraries , Taiwan, Province of China	1	0	1	0.17	18
51	National Electronic Information Consortium (NEICON) , Russian Federation	1	0	1	0.17	18
52	National Electronic Information Consortium (NEICON) , Russian Federation	1	0	1	0.17	18
53	The Provincial Public Library – the Copernicus Library in Toruń and Nicolaus Copernicus University in Toruń , Poland	1	0	1	0.17	18
54	Ubiquity Press , United Kingdom	1	0	1	0.17	18
55	Universidad Nacional Autónoma de México , Mexico	0	1	1	0.17	18
56	Universidade Federal do Rio Grande do Sul, Brazil	0	1	1	0.17	18
57	Universitas Gadjah Mada , Indonesia	0	1	1	0.17	18
58	University of Bologna , Italy	1	0	1	0.17	18
59	University of Colorado at Boulder , United States	1	0	1	0.17	18
60	University of the Punjab, Department of Information Management , Pakistan	0	1	1	0.17	18

The Table 2 ranks publishers based on their number of journals listed among 60 total journals. "MDPI AG, Switzerland" topped the list with **26.96%**, securing the first rank. Following them, "University of Tehran, Iran, Islamic Republic of" obtained the second rank with 10 %. The 16 publishers got 0.17%.

Table 3 presents the distribution of languages used in publications, including English, Urdu, Spanish, German, Ukrainian, Polish, Indonesian, Italian, Romanian, Chinese, Russian, Portuguese, and Persian. Among the combination of 17 languages considered, publications in English is the most prevalent, accounting for 60%. Persian is used in 16.25% of publications. Only 0.17% of publications are in Russian, English- Spanish and English -Urdu at least rank.

Table 3: Language Usage within Journals

Sl.No.	Language	AI	ML	Total	%
1	English	134	202	336	60
2	Percian	42	49	91	16.25
3	Chaineese	32	15	47	8.4
4	English, Romanian	14	13	27	4.85
5	English, Italian	7	4	11	1.96
6	English, French	5	3	8	1.42
7	English, German	4	5	9	1.6
8	English, Chinese	4	2	6	1.07
9	English, Spanish, Portuguese	3	3	6	1.07
10	English, Indonesian	2	2	4	0.72
11	English, Russian, Ukrainian	4	0	4	0.72
12	English, Russian	3	0	3	0.54
13	English, Ukrainian	3	0	3	0.54

Sl.No.	Language	AI	ML	Total	%
14	English, Polish	2	0	2	0.35
15	Russian	1	0	1	0.17
16	English, Spanish	0	1	1	0.17
17	English, Urdu	0	1	1	0.17
		260	300	560	100

Table 4: License-based Distribution of Publication

SL. No.	Creative Commons License	AI	ML	Total	%
2	CC BY	153	207	360	64.28
1	CC BY NC	52	71	123	21.96
3	CC BY-NC-ND	42	17	59	10.53
4	CC BY-SA	3	2	5	0.89
6	CC BY-SA	2	2	4	0.71
8	CC BY, a CC BY-SA, a CC BY-NC or a CC BY-NC-SA	3	1	4	0.71
7	CC BY NC SA	3	0	3	0.54
5	CC BY ND	1	0	1	0.17
9	CC BY or a CC0	1	0	1	0.17
		260	300	560	100

Table 4 illustrates the distribution of licenses among 9 categories. The highest rank, with 64.28%, was achieved by "CC BY". Following closely with 21.96% was "CC BY NC". In contrast, "CC BY ND" and "CC BY or a CC0" obtained the lowest rank with 0.17%.

The concept of authorship evolved throughout the 20th century and remains relevant today. Collaborative research projects involving at least two individuals entail both mental and physical effort. This practice is more prevalent in the sciences compared to the humanities (Karisiddappa et al., n.d.).

In this dataset, there are 560 articles distributed across various layers of authorship. The table illustrates the breakdown of authorship distribution.

5: Distribution of authorship pattern

Sl.No.	Author	ML	AI	Total	%	Cumulative Number	Cumulative %
1	Single Author	40	65	105	18.75	105	1.93
2	Two Author	61	53	114	20.35	219	4.02
3	Three Author	72	57	129	23.03	348	6.4
4	Four Author	50	36	86	15.35	434	7.98
5	Five Author	42	22	64	11.45	498	9.19
6	Six Author	15	12	27	4.82	525	9.65
7	Seven Author	3	9	12	2.15	537	9.89
8	Eight Author	7	3	10	1.8	547	10.08
9	Nine Author	2	1	3	0.53	550	10.11
10	Ten Author	2	1	3	0.53	553	10.17
11	Eleven Author	5	1	6	1.07	559	10.28
12	Thirteen Author	1	0	1	0.17	560	10.3
		300	260	560	100	5435	100

Note: AI-Artificial Intelligence, ML- Machine Learning.

Table 5 illustrates twelve patterns of authorship. The leading pattern is the Three-authorship pattern, comprising 22.03% of the total, followed by the Two-authorship pattern at 20.35%, securing second place. The Single-authorship pattern ranks third with 18.75%. The pattern with thirteen authors obtained the least placement, accounting for 10.03%.

Table 6 illustrates the distribution of articles by year. In 2023, the highest number of articles were published, totaling 167, representing 29.84 % of the total. The second highest was in 2022, with 25.53% of the articles, and the lowest was in 2020, with 73 publications accounting for 13.03%.

Table 6: Year-wise distribution of Articles

Sl. No.	Year	AI	ML	Total	%
1	2024	27	19	46	8.21
2	2023	82	85	167	29.84
3	2022	67	76	143	25.53
4	2021	48	83	131	23.39
5	2020	36	37	73	13.03
		260	300	560	100

Note: AI-Artificial Intelligence, ML- Machine Learning.

Table 7: Mode of Access wise distribution

Sl. No.	Year	OA		Total	%	CA		Total	%
		AI	ML			AI	ML		
1	2024	19	10	29	9	8	9	17	7.14
2	2023	49	42	91	28.27	33	43	76	31.94
3	2022	44	36	80	24.85	23	40	63	26.48
4	2021	27	48	75	23.29	21	35	56	23.52
5	2020	23	24	47	14.59	13	13	26	10.92
		162	158	322	100	98	140	238	100

Note: OA- Open Access, CA- Closed Access, AI-Artificial Intelligence, ML- Machine Learning.

Table 7 details the mode of article access. In 2023, there were 91 articles available through Open access and 76 through Closed access. The year 2022 saw 80 articles accessible via Open access and 63 articles are Closed access. In 2020, there were 47 articles available through Open access and 26 articles are Closed access.

VII. Findings

- In the study, the journal "Data" ranked first among 64 journals, accounting for 25.17% of the ranking list, "Journal of Information Technology Management" placed 2nd rank. while 25 journals got 19th place with 0.17%.
- MDPI AG, Switzerland, secured the top position among publishers with 151 publications, representing 26.85%. Conversely, 16 publishers, tied for 18th place with a single publication each, accounting for 0.17%.
- English dominated other languages with 336 publications published in English.
- The CC BY license was used by 360 publications (64.28%), while a combination of CC BY or CC0 and CC BY-ND licenses was used by single publications (0.17%).
- A significant portion of publications, 129 in total (23.03%), were authored by 3 authors secured 1st place, while a single publication (0.17%) was authored by 13 authors secured least place.
- In the year 2023 article publication level is high (29.84 %) and the publication level is less in the year 2020(13.03%).
- In 2023, 28.27% of the articles are comes under Open access, and 31.94% articles are as closed access. In contrast, in 2024, only 9% of the articles are Open access, while 7.14% were categorized as closed access.

VIII. Conclusion

In this study, the author studied the articles published in the Directory of Open Access Journals(DOAJ). The study of journal articles was analyzed as author-wise distribution, year-wise distribution, mode of accession-wise distribution, rank list of journals and publishers, language, and license used for the publication, this study provides a clear picture of the topic, and the study helps to bring new development in the

field of Library and Information Science(LIS). It suggests doing more innovative publications in the field of LIS.

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