

Digital Sustainability Intelligence and Social Media Analytics: A Bibliometric Analysis

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Abstract. The combination of artificial intelligence (AI) and social media analytics provides the means to recognize and predict sustainability-related trends from large volumes of publicly available user data. Its adoption, however, is constrained by concerns about privacy, ethics, and transparency. This bibliometric study analyzed 559 documents from 274 sources, written by 3,414 authors between 2020 and 2025, using RStudio. The annual growth rate was 3.27%, with an average of 71.57 citations per document. Publications in IEEE Access grew significantly, while Scientific Reports and Heliyon grew after 2023. Deep learning, big data, healthcare, privacy, federated learning, and explainable AI were at the center of AI and machine learning research. The findings of this study can help researchers, managers, and policymakers make ethical, data-driven sustainability decisions.

Keywords. Artificial intelligence; bibliometric analysis; social media analytics; sustainability trends; ethical AI; privacy

I. INTRODUCTION

The combination of artificial intelligence (AI) and social media analytics has transformed the identification and prediction of sustainability trends and has enabled data-driven decision-making in both academic and industry settings [1]. AI-based trend estimation is attracting wide interest, but it still faces several challenges, such as data privacy and the ethical use of AI, that make trend prediction particularly difficult [2]. Social media generates large amounts of unstructured data, and these data can show how aware people are of sustainability issues and how they engage with them. This study uses a bibliometric analysis to map the research literature on AI, sustainability, and social media analytics, and to identify its main sources, authors, and themes, as a basis for more responsible, technology-based decisions [3], [4].

II. REVIEW OF LITERATURE

AI, sustainability, and social media analytics are no longer niche topics in academia; over the last few years they have moved to the forefront of research. The number of publications increased between 2020 and 2025, which shows that researchers from different sectors are paying much greater attention to how AI connects with questions of sustainability [1].

Terms such as machine learning (ML), deep learning (DL), and big data analytics have become commonplace. With such data, investigators can track sustainability patterns and learn what consumers are doing and thinking through social media. This is not the whole picture, however. Other technologies gaining traction include blockchain, federated learning, and explainable AI. This interest came mostly from a growing concern with privacy, not only security, and from harder questions about transparency and ethics in the digital space [2].

In healthcare, online communication, and decision-making, AI-powered analytics has come to play a key role, and the COVID-19 pandemic accelerated developments in this field [3], [5]. The tools suddenly had to cope with higher stakes. Cross-disciplinary work has also grown markedly: IEEE Access, Scientific Reports, and Heliyon have published much of the research at the intersection of these fields.

Recent studies of AI in social media monitoring have shown that it monitors sustainability, creates awareness of it, engages stakeholders, supports better decisions, and indicates which sustainability trends may emerge next [4]. This research area has evolved considerably over the last five years.

III. RESEARCH METHODOLOGY

The study used a quantitative bibliometric approach that examined what has previously been written and published on the subject. Articles were retrieved from the Lens.org database with specific search strings, and only the records

that met the inclusion criteria were retained, which ensured the quality of the input data.

The bibliographic data were cleaned before analysis by correcting inconsistencies. The analysis was carried out in RStudio with the Bibliometrix package and its Biblioshiny interface, which were used for data processing, visualization, and science mapping.

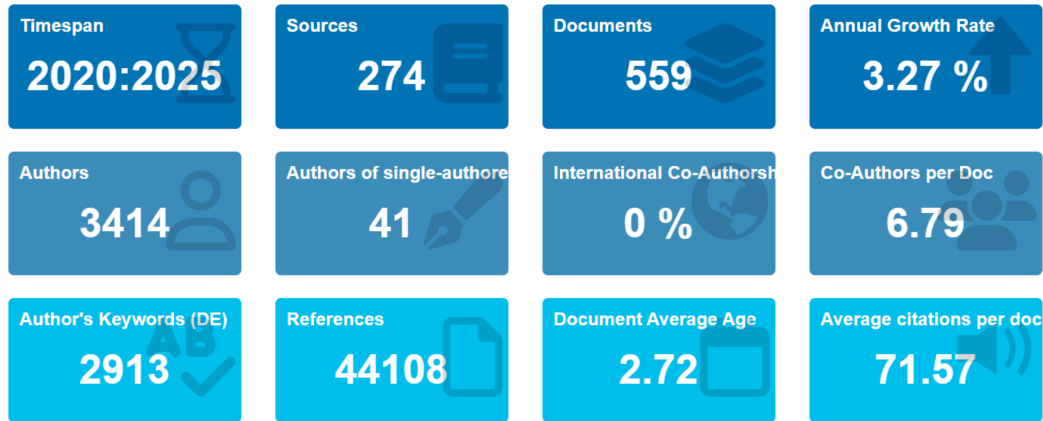


Fig. 1. Summary statistics of the bibliometric dataset, 2020 to 2025 (generated with Biblioshiny, Bibliometrix R package).

The analysis examined publication trends over time, authorship patterns, the most frequent sources, the distribution of citations across the literature, and shifts in the themes of the field. Bibliometric analysis is a common method because it offers a structured and transparent view of how a research field has developed. Its replicability also matters: a researcher who follows the same procedure should arrive at the same results, which is more important than is often acknowledged.

The bibliometric analysis of the period from 2020 to 2025 shows rising research interest in studies of AI and sustainability on social media platforms. The dataset comprises 559 documents from 274 sources contributed by 3,414 authors (Fig. 1), which indicates a strong collaborative research trend. The annual growth rate of 3.27% indicates steady development of the field, and the average of 71.57 citations per document indicates considerable academic impact of the published studies [1], [6].

IV. OBJECTIVES

- To describe the growth of publications on AI, sustainability, and social media analytics from 2020 to 2025, including annual production, growth rate, and citations.
- To identify the leading sources and authors publishing in this area.
- To identify the dominant, emerging, and declining research themes through keyword, trend topic, thematic map, and co-occurrence network analyses.
- To outline the implications of these patterns for researchers, managers, and policymakers.

V. FINDINGS

The production of sources over time (Fig. 2) shows that IEEE Access consistently led this domain from 2020 to 2025. Scientific Reports and Heliyon also grew significantly between 2023 and 2025, which signals increasing interdisciplinary interest in AI and sustainability. The steady increase

in articles in the leading sources shows the growing academic interest in, and relevance of, this new field, and the same pattern suggests that sustainability-related AI studies are also rising in high-impact outlets [1], [6].

Between 2020 and 2025, many scholars contributed to studies of AI and sustainability (Fig. 3), among them Li Y., Liu Y., and Zhang Y. Some maintained steady publication activity, whereas others showed growing influence through higher citation impact over the years. The variation in article output and citation performance reflects contributions from both new and established researchers, and the trend suggests growing academic engagement and collaboration in sustainability-related AI research [1], [6].

Annual scientific production fluctuated over the period (Fig. 4). Output peaked in 2021 and declined to a low in 2024 before rising sharply in 2025. The sharp increase in 2025 indicates a revival of academic interest or scientific productivity, consistent with the view that publication trends follow changing research priorities [1].

The keyword analysis (Fig. 5) shows that AI and ML are the dominant research themes, which reflects their growing importance among researchers. The frequent occurrence of terms such as COVID-19, deep learning, and big data demonstrates strong interdisciplinary applications in healthcare and data-driven decision-making. There is also increasing interest in ethical systems, with topics such as privacy, blockchain, and security. These results show that many fields have benefited from AI-related technology [1].

The trend topics (Fig. 6) show a clear shift in research focus. Earlier studies emphasized technologies such as 5G, blockchain, and deep learning, whereas more recent work increasingly focuses on AI, federated learning, digital health, and large language models. Topics related to ML and AI show growing potential for innovation and data-driven solutions across a variety of industries. As these technologies become more capable, they are likely to remain at the center of modern scientific research [1].

The thematic map (Fig. 7) shows that AI, ML, and the Internet of Things (IoT) are basic themes, which means that they are highly relevant but less developed in current research. Privacy, security, and federated learning, by contrast, stand out as well-developed motor themes, which re-

flects increased scholarly interest in secure and ethical AI systems. Emerging areas such as explainable AI and well-being suggest that AI technologies should support humans rather than limit them, as the literature also indicates [2], [3].

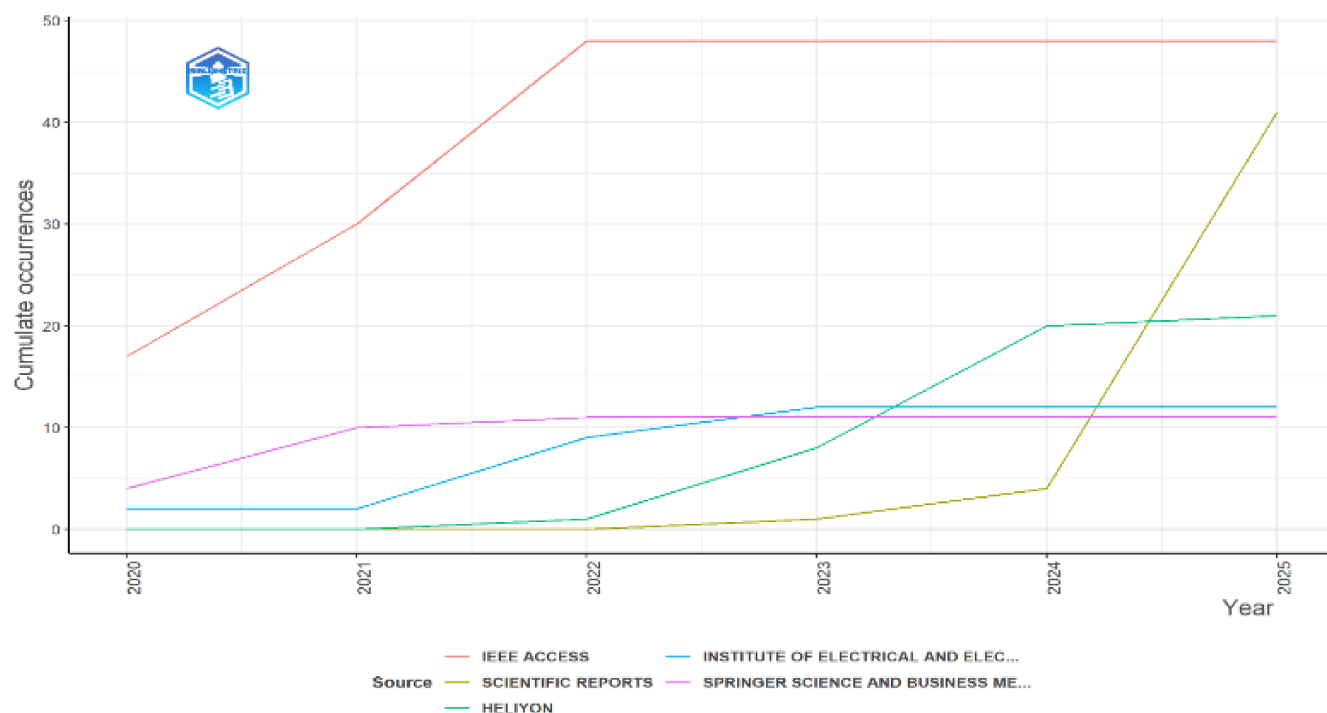


Fig. 2. Annual production of the leading sources, 2020 to 2025: IEEE Access, Institute of Electrical and Electronics Engineers (IEEE), Scientific Reports, Springer Science and Business Media, and Heliyon.

In the network visualization (Fig. 8), AI is the dominant node and is most strongly connected with ML, DL, healthcare, and data. The clusters show strong links, which indicates increasing interdisciplinary collaboration and knowledge integration in studies of digital innovation. Smaller

clusters at the edges of the map represent emerging or specialized topics that are still developing in this area. The structure as a whole demonstrates the growing contribution of AI-centered research to contemporary technology and healthcare innovation [3], [4].

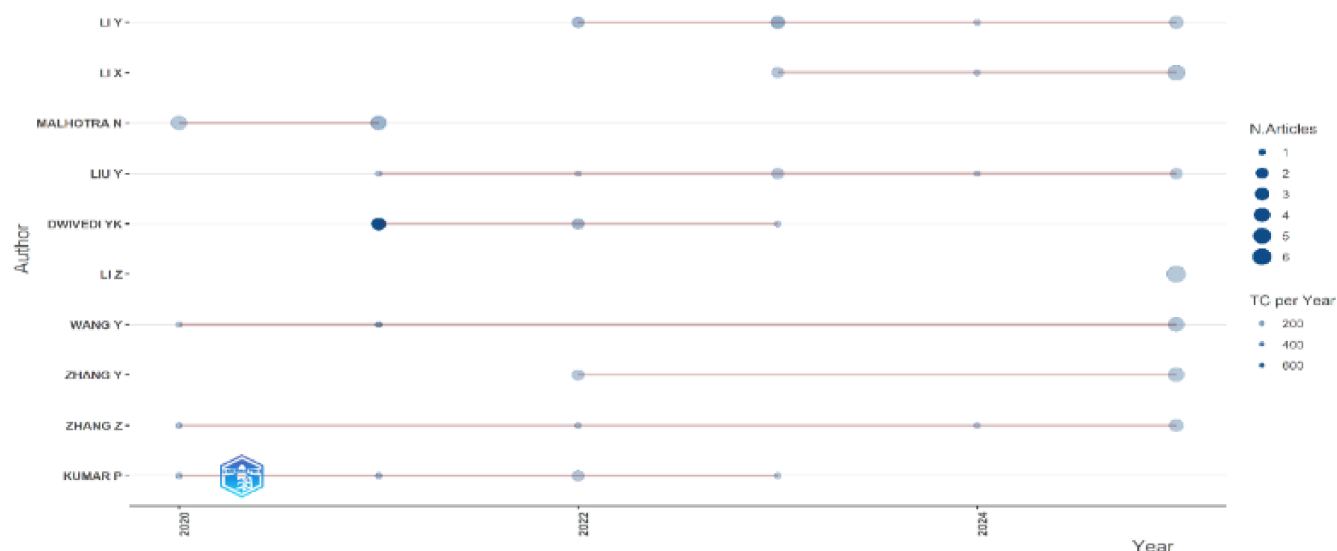


Fig. 3. Authors' production over time, 2020 to 2025.

VI. IMPLICATIONS

Research into sustainability and social media is strengthening the standing of AI. The findings help managers implement AI ethically in practice, benefit society through better

digital services, and direct researchers toward inquiries into generative AI, federated learning, and related topics.

Future research can extend the analysis to broader databases and industry applications, and to AI for sustainability innovation.

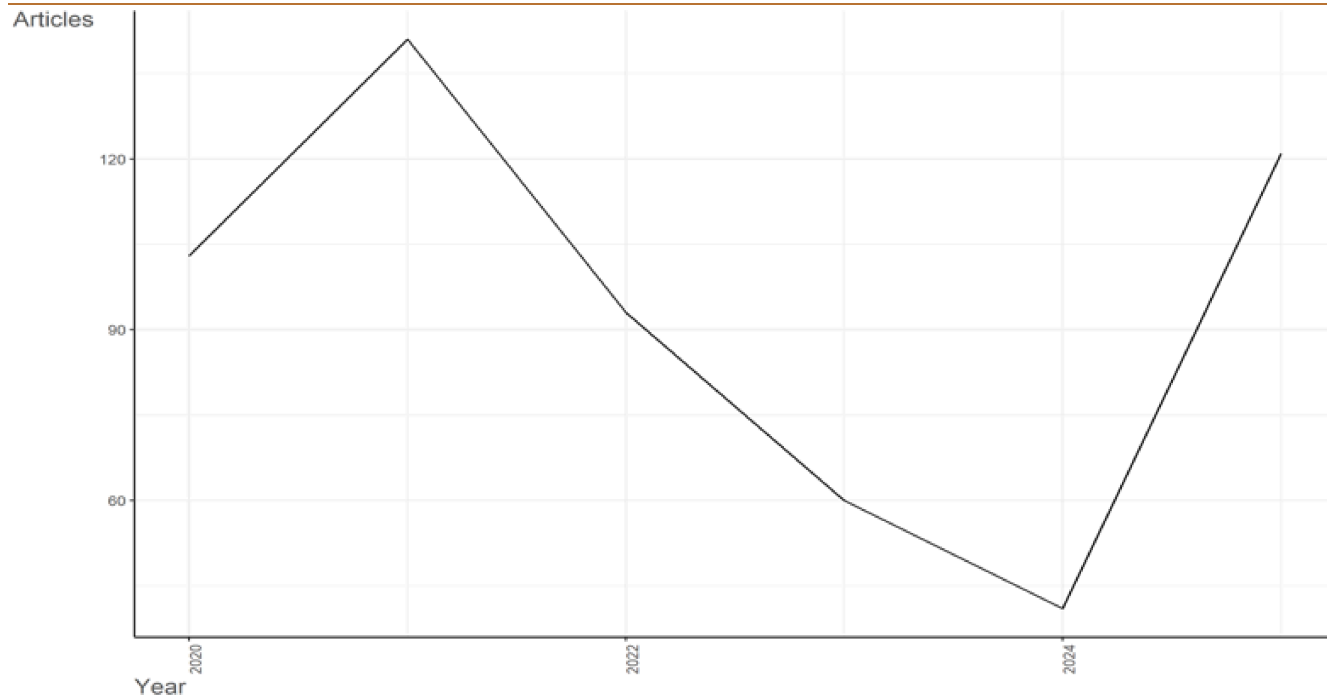


Fig. 4. Annual scientific production, 2020 to 2025.

VII. CONCLUSION

The analysis showed that interest in AI and sustainability on social media grew from 2020 to 2025. The body of research reviewed revealed that many researchers now collaborate to write papers and develop ideas. AI is increasingly deployed to ensure that new technologies have a positive impact and to find solutions based on data analysis. The research indicates that AI could help society become more sustainable and could draw in professionals from fields that do not typically communicate with each other; such a cross-disciplinary approach appears meaningful. Federated learning, digital health, and explainable AI emerged as further

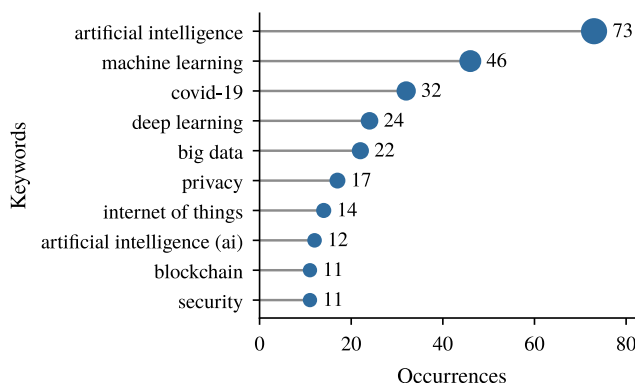


Fig. 5. Most relevant words and their occurrence frequencies in AI research.

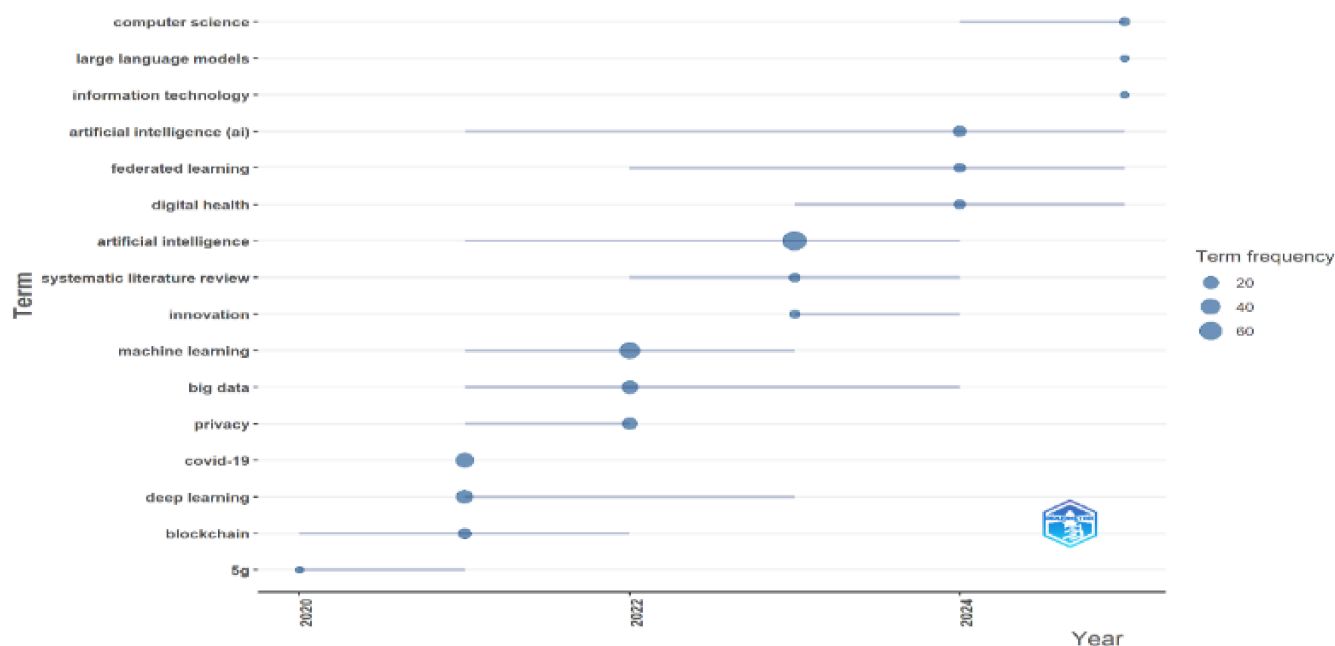


Fig. 6. Trend topics and temporal evolution of key terms in AI research.

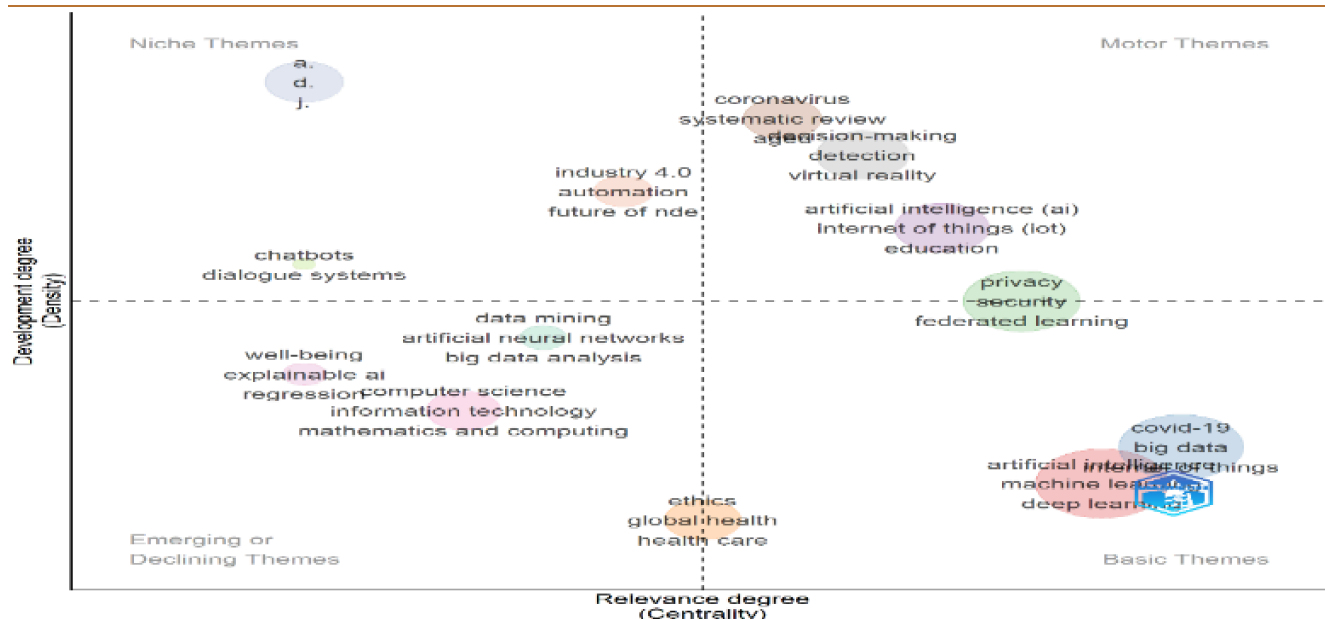


Fig. 7. Thematic map of keyword clusters in the dataset, plotted by relevance degree (centrality) and development degree (density) into motor, niche, emerging or declining, and basic themes (authors' analysis with Bibliometrix and Biblioshiny).

areas of interest, and as serious directions that merit attention. This research offers managers, policymakers, and scholars a useful point of departure. A significant part of future work lies in using AI well, whether to investigate what is happening in sustainability on social media or to anti-

pate future developments. Efforts are also emerging to understand which levers can influence outcomes before they occur. Being proactive rather than reactive is where this type of work deserves a place.

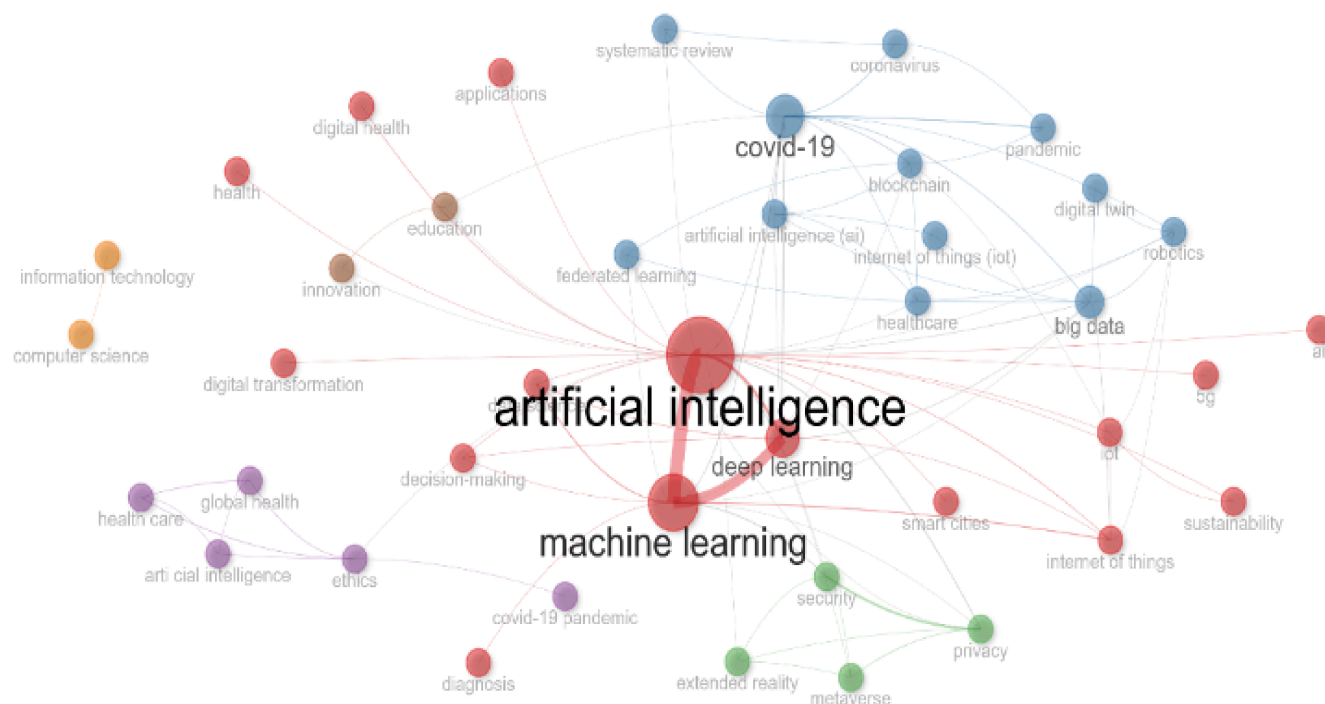


Fig. 8. Keyword co-occurrence network of the dataset; node size reflects keyword frequency and colors mark clusters (authors' analysis with Bibliometrix and Biblioshiny).

AUTHOR CONTRIBUTIONS

All authors contributed to the conception and preparation of this work and approved the final version of the manuscript.

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DECLARATION OF GENERATIVE AI USE

The authors declare that no generative artificial intelligence tools were used in the preparation of this manuscript. The authors take full responsibility for the content of the publication.

DATA AVAILABILITY

This study used bibliographic records retrieved from the publicly available Lens.org scholarly database.

ETHICS STATEMENT

This study used publicly available, de-identified data and did not involve direct interaction with human participants or animals; ethical approval was therefore not required.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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