How to Discover the Evolution of AI in the Research Area: A Methodological Proposal

1   Introduction

Healthcare organizations are undergoing a significant transformation driven by the integration of AI and machine learning technologies, aimed at enhancing patient outcomes, optimizing systems, and improving decision-making processes [Sunarti et al., 2021, Kumar et al., 2023, Kitsios et al., 2023, Lee and Yoon, 2021]. The revolutionary changes due to AI applications are particularly evident in areas such as diagnostics, medical imaging, virtual patient care, drug discovery, patient engagement, and administrative task [Al Kuwaiti et al., 2023]. The AI can play a critical role in clinical decision-making and disease diagnosis by analyzing large volumes of data to uncover insights that might remain hidden in the vast expanse of medical data, to addresses diagnostic errors, and to enhance the accuracy of clinical judgments through image-based diagnostics [Khalifa and Househ, 2021, Krishnan et al., 2023].The recent literature reviews on artificial intelligence in healthcare highlight that artificial intelligence is not limited to specific research areas, as it can be used for various purposes, spanning from drug discovery and vaccine trials to administrative and managerial issues. [Khalifa et al., 2024] investigates the role of AI in clinical decision support (CDS) systems, identifying six fundamental domains where AI contributes to advancing CDS: Data-Driven Insights and Analytics, Diagnostic and Predictive Modelling, Treatment Optimisation and Personalised Medicine, Patient Monitoring and Telehealth Integration, Workflow and Administrative Efficiency, Knowledge Management and Decision Support. [Lee and Yoon, 2021] examine the impact of artificial intelligence (AI)-based technology applications on the healthcare industry through the analysis of diverse real-world cases. These real-world cases span from diagnostic assistance, disease treatments, medical error reduction, patient engagement and participation, operational efficiency, reduction of medical cost to increased productivity and new job creation. [Al Kuwaiti et al., 2023] uncover the role of AI in healthcare along the following key aspects: (i) medical imaging and diagnostics, (ii) virtual patient care, (iii) medical research and drug discovery, (iv) patient engagement and compliance, (v) rehabilitation, and (vi) other administrative applications. This review concludes underscoring the challenges due to the AI utilization related to ethical and social aspects, governance issues, technical topics. [Ali et al., 2023] discusses the benefits, challenges, methodologies, and functionalities associated with AI in the healthcare sector. The review's findings indicate that the benefits of AI are addressed to individuals, organizations, and health sectors levels. The main challenges concern data integration, privacy concerns, legal issues, and patient

safety. Common AI methodologies include machine learning, image processing, data mining, expert systems, virtual reality, computer vision, and data science. Finally, the AI functionalities encompass diagnosis, treatment, information sharing, security, consultation, monitoring, data collection, and remote surgery. [Zahlan et al., 2023] conducts a systematic literature review (SLR) on AI, innovation, and healthcare to offer research directions in healthcare management fields. This SLR aims at investigating the most relevant AI-based healthcare applications, exploring the challenges and understanding the presence of AI in student's curricula. This SLR is integrated with the exploratory study of 2747 AI-based medical startups to better understand the drivers to foster the AI healthcare startups, the AI innovation and adoption. The aforementioned literature reviews analyze a small sample of papers without keeping in account of the research area that could enrich their findings. Instead, the acknowledge of research area could give useful insights on understanding the AI in healthcare inasmuch AI research in healthcare is disseminated across various publications witnessing the diverse, cross-cutting, and interdisciplinary nature of AI applications in healthcare [Zahlan et al., 2023]. Indeed, on the one hand, [Zahlan et al., 2023] figure out a predominance of publication in medical journal and a gap in the literature regarding the intersection of AI innovation in healthcare with business and management. On the other one, they recognize that the nature of the journal can create a bias in addressing a paper to an area rather than an another one because the [Young, 2022]'s commentary paper, focusing on business management challenges faced by AI healthcare startups, was published in a medical journal rather than a business or technology-focused publication.

2   Contribution of the work and research questions

According to the findings of [Zahlan et al., 2023] review that the multiple perspectives have an increasing interest in AI field, this paper aims to unveil the state of the art in AI and the research directions from a business and management perspective. In doing so this study contributes to the analysis of the AI in healthcare, differentiating itself from the previous literature reviews that investigate various aspects related to AI, without emphasizing the area of the research. Furthermore, considering that a business and management publication could be published in a journal belongs to a different research area, this paper presents an innovative method to reassign each paper to the fitting research area, regardless of the initial research area. This innovative method contributes to enhance the effectiveness of the SLR that consists in "synthesizing the literature and revealing the depth of knowledge on an area's critical key concepts and the relationships between these concepts" [Watson, 2015]. Thus, this paper contributes also methodologically presenting an automatic procedure for filter the paper according to the research area.
Against this backdrop, our research question is the following:

"How is the Artificial Intelligence evolving in healthcare sector compared to the business and management research area?"

3 Methodology

The methodology is articulated into the following phases:

1. Optimization of literature research results.

2. Analysis of literature research results.

The optimization of literature research results is a key and critical aspect in a literature review and this paper presents a new method for reorganized the research results, obtained by querying the main databases with a string of keywords. Indeed, dealing with an unbalanced sample could lead to a biased results in many research analyses. In a bibliometric review on AI and health a simple query leads to a huge number of papers belonging to medicine journals. As consequence it is not possible to discover the topics in other research areas. Moreover, journals with a high impact factor tend to be fewer in number compared to those with a low impact factor, and this distribution varies depending on the research area of the journal. To overcome such problem, researchers manually refine the query and reduce substantially the number of collected papers, loosing information. Departing from the previous literature in the present paper we propose a method based on the following steps:

1. Use the Scimago Journal ranking to initially categorize the research areas and gather journal rankings.

2. A specialization index [Sampagnaro, 2023] is used to assess the level of specialization in each research area.

3. Use a zero-shot classification method [Pàmies et al., 2023] along with a support vector machine (SVM) classifier [Srivastava and Bhambhu, 2010] to re-categorize the papers.

This first phase ends with a database that assigns the search results to the most appropriate areas regardless of the journal's area of membership. In the phase "Analysis of literature research results compared to research area" we applied the consolidated literature analysis techniques to analyze the evolution of AI in healthcare sector compared to the business and management research area.

4 Results

The main findings on the reorganizations of the databases are not available, yet. However, information on the size of the initial database is given below. We performed individual searches in the WoS and Scopus databases using specific keyword combinations such as "AI" and "health," "artificial intelligence" and "health," "AI" and "hospital," "artificial intelligence" and "hospital," "AI" and "healthcare," and "artificial intelligence" and "healthcare." We excluded terms

like "aortic" and "insufficiency." The search was restricted to English-language research articles and conference papers published in peer-reviewed journals, excluding review articles. There were no limitations on publication dates. After merging and cleaning the data, we gathered a total of 8,954 papers.

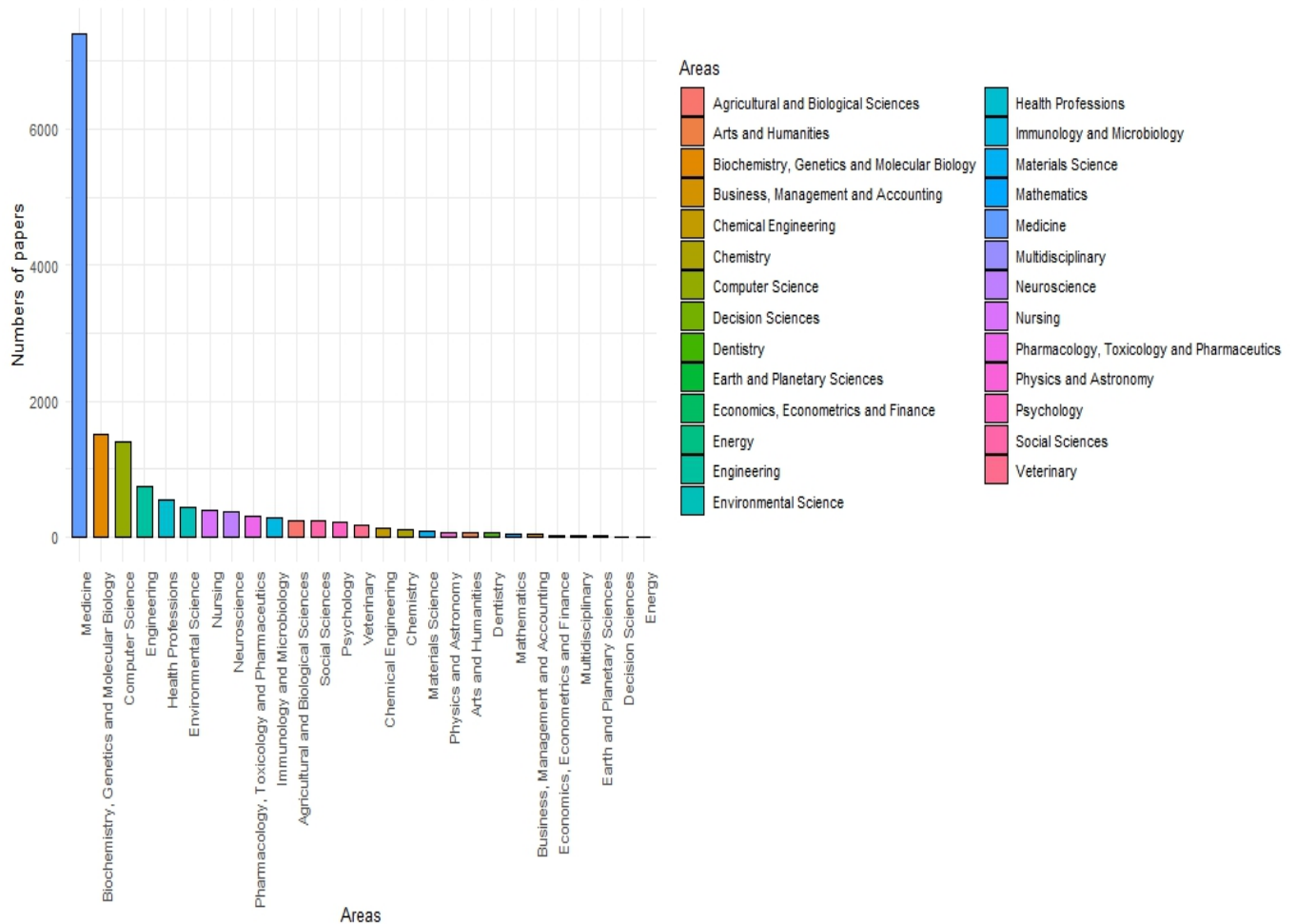According to the Scimago research area, the distribution of the papers is the following:

Figure 1: Distribution of papers in the various Scimago areas.

In the first application of the method, we have obtained the following redistribution:
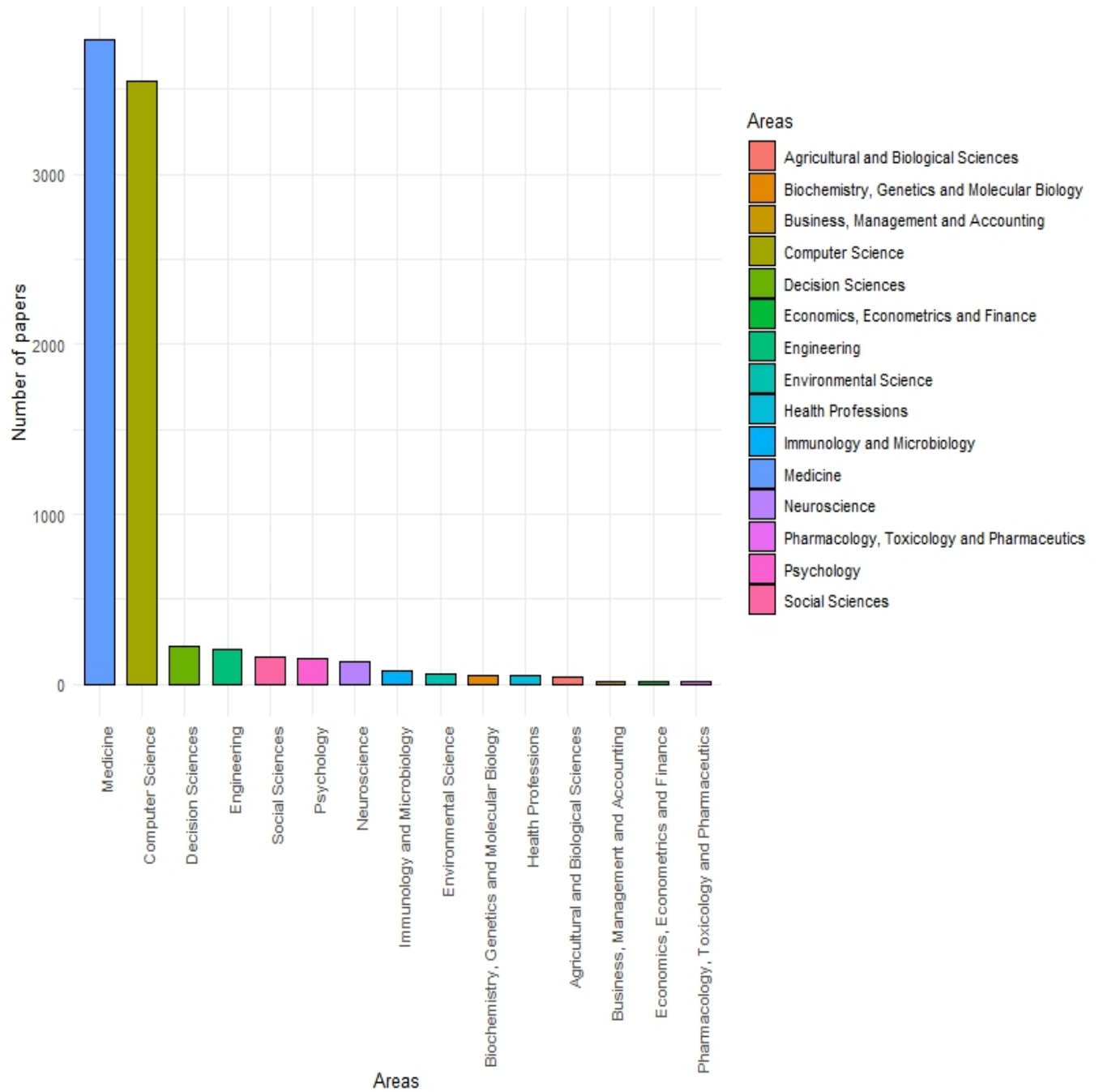

Figure 2: Distribution of papers in the various areas after redistribution.

In the next step, this database will be validated with appropriate measure and the topic analysis on the final database will be performed.

5   Conclusion

The paper examines the impact of AI on the healthcare industry. It highlights that this change is being studied from various angles, including individual, organizational, and sector-wide perspectives. The key value of this paper lies in presenting a novel approach to bibliometric analysis, which helps evaluate researchers' work in often overlooked but still significant areas.

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