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PAPER

The Role of Artificial Intelligence in the Diagnosis of Neoplastic Diseases: A Systematic and Bibliometric Review

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ABSTRACT

Artificial intelligence (AI) has significantly transformed the medical field, especially in the diagnosis, treatment, and management of oncological diseases. It has had a profound impact on clinical decision-making and has enhanced the quality of life for various populations. This study aims to comprehensively assess the inherent relationship between AI and medicine and to uncover both its positive and negative implications. To achieve a comprehensive understanding, a thorough systematic review of articles was conducted, examining a total of 80 papers published between 2017 and 2023. These articles were carefully selected from well-known open-access databases, such as Scopus, IOPscience, IEEE Xplore, Google Scholar, ResearchGate, and ProQuest. A key finding from this review is that the majority of research on this topic has been published in scientific journals ranked in the first-quartile (Q1), underscoring the importance and high quality of research in this field. The United States, China, India, the United Kingdom, and Canada are the foremost countries in publishing on this topic. Most of the research is published in first-quartile (Q1) journals, representing 51% of the studies. Only 1% of articles appear in third-quartile (Q3) journals. IEEE Xplore is renowned as the primary database for accessing high-impact studies in this field. Future research should prioritize investigating the long-term impact of AI on patient clinical outcomes. International collaborative research could promote innovation and fairness in the implementation of artificial intelligence (AI) in oncology.

KEYWORDS

artificial intelligence (AI), machine learning (ML), neoplastic diseases, cancerous diseases, systematic and bibliometric review

1 INTRODUCTION

Artificial intelligence (AI) serves as a fundamental tool for optimizing and automating mechanical tasks that require the prior analysis of large amounts of data

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across various sectors. In the fields of medicine and human biology, it is already being successfully used to develop new therapeutic options, expedite molecular diagnosis, and aid in clinical decision-making. However, it is already evident that AI is currently assisting medical professionals in diagnosing diseases, planning personalized treatments, and designing drugs for specific applications. In line with other medical and academic disciplines, the use of AI technologies in maternal-fetal medicine has recently experienced a significant surge and is increasingly employed in the diagnosis and treatment of medical conditions [1]. Research supports the notion that similar approaches are highly beneficial in guiding traditional association-discovery methods in the biomedical sciences [2]. A new engineering funnel feature has been introduced to represent DNA variants. It has been done using a 70-feature vector that compiles up-to-date conservation, functional, and ensemble scores [3]. Given the complexity of analyzing a substantial amount of diverse data from multiple sources, computational models can aid doctors in their daily tasks by providing diagnostic and prognostic support [4]. This study presents a model for predicting the survival outcomes of cancer patients and investigates the impact of clinical variables on the prediction [5]. A comprehensive study on automatic diabetes detection and diagnostic techniques has been conducted. The main papers are compiled from the Scopus scientific repositories after a rigorous selection process [6]. The field of AI in pathology is expanding to include the assessment of disease severity and the prediction of prognosis [7]. While the majority of AI research in pathology continues to concentrate on cancer detection and tumor classification, it is important to note that pathological diagnosis involves more than just morphological diagnosis. It is a complex process that involves the evaluation and judgment of various types of clinical data related to different organs and diseases [8]. The evaluation of intelligent systems as a scientific and methodological discipline is evolving, but there is a need for more systematic research and implementation of these methods [9]. The AI-based model ANAKIN has been developed to predict the survival fraction of various cell lines when exposed to different types of radiation [10]. There are 14 frameworks available for the application and evaluation of AI in medicine, with a focus on transparency, reproducibility, ethics, and effectiveness [11]. However, there is less discussion about the surveillance stage and the role of participation [12]. In the new era of deep learning-assisted pathology, the databank, integration, and cloud laboratory are becoming essential components of daily pathology practice [13]. Advances in technology over the past decade have enhanced our understanding, challenging the dominance of evidence-based medicine through AI [14]. Pandemics have highlighted the significance of digital health as a crucial component of public health services, particularly when social distancing is necessary or when the volume of patients is substantial enough to strain medical facilities [15]. The rapid advancement of AI in clinical and biomedical fields is a major focus in many communities, as it has the potential to enhance professionals in the health care system [16]. Explainable artificial intelligence (XAI) has the potential to enhance the performance of AI models [17], build user trust, and aid in decision-making, thereby encouraging its adoption in biomedicine and healthcare [18]. Advances in AI can enhance patient selection and monitoring in clinical trials, leading to higher success rates and lower drug development costs [19]. AI can improve the detection of central serous retinopathy (CSR), enabling accurate and rapid diagnoses. However, more research is needed to enhance computational complexity [20]. AI is revolutionizing drug discovery [21], with the potential to automate the creation of new biologically active molecules and synthesis planning [22]. The argument is made for the necessity of progressing from XAI to causality, which assesses the quality of explanations and is an attribute of the individual, while explaining ability is an attribute of the system [23]. AI, using deep learning (DL) techniques, can expedite the diagnosis and treatment of COVID-19 by integrating various forms of data to develop valuable platforms for doctors and researchers [24]. The demand for interpretable deep learning methods in drug discovery is high [25]. Cancer is becoming more prevalent due to technological advances and increased exposure to radiation. Among various types of cancer, lung cancer has a high mortality rate and is difficult to diagnose [102]. In the medical field, AI has attracted considerable attention because of its ability to quickly analyze data, make informed decisions, and process large volumes of information that would be unmanageable for humans. Within this context, the systematic review of the literature is an essential tool. It allows for the consolidation and meticulous examination of all qualitative aspects inherent to the research field. This meticulous methodology aims to categorize and synthesize all existing information related to the topic at hand. Thus, it not only offers a comprehensive overview of the advancements and achievements made through the use of AI in medicine but also establishes a solid foundation to effectively guide future research. In summary, all background or relevant information related to the topics addressed undergoes rigorous scrutiny, with the aim of precisely and substantively guiding subsequent research efforts. Consequently, this paper focuses on identifying the significance of AI in the diagnosis of neoplastic diseases. A research study was conducted using a systematic literature review to support this focus. Therefore, this paper will describe the systematic review as follows: Section II will detail the theoretical background. Section III explains the review methodology. Section IV presents the findings of the systematic review. Finally, Section V presents the conclusions and proposes recommendations for future research.

2 REVIEW METHODOLOGY

A systematic literature review (SLR) approach was used, following the guidelines of B. Kitchenham, as illustrated in Figure 1. Through this, a comprehensive analysis of the impact of AI on the diagnosis of neoplastic diseases will be conducted, with the aim of obtaining answers to the defined research questions.

It is necessary to maintain a record of the procedure used by creating a database of the search equations, exclusion criteria, and quality assessment employed for this paper in order to attain consistent and conclusive results.

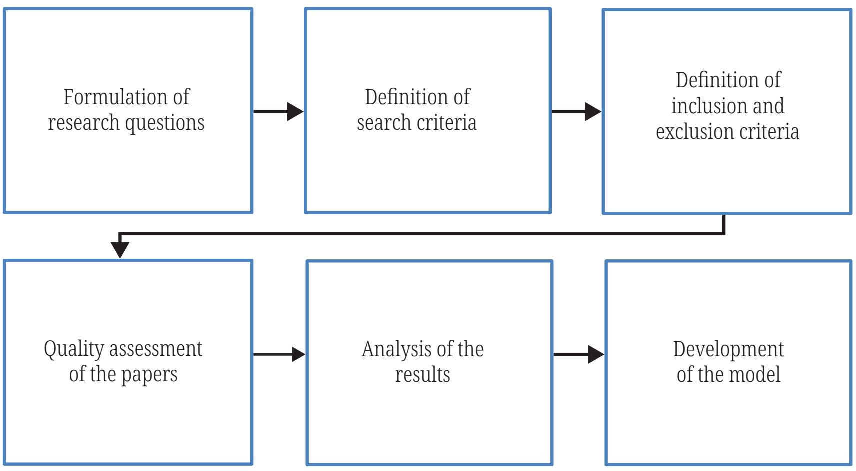

Fig. 1. SLR stages

2.1 Research main problems and motivation

Given the significance of research on AI in diagnosing neoplastic diseases, it is crucial to develop a search strategy that enables efficient data retrieval from each study for a thorough analysis. The research questions (RQ) are crucial. Table 1 provides five RQs and their corresponding motivations.

Table 1. Research problems and motivation

Research Question	Motivation
RQ1: What are the quartile levels of the journals where research on the effect of AI in the diagnosis of neoplastic diseases has been disseminated?	To identify quartile levels of the journals where research on the effect of AI in the diagnosis of neoplastic diseases has been published.
RQ2: What are the most used topics in research about AI and its influence on the diagnosis of neoplastic diseases?	To point out the most used topics in research on AI and its influence on the diagnosis of neoplastic diseases.
RQ3: What are the most prominent keywords in research about AI and its influence on the diagnosis of neoplastic diseases?	To stablish the most relevant keywords in research on AI and its influence on the diagnosis of neoplastic diseases.
RQ4: What are the articles that have been most published by country in research about AI and its influence on the diagnosis of neoplastic diseases?	To determine the articles that have been most published by country in research on AI and its influence on the diagnosis of neoplastic diseases.
RQ5: Which are the articles whose conclusions are defined by their higher Objectivity and lower Polarity, by country, in research about AI and its influence on the diagnosis of neoplastic diseases?	To specify the articles whose conclusions are characterized by high Objectivity and low Polarity, by country, in research about AI and its influence on the diagnosis of neoplastic diseases.

2.2 Information sources and search strategies

The databases used for the search of necessary research papers included: Scopus, IEEE Xplore, IOPscience, Google Scholar, ProQuest, and ResearchGate. The search method involves the use of keywords, as illustrated in Table 2.

Table 2. Search descriptors and their synonyms

Descriptor	Description
AI/computational intelligence/robotic intelligence	Independent Variable (A)
Diagnosis of neoplastic diseases/analysis of neoplastic diseases/evaluation of neoplastic diseases	Dependent Variable (B)

The search method was conducted using a set of terms designed to streamline the process of explanation and information abstraction. This set of terms is referred to as the search equation and varies depending on the information source, as illustrated in Table 3.

Table 3. Information sources and equations search

Source	Search Equation
Scopus	(TITLE("AI" OR "computational intelligence" OR "robotic intelligence") OR ABS(""AI" OR "computational intelligence" OR "robotic intelligence") OR AUTHKEY(""AI" OR "computational intelligence" OR "robotic intelligence")) AND (TITLE("diagnosis of neoplastic diseases" OR "analysis of neoplastic diseases" OR "evaluation of neoplastic diseases") OR ABS("diagnosis of neoplastic diseases" OR "analysis of neoplastic diseases" OR "evaluation of neoplastic diseases") OR AUTHKEY("diagnosis of neoplastic diseases" OR "analysis of neoplastic diseases" OR "evaluation of neoplastic diseases"))
IEEE Xplore	(("Publication Title": "AI" OR "Publication Title": computational intelligence OR "Publication Title": "robotic intelligence") AND ("Publication Title": "diagnosis of neoplastic diseases" OR "Publication Title": "analysis of neoplastic diseases" OR "Publication Title": "evaluation of neoplastic diseases")) OR (("Abstract": "AI" OR "Abstract": computational intelligence OR "Abstract": "robotic intelligence") AND ("Abstract": "diagnosis of neoplastic diseases" OR "Abstract": "analysis of neoplastic diseases" OR "Abstract": "evaluation of neoplastic diseases")
IOPscience	("AI" OR "computational intelligence" OR "robotic intelligence") AND ("diagnosis of neoplastic diseases" OR "analysis of neoplastic diseases" OR" evaluation of neoplastic diseases")
Google Scholar	("AI" OR "computational intelligence" OR "robotic intelligence") AND ("diagnosis of neoplastic diseases" OR "analysis of neoplastic diseases" OR" evaluation of neoplastic diseases")
ProQuest	("AI" OR "computational intelligence" OR "robotic intelligence") AND ("diagnosis of neoplastic diseases" OR "analysis of neoplastic diseases" OR" evaluation of neoplastic diseases")
Research Gate	("AI" OR "computational intelligence" OR "robotic intelligence") AND ("diagnosis of neoplastic diseases" OR "analysis of neoplastic diseases" OR" evaluation of neoplastic diseases")

2.3 Identified studies

Upon completing the search for papers in each information source, a collection of research papers is obtained, as shown in Figure 2.

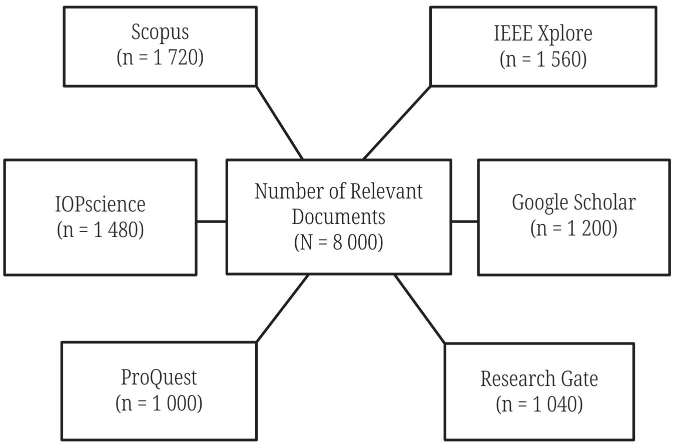

Fig. 2. Number of studies identified

2.4 Selection criteria

Exclusion criteria (EC) have been established to accurately assess the quality of the literature. The retrieved papers are included in the research based on a specific list of exclusion criteria. To narrow down the papers, eight exclusion criteria were utilized, which are outlined below.

EC1: The papers are more than seven years old.
EC2: The papers are not written in English.

EC3: The papers were not published in peer-reviewed journals or conferences.
EC4: The reviewed papers are bibliometric reviews or systematic reviews.
EC5: The titles and keywords of the papers are not very appropriate.
EC6: The full text of the paper is not available.
EC7: The papers are not unique.
EC8: It's a short paper with less than 10 pages in length.

2.5 Studio selection

Initially, 8,000 papers were retrieved using relevant keywords for the study. The steps for selection and filtering that were used are detailed below.

Step 1: Apply exclusion criteria to ensure that this review excludes irrelevant papers.
Step 2: Utilize the quality assessment to incorporate studies that offer accurate answers to the proposed research questions.

Consequently, the outcome of this phase is 80 papers, as depicted in Figure 3.

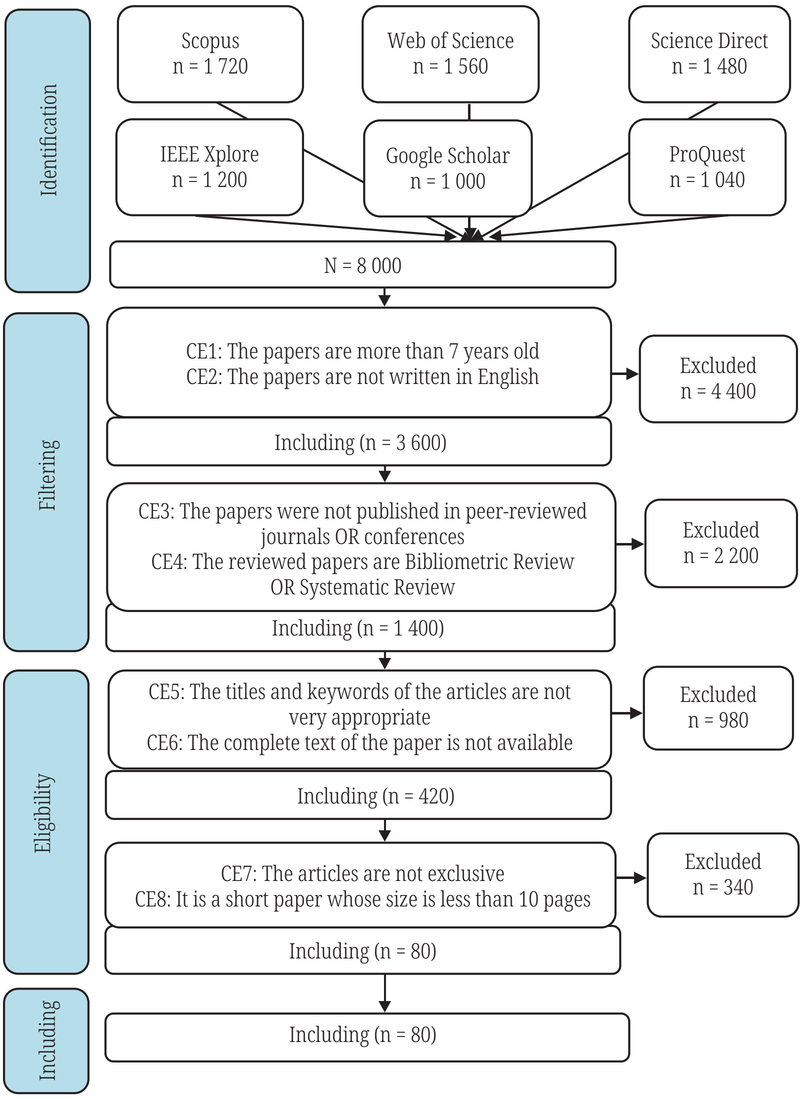

Fig. 3. PRISMA flow chart

2.6 Quality assessment

During this stage, the selected papers were analyzed using seven quality criteria (QA). During the final stage of selection and filtering, the official list of included papers was also compiled through a quality assessment to ensure that the research described in the papers is comprehensible and accurate (refer to Table 4).

Table 4. Quality assessment criteria

Quality Criterion (QA)	Criterion
QA1	Is the research objective clearly detailed?
QA2	Is the research methodology well specified?
QA3	Is the document well structured?
QA4	Is the dataset used clearly identified?
QA5	Are the paper's conclusions in line with the objectives?
QA6	Does the document address the context in which the research was conducted?
QA7	Are the experiment's solutions clearly identified and reported?

For each paper that was fully analyzed, the seven criteria were used to assess its quality on a scale. A rating scale of 1 to 3 was utilized, with 1 representing "Poor," 2 representing "Fair," and 3 representing "Excellent." The minimum score for exclusion was 11.5.

As a result of the assessment of the 80 papers, it was found that all primary studies met each of the QAs with a score greater than or equal to 11.5. Through this assessment, the exact number of publications to be included in the study was determined (refer to Table 5).

Table 5. Quality assessment results

Ref.	Type	QA1	QA2	QA3	QA4	QA5	QA6	QA7	Score
[1]	Journal	3	1	3	2	2	1	2	14
[2]	Journal	1	1	3	3	1	3	1	13
[3]	Journal	1	3	2	1	3	1	3	14
[4]	Journal	3	3	3	2	1	3	2	17
[5]	Journal	2	3	1	3	1	2	3	15
[6]	Journal	1	2	1	3	1	3	1	12
[7]	Journal	2	2	1	3	3	3	2	16
[8]	Journal	3	2	2	1	2	1	3	14
[9]	Journal	3	3	3	1	2	3	3	18
[10]	Journal	2	3	2	2	3	1	3	16
[11]	Journal	2	3	1	3	3	2	3	17
[12]	Conference	1	1	3	1	1	3	3	13
[13]	Journal	3	3	2	3	2	1	2	16
[14]	Journal	1	1	2	2	3	1	3	13

(Continued)

Table 5. Quality assessment results *(Continued)*

Ref.	Type	QA1	QA2	QA3	QA4	QA5	QA6	QA7	Score
[15]	Journal	3	2	2	3	3	3	2	18
[16]	Journal	1	1	2	3	1	3	3	14
[17]	Journal	3	3	1	2	2	1	3	15
[18]	Journal	2	3	2	1	2	2	2	14
[19]	Journal	2	1	2	1	2	3	1	12
[20]	Journal	1	1	1	3	3	3	1	13
[21]	Journal	1	1	2	3	1	3	3	14
[22]	Journal	2	3	2	3	2	2	1	15
[23]	Journal	1	3	2	1	2	1	2	12
[24]	Conference	2	3	1	1	1	1	3	12
[25]	Journal	3	3	2	1	2	3	2	16
[26]	Journal	1	2	3	1	3	2	3	15
[27]	Journal	1	2	2	1	3	2	1	12
[28]	Journal	1	3	3	2	2	1	3	15
[29]	Journal	1	1	3	3	3	3	1	15
[30]	Journal	1	1	2	1	3	3	1	12
[31]	Journal	1	1	1	3	2	1	3	12
[32]	Journal	3	3	1	2	3	3	3	18
[33]	Journal	2	2	1	3	1	2	1	12
[34]	Journal	3	2	2	1	3	3	1	15
[35]	Journal	2	1	2	3	1	1	2	12
[36]	Journal	2	3	2	1	3	1	2	14
[37]	Conference	1	2	1	3	2	3	3	15
[38]	Conference	3	3	2	2	1	2	3	16
[39]	Journal	3	1	1	1	3	1	2	12
[40]	Journal	3	2	3	3	3	1	3	18
[41]	Conference	1	3	2	2	1	2	1	12
[42]	Journal	2	3	1	2	3	2	2	15
[43]	Journal	1	2	3	3	1	1	2	13
[44]	Journal	2	2	3	3	3	2	3	18
[45]	Journal	1	1	2	1	3	3	1	12
[46]	Journal	2	3	1	1	1	3	1	12
[47]	Journal	1	1	1	2	3	2	3	13
[48]	Journal	3	2	3	1	1	3	3	16
[49]	Journal	2	3	3	3	2	3	1	17
[50]	Journal	2	2	1	3	1	2	2	13

(Continued)

Table 5. Quality assessment results *(Continued)*

Ref.	Type	QA1	QA2	QA3	QA4	QA5	QA6	QA7	Score
[51]	Journal	1	3	2	3	1	1	3	14
[52]	Journal	1	3	1	3	3	1	2	14
[53]	Conference	1	1	3	2	2	2	1	12
[54]	Journal	1	3	3	1	1	1	2	12
[55]	Journal	1	2	2	2	3	1	3	14
[56]	Journal	3	2	1	1	1	3	2	13
[57]	Journal	3	1	3	2	2	3	2	16
[58]	Journal	3	1	2	3	2	3	1	15
[59]	Journal	2	2	2	2	3	3	3	17
[60]	Journal	3	2	1	2	1	2	3	14
[61]	Conference	1	3	3	2	3	1	1	14
[62]	Conference	3	1	3	3	3	1	1	15
[63]	Journal	3	3	1	1	3	2	1	14
[64]	Journal	2	1	3	1	3	3	1	14
[65]	Journal	1	2	2	1	3	1	3	13
[66]	Journal	2	3	3	2	3	2	3	18
[67]	Journal	3	2	3	3	2	2	1	16
[68]	Journal	1	1	2	2	1	3	3	13
[69]	Journal	3	3	1	1	3	1	1	13
[70]	Journal	1	1	1	3	3	3	2	14
[71]	Journal	2	3	3	1	3	1	3	16
[72]	Conference	3	2	3	2	3	1	1	15
[73]	Journal	1	1	3	2	2	1	2	12
[74]	Journal	2	2	1	2	3	2	3	15
[75]	Conference	2	2	1	2	1	1	3	12
[76]	Conference	1	3	1	2	3	2	2	14
[77]	Conference	2	2	2	1	2	2	2	13
[78]	Journal	1	3	3	2	1	3	1	14
[79]	Journal	1	2	2	3	3	3	2	16
[80]	Journal	2	2	2	1	2	1	2	12

2.7 Strategies of data extraction

During this phase, the final list was acquired, and the necessary information was extracted to answer the research questions.

The data obtained from each paper includes the following: paper title, URL, source, year, country, ISSN, type of publication, publication name, authors, affiliation, quartile, H-index, number of citations, methodology, abstract, and keywords. Similarly, it's important to note that not all papers addressed all the research questions.

2.8 Synthesis of findings or data synthesis

The report obtained to address each of the research questions RQ1–RQ7 was tabulated and presented as quantitative data. This data was then used to conduct a statistical comparison between the various analyses for each research question. The processed statistics have helped to identify specific research patterns and directions that have been analyzed in recent years.

3 RESULTS AND DISCUSSION

3.1 General description of studies

Figure 4 presents a scatter plot of 80 articles grouped through cluster analysis based on the similarities of their conclusions. Each point on the graph represents an article. The positions of these points, determined by 'x' and 'y' coordinates obtained through multidimensional scaling (MDS), enable their visualization in a two-dimensional space. This technique reveals the structure of the clusters and the relationships between the documents. The graph clearly displays four distinct groups of articles, referred to as clusters, each assigned a different color. This visual representation helps to understand how the articles are interconnected after being grouped and their dimensionality reduced.

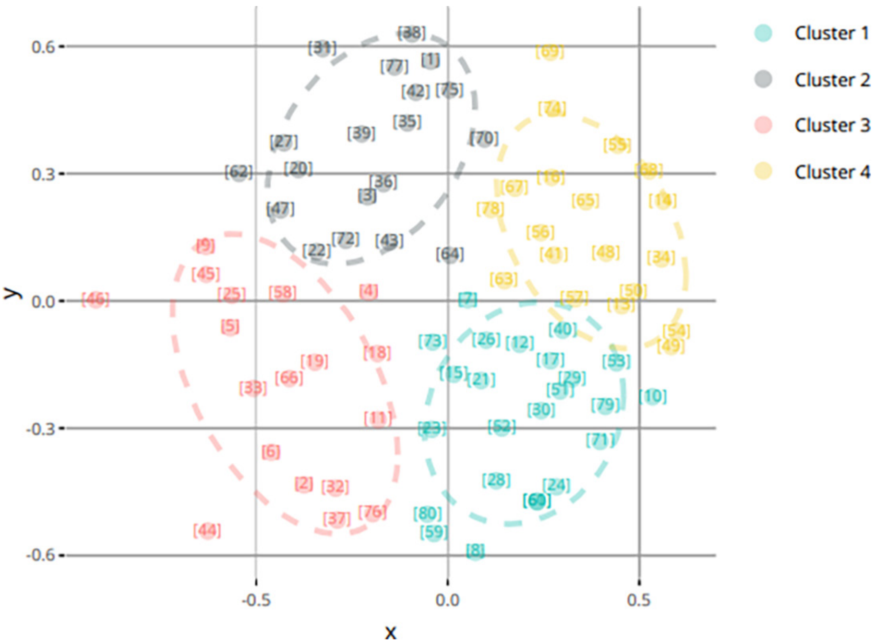

Fig. 4. Clusters by similarity of conclusions

Very similar cluster pairs refer to clusters with points that are close to each other or overlapping in the graph. Clusters 1 and 2 contain points that are closely located, suggesting that the conclusions of the articles in these clusters share more common characteristics compared to other clusters. Very Different Cluster Pairs: These clusters consist of points that are more dispersed in the graph. Clusters 3 and 4 are located at opposite extremes, indicating that the conclusions of the articles in these clusters have less in common with each other.

According to the authors, Henning W. Zimmermann and Till Herbold [43], there will always be similarities in the conclusions when a specific topic is addressed. On the other hand, authors Raghad Alhassnan and Saad Samargandy [44] share a similar perspective, stating that there will always be many similarities. Conversely, authors Robert Goldin and Stefan G. Hubscher [45] argue that conclusions should vary and be based on different criteria and opinions.

Therefore, there is a clear trend among the papers, with very similar conclusions. The outcome would depend on the type of research being conducted.

Figure 5 displays papers by year and source, which are the focus of scientific production.

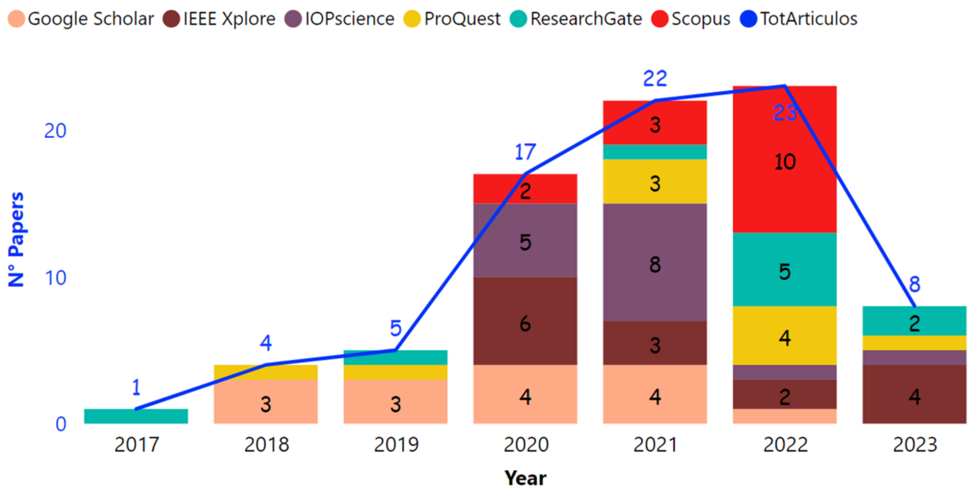

Fig. 5. Papers by year and source

After analyzing 80 papers reviewed between 2020 and 2022, it was found that there was an increase in publications, with the majority being published in Scopus. The research concluded in the second quarter of 2023, and the eight articles from that year, selected for their relevance, constitute the complete set of references for our review. These have been included in the study because of their essential contribution to the entire manuscript. The information up to June 2023 is considered definitive, encompassing all the relevant findings for our analysis.

According to authors Alexander Hann and Christian Trautwein [46], reliable and accurate information can be obtained from sources such as Scopus, IOPscience, and IEEE Xplore. On the other hand, authors Robert Goldin and Stefan G. Hubsche [47] believe that the accuracy of a paper depends on the credibility of its sources, particularly if they come from prestigious authors or institutions. However, according to authors Aziza Alkhaldi and Mamoon Rashid [48], accuracy does not necessarily depend on the source of publication but on the entity conducting the research.

It can be observed that there was an increase in publications between 2020 and 2022, as the topics to be discussed became more well-known during those years.

3.2 Answers to research questions

The answers to the research questions posed in the study are presented below. Taking into consideration the respective comments, their discussions, and the implications for future work.

In this section, the results obtained from the search process are presented. A bibliographic search was conducted for papers in journals and conferences related to the use of AI in the diagnosis of neoplastic diseases. We selected and used some well-known paper databases for the search. Only the most important papers were selected after a thorough review.

Additionally, a quality assessment was conducted to ensure that the selected papers were the most suitable for the study. A total of 80 papers comprised the final dataset for the present research. The results are presented in relation to the research questions.

For the processing of unstructured texts, which is part of this study, we have followed the stages depicted in Figure 1.

RQ1: What are the quartile levels of the journals where research on the effect of AI in the diagnosis of neoplastic diseases has been disseminated?

In Figure 6, quartiles are used to represent the distribution of scientific publications based on their objectives. Four quartiles were identified, and there is also a group of papers that do not fall into any quartile category. These quartiles correspond to various search sources. The broader flows indicate a higher number of research studies from that quartile indexed in the respective database.

According to Ferrada Cristian [49], Sankey diagrams illustrate flows and their respective quantities in proportion to each other. The width of the arrows or lines is used to represent their magnitudes, with wider arrows indicating greater flow quantity [50]. A Sankey diagram is created using quantitative data from a dataset [51] or data extracted from it (e.g., using pivot tables) [52]. The data preparation that precedes the design process is fundamental [53].

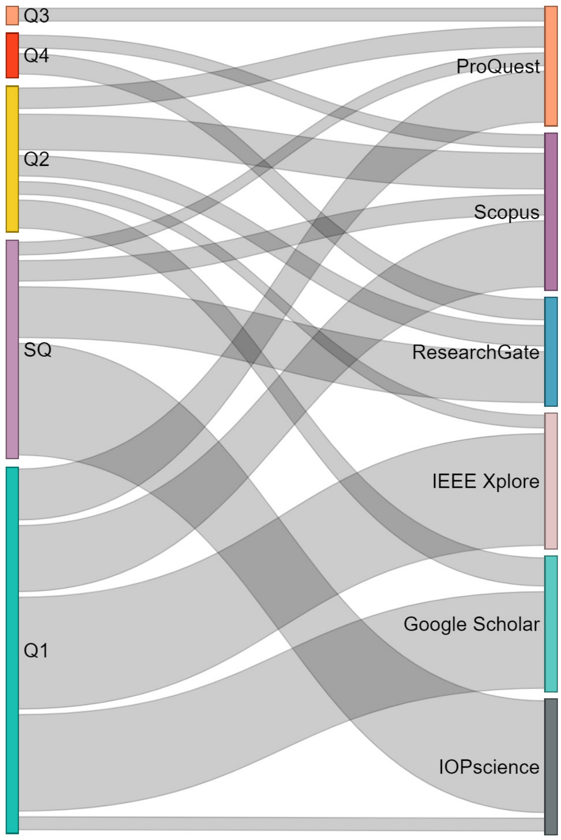

Fig. 6. Quartiles by means of publication

In response to RQ1, the analysis reveals that the majority of publications are Q1, occupying 51.0% of the selected studies, and the quartile with fewer publications is Q3, which occupies a small part of 1.0%. The line connecting Q1 with IEEE Xplore is wider than the others, indicating that IEEE Xplore contains a substantial amount of research published in Q1 quartile journals on the topic of AI and the diagnosis of neoplastic diseases.

The author, Darren Treanor [54], presents his opinion in his research paper, discussing various quartiles such as Q1, Q2, etc. Therefore, this indicates that journals in Q1 are more prestigious and cited more frequently than journals in other quartiles. Thus, we can conclude that this research has been conducted by analyzing prestigious journals. The similarity with the author Jakob Nikolas Kather [55] is appreciated. In his research paper, he explains that the most cited journals are in Q1, referring to the quartiles. However, in his paper, author Tomasz Arodz [56] mentions that most of the journals belong to Q1, which adds credibility to scientific papers and provides prestige and scientific contribution, resulting in a significant impact and enhanced research credibility.

Table 6. Quartiles by means of publication

Source	Q1	Q2	Q3	Q4	SQ	Total
Google Scholar	12	3	0	0	0	**15**
IEEE Xplore	14	1	0	0	0	**15**
IOPscience	1	0	0	0	14	**15**
Scopus	8	4	0	1	2	**15**
ProQuest	6	2	1	0	1	**10**
ResearchGate	0	2	0	2	6	**10**
Total	**41**	**12**	**1**	**3**	**23**	**80**

Some journals do not have quartiles (SQ) because they have recently been included in the index, and it takes time to accumulate enough data for an impact analysis. Some researchers may have a low publication frequency or a small number of citations, which limits their citation volume for quartile classification. Delays in updating metrics or editorial changes can also affect quartile assignments. Conferences are not included in this quartile ranking system, as it only considers periodically published materials.

Thus, the quartile emerges as a key indicator of a journal's relevance and prestige, with Q1 quartile journals ensuring a mark of excellence. This status reflects a preference and recognition by the scientific community for high-quality research, typically distinguished by its high impact factor and prominence in the international field.

RQ2: What are the most commonly used topics in research on AI and its influence on the diagnosis of neoplastic diseases?

Table 7 presents the most frequently used bigram concepts found in the articles, sorted by study years. The primary objective is to highlight the most significant themes in this area of study, presented in the form of bigrams. The chosen bigrams represent word combinations that have been identified as significant and recurring in the scientific literature under review. These combinations do not necessarily represent individual or independent methods. For example, terms such as "logistic regression" are listed in the table to show their relevance and frequency in the studies analyzed, not to categorize them as independent methods.

According to Arturo Montejo [71], an n-gram model is a type of probabilistic model that allows for statistical prediction [72] of the next element in a sequence of elements observed up to that point. An n-gram model can be defined as a Markov chain of order n-1 [73]. More precisely, an n-gram model predicts Xi based on Xi-1, Xi-2..., Xi-n [74]. Due to computational limitations and the typically open-ended nature of problems (where there are usually infinitely many possible elements), it is often assumed that each element depends only on the last n elements of the sequence [75].

For the results of RQ2, the findings presented in this table indicate that the most frequently used concept (topic) is "AI," which is mentioned in 52 papers published from 2017 to 2023. The second and third concepts, "machine learning" and "deep learning," are mentioned in 50 and 42 papers published from 2017 to 2020, respectively. Additionally, the years 2021 and 2022 have the highest number of concepts (topics).

Table 7. Topics by year of publication

Topic (Bigram)	2017	2018	2019	2020	2021	2022	2023	Total
AI	1	3	3	9	15	16	5	**52**
Machine learning	1	4	1	10	12	17	5	**50**
Deep learning	1	4	2	6	11	14	4	**42**
Neural networks	0	4	2	6	7	13	6	**38**
Neural networks	0	4	3	5	5	13	3	**33**
Random forest	0	3	1	1	2	8	4	**19**
Health care	0	1	0	5	4	6	0	**16**
Artificial neural	0	1	0	1	3	7	2	**14**
Learning algorithms	0	1	0	7	3	2	0	**13**
Big data	0	0	1	6	2	3	0	**12**
Convolutional neural	0	0	0	2	5	4	1	**12**
Natural language	1	1	0	2	2	6	0	**12**
Breast cancer	0	2	0	2	2	3	1	**10**
Logistic regression	0	1	0	1	5	2	1	**10**
Clinical practice	0	1	2	0	2	0	4	**9**
...	...	...	...	...	...	...	...	**...**
Total	**48**	**173**	**232**	**592**	**968**	**988**	**390**	**3391**

According to the authors Shankargouda Patil, Sarah Albogami, and Jagadish Hosman [76], the term "AI" is gaining more recognition nowadays as it is an emerging technology that will be utilized in the future across various fields of study. Similarly, authors Sheetal Mujoo and Mona Awad Kamil [77] argue that these topics are being increasingly utilized in scientific research. On the other hand, author David Nam [78] argues that these terms had been used in previous research, but with less frequency, as they were just beginning to be applied.

Therefore, it can be inferred that this topic has gained relevance in the field of medicine due to the increasing application of AI in medical research.

RQ3: What are the most prominent keywords in research on AI and its impact on the diagnosis of neoplastic diseases?

Figure 7 displays the keywords that are the focus of scientific production, with two keywords being the most recurrent in publications. Part A displays a word cloud with varying sizes, while Part B shows a bar graph representing the frequency of keywords related to the topic. The keywords are displayed on the vertical axis (left), while the frequency of each keyword is shown on the horizontal axis (right) through bars and numbers.

According to Beatriz Méndez [79], there is a formula in the document that enables the calculation of the weight of each subtree [80] based on the input keywords [81], thereby evaluating all potential outcomes [82]. This formula is known as the context resemblance function $CR = (1+|C_q|) / (1+|C_d|)$ [83].

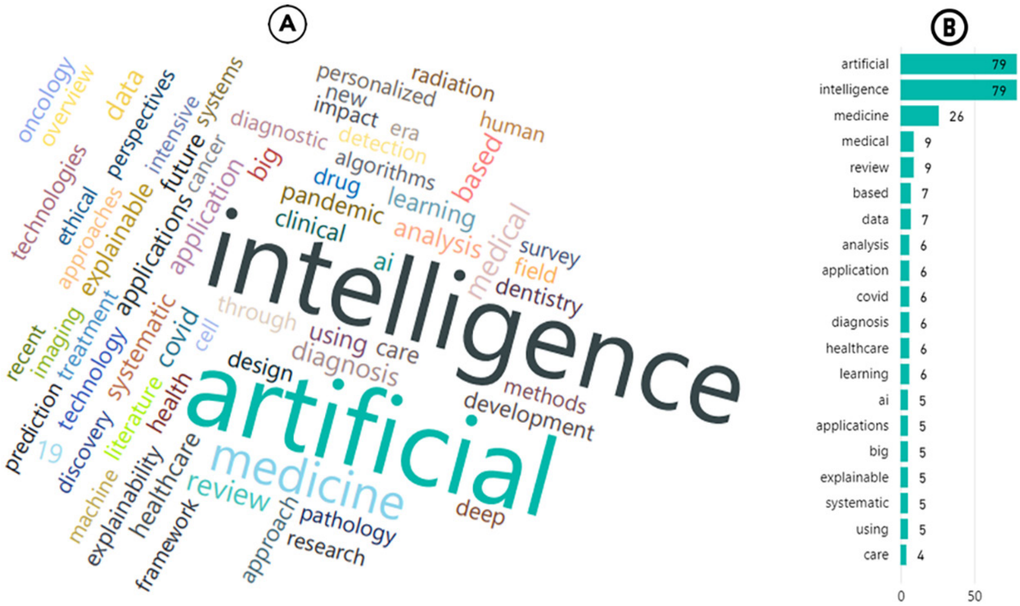

Fig. 7. Most relevant keywords

The two primary keywords, "artificial" and "intelligence," appear 79 times, indicating their frequent occurrence in the analyzed documents. Other important terms include "medicine" (26 occurrences), "medical" and "review" (both 9 occurrences), and so on. Terms such as "data," "analysis," "application," "COVID," "diagnosis," "healthcare," "learning," "AI applications," and "big" appear with frequencies ranging between 7 and 5 times.

Figure 8 depicts a bibliometric network illustrating the relationships between the keywords used in the scientific documents under review. This technique enables the identification and analysis of patterns and trends in the literature, as well as the interconnections between different terms and concepts. The thicker the line connecting two nodes, the stronger the association or the higher the frequency of co-occurrence between the keywords (---: 24 occurrences, ---: 18 occurrences, ---: 16 occurrences).

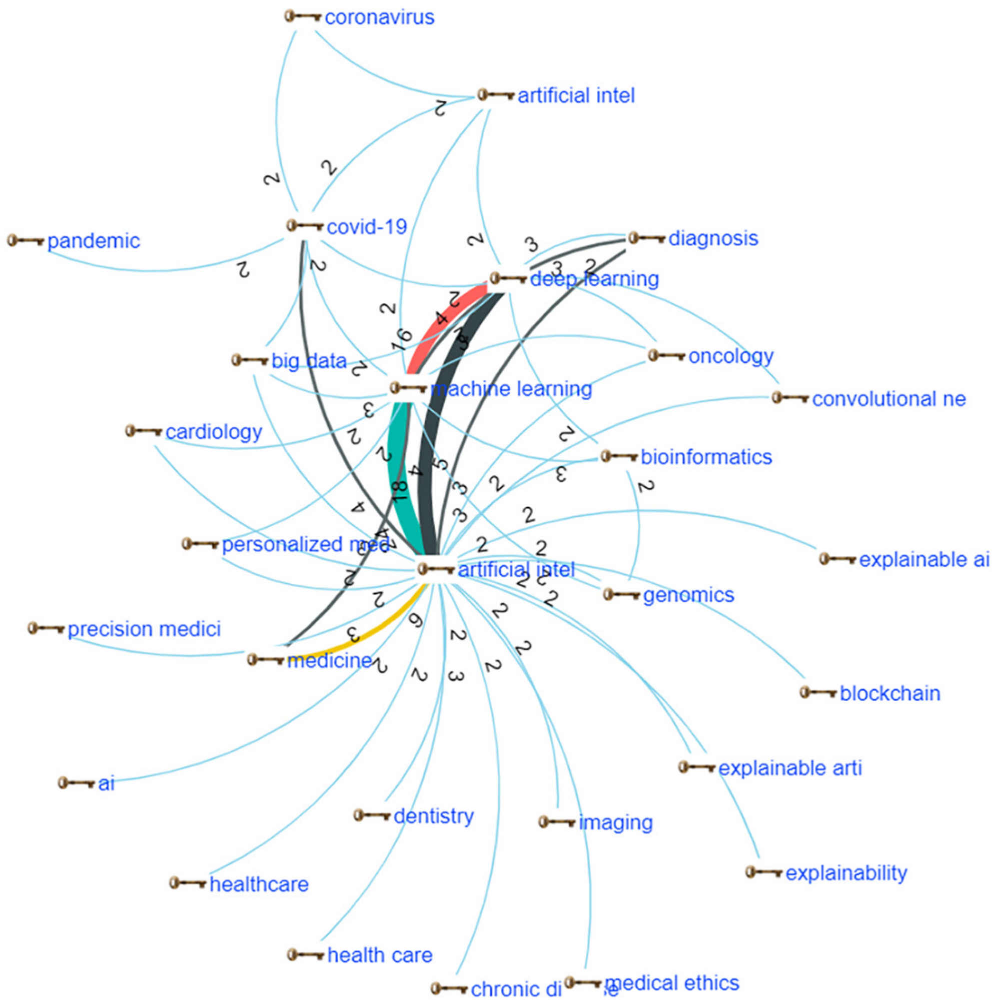

Fig. 8. Keywords by number of articles

Terms such as "machine learning," "big data," "AI," "deep learning" (DL), "diagnosis," "bioinformatics," and "genomics" are interconnected, indicating a strong relationship between these topics in the studied documents. This indicates that there is a substantial amount of research that spans across these fields.

According to the authors, Clare McGenity, Rebecca Randell, and Christopher Bellamy [84], they emphasize the most pertinent aspects of the systematic review obtained from databases such as Scopus, IEEE Explore, etc. They present the key themes of the journal, the results of which are essential for research. On the other hand, authors Lukas Buendgens, Didem Cifci, and Narmin Ghafari Laleh [85] mention in their paper that the keyword search involves two terms: "intelligence" and "artificial," which have been designated as key terms. However, in his paper, the author Yahya Bokhari [86] mentions that "AI" is commonly used as a keyword for search purposes.

It can be inferred that keywords have become essential for searching information within scientific journals, as they are widely used nowadays.

RQ4: Which papers have been published the most by countries, regarding AI and its influence on the diagnosis of neoplastic diseases?

Figure 9 depicts the countries targeted for scientific production are displayed. Guillermo Aponte [87] utilizes a fundamental mathematical model to rank the number of papers published by different countries, incorporating data collection [88], where they visualize and summarize data about the published studies and their respective statistical analyses [89] as well as [90].

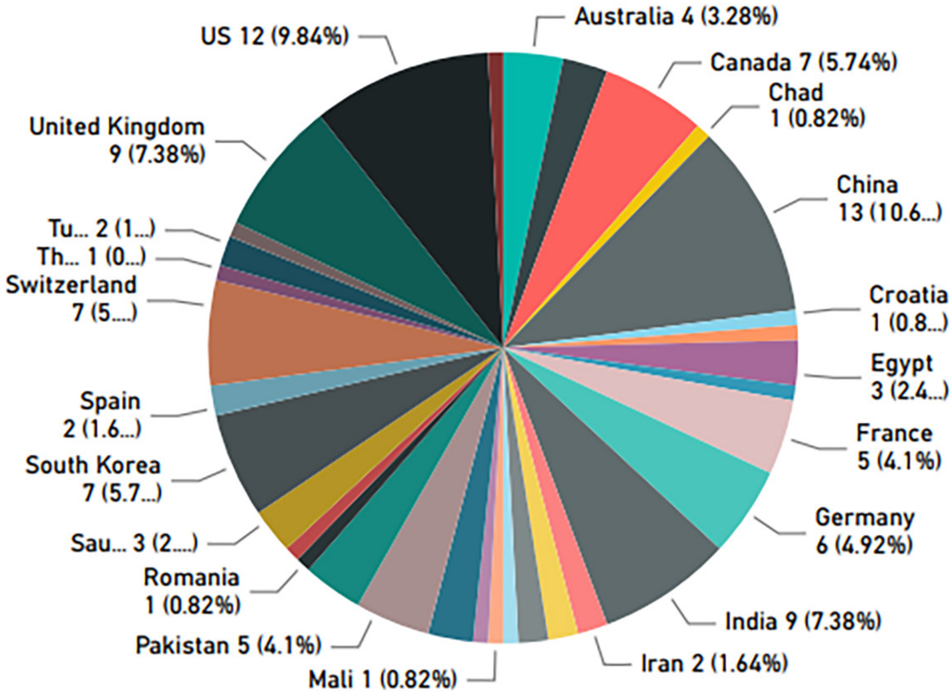

Fig. 9. Number of papers by various countries

In terms of the results for RQ4, the countries with the highest number of published papers are the US, China, India, UK, and Canada (see Figure 10).

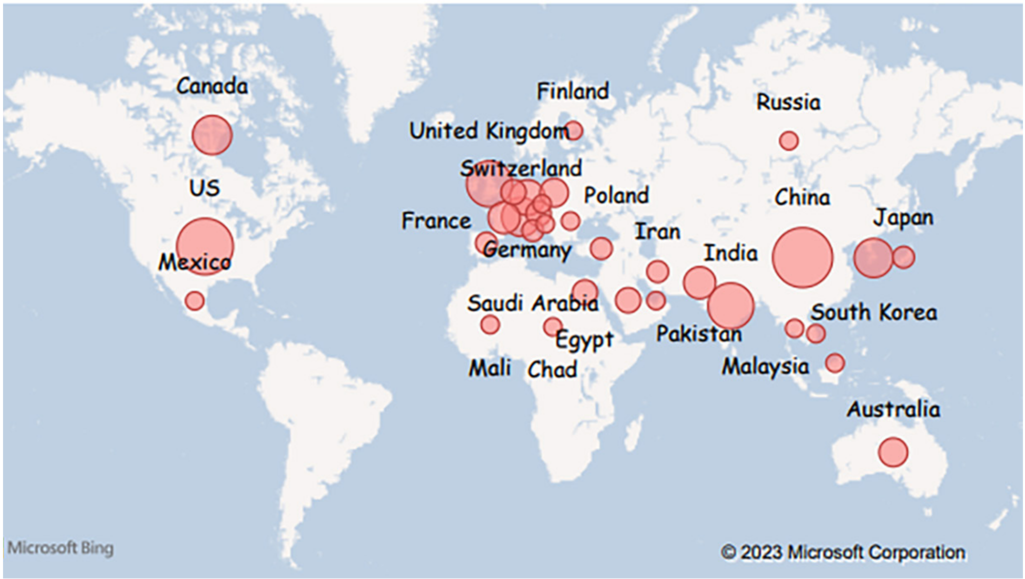

Fig. 10. Most number of papers published by various countries

For authors Zuhui Zhang and Ying Wang [91], the countries that publish the most are primarily from the European and Asian continents, where research levels are high. The similarity in the opinions of authors Hongzhen Zhang and Arzigul Samusak [92] regarding the countries that conduct the most elaborate scientific studies is noteworthy. In contrast, author Aikeliyaer Ainiwaer [93], in his research, asserts that North American countries also have a good percentage of publications and even rank within the Q1 and Q2 quartiles.

The graphs clearly show that the countries with the highest number of published papers on research related to the use of AI in diagnosing neoplastic diseases are diverse, with China, the US, and the UK being the main contributors.

RQ5: Which papers have conclusions characterized by higher Objectivity and lower Polarity, by country, in the research on AI and its influence on the diagnosis of neoplastic diseases?

Figure 11 illustrates papers with conclusions characterized by high objectivity and low polarity displayed by country, representing targets of scientific production.

According to Aitana Villaplana [94], one way to represent the proximity of words is to create a new vector with each word as coordinates [95], where the value of the coordinates is the product of the previous vectors [96]. In this way, if a word is repeated frequently in one text (let's say it's repeated 10 times) and not at all in the other (0), it will count as 10*0=0 times in the new vector. This approach provides a measure of similarity [97]. If we sum up all the coordinates of this new vector, we obtain an initial measure of the similarity between the two phrases [98].

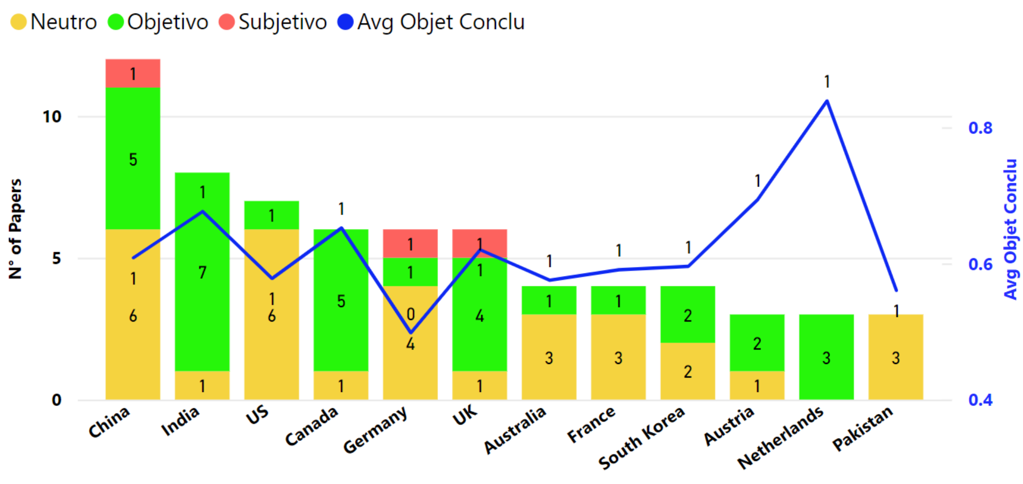

Fig. 11. Papers characterized by high objectivity and low polarity, by country

For the results of RQ5, as can be seen, the papers selected for this review have conclusions characterized by high objectivity and low polarity by country. India has eight papers, followed by China and Canada with five papers each, and the UK with four papers of high objectivity (see Figure 12).

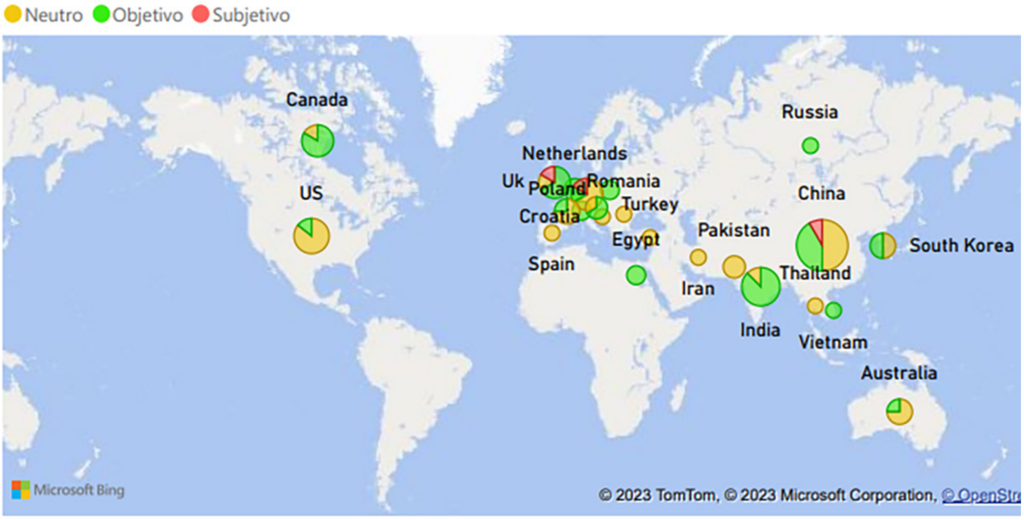

Fig. 12. Geographical distribution of very objective papers with low polarity

In the study by Kaisaierjiang Kadier and Lian Qin [99], their research clearly indicates that the objectivity of a study is influenced by the prestige of the journal in which it is published. Additionally, authors Rena Rehemuding and Xiang Ma [100] argue that countries with a higher number of publications tend to demonstrate greater objectivity and less polarity. However, according to author Yi-Tong Ma [101], everything would depend on the content of the research, which would provide greater objectivity in their studies. Given that there are various methods for evaluating the objectivity of conclusions in academic journals, it can be argued that the assessment ultimately relies on the content of the published research information.

4 CONCLUSION

This research provides analysis and statistical graphics on the use of AI and its impact on the diagnosis of neoplastic diseases, based on 80 papers published from 2017 to 2023. For the paper selection, exclusion criteria were applied according to the guidelines proposed by B. Kitchenham (2007), and data extraction was performed using the Mendeley desktop tool. Additionally, seven research questions were formulated. In RQ1, Q1 is the primary quartile for the development of AI. RQ2 indicates that the most commonly used concepts (topics) are "AI," followed by "ML" and "DL." RQ3 shows that the most frequently used keyword is "intelligence," followed by "artificial." RQ4 reveals that China has the highest number of scientific journal publications, followed by the US, India, the UK, and Canada. RQ5 identifies the papers with conclusions characterized by high objectivity and low polarity, primarily from India, followed by China, Canada, and the United Kingdom.

During the course of this research, we encountered some limitations, including the absence of other studies that have conducted bibliometric analyses or identified significant topics (such as bigrams or trigrams) for comparison with our findings. For future research, it is important to continue examining updated publications and works related to the subject under review, with a focus on AI and its impact on the diagnosis of neoplastic diseases. This will help raise awareness among researchers and professionals when implementing study enhancements in any field, thereby strengthening the trend in future investigations.

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