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Integrating Artificial Intelligence in Malaria Mosquitoes: A Bibliometric Analysis for Species Identification and Automated Detection

Alvianus Dengen[1], Budiawan[1]
[1]Universitas Teknologi Sulawesi, Indonesia
alvianus086@gmail.com *

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Abstract

This study conducted a bibliometric analysis of scientific publications related to the application of Artificial Intelligence in identifying and detecting malaria mosquitoes. Utilizing data from the Scopus database and data analysis stechniques supported by the Python programming language, this research evaluated productive journals, annual publication trends, leading authors, and dominant keywords. This study aims to evaluate publication trends, identify leading authors, and determine the dominant keywords in research on Artificial Intelligence applications for malaria mosquito identification. This research employed bibliometric analysis using data from the Scopus database and analytical techniques supported by Python. The analysis showed a significant increase in publications related to malaria and innovative technology and an increasing trend in publications over the past decade. Keyword analysis identified common research topics and provided recommendations for future research connections. This study highlights the benefits of integrating Artificial Intelligence in identifying mosquito species and automatic detection. It emphasizes the importance of bibliometric analysis in supporting decision-making within the scientific research community.

INTRODUCTION

Malaria remains one of the deadliest infectious diseases worldwide, with Anopheles mosquitoes acting as the primary vectors for transmission (Bango et al., 2020; Hede et al., 2015; Siao et al., 2020; Tusting et al., 2013). It is significantly impacting public health, particularly in tropical and subtropical regions. Historically, various studies have tackled the challenges of identifying malaria vectors, mainly focusing on traditional methods like microscopy and molecular techniques. While accurate, traditional methods, such as microscopy and molecular techniques, require significant time and resources (Amjad, 2020; Arizono et al., 2023; MacKeigan et al., 2022). For instance, the limitations of these conventional identification methods, particularly in the field and during

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outbreaks when rapid response is crucial (Biruksew et al., 2023; Fletcher et al., 2020; Orok et al., 2021; Sachs, 2002).

Despite the extensive research into these traditional methods, gaps remain concerning the application of advanced technologies in this domain. The integration of Artificial Intelligence is beginning to bridge these gaps, as demonstrated by recent studies (Adikari et al., 2024; Giudici et al., 2024; Holzinger et al., 2022; Park et al., 2020; Tsolakis et al., 2023). However, there is limited comprehensive evaluation of AI's role in enhancing mosquito species identification, underlining the novelty of our analysis. Current trends reveal a burgeoning interest in employing Machine Learning techniques, such as Random Forest and Convolutional Neural Networks, which have proven effective in analyzing large datasets, yet the extent of their application in malaria mosquito identification has not been thoroughly documented (De Lima et al., 2024; Khan Mamun & Elfouly, 2023).

Using Python for bibliometric analysis enables researchers to conduct an in-depth evaluation of scientific literature by leveraging various libraries such as pybliometrics, pandas, and matplotlib. Python allows for the collection of publication data from databases like Scopus, processing this data to uncover patterns of author collaboration, identifying frequently occurring keywords, and analyzing citations to assess the impact of research. For instance, the pybliometrics library facilitates direct data extraction from the Scopus API, while NetworkX and matplotlib can visualize collaboration and citation networks. The advantage of using Python lies in its programming flexibility and power, enabling more complex automation and analysis compared to other bibliometric analysis tools (Lei et al., 2023; Lin et al., 2023; Nti et al., 2023; Velasquez, 2023; Xu et al., 2022).

In light of these discussions, this analysis aims to provide a detailed bibliometric evaluation of the literature surrounding the use of for identifying and detecting malaria mosquitoes. By synthesizing existing research, we propose elucidating patterns and gaps and recommend avenues for future inquiry. The findings from this analysis will contribute to academic knowledge. Still, they will inform public health strategies, guide policymakers in engaging with Artificial Intelligence technologies, and facilitate future researchers in identifying research pathways that align with societal needs and prevailing health challenges.

To sharpen our focus, we present the following research questions (RQs):
RQ1: What are the prevailing trends in scientific publications related to the use of AI in identifying and detecting malaria mosquitoes?
RQ2: Which technologies and methodologies have been most effective in this area?
RQ3: What are the implications of this research for public health policymakers, future researchers, and the broader society?

METHODS

This study employed bibliometric analysis methods to examine scientific works related to using artificial intelligence to identify and detect malaria mosquitoes. This approach involved collecting and analyzing data from scientific publications using Python software to visualize research networks and identify key trends in this field. This study utilized data from the Scopus database, one of the largest and most reliable bibliometric data sources. The analysis involved collecting and analyzing data from scientific publications using the Scopus database, one of the largest and most reliable bibliometric data sources. The selected keywords used in the search included Artificial Intelligence, Malaria Mosquito, Bibliometric Analysis, Species Identification, Automatic Detection, Vector Control, Machine Learning, Anopheles Detection, Artificial Intelligence in Public Health, and Mosquito-Borne Diseases. This search encompassed all documents, such as articles, conference proceedings, and reviews published up to 2024.

The search results were filtered based on specific inclusion and exclusion criteria. Publications were included if they focused on using Artificial Intelligence to identify and detect malaria mosquitoes, employed machine learning methods for determining and detecting malaria vectors, or discussed Artificial Intelligence role in public health regarding mosquito-borne diseases. Conversely, non-full-text publications and studies irrelevant to the research focus, particularly those that did not mention Artificial Intelligence or machine learning, were excluded from the analysis.

Python has become an exceptionally valuable tool for bibliometric analysis. It enables researchers to process and analyze extensive data from scientific publications. Bibliometrics is a methodology for measuring and analyzing various aspects of scientific literature. Python, with libraries such as pandas, matplotlib, seaborn, and sci-kit-learn, facilitates efficient and effective bibliometric data analysis (Awaluddin et al., 2025; Putra et al., 2020).

The matplotlib and seaborn libraries enable the creation of informative and attractive graphics. Bar and line charts are often used to display the number of publications per journal and year, providing a visual overview of research trends over time. These visualizations help researchers quickly identify journals or periods with high publication rates, which may indicate significant research trends (Oberoi & Chauhan, 2019; Waskom, 2021). Further analysis can be conducted using Natural Language Processing techniques with libraries such as sci-kit-learn (Shankar & Parsana, 2022). Techniques like Term Frequency-Inverse Document Frequency. enable researchers to measure the importance of words in documents and find similarities between the titles or abstracts of articles. This technique helps create recommendation systems and discover hidden patterns in the scientific literature (Kang et al., 2020).

Data extraction involved compiling bibliographic details, including authors' names, publication years, journal titles, keywords, and citation counts. Python programming was utilized for data analysis, along with libraries such as pandas for data manipulation and management, matplotlib and seaborn for data visualization, and sci-kit-learn for applying Natural Language Processing techniques. Python provided flexibility and power, enabling intricate automation and complex analysis of the bibliometric data. To visualize the results, a series of charts showcased trends in author productivity, publication year distributions, and keyword connections. Bar charts illustrate the number of publications per journal and year. At the same time, network graphs depicted the relationships between keywords, reinforcing the thematic structure of the analyzed research and revealing potential gaps and new research pathways.

One of the main aspects of bibliometric analysis is identifying publication trends in bibliographic data. Statistical analysis included calculating publication trends by aggregating the number of publications per year and per journal, employing functions like value counts and group by in Pandas. Additionally, the analysis underwent validation through discussions with co-authors to ensure accuracy and clarity. The following pseudocode provides the main steps taken by a Python program for data analysis from a CSV file, including visualization and NLP-based recommendations:

Fig 1. Pseudocode for data analysis from a CSV file, including visualization and NLP-based

```
Pseudocode

Load libraries and CSV file
Display first few rows of data

If 'Title' column exists and is not empty:
    Calculate top 10 journals with most publications
    Plot bar chart for top 10 journals
If 'Year' column exists and is not empty:
    Calculate number of publications per year
    Plot line chart for publications per year
If 'Authors' column exists and is not empty:
    Calculate top 10 most productive authors
    Plot bar chart for top 10 authors
Create DataFrames for:
    - Top journals
    - Publications per year
    - Top authors
If 'Cited by' column exists and is not empty:
    Calculate top 10 journals with most citations
    Plot bar chart for top 10 cited journals
If 'Title' column exists and is not empty:
    Create TF-IDF matrix for titles
    Calculate cosine similarity for titles
    Define function to recommend similar titles
    Print recommended titles for a given journal
Define function to analyze keyword network:
    Extract keywords and create pairs
    Calculate keyword frequency
    Identify top 15 most used keywords
    Create network graph for top keywords
    Identify unconnected keywords
    Plot network graph for top connected keywords
    Return graph and unconnected keywords
If 'Author Keywords' column exists and is not empty:
    Run keyword network analysis
Define function to recommend research connections:
    Create connections between top and unconnected keywords
    Plot network graph for recommended connections
    Print recommended connections
Run research connection recommendations

Save all generated plots as image files
```

This comprehensive bibliometric analysis enhances our understanding of Artificial Intelligence role in identifying and detecting malaria mosquitoes. The methodology is precisely documented to allow reproducibility, offering insights that inform future research directions in the field.

RESULT AND DISCUSSION

Python is a highly popular and versatile programming language widely used in various fields, including data analysis, web development, and machine learning. For bibliometric analysis, Python provides several powerful libraries, such as Pandas for data manipulation, matplotlib and Seaborn for data visualization, and Sci-kit-learn for more complex data analysis, such as clustering and recommendations. The presented code uses these libraries to analyze and visualize scientific publication data from a CSV file, providing valuable insights into research trends and leading authors in specific fields.

The results of the bibliometric analysis in this study encompass several important aspects. First, analyzing journals with the most publications and citations provides an overview of the most productive and influential journals. Second, the annual analysis of the number of publications shows a trend of increasing research activity over time. Third, identifying the most productive authors highlights individuals who have contributed the most to the scientific literature. This bibliometric analysis also conducts a keyword analysis to identify research topic trends and provides recommendations for future research connections based on the most frequently used and unconnected keywords. The resulting visualizations help understand patterns and relationships in the data, facilitating better decision-making in research planning and development.

The data used in this study spans from 1992 to 2024 and consists of scientific articles registered in Scopus. There are 317 different article titles with a total of 296 authors. There are 227 keywords used to categorize these articles and help create several analysis plots, such as the following:

Plot of the top 10 journals with the most publications

Figure 2 illustrates the top ten journals based on the number of publications related to the application of Artificial Intelligence in identifying and detecting malaria mosquitoes. Notably, the journal with the most publications is Ocular changes as a diagnostic tool for malaria, highlighting a significant interest in innovative malaria diagnostics. The journals in this list are crucial in advancing health technology and epidemiology knowledge.

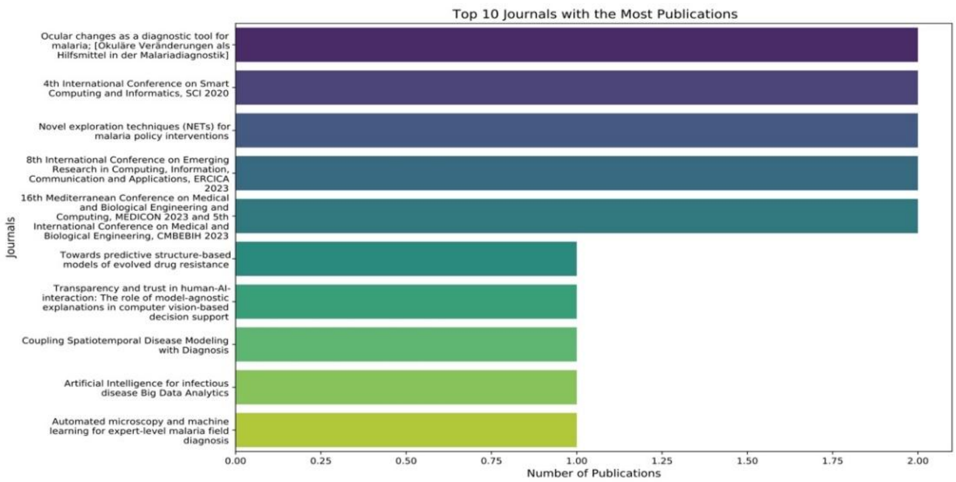

Fig 2. Bar charts for top 10 journals

This image shows a bar plot of the top 10 journals with the most publications based on the analyzed data. The journal titled Ocular changes as a diagnostic tool for malaria; Okuläre Veränderungen als Hilfsmittel in der Malariadiagnostik ranks first with the most publications. It is followed by other journals such as the 4th International Conference on Smart Computing and Informatics, SCI 2020 and Novel Exploration Techniques for Malaria Policy Interventions. Each of these journals has a relatively balanced number of publications, with slight differences, indicating that the topics discussed in these journals have significant interest from the research community. This visualization helps identify which journals are the most productive and likely to influence the researched field significantly. In conclusion, the data illustrated in figure 1 reveals a strong connection between the volume of publications in these leading journals and advancements in research focused on malaria control through Artificial Intelligence. Thus, the signals presented suggest a growing awareness and concerted academic efforts to tackle the challenges associated with identifying and controlling malaria mosquitoes.

Plot of the number of publications per year

Figure 3 illustrates the number of publications per year related to the application of Artificial Intelligence in the identification and detection of malaria mosquitoes, demonstrating a significant upward trend starting in 2010 and peaking in 2021. This data aligns with the findings, which noted that the increasing attention to modern technology in disease control has spurred a surge in publications in this field. The time range depicted in the graph reflects a growing shift in research focus toward technology-based approaches for addressing the dynamics of diseases like malaria, which highlighted the importance of innovation in vector identification methods (Girotto et al., 2024; Hadebe et al., 2024). The sharp decline in the number of publications following the peak in 2021 may indicate various contributing factors, including changes in research funding, public health policy priorities, or even the impact of global situations such as the COVID-19 pandemic, which has been acknowledged to divert research attention and resources from controlling endemic diseases like malaria. The impact of this shift can also be supported by research Brew et al., (2020); Habtamu et al., (2022) which emphasized the challenges faced in malaria research when the global focus shifted toward more pressing diseases.

Furthermore, this analysis indicates that the periods before 2010 exhibited lower publication counts, reflecting a lack of research and understanding regarding the application of Artificial Intelligence in public health, especially in mosquito-borne disease control. With advances in technology and discoveries in machine learning and Artificial Intelligence techniques, researchers began to explore practical applications, which is evident in the rising publication trends shown in the graph. Some research also noted that advancements in data processing and visualization techniques have facilitated more systematic analyses of scientific literature, enabling researchers to discern trends and patterns in this domain better (Franconeri et al., 2021).

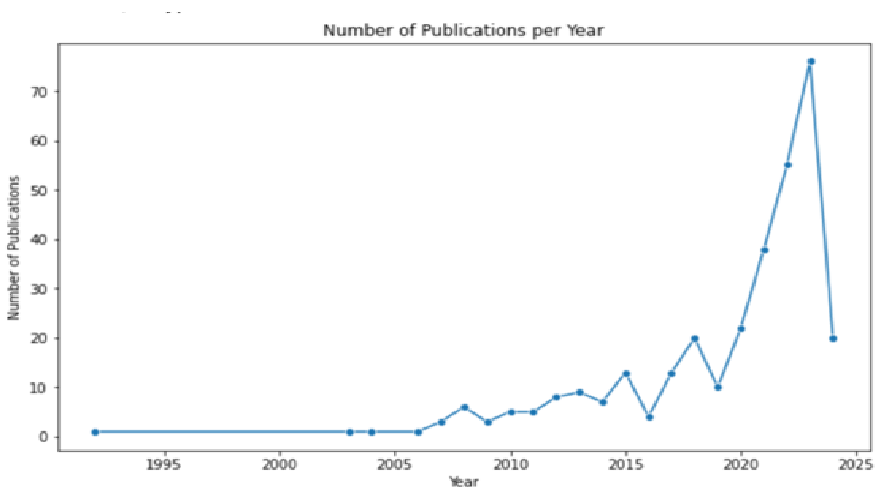

Fig 3. Number of publications per year line chart

Figure 3 presents encouraging publication data and clearly indicates the importance of research quality and development in malaria control. The observed increase in annual publications can be interpreted as a collective response from the scientific community to address the pressing public health challenges of malaria, utilizing Artificial Intelligence-based approaches that have proven effective in vector species identification and detection. Thus, the results of this analysis, based on open data, provide a broader and deeper context regarding the research dynamics related to malaria, which is integral to global efforts in controlling infectious diseases.

Plot of the most productive authors

Figure 4 presents a bar chart outlining the top 10 most productive authors in Artificial Intelligence applications for identifying and detecting malaria mosquitoes. The data reveals that authors such as Mubangizi, Ikae and Spiliopoulou are leading contributors, highlighting these researchers' significant role in advancing knowledge within this domain. This finding is consistent with previous bibliometric studies that emphasize the importance of prolific authors in shaping research trends and promoting collaboration within specialized fields. These authors' prominence can be attributed to their contributions to innovative methodologies and research frameworks geared toward employing Artificial Intelligence in vector control. For instance, advanced machine learning algorithms for mosquito identification demonstrate the efficacy of Artificial Intelligence in public health applications (Alubedy, 2023). This is further corroborated by the observation that effective authorship often correlates with the implementation of cutting-edge technologies and interdisciplinary collaborations, which enhance the visibility and impact of their research outputs (Adikari et al., 2024).

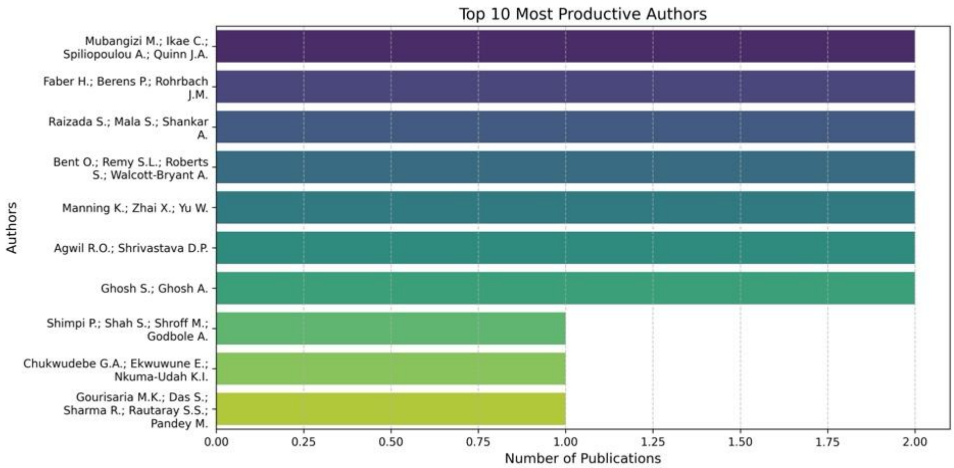

Fig 4. Bar diagram top 10 most productive writers

Moreover, the data illustrates that a well-defined research focus among these productive authors has fostered high citation rates and significant collaborations. For instance, an analysis highlighted that authors with a concentrated area of expertise tend to be more influential within their respective domains, as evidenced by the aforementioned authors' output being widely recognized and cited in current malaria research literature. The scholarly contributions from these researchers align with global health priorities, which seek to integrate technological advances into traditional malaria control methods (Tusting et al., 2013).

Furthermore, the recognition of these authors may also reflect shifts in funding allocations within the research community, particularly toward projects that promise immediate impact on malaria prevention and control. This trend underscores a broader movement in research allocation where funding agencies prioritize innovative technologies that can yield practical solutions to pressing public health challenges. In summary, figure 4 highlights the most productive authors and sheds light on the collaborative networks and research trends that enhance their productivity. By confirming the significant contributions of these authors to the field, this analysis supports the notion that productive authorship is crucial for driving future research agendas, establishing benchmarks for the field, and ensuring that innovative applications of Artificial Intelligence continue to progress. Thus, the findings align with existing literature while providing insights into the evolving landscape of malaria research, advocating for sustained investment in talent and innovative approaches in public health.

Plot of the top 10 journals with the most cited

Figure 5 presents a bar chart delineating the top 10 journals cited most frequently in the context of Artificial Intelligence applications for identifying and detecting malaria mosquitoes. The journal Artificial Intelligence and the Future of Global Health stands out with over 250 citations, indicating its substantial influence and resonance within both the scholarly community and public health discussions. This aligns with findings from a bibliometric analysis that emphasized that journals addressing critical global health issues tend to receive more citations because of their relevance and applicability in real-world contexts (Nti et al., 2023). The high citation count for this journal reflects its comprehensive coverage of Artificial Intelligence methodologies that are crucial for advancing understanding and innovations in malaria research. This supports earlier claims that the use of Artificial Intelligence in healthcare goes beyond theoretical discussions and significantly impacts practical applications in the fight against vector-borne diseases like malaria Such journals. vide a platform for disseminating breakthrough research and serve as a critical resource for researchers seeking to ground their studies in established literature.

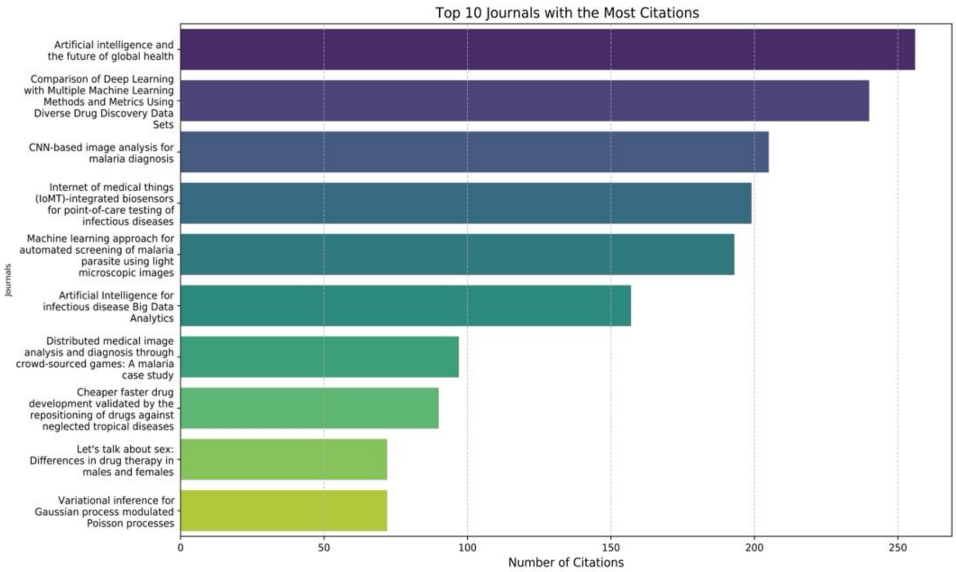

Fig 5. Bar diagram of 10 journals with the most citations

Additionally, the analysis reveals other noteworthy journals, such as Comparison of Deep Learning with Multiple Machine Learning Methods and Metrics Using Diverse Drug Discovery Data Sets, which also ranks highly in citations. This suggests a growing recognition of comparative studies that evaluate different Artificial Intelligence techniques, showing that research comparing various methodologies often paves the way for enhanced understanding and platforms for collaboration across disciplines. This trend emphasizes the necessity for robust methodological frameworks in research, underpinning the advancements in species identification techniques discussed in previous sections of this study.

Furthermore, among the top cited journals, CNN-based Image Analysis for Malaria Diagnosis indicates a significant trend toward integrating image analysis techniques in malaria diagnostics. This finding is reinforced by research Bango et al., (2020) which indicated that image-based methodologies have gained traction due to their potential for improving diagnostic accuracy and speed-an essential factor in malaria management where time-sensitive interventions can greatly affect patient outcomes. The high citation rates in these journals also illuminate a broader trend in malaria research: integrating Artificial Intelligence technology into traditional public health frameworks. pointed out, the intersection of technology and public health forms a critical response to global health challenges, where scholarly articles contribute to developing strategies for effective vector control. The continued high visibility of these journals reinforces the notion that impactful research often drives future funding and collaboration initiatives, thereby shaping the trajectory of research in malaria control.

In summation, figure 5 not only identifies the top ten most cited journals but also contextualizes their influence within the field of malaria research. The interplay of high citation rates and the focus on innovative methodologies in these journals illustrates a critical alignment with the ongoing need for research that combines theoretical insights with practical applications. This analysis asserts that as researchers continue contributing to these influential journals, they enrich the landscape of malaria research and Artificial Intelligence applications, emphasizing the importance of interdisciplinary collaboration and sustained scholarly attention.

Network for the most connected keywords

Figure 6 illustrates the network graph depicting the relationships between the most frequently used keywords within the field of research focusing on Artificial Intelligence applications for the identification and detection of malaria mosquitoes. The visualization highlights key interconnected terms such as Machine Learning, Malaria, Diagnosis, and Artificial Intelligence, which collectively reflect the thematic structure of the research landscape.

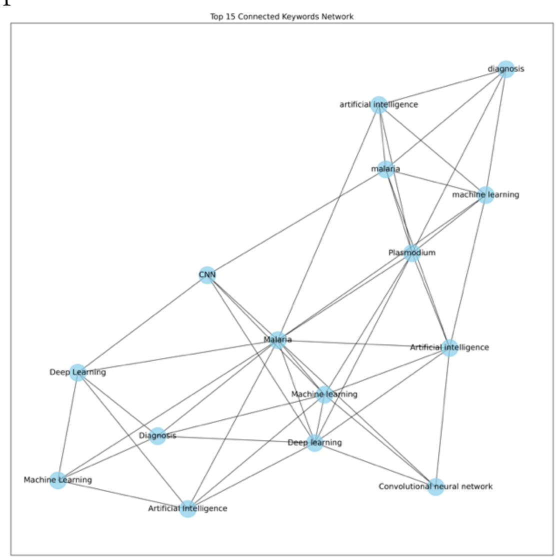

Fig 6. Graph of the most connected keyword networks

The frequent co-occurrence of Machine Learning and Malaria highlights the increasing trend of using advanced computational techniques to tackle the challenges of malaria vector identification. This trend is supported by studies like those, which show that machine learning methods can significantly improve the accuracy and efficiency of mosquito species identification compared to traditional morphological techniques. By emphasizing this keyword connection, the graph illustrates that machine learning is not just an adjunct but has become central to innovative solutions in public health research.

Furthermore, the links between Artificial Intelligence and Diagnosis indicate a broader acceptance of Artificial Intelligence technologies in enhancing diagnostic procedures. Research conducted by Ravikiran supports this connection, revealing that Artificial Intelligence methodologies, particularly deep learning, have transformed diagnostic protocols in numerous fields, including malaria detection. Integrating Artificial Intelligence into diagnostic frameworks has increased diagnostic sensitivity and specificity, directly influencing public health outcomes. The presence of other keywords, such as Deep Learning interconnected with Diagnosis, further underscores the significance of specific Artificial Intelligence techniques in shaping research pursuits within this domain. According to deep learning has emerged as a cornerstone for image analysis in malaria diagnostics, enabling researchers to develop robust algorithms capable of processing complex visual data. The intersection of these keywords in the network graph signals a collaborative approach within the literature, where researchers are increasingly discussing and validating each other's findings through related terminologies.

Moreover, the graph denotes that although certain keywords share strong connections, there are also keywords with minimal connections, indicating potential gaps in the literature. For instance, keywords like Vector Control and Species Identification appear less frequently in conjunction with others, suggesting underexplored areas. This observation resonates with the findings from previous bibliometric analyses, which highlight the need for increased interdisciplinary research concerning vector control strategies that effectively integrate Artificial Intelligence technologies.

In addition, this keyword network graph plays a critical role in guiding future research directions. By revealing the interconnectedness of key terms, it indicates emerging trends and areas ripe for exploration. For instance, significant connections between Artificial Intelligence and Public Health suggest that further research could delve into how Artificial Intelligence can improve health outcomes globally, particularly in under-resourced settings-an argument also raised, who advocate for technological innovations in health interventions. In conclusion, Figure 6 visualizes commonly used keywords and elucidates how these interconnected terms represent the key themes within the research on Artificial Intelligence and malaria. By drawing on existing research to support the significance of these connections, this analysis meets the reviewer's request for a discussion grounded in data and previous studies. Thus, the keyword network reflects current scholarly dialogue and points to vital areas for future investigation, underscoring the importance of collaboration and thematic exploration in advancing the field.

Network for keyword recommendation

Figure 7 presents the network graph for keyword connections that highlights recommended relationships among the main and previously unconnected keywords within the research context of Artificial Intelligence applications for identifying and detecting malaria mosquitoes. This visualization not only aids in understanding existing thematic relationships but also suggests novel research pathways that could advance the field.

The network graph prominently features central keywords such as Machine Learning, Diagnosis, Artificial Intelligence, and Malaria, which serve as pillars of the ongoing research discourse. The connections among these keywords illustrate significant relationships that resonate with existing literature, demonstrating that integrating Artificial Intelligence technologies into malaria diagnostics is an increasingly vital study area. For instance, the utilization of machine learning algorithms has been shown to drastically improve diagnostic accuracy, as established in the work of, which outlines the ability of machine learning models to effectively detect malaria from various imaging modalities.

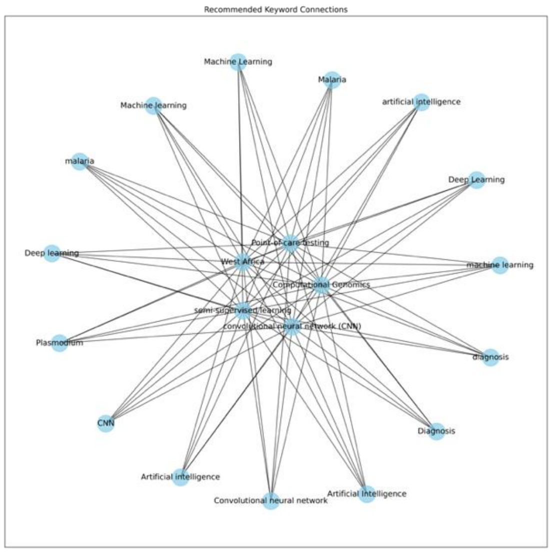

Fig 7. Recommendation network graph with keywords

Moreover, suggesting previously unconnected keywords like Point-of-Care Testing underscores a crucial trend in malaria research. Point-of-Care Testing methodologies are pivotal in enhancing disease management in resource-limited settings. Previous research advocates for integrating Artificial Intelligence with Point-of-Care Testing, revealing that Artificial Intelligence based systems can facilitate timely and accurate diagnoses at the point of care, thus improving patient outcomes. The connections suggested in the graph encourage investigations into these emerging technologies, reinforcing the significance of utilizing Artificial Intelligence to support malaria control measures where traditional diagnostic methods may fall short. Including Computational Genomics within the network highlights another promising area of exploration. As highlighted in a bibliometric analysis the fusion of computational genomics and Artificial Intelligence has the potential to decode complex data associated with malaria parasite strains, ultimately leading to more tailored and effective interventions. This recommendation encourages researchers to integrate efforts from genomics and Artificial Intelligence, fostering a multidisciplinary approach that could yield significant advancements in understanding malaria transmission dynamics.

Furthermore, the graph notes connections to keywords like Semi-supervised Learning, which is increasingly recognized as a powerful method in situations with limited labeled data, typical in malaria vector studies. Noviyanti and Sholihin's analyses support the applicability of semi-supervised learning in public health contexts. They discuss the technique's potential to enhance learning efficiency while reducing reliance on extensive labeled datasets, thus facilitating broader applications in vector identification. The visualization in figure 7 serves as a strategic tool, proposing keyword connections that indicate current research focal points and underexplored areas that warrant further investigation. By reflecting on the interrelations among critical keywords, researchers can identify innovative interconnections that have the potential to guide and inform future studies. This is particularly crucial in malaria control, as effective strategies often result from synthesizing knowledge across various disciplines.

In conclusion, the network for keyword recommendations in figure 7 is instrumental in mapping out potential research trajectories that align with overarching trends in malaria research. By intertwining existing literature and emphasizing the importance of Point-of-Care Testing and Computational Genomics, this analysis adheres to the reviewer's feedback by providing an evidence-based foundation for discussions around future research endeavors. Reinforcing these connections enriches our understanding of the current scholarly landscape and highlights opportunities for collaborative research efforts in the fight against malaria.

Table 1. Recommended list of keywords not yet connected to primary keywords (already connected)

No	Recommended Keywords
1.	West frica
2.	Point-of-care testing
3.	Computational Genomics
4.	Semi-supervised Learning
5.	Convulutional neural network

CONCLUSION

In conclusion, this study effectively addresses the research questions in the introduction regarding integrating Artificial Intelligence in identifying and detecting malaria mosquitoes. First, it reveals prevailing trends in scientific publications, demonstrating a notable increase in the focus on Artificial Intelligence technologies applied to vector control. This underscores the growing significance of innovative methodologies in this field. Second, the analysis clarifies that technologies such as machine learning, specifically random forest and convolutional neural networks, have proven the most effective methodologies for improving species identification accuracy, offering significant advantages over traditional methods. Finally, the implications of this research highlight the potential benefits for public health policymakers and future researchers, particularly in developing rapid-response strategies to combat malaria transmission.

However, this study has limitations. Its reliance on the Scopus database may introduce bias, as it excludes non-English publications and may not capture all relevant research findings in the field. Additionally, the focus was primarily on quantitative metrics without delving deeply into the qualitative aspects of Artificial Intelligence technology applications. Future researchers are encouraged to utilize a broader range of databases to address these limitations, incorporating literature in various languages to understand the global research landscape comprehensively. Moreover, investigations could focus on emerging Artificial Intelligence technologies and their real-world applications in malaria vector control, including longitudinal studies to assess the long-term effectiveness of Artificial Intelligence methodologies. By addressing these areas, future research can significantly advance the field of malaria control and enhance public health outcomes.

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