Issues in Information Systems
Volume 26, Issue 2, pp. 418-432, 2025

DOI: https://doi.org/10.48009/2_iis_132

Augmenting radiology through artificial intelligence: a bibliometric review of the evolving role of radiologists

Cherie Noteboom, *Dakota State University, Cherie.Noteboom@dsu.edu*
Vahini Atluri, *Dakota State University, Vahini.Atluri@trojans.dsu.edu*
Andy Behrens, *Dakota State University, Andy.Behrens@dsu.edu*

Abstract

The integration of artificial intelligence (AI) into radiology is modifying clinical practice, workflows and reshaping the roles and responsibilities of radiologists. The bibliometric review analyzes the evolving intersection of AI and radiology literature by examining 364 peer-reviewed publications from 2019 to 2024 retrieved from major academic databases. The data was analyzed using a bibliometric analysis and four clusters were identified as key areas: radiology practice, disease-specific imaging applications, technical performance evaluation, and ethical considerations. The findings reveal an increasing volume of AI-related radiology research and highlight the potential of AI to enhance radiology practice and the continued necessity of radiologists' expertise. The study contributes to the literature by offering bibliometric analysis of the influence of AI on radiology practice, current trends, and underexplored areas. The findings inform future research and guide the strategic integration of AI into radiological education, clinical practice, and communication.

Keywords: artificial intelligence, technology, bibliometric, literature review, radiologist, radiology

Introduction

The integration of Artificial Intelligence (AI) into radiology is reshaping healthcare by offering significant enhancements in accuracy, clinical workflows, and decision-making processes. AI encompasses a range of algorithms and systems designed to analyze complex medical data, learn from patterns in these datasets to improve their performance, and assist healthcare professionals in interpreting results and making informed clinical decisions (Hansun et al. 2023). AI plays a role in improving patient safety, reducing human medical errors, and optimizing operational healthcare system efficiency in radiology (Albiol et al. 2022). Applications range from administrative tasks, such as scheduling appointments and selecting imaging protocols, to complex processes like image reconstruction, quality improvement, lesion detection, and organ segmentation (Ansari et al. 2023).

Radiology is an essential medical specialty utilizing imaging technologies such as X-ray, computed tomography (CT), and magnetic resonance imaging (MRI) to diagnose a wide range of diseases (Chiu, Heng-Sheng, and Yuh-Min 2022) and has been influenced by AI advancements. The adoption of AI technologies is transforming how radiological images are interpreted and analyzed. AI is now routinely assisting radiologists in improving diagnostic accuracy and reducing interpretation errors, particularly in cases involving infectious diseases such as tuberculosis (TB) (Hansun et al. 2023). During the COVID-19 pandemic, AI played a critical role in the interpretation of thoracic imaging, helping identify COVID-related abnormalities on chest X-rays and CT scans (Cellina et al. 2022).

The ability of AI to process large datasets and perform real-time analysis has proven invaluable, particularly in the context of infectious diseases. For instance, AI models used in thoracic imaging have shown considerable success in detecting pulmonary diseases, including TB (Liu, Parker, and Jung 2021). In one study, AI achieved an accuracy range of 89% to 96% in detecting TB from chest radiographs (Zhong et al. 2022). Furthermore, deep learning models, such as AlexNet, GoogLeNet, and ResNet, have demonstrated high levels of accuracy for TB detection, with some models reaching diagnostic accuracy above 90% (Jiang et al. 2024). AI has demonstrated success in improving the detection of abnormalities such as pleural effusion, fibrosis, and infiltration, all of which are common in TB and other lung diseases (Abdulrahman and Salem 2020). These improvements are positively impacting patient outcomes. The technologies have the potential to improve diagnostic accuracy, streamline workflows, and enhance patient care (Codari et al. 2019).

Despite these technological advancements, the expertise of radiologists remains indispensable. While AI excels at pattern recognition and use of AI-generated output, radiologists' oversight ensures clinical context, ethical oversight, and human judgment in diagnostic decisions (Novak et al. 2024). Traditionally, radiologists have viewed themselves as expert diagnostics, responsible for interpreting complex imaging data, correlating findings with clinical information, and making informed decisions in collaboration with other healthcare providers. They maintain role in patient care by exercising clinical reasoning, offering nuanced interpretations and ensuring that diagnostic outcomes are actionable and contextually appropriate (Knechtges and Carlos 2007). As AI evolves, the role of radiologists is transitioning from image interpreters to key collaborators in algorithm development and clinical decision-making (Martucci et al. 2023). This shift underscores the importance of incorporating AI competencies into radiology education. Preparing the next generation of radiologists in AI technologies is essential to equip them for the future, where AI will be an integral part of patient care (Barreiro-Ares et al. 2023). Radiologists must engage in AI education and actively participate in the validation and integration of AI systems into clinical practice (Zanardo, Visser, Colarieti, Cuocolo, Klontzas, Pinto dos Santos, and Sardanelli 2024). Currently, many radiologists view AI as a supportive tool that can enhance their diagnostic performance, but not a substitute for their clinical expertise. They see their evolving role as one of supervising AI outputs, ensuring quality and relevance, and maintaining ethical and legal accountability in patient care.

Traditionally, radiologists have functioned as expert interpreters of medical images, providing diagnostic support across a wide range of clinical scenarios. However, the introduction of AI is gradually redefining their professional identity. Increasingly, radiologists are required to oversee AI model outputs, ensure contextual accuracy, and contribute to system design and evaluation. Recent surveys reveal a mix of optimism and concern: while many radiologists recognize the efficiency gains AI can bring, others worry about potential deskilling and loss of clinical authority (Zhong et al., 2022; Zanardo et al., 2024). This duality reflects current perceptions in the field, where some radiologists embrace the opportunity to evolve into hybrid roles that combine medical expertise with AI literacy. While others fear a loss of autonomy or devaluation of clinical judgement (Lombi and Rossero 2024). This duality reflects a broader transformation in radiological practice and underscores the need for ongoing education, interdisciplinary collaboration, and ethical vigilance as the profession adapts.

As AI continues to mature, its integration into radiology will grow, redefining professional roles and expanding opportunities to enhance clinical outcomes and healthcare system efficiency.

As AI adoption grows, it will redefine professional responsibilities and open new opportunities to improve clinical outcomes and radiology practice. To inform the area, we conducted our study to investigate how AI technology is transforming the roles of radiologists in clinical practice.

In light of these dynamic shifts, this study aims to systematically map how AI integration is influencing the core functions and future trajectory of radiology as a profession. To provide a comprehensive understanding of these developments, this paper is organized as follows. First, we present the research question and describe the bibliometric methodology used to analyze the literature. Next, we provide results that include publication trends, keyword analyses, and thematic clustering of the literature. We then interpret the four major thematic clusters—radiology practice, disease-specific applications, technical performance, and ethical considerations—through a detailed discussion supported by recent studies. Finally, we offer conclusions, highlight limitations, and propose directions for future research. Together, these sections offer a structured and evidence-based examination of how AI is reshaping the radiology landscape.

Research Question

To understand the evolving role of radiologists in the context of AI, this study is guided by the overarching research question: *What themes emerge around radiologists' changing roles due to AI integration?*

Methodology

This study employs a bibliometric review. Peer-reviewed literature was analyzed at the intersection of Artificial Intelligence (AI) in radiology from 2019 to 2024. The review uses co-occurrence analysis, publication trends, database sourcing, and thematic clustering to uncover emerging concepts and knowledge structures in the field.

Data Sources and Search Strategy

The data was collected from five major academic databases: PubMed/Medline, Elsevier ScienceDirect, IEEE/IET Electronic Library, ACM Digital Library, and ProQuest Central. The databases were selected to provide comprehensive coverage across clinical, technical, and interdisciplinary domains. We used the search query ("Artificial Intelligence" OR "AI") AND ("radiologist" OR "radiology") AND "role" for our search strategy. The search was limited to articles published between January 1, 2019, and December 31, 2024. The inclusion of a five-year span allows for tracking developments in the rapidly evolving intersection of AI and radiology.

Inclusion and Exclusion Criteria

Inclusion and exclusion criteria were applied during the selection process. Articles were included if they were peer-reviewed, published in English, available in full text, and specifically focused on the role of radiologists or the application of artificial intelligence in radiology. Only studies published between January 1, 2019, and December 31, 2024, were considered to capture recent developments in the field. A total of 482 articles were initially retrieved. After duplicate removal and relevance screening, 364 articles were retained for final analysis. We conducted reference management using Zotero.

In contrast, publications were excluded if they were not available in English or if they were research proposals, works-in-progress, dissertations, book chapters, abstracts, posters, panels, or discussion papers. Additionally, studies that focused on other medical disciplines outside the scope of radiology were also excluded. These criteria helped narrow the dataset to publications directly addressing the intersection of AI and radiology practice.

Data Analysis Techniques
The analysis involved multiple techniques listed below:
Annual Publication Trends: Tracking publication frequency to understand research momentum over time.
Database Distribution: Analyzing the origin of articles across databases to identify disciplinary contributions.
Keyword Co-Occurrence Network: A co-word analysis was conducted to identify high-frequency terms and cluster them into thematic groups.
Word Cloud: A visual tool was used to highlight prominent concepts and key terminology.

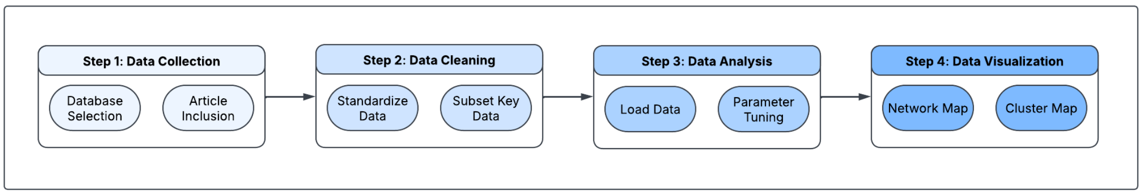

Figure 1. Methodological Stages in Bibliometric Analysis

Results

The findings of this bibliometric review are structured to reflect both the descriptive scope and the conceptual depth of literature. First, we present a quantitative overview of publication trends and source distribution across academic databases. The quantitative overview is followed by an exploration of the literature using keyword co-occurrence networks and cluster-based analysis to uncover underlying research themes related to the role of AI in radiology.

Research output and source profiling
This section outlines the volume, temporal progression, and source distribution of peer-reviewed articles related to AI in radiology from 2019 to 2024. These foundational insights establish the structural landscape of the dataset and inform the context for the analysis that follows.

Annual publication trends

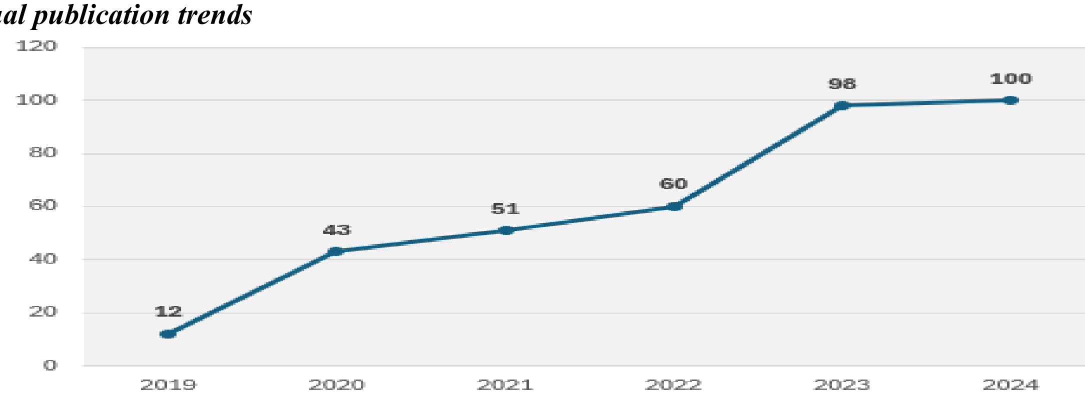

Figure 2. Annual Distribution of Published Articles

Figure 2 shows a clear upward trend in the number of publications focused on AI and the evolving roles of radiologists. In 2019, interest in the topic began with 12 published articles. This was followed by an increase in 2020, reflecting growing academic and clinical attention. The upward trend continued steadily through

Issues in Information Systems
Volume 26, Issue 2, pp. 418-432, 2025

2021 and 2022. A sharper rise in 2023 suggests heightened relevance and research activity, which has persisted into 2024. This trend underscores the increasing significance of AI in radiology, highlighting its expanding role in augmenting radiology practice and redefining radiologist's roles within the field.

Database distribution

Figure 3 Bibliographic Distribution Across Databases presents the distribution of 364 articles across the major research databases utilized in the literature review. PubMed represents medical and clinical publications and accounted for the largest share, with 198 articles. ScienceDirect contributed 82 articles, reflecting significant input from scientific and technical research in healthcare and AI. ABI/INFORM provided 60 articles, indicating a contribution from business and management perspectives. IEEE contributed 21 articles, emphasizing the role of engineering and technological innovation in AI-related radiology research. The ACM Digital Library included 3 relevant articles that met the inclusion criteria. This distribution highlights the multi-disciplinary nature of the topic, spanning healthcare, technology, and information systems domains.

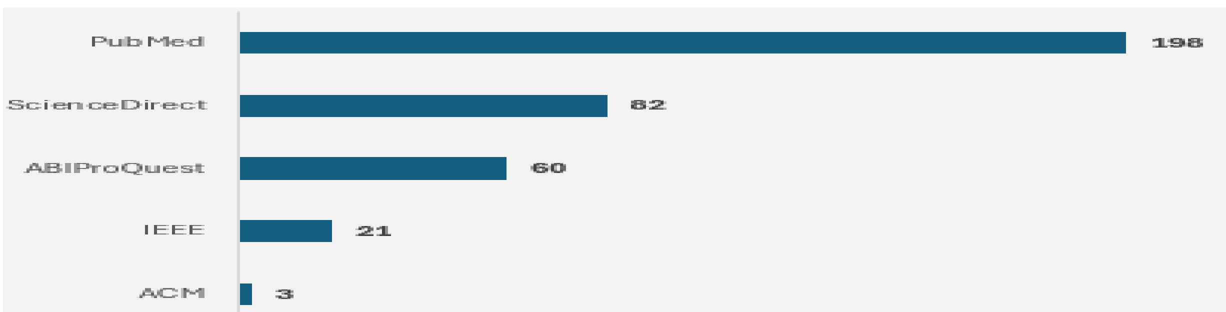

Figure 3. Bibliographic Distribution Across Databases

Knowledge mapping and Thematic structure

Building on the descriptive overview, this section uses bibliometric tools to visualize and interpret the thematic composition of the literature. A word cloud and keyword co-occurrence network are employed to surface prominent research themes, identify conceptual linkages, and explore how AI is influencing the roles and practices of radiologists. The results are shown in Figure 4.

Keyword Frequency Visualization

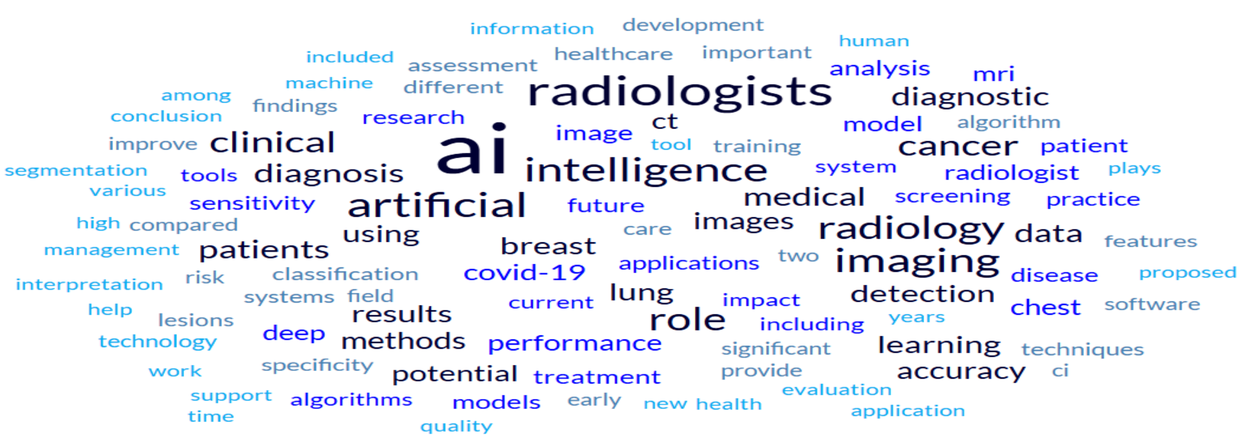

Figure 4. Terminology Landscape from Abstracts: AI and Radiology

The word cloud illustrates the most frequently occurring terms within the dataset, offering a visual summary of prominent themes in the literature. The size of each word reflects its frequency and relative importance. This SLR-based visualization captures key concepts in literature on the integration of artificial intelligence (AI) in radiology and radiologists' evolving roles. It underscores the central role of radiologists, with a focus on technologies, radiologists' roles, and the impact of AI-driven methods on patient outcomes. Core focus areas are machine learning, clinical workflow integration, and the evolving responsibilities of radiologists in a healthcare system increasingly shaped by AI technologies.

Keyword Co-Occurrence Network and Thematic Clusters

To explore the central research question, what themes emerge around radiologists' changing roles due to AI integration? we conducted a bibliometric analysis of relevant literature, identifying four clusters that frame our investigation. These clusters raised and informed the following guiding sub-questions:

1. Radiology Practice (Red Cluster**):** How is the integration of AI transforming the roles, responsibilities, and educational needs of radiologists in clinical practice?
2. Clinical Imaging and Disease Applications (Blue Cluster**):** How does AI enhance the accuracy and effectiveness of diagnostic imaging?
3. Technical Performance and Model Evaluation (Green Cluster): What methods are most frequently employed to evaluate the performance and reliability of AI systems in radiology?
4. Ethical Considerations and Bias (Yellow Cluster): How do fairness and bias concerns influence the deployment of AI in radiology?

These guiding sub-questions support a structured interpretation of the bibliometric findings and provide a conceptual road map for understanding the landscape of AI in radiology practice.

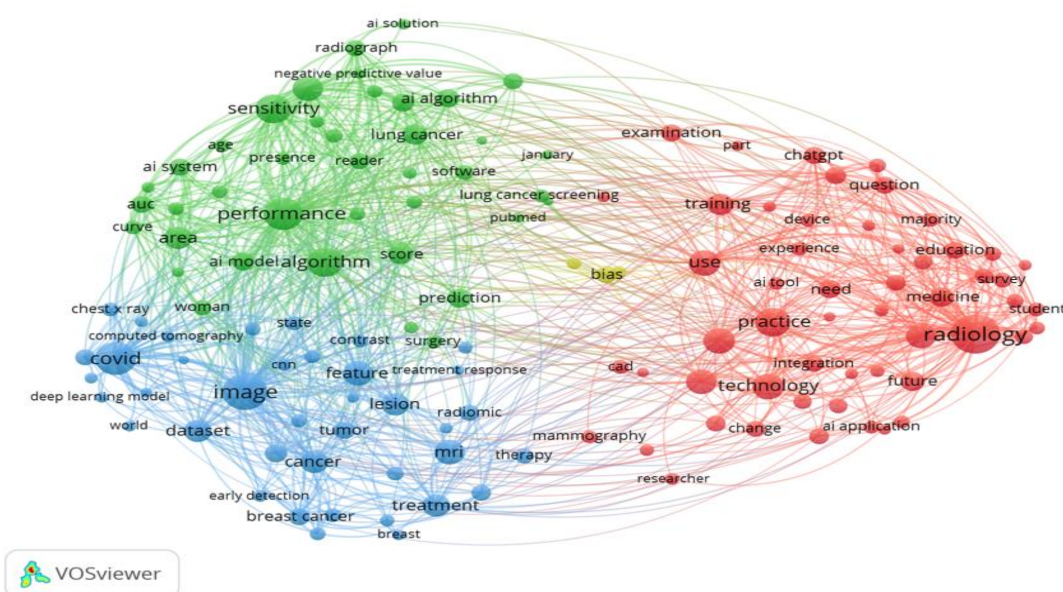

Figure 5. Multi-cluster Keyword Network Depicting the Role of AI in Radiological Research

The interpretation of the network diagram is based on the structure and clusters. The diagram shows a multicolored network of keywords where the nodes (circles) represent individual keywords, and the edges (lines) indicate co-occurrence relationships between keywords within our corpus. The node size indicates the frequency or prominence of the keyword. The colors represent the different thematic clusters generated from data analysis. The density and centrality of "radiology" in the RED Clinical Practice cluster positions it as the conceptual anchor in evaluating AI's augmented impact and answers: How is the integration of AI transforming the roles, responsibilities, and educational needs of radiologists in clinical practice?

Radiology Practice (Red Cluster) emphasizes clinical radiology practice, technology adoption, and training. The cluster reflects the growing interest in integrating AI into routine radiological workflows and the associated challenges of implementation and education. The key terms of radiology, impact, use, practice, development, future, patient care, integration, training, chatgpt, and implication reflect literature discussions surrounding the adoption, integration, and practical implications of AI in clinical radiology. It includes terms related to change such as "development", "integration", "practice". The professional roles and attitudes are alluded to with the words of "impact", "need", "perspective". The popularity and emergence of generative AI technologies and use in radiology documentation, education and patient communication is see in the presence of the term "chatgpt".

Clinical Imaging and Disease Applications (Blue Cluster) represents literature focused on medical conditions and detection techniques and answers: How does AI enhance the accuracy and effectiveness of diagnostic imaging? The cluster indicates a strong research emphasis on applying AI to detect and classify various illnesses using medical imaging. The cluster focuses on the application of AI in diagnostic imaging, particularly in Cancer detection with words of breast cancer, tumor and lesion. The imaging modalities are represented with words of MRI, mammography and image processing tasks with segmentation, prediction, and feature extraction. The term "covid" may highlight a research trend where AI tools were rapidly developed and deployed for pandemic-related diagnosis using AI supported radiology testing identification during Covid Pandemic.

Technical Performance and Model Evaluation (Green Cluster) encompasses terms related to technical performance evaluation and answers: What methods are most frequently employed to evaluate the performance and reliability of AI systems in radiology? These studies are primarily concerned with assessing the diagnostic effectiveness and reliability of AI. Key terms are performance, algorithm, accuracy, sensitivity, specificity, dataset, covid, image, cxr, chest x-ray and represent the technical evaluation of AI systems used in radiology. Emphasis is placed on performance metrics with accuracy, specificity and sensitivity critical for validating AI models. Model types and techniques are identified with words CNN, AI model, AI solution.

Ethical Considerations and Bias (Yellow Cluster) focuses on bias issues of AI. The high degree of interconnection among these clusters highlights the integrated nature of AI in radiology, integrating technological development with clinical implementation and performance evaluation. Key terms of bias, source bridge Clinical Imaging and Disease Applications (Blue) and Technical Performance and Model Evaluation clusters. The Ethical Considerations and Bias cluster may introduce concerns over fairness, transparency, and generalizability with the word "bias". The Yellow Cluster position at the intersection of all clusters implies that discussions about bias permeate the entire network.

Overall, the highly central nodes are radiology, performance, accuracy, image are the most central and connected keywords, suggesting that both practical outcomes and technical performance are crucial across literature. The graph shows strong interconnectivity between clusters, indicating a strong connection between Radiology Practice (Red Cluster), Clinical Imaging and Disease Applications (Blue Cluster) and Technical Performance and Model Evaluation (Green Cluster) & Ethical Considerations and Bias (Yellow Cluster) representing the key areas of Radiology. An emerging trend is identified with the large node for chatgpt marking the influence of generative AI in radiology.

Table 1. Summary of AI in Radiology Clusters: Themes, Key Terms, and Interpretations

Color	Cluster Theme	Key Terms	Interpretation
Red	**Radiology Practice**	radiology, impact, practice, development, future, integration, training, chatgpt, medicine	Focuses on the implications, applications and future of AI in radiological practice
Blue	**Clinical Imaging and Disease Applications**	mri, cancer, lesion, tumor, breast cancer, segmentation, treatment, prediction	Concentrates on diagnostic imaging applications, especially cancer-related and COVID.
Green	**Technical Performance and Model Evaluation**	performance, accuracy, sensitivity, specificity, algorithm, dataset, covid, image, cxr	Emphasizes model accuracy, evaluation metrics, and COVID-related imaging. Centers on AI use for detecting various diseases using medical imaging techniques. Highlights research measuring AI effectiveness using metric
Yellow	**Ethical Considerations and Bias**	bias, examination, ai software, clinical setting	Bridging cluster—highlighting ethical or systemic concerns

Discussion

Our analysis discovered four dominant clusters based on literature from 2019 to 2024. The findings reflect the interdisciplinary and evolving nature of AI in radiology. The following section discusses insights from our bibliometric analysis of 364 articles and synthesizes current literature to support and expand the understanding of each cluster.

Radiology Practice (Red Cluster) The red cluster centers on the broader implications of AI for radiology practice and patient care. Central terms such as "radiology," "impact," "practice," "use," "development," and "training" reflect the transformation of radiological workflows, roles, and professional identity. The inclusion of terms like "future," "change," and "integration" suggests forward-looking concerns, including the need for adaptive training and evolving skills. The frequent appearance of "chatgpt" and "gpt" reflects the growing attention to generative AI and large language models (LLMs) in the medical context, potentially reshaping how radiological data is reported and explained.

Current literature supports our findings. As of 2025, nearly 700 AI/ML tools have received FDA clearance or approval, with 76% (531 out of 691) specifically impacting radiology. AI industry growth is demonstrated by the doubling of AI-focused exhibitors, increasing from 48 in 2019 to over 90 in 2023. AI applications in radiology span a wide array of areas, including ordering, image analysis, treatment planning, and departmental operations (Korfiatis et al. 2025). Future-focused keywords such as "integration" and "change" appeared in over 45% of studies, emphasizing expectations for AI-driven transformations in the field. The mention of "chatgpt" and "GPT" increasing by more than 300% in 2023 compared to 2022, with nearly one-third of the studies published between 2023 and 2024 referencing LLMs in radiological education and clinical reporting (Wei 2025).

However, AI in diagnostic radiology faces critical challenges, such as up to 24% error rates in postoperative cases and issues of underperformance due to biased datasets, including gender imbalances. AI systems have been shown to disrupt established workflows, prolong reading times, and erode clinician trust. Strategies to mitigate these challenges emphasize multimodal data integration, diverse training datasets, and explainable AI frameworks. (Katal, York, and Gholamrezanezhad 2024). According to a recent survey, the main barriers to AI implementation in clinical practice include costs, lack of validation, integration challenges with clinical systems, and legal and ethical concerns. Twenty-nine percent of respondents pointed to data privacy and ethical issues as primary obstacles, underscoring the need for improvements in cost management, AI tool validation, and seamless integration into clinical workflows (Zanardo, Visser, Colarieti, Cuocolo, Klontzas, Pinto dos Santos, Sardanelli, et al. 2024).

The Clinical Practice (Red Cluster) highlights the sociotechnical dimensions of AI integration into radiology, combined with the literature, it reveals both opportunities and challenges.

Clinical Imaging and Disease Applications (Blue Cluster) The blue cluster reflects AI's role in disease-specific radiological applications with a focus on oncology and advanced imaging modalities like MRI and mammography. High frequency co-occurrences of terms such as "cancer," "lesion," "mri," "tumor," and "breast cancer" indicate a strong emphasis on diagnosis and treatment planning across clinical specialties. The bibliometric network suggests that AI is playing a role in core medical imaging tasks such as lesion segmentation, classification, and prediction. These themes are especially prominent in oncology-related subfields, where early and accurate detection is critical. The prominence of "feature" and "prediction" further highlights the use of advanced AI techniques such as deep learning in clinical classification tasks. This theme underscores the close integration of AI technologies with existing diagnostic tools, paving the way for more personalized and precise medical interventions.

Current literature supports our discussion by emphasizing disease-specific applications such as cancer, imaging modalities (MRI, CT), segmentation, and predictive analytics. AI has improved the accuracy and efficiency of diagnostic imaging, with studies reporting AI systems can achieve up to 98% accuracy in tasks such as detecting lung nodules on CT scans. AI systems have demonstrated workflow enhancements by reducing image interpretation times by 50%, accelerating diagnoses in clinical settings. AI-enabled tools detected 8.4% more lung nodules than human radiologists, improving detection rates, and contributed to an 11.2 minute reduction in workflow time for chest radiographs in emergency departments, highlighting the capacity of AI to augment clinical precision and streamline operational processes and reduce operational costs (Khalifa and Albadawy 2024).

Beyond diagnostics, AI is improving medical practice by boosting diagnostic accuracy, surgical precision, and patient outcomes. Studies show that AI-driven algorithms improve early disease detection, particularly in oncology—by identifying subtle tissue changes in imaging data. In surgical contexts, AI-powered 3D models and navigation systems enhance precision, reduce errors, and support better intraoperative coordination. Predictive models also aid in anticipating disease progression and postoperative complications, enabling timely interventions and better recovery outcomes. Looking ahead, AI is poised to enable remote diagnostics, personalized treatment plans, and transformative healthcare workflows (Miyoshi 2025). In the domain of 3D reconstruction, AI-based techniques are evolving rapidly, categorized into explicit and implicit approaches. Models like CuNeRF have achieved performance increases with PSNR scores of 39.62 dB and SSIM values of 0.9786, delivering high-resolution reconstructions from low-resolution inputs. These advances underscore the potential of AI to enhance radiological imaging.

Despite the progress, key challenges such as clinical validation, computational efficiency, and model interpretability persist, and must be addressed to ensure safe, trustworthy, and effective deployment of AI in radiology practice (Yang et al. 2025). The Clinical Imaging and Disease Applications (Blue Cluster) indicates the influence of AI on medical imaging with current strengths and areas for improvement.

Technical Performance and Model Evaluation (Green Cluster) The green cluster encompasses the computational backbone of AI in radiology. Keywords like "algorithm," "accuracy," "performance," "dataset," "value," and "sensitivity" point to a focus on algorithmic design and evaluation. This theme highlights the field's concern with methodological rigor—validating AI tools against well-established metrics like specificity, AUC, and predictive value. The appearance of disease-specific terms like "covid," "nodule," and "lung cancer" suggests application-driven development, while the presence of "chest x-ray" and "cnn" indicates model training based on radiographic data. The size and centrality of "performance" and "accuracy" signal that improving diagnostic reliability remains a core objective. This cluster also speaks to the increasing availability and use of large datasets.

The current literature reflects the importance of the cluster and focuses on model accuracy, sensitivity, specificity, datasets and clinical validation. For example, a study assessed the performance of mainstream large language models (LLMs), including GPT-4, Claude, Bard, Tongyi Qianwen, and Gemini Pro, in radiology board exams. GPT-4 achieved the highest accuracy at 83.3%, significantly outperforming the other models. Claude scored 62%, Bard 54.7%, Tongyi Qianwen 70.7%, and Gemini Pro 55.3%. GPT-4 excelled across both lower-order (82.6%) and higher-order (83.7%) questions, highlighting its strong diagnostic capabilities. In specialty-specific evaluations, GPT-4 showed outstanding accuracy in areas like neurology (100%) and genitourinary (90.5%), while Tongyi Qianwen also demonstrated notable performance at 70.7%. These results emphasize the potential of LLMs like GPT-4 to enhance diagnostic accuracy and medical training in radiology (Wei 2025).

The establishment of the Radiology AI Lab for real-time, objective measurement of AI's impact on radiologists' workflows was successfully realized at the Leiden University Medical Centre. The lab employed non-invasive biometric techniques, including eye-tracking, heart rate monitoring, and facial expression analysis, to assess radiologist-AI interactions. In a pilot test, four radiologists read 32 ultra-low-dose CT cases in both standard and AI-annotated workflows, providing valuable insights into the real-time effects of AI tools on radiologists' performance. These efforts underscore the importance of clinical end-user evaluation in optimizing AI integration seamlessly into medical workflows (Paalvast et al. 2025).

Key statistical insights for designing and appraising AI algorithm evaluations were for focus of one study, which found AUC values for AI in thoracic disease detection ranged from 0.973 to 1, while specificity varied from 56.6% to 100%, and sensitivity ranged from 91.3% to 100%. In comparing AI-assisted and AI-unassisted diagnoses, 92% of 24 studies used paired designs, highlighting their preference in clinical evaluations. The article emphasized the importance of methodological rigor and provided a framework for robust assessment, ensuring the reliable clinical application of AI algorithms (Park et al. 2023). Technical Performance and Model Evaluation (Green Cluster) and current literature emphasize the role of algorithmic assessment in advancing AI's clinical use. Continued focus on standardized metrics, diverse datasets and trustworthy, high-performing AI solutions are needed to reliably support clinical decision-making.

Ethical Considerations and Bias (Yellow Cluster) captures bridging terms such as "bias," "dataset," "source" which occupy central positions in the bibliometric network, connecting technical, clinical, and professional themes. These nodes represent concerns that cut across clusters. "Bias" is particularly prominent and may indicate challenges related to AI in radiology practice. The bridging terms enable integrated themes. Current literature highlights key challenges in addressing bias within medical imaging AI, focusing on algorithmic fairness, ethical deployment, and real-world clinical applications. With less than 6% of radiology papers sharing experimental data, the generalization of AI models to diverse patient populations is hindered (Hasanzadeh et al. 2025). Unsupervised methods like principal component analysis and hierarchical clustering help identify dataset bias, while preprocessing techniques such as re-sampling and re-weighting aim to address class imbalances (Tejani et al. 2024)**.**

Ethical AI design principles emphasize inclusivity and transparency, with organizations such as The World Health Organization (WHO) promoting equity in AI development (Koçak et al. n.d.). Regulatory bodies, such as the Food and Drug Administration (FDA)'s proposal, stress the importance of real-world performance monitoring to track and mitigate emerging biases (Hasanzadeh et al. 2025). Programs focused on AI model surveillance are prioritized to ensure quality assurance and prevent perpetuation of historical biases. Fairness metrics like Demographic Parity and Equalized Odds are essential to ensure equitable performance across diverse groups, with strategies like engaging multidisciplinary teams and conducting subgroup performance analysis aiding in this effort (Tejani et al. 2024). Continuous post-deployment monitoring is crucial for identifying data shifts that may affect model accuracy, particularly in underrepresented populations, helping to reduce the risks of AI exacerbating health disparities (Tejani et al. 2024).

Figure 6 publications over time visualization provides a conclusion to our discussion. Keywords are sized based on their frequency of occurrence and colored by average publication year, with blue representing earlier mentions and yellow indicating more recent topics. Prominent clusters emerge around performance metrics (e.g., "sensitivity", "auc", "ai model"), clinical applications (e.g., "lung cancer", "tumor", "mammography"), and educational or practice-related themes (e.g., "training", "practice", "student", "chatgpt"). Newer themes like “chatgpt” and “bias” signal shifting interests toward generative AI and ethical considerations. The network underscores the evolving focus of the field and identifies key areas of transition in research topics.

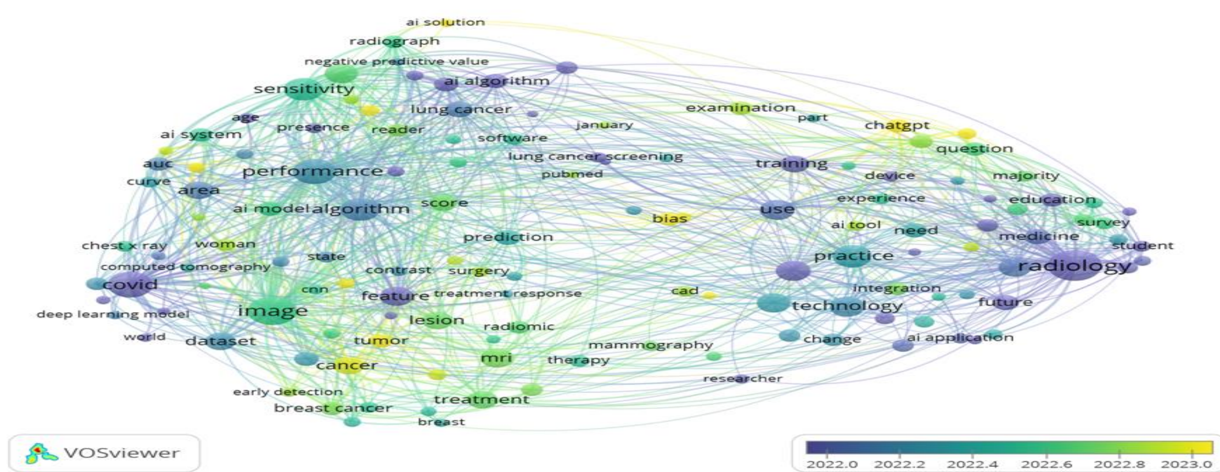

Figure 6. Publications Over Time

Overall, our analysis offers a snapshot of the current research landscape at the intersection of AI and radiology. The findings reveal a field that is both technically advanced and clinically grounded, with a growing awareness of ethical implications. Clusters underscore the maturity of topics such as radiology, COVID, performance, and AI algorithms, while also highlighting the emergence of innovative terms such as generative AI with ChatGPT, bias, and AI solutions. The change from “ai system” to “ai solution” is interesting to note in the transition over time.

Limitations

This review is limited by the exclusion of non-English studies, potential database bias due to PubMed dominance, and the use of abstract-only text mining, which may overlook deeper insights. The selected timeframe may have excluded earlier or emerging research. Additionally, despite predefined criteria, some subjectivity in study selection is possible.

Conclusions

This bibliometric mapping offers a mapping of the literature on IA in radiology and discovers four major clusters. It identifies established research areas and areas where further exploration is needed. For instance, while technical performance and disease-specific applications are extensively studied, practical implementations of generative AI in radiological practice remain relatively underdeveloped. Likewise, ethical considerations such as bias and trust are gaining traction but still lack depth in literature. Future research should aim to bridge these clusters—integrating algorithm development with clinical application and align technological innovation with the evolving roles and responsibilities of radiologists, while maintaining a focus on fairness and bias in AI systems.

A key insight from our bibliometric analysis of the literature is the lack of Information System (IS) Theory wording. Potentially, the lack of theoretical terms indicates a lack of theory use. Future studies should utilize IS theories to provide a deeper understanding of the factors influencing AI-driven transformation into radiology. Methodologically, the paper contributes by applying bibliometric techniques and co-word network analysis methodology to extract insights from AI and radiology literature data with approaches that can be applied to other domains. Ultimately, this study highlights that radiologists are not being replaced, but rather repositioned as interpreters, collaborators, and educators in AI-integrated diagnostic systems.

References

Abdulrahman, Tajaldeen, and Alghamdi Salem. 2020. “Evaluation of Radiologist’s Knowledge about the Artificial Intelligence in Diagnostic Radiology: A Survey-Based Study.” *Acta Radiologica Open* 9(7). doi:10.1177/2058460120945320.

Albiol, Alberto, Francisco Albiol, Roberto Paredes, Juana María Plasencia-Martínez, Ana Blanco Barrio, José M. García Santos, Salvador Tortajada, Victoria M. González Montaño, Clara E. Rodríguez Godoy, Saray Fernández Gómez, Elena Oliver-Garcia, María de la Iglesia Vayá, Francisca L. Márquez Pérez, and Juan I. Rayo Madrid. 2022. “A Comparison of Covid-19 Early Detection between Convolutional Neural Networks and Radiologists.” *Insights into Imaging* 13(1). doi:10.1186/s13244-022-01250-3.

Ansari, Sanam, Ahmad Habibizad Navin, Amin Babazadeh Sangar, Jalil Vaez Gharamaleki, and Sebelan Danishvar. 2023. “A Customized Efficient Deep Learning Model for the Diagnosis of Acute Leukemia Cells Based on Lymphocyte and Monocyte Images.” *Electronics* 12(2):322. doi:10.3390/electronics12020322.

Barreiro-Ares, Andrés, Annia Morales-Santiago, Francisco Sendra-Portero, and Miguel Souto-Bayarri. 2023. "Impact of the Rise of Artificial Intelligence in Radiology: What Do Students Think?" *International Journal of Environmental Research and Public Health* 20(2):1589. doi:10.3390/ijerph20021589.

Cellina, Michaela, Maurizio Cè, Giovanni Irmici, Velio Ascenti, Natallia Khenkina, Marco Toto-Brocchi, Carlo Martinenghi, Sergio Papa, and Gianpaolo Carrafiello. 2022. "Artificial Intelligence in Lung Cancer Imaging: Unfolding the Future." *Diagnostics* 12(11):2644. doi:10.3390/diagnostics12112644.

Chiu, Hwa-Yen, Chao Heng-Sheng, and Chen Yuh-Min. 2022. "Application of Artificial Intelligence in Lung Cancer." *Cancers* 14(6):1370. doi:10.3390/cancers14061370.

Codari, Marina, Luca Melazzini, Sergey P. Morozov, and Cornelis C. van Kuijk. 2019. "Impact of Artificial Intelligence on Radiology: A EuroAIM Survey among Members of the European Society of Radiology." *Insights into Imaging* 10(1):1–11. doi:10.1186/s13244-019-0798-3.

Hansun, Seng, Ahmadreza Argha, Siaw-Teng Liaw, Branko G. Celler, and Guy B. Marks. 2023. "Machine and Deep Learning for Tuberculosis Detection on Chest X-Rays: Systematic Literature Review." *Journal of Medical Internet Research* 25(1):e43154. doi:10.2196/43154.

Hasanzadeh, Fereshteh, Colin B. Josephson, Gabriella Waters, Demilade Adedinsewo, Zahra Azizi, and James A. White. 2025. "Bias Recognition and Mitigation Strategies in Artificial Intelligence Healthcare Applications." *Npj Digital Medicine* 8(1):1–13. doi:10.1038/s41746-025-01503-7.

Jiang, Zhengqiang, Ziba Gandomkar, Phuong Dung (Yun) Trieu, Seyedamir Tavakoli Taba, Melissa L. Barron, Peyman Obeidy, and Sarah J. Lewis. 2024. "Evaluating Recalibrating AI Models for Breast Cancer Diagnosis in a New Context: Insights from Transfer Learning, Image Enhancement and High-Quality Training Data Integration." *Cancers* 16(2):322. doi:10.3390/cancers16020322.

Katal, Sanaz, Benjamin York, and Ali Gholamrezanezhad. 2024. "AI in Radiology: From Promise to Practice − A Guide to Effective Integration." *European Journal of Radiology* 181:111798. doi:10.1016/j.ejrad.2024.111798.

Khalifa, Mohamed, and Mona Albadawy. 2024. "AI in Diagnostic Imaging: Revolutionising Accuracy and Efficiency." *Computer Methods and Programs in Biomedicine Update* 5:100146. doi:10.1016/j.cmpbup.2024.100146.

Knechtges, Paul Martin, and Ruth C. Carlos. 2007. "The Evolving Role of the Radiologist within the Health Care System." *Journal of the American College of Radiology : JACR* 4(9):626–35. doi:10.1016/j.jacr.2007.05.014.

Koçak, Burak, Andrea Ponsiglione, Arnaldo Stanzione, Christian Bluethgen, João Santinha, Lorenzo Ugga, Merel Huisman, Michail E. Klontzas, Roberto Cannella, and Renato Cuocolo. n.d. "Bias in Artificial Intelligence for Medical Imaging: Fundamentals, Detection, Avoidance, Mitigation, Challenges, Ethics, and Prospects." *Diagnostic and Interventional Radiology* 31(2):75–88. doi:10.4274/dir.2024.242854.

Korfiatis, Panagiotis, Timothy L. Kline, Holly M. Meyer, Sana Khalid, Timothy Leiner, Brenna T. Loufek, Daniel Blezek, David E. Vidal, Robert P. Hartman, Lori J. Joppa, Andrew D. Missert, Theodora A. Potretzke, Jerome P. Taubel, Jason A. Tjelta, Matthew R. Callstrom, and Eric E. Williamson. 2025. "Implementing Artificial Intelligence Algorithms in the Radiology Workflow: Challenges and Considerations." *Mayo Clinic Proceedings: Digital Health* 3(1):100188. doi:10.1016/j.mcpdig.2024.100188.

Liu, Lu, Kevin J. Parker, and Sin-Ho Jung. 2021. "Design and Analysis Methods for Trials with AI-Based Diagnostic Devices for Breast Cancer." *Journal of Personalized Medicine* 11(11):1150. doi:10.3390/jpm11111150.

Lombi, Linda, and Eleonora Rossero. 2024. "How Artificial Intelligence Is Reshaping the Autonomy and Boundary Work of Radiologists. A Qualitative Study." *Sociology of Health & Illness* 46(2):200–218. doi:10.1111/1467-9566.13702.

Martucci, Matia, Rosellina Russo, Carolina Giordano, Chiara Schiarelli, Gabriella D'Apolito, Laura Tuzza, Francesca Lisi, Giuseppe Ferrara, Francesco Schimperna, Stefania Vassalli, Rosalinda Calandrelli, and Simona Gaudino. 2023. "Advanced Magnetic Resonance Imaging in the Evaluation of Treated Glioblastoma: A Pictorial Essay." *Cancers* 15(15):3790. doi:10.3390/cancers15153790.

Miyoshi, Norikatsu. 2025. "Use of AI in Diagnostic Imaging and Future Prospects." *JMA Journal* 8(1):198–203. doi:10.31662/jmaj.2024-0169.

Novak, Alex, Max Hollowday, Abdala Trinidad Espinosa Morgado, Jason Oke, Susan Shelmerdine, Nick Woznitza, David Metcalfe, Matthew L. Costa, Sarah Wilson, Jian Shen Kiam, James Vaz, Nattakarn Limphaibool, Jeanne Ventre, Daniel Jones, Lois Greenhalgh, Fergus Gleeson, Nick Welch, Alpesh Mistry, Natasa Devic, James Teh, and Sarim Ather. 2024. "Evaluating the Impact of Artificial Intelligence-Assisted Image Analysis on the Diagnostic Accuracy of Front-Line Clinicians in Detecting Fractures on Plain X-Rays (FRACT-AI): Protocol for a Prospective Observational Study." *BMJ Open* 14(9):e086061. doi:10.1136/bmjopen-2024-086061.

Paalvast, Olivier, Merlijn Sevenster, Omar Hertgers, Hubrecht de Bliek, Victor Wijn, Vincent Buil, Jaap Knoester, Sandra Vosbergen, and Hildo Lamb. 2025. "Radiology AI Lab: Evaluation of Radiology Applications with Clinical End-Users." *Journal of Imaging Informatics in Medicine*. doi:10.1007/s10278-025-01453-2.

Park, Seong Ho, Kyunghwa Han, Hye Young Jang, Ji Eun Park, June-Goo Lee, Dong Wook Kim, and Jaesoon Choi. 2023. "Methods for Clinical Evaluation of Artificial Intelligence Algorithms for Medical Diagnosis." *Radiology* 306(1):20–31. doi:10.1148/radiol.220182.

Tejani, Ali S., Yee Seng Ng, Yin Xi, and Jesse C. Rayan. 2024. "Understanding and Mitigating Bias in Imaging Artificial Intelligence." *RadioGraphics* 44(5):e230067. doi:10.1148/rg.230067.

Wei, Boxiong. 2025. "Performance Evaluation and Implications of Large Language Models in Radiology Board Exams: Prospective Comparative Analysis." *JMIR Medical Education* 11(1):e64284. doi:10.2196/64284.

Yang, Yuezhe, Boyu Yang, Yaqian Wang, Yang He, Xingbo Dong, and Zhe Jin. 2025. "Explicit and Implicit Representations in AI-Based 3D Reconstruction for Radiology: A Systematic Literature Review."

Zanardo, Moreno, Jacob J. Visser, Anna Colarieti, Renato Cuocolo, Michail E. Klontzas, Daniel Pinto dos Santos, and Francesco Sardanelli. 2024. "Impact of AI on Radiology: A EuroAIM/EuSoMII 2024 Survey among Members of the European Society of Radiology." *Insights into Imaging* 15(1):240. doi:10.1186/s13244-024-01801-w.

Zanardo, Moreno, Jacob J. Visser, Anna Colarieti, Renato Cuocolo, Michail E. Klontzas, Daniel Pinto dos Santos, Francesco Sardanelli, and European Society of Radiology (ESR). 2024. "Impact of AI on Radiology: A EuroAIM/EuSoMII 2024 Survey among Members of the European Society of Radiology." *Insights into Imaging* 15(1):240. doi:10.1186/s13244-024-01801-w.

Zhong, Jim, Rosemary Ho, Gourtsoyianni Sofia, Laura Oleaga, Carlo Catalano, Minerva Becker, and Vicky Goh. 2022. "Attracting the next Generation of Radiologists: A Statement by the European Society of Radiology (ESR)." *Insights into Imaging* 13(1). doi:10.1186/s13244-022-01221-8.