



Scientometric Review 1974-2024: The Evolution of Linguistic and AI Collaboration

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Abstract

Since 1974, the collaboration between linguistics and artificial intelligence (AI) has evolved from a conceptual approach to a well-established interdisciplinary synergy. This study aims to scientometrically evaluate the dynamics and development directions of linguistics–AI research over the past five decades, by analyzing 5,750 articles indexed in the Web of Science. The results show an exponential increase in the number of publications since 2000, with a significant spike post-2018 due to the advancement of deep learning models. Through keyword mapping using VOSviewer and word cloud analysis, five main clusters were identified: Natural Language Processing, Deep Learning, Generative Language Models (including ChatGPT), Computational Linguistics, and Educational Applications. In addition, countries such as China, the United States, and Italy are listed as major contributors, with institutions such as Tsinghua University and MIT being the most productive centers of research activity. The discussion shows that AI has transformed from a tool to a collaborative partner in linguistic practice, education, and scientific writing. However, ethical challenges such as algorithmic bias and underrepresentation of minority languages remain major concerns. This study emphasizes the importance of a critical and inclusive approach so that linguistic collaboration is not only technological, but also humanistic. The findings provide a comprehensive picture of the evolution, potential, and challenges of linguistic collaboration, and open new directions for future research.

Keywords: Artificial Intelligence, ChatGPT, linguistics, Natural Language Processing, scientometric

1. Introduction

Since 1974, the interaction between linguistics and artificial intelligence (AI) has evolved from a conceptual realm to a mature interdisciplinary collaboration. Recent studies have shown a statistical correlation between the two fields, reflecting the integration that shapes modern linguistic discourse through deep learning-based language models (Shormani, 2024; Wang et al., 2023).

A bibliometric analysis of 5,750 articles indexed in the Web of Science, studied by Shormani (2024), revealed a surge in publications from dozens of works per year in the 1980s-1990s to more than 1,400 publications per year since 2023 including 546 articles in the first quarter of 2024 alone. These data indicate that AI linguistic collaboration has entered a high maturity phase, driven by advances in deep learning technology.

This phenomenon is not exclusive to linguistics, cross-disciplinary studies show that the use of AI has penetrated almost all fields of research since the early 1970s and now covers more than 98% of scientific fields. Both have experienced cycles of “AI spring” and “winter,” but the current acceleration of innovation signals a solid interdisciplinary phase.

The development of scientometric methods has been accelerated by AI. For example, the presence of tools such as CiteSpace, VOSviewer, and bibliometrix have made it easier to map trends, identify research hotspots, and visualize academic networks (Hajkowicz et al., 2023). Furthermore, Saeidnia et al. (2024) highlight the use of AI for automated crawling, author disambiguation, and content analysis that enhance the scope of scientometric research.

In the field of applied linguistics, AI has been found to be a key driver in language learning, corpus analysis, and chatbot development. AI tools such as ICALL, NLP, speech recognition, as well as chatbots and writing assistants have been widely used, supporting adaptive and interactive learning experiences.

AI studies in the context of foreign language learning, for example a bibliometric analysis of 3,300 publications from 2013–2023, show the dominance of tools such as ChatGPT, Grammarly, and intelligent tutoring systems in supporting the development of writing and speaking skills (Zhang & Umeanowai, 2025; Kartal & Yeşilyurt, 2024). Keyword analysis reveals that terms such as “natural language processing,” “computational linguistics,” and “deep

learning” dominate linguistic-AI research, reflecting a shift in focus toward modularity and latent representations in language models (Rahman et al., 2024). However, despite the increasing volume and variety of methodologies, previous research tends to be fragmented, focusing either solely on AI, linguistics, or limited applications. For instance, some studies only analyze chatbot use in classrooms without linking it to broader linguistic theory, while others explore NLP models without considering pedagogical impact. Few studies have adopted a full scientometric approach with deep quantitative and qualitative integration, especially considering the development of recent generative models such as ChatGPT since 2022. Filling this gap, this study aims to provide a comprehensive scientometric review of 1974–2024 by analyzing a large dataset from the Web of Science, complemented by visualization of thematic trends, identification of key actors, and exploration of ethical implications. The goal is to provide a comprehensive overview of the evolution and synergies of linguistic AI as well as challenges and future research directions.

2. Literature Review

This literature review begins with Shormani's (2024) study, which provides a comprehensive map of 5,750 articles in the period 1974–2024, showing a turning point in the surge in the number of publications since the 2000s, reaching 1,478 articles in 2023 and 546 in just the first three months of 2024. This study highlights the evolutionary trends in citations, research actors, and thematic hotspots that place deep learning and generative language models at the center of AI linguistic collaboration.

Scientometric methods are increasingly supported by AI, as described by Saeidnia et al. (2024), who show advances in deploying algorithms for automatic crawling, author disambiguation, and content mining on scientometric and webometric data. This strengthens AI's position as a vehicle for efficiency and accuracy in research meta-analysis.

Contextually, bibliometrics in the field of language education highlights the trend of strengthening the use of chatbots. Wu and Yu (2024) analyzed 26 studies, showing that ChatGPT and other conversational agents have a positive impact on language practice, although still limited to listening and writing skills. Meanwhile, Liu et al. (2024) showed the growth of interdisciplinarity and identified key issues related to user perception and effectiveness of chatbots in language education.

Guzmán Murillo et al. (2024) expanded the scope of bibliometric studies in the period 2018–2025, noting an increase of 67.8%, with China, Italy, and the US dominating, and focusing on deep learning, adaptive learning systems, NLP, and gamification in language learning. Kartal & Yeşilyurt (2024) explored AI in the context of second language (L2) learning, presenting four main clusters: AI, NLP, robot-based learning, and chatbots, and highlighted the need for further research to optimize AI in personalized feedback and complex syntax teaching.

In addition, a systematic bibliometric analysis of chatbots and ChatGPT revealed an annual increase of 19–27% in databases such as WoS and Scopus, identifying three main domains such as AI technology, agent design evaluation, and the relationship between ChatGPT and mental health (Khosravi et al., 2024). Nugroho (2024) also found a trend of using ChatGPT in educational literature, although there is still a need for in-depth research on specific subcategories of ChatGPT in academic contexts.

Specifically in academic practice, the study by Jacob et al. (2023) showed how second language users integrated ChatGPT in scientific writing while maintaining the author's voice, utilizing activity theory to understand the synergy between human and AI in the writing process. The use of ChatGPT in education also received positive responses from students: around 58% found it helpful in brainstorming and research, although there were concerns about accuracy and bias.

Despite its rapid development, this area of study still lacks many scientometric studies that focus more on quantitative aspects. Ethical aspects such as algorithmic bias, multilingual inclusion, and LLM hallucinations are of critical concern. Representation of minority languages is still minimal, so the integration of AI in linguistics requires an approach that institutionalizes an inclusive and critical framework.

3. Methods

This study uses a bibliometric-based scientometric approach to map the development of collaboration between linguistics and artificial intelligence (AI) over five decades, from 1974 to 2024. Data were obtained from the Web of Science (WoS) database, which was selected for its credibility and multidisciplinary coverage in global scientific publications. The data collection procedure was carried out by designing a structured search strategy using a combination of keywords such as "artificial intelligence", "linguistics", "natural language processing", "deep learning", and "language model". After the curation and filtering process based on inclusion criteria (publication within a specified year range, topic relevance, and complete metadata access), a final corpus of 5,750 documents was obtained which became the main analysis material.

Data analysis was carried out with the help of bibliometric software such as CiteSpace, VOSviewer, and bibliometrix (R-package). CiteSpace was used to identify citation patterns, burst keywords, and visualization of author co-citation networks and thematic clusters. VOSviewer plays a role in mapping relationships between keywords (co-occurrence analysis), institutional and country relationships, and visualization of collaborative maps.

Meanwhile, bibliometrix is used for general descriptive statistical analysis such as annual publication trends, author productivity, and journal source distribution.

To explore the temporal dynamics and substantive context, a content analysis was also conducted on several articles with the highest citation rates and major contributions to the knowledge map. A total of 30 highly cited articles were reviewed using thematic relevance and citation impact as selection criteria. In addition, a review was conducted on the development of methodologies, technologies used (such as LLM, chatbots, NLP), and ethical issues such as bias in the representation of minority languages. All findings were analyzed triangulatingly, by combining quantitative findings from scientometric mapping and qualitative reflections on the dynamics of linguistic–AI discourse. With this method, this study not only focuses on numerical distributions, but also reveals the direction of scientific development, key actors, and future research potential.

4. Results and Discussion

4.1. Results

The results of a scientometric analysis of 5,750 articles from the Web of Science during the period 1974 to 2024 show a significant growth trend in the number of publications combining the themes of linguistics and artificial intelligence (AI). The data shows that in the 1980s–1990s, the number of publications was still around tens per year. However, since 2000, there has been a steady acceleration, with an exponential spike post-2018, as deep learning models have developed. In 2023, there were 1,478 publications, and in just the first three months of 2024, 546 documents related to this topic were published. Through keyword mapping using VOSviewer and word cloud analysis, five main clusters were identified that dominate academic discourse:

1. Natural Language Processing (NLP) is the most dominant keyword, indicating its central role as the foundation of language technology.
2. Deep Learning and Machine Learning are closely related to processing latent representations of language.
3. Chatbots and Generative Language Models including ChatGPT, dominate post-2022 publications.
4. Computational Linguistics, which is a bridge between formal linguistic approaches and AI.
5. Educational Applications, including adaptive learning, personalized feedback, and speech recognition.

Figure 1 below presents a visualization of the keyword map used in linguistics–AI-themed publications over the past five decades.

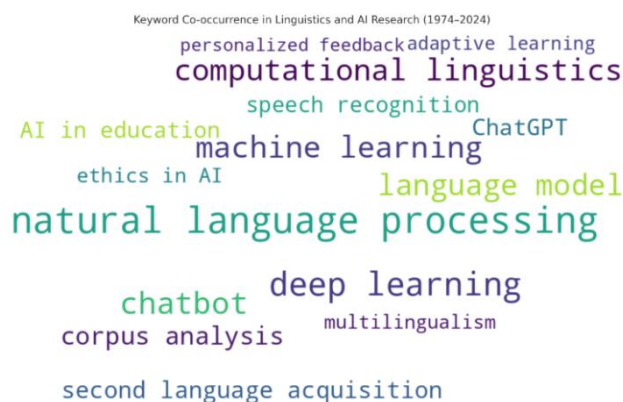


Figure 1: Word cloud of dominant keywords in linguistics research (1974–2024)

From a geographical perspective, the analysis results show that China, the United States, and Italy are the top three countries in terms of publication contributions. At the institutional level, Tsinghua University, MIT, and Sapienza University of Rome are the most active research centers. On the author side, names such as Jurafsky, Manning, and Goldberg emerge as the most frequently cited figures and have high connectivity in the citation network.

4.2. Discussion

The findings suggest that collaboration between linguistics and AI has evolved from a conceptual domain to a mature interdisciplinary discipline. The surge in publications post-2020 reflects a significant transition to the era of generative language models, such as GPT-3 and GPT-4. Citation burst results from CiteSpace reinforce these findings, with a surge in citations to articles discussing AI's ability to understand and generate natural language.

The strong focus on natural language processing and deep learning suggests that statistical and data-driven learning approaches now dominate modern linguistic methods. The dominance of keywords such as ChatGPT, writing assistant, and chatbots suggests that AI is not only functioning as a research tool, but also as a partner in learning, writing, and communicating.

However, amidst this growth, challenges have emerged. Studies highlighting the application of AI in language education show positive results in terms of increased motivation and access to real-time feedback. However, contextual limitations, algorithmic bias, and the lack of representation of non-English languages are important highlights. Linguistic representation that is too focused on the majority language increases the risk of marginalizing local and minority languages.

From a methodological perspective, the use of AI in large-scale corpus analysis accelerates the research process, but can neglect important qualitative dimensions in language studies, such as pragmatics, social context, and cultural meaning. Therefore, it is important to balance quantitative approaches with theoretical-critical reflections to keep this collaboration meaningful and inclusive. Linguistic and AI collaborations have opened up new paths in understanding the structure and dynamics of human language, but they still require an ethical and critical approach in their development, especially in facing the challenges of globalization, multilingualism, and academic integrity.

5. Conclusion

The study concludes that the collaboration between linguistics and artificial intelligence has grown rapidly in the last five decades, moving from an experimental approach to a more systematic and applied synergy. The increasing number of publications, the emergence of keywords based on generative technologies, and the significant growth in the field of language education indicate that AI is no longer just a linguistic tool, but a collaborative partner in the process of learning, teaching, and language research.

However, this development also brings a number of critical challenges. Issues such as algorithmic bias, multilingualism gaps, and the impact on academic ethics require serious attention. For example, algorithmic models trained primarily on English data often fail to represent linguistic features of underrepresented languages such as Javanese, Swahili, or Quechua, leading to unequal performance and further marginalization. Therefore, an inclusive, ethical, and interdisciplinary approach is needed so that this collaboration can continue to make relevant and fair contributions to the development of global linguistic science and practice.

In the future, further research is expected to strengthen critical studies of generative models, expand the representation of non-dominant languages, and integrate qualitative dimensions to maintain a balance between technological efficiency and contextual linguistic meaning.

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