

УДК 372:881.111.1

РОЛЬ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА В ЛИНГВИСТИКЕ И ПЕДАГОГИКЕ

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Аннотация. Интеграция искусственного интеллекта (ИИ) в образование и лингвистику трансформирует подходы к изучению и преподаванию языков. Платформы, такие как Duolingo, использующие большие языковые модели, позволяют создавать персонализированные уроки, повышая эффективность обучения. В статье анализируется роль ИИ в лингвистическом анализе, включая обработку естественного языка и семантический анализ, а также его влияние на педагогические методы, такие как автоматическая оценка и интеллектуальные обучающие системы. Рассматриваются платформы на основе ИИ, их преимущества, вызовы и этические аспекты, подчеркивая необходимость баланса между технологиями и человеческим взаимодействием.

Ключевые слова: искусственный интеллект, обучение языкам, лингвистический анализ, педагогические технологии, персонализированное обучение, большие языковые модели.

THE ROLE OF ARTIFICIAL INTELLIGENCE IN LINGUISTICS AND PEDAGOGY

Abstract. The integration of artificial intelligence (AI) into education and linguistics is reshaping approaches to language learning and teaching. Platforms like Duolingo, leveraging large language models, enable personalized lessons, enhancing learning efficiency. This article examines AI's role in linguistic analysis, including natural language processing and semantic analysis, and its impact on pedagogical methods, such as automated assessment and intelligent tutoring systems. AI-driven platforms, their benefits, challenges, and ethical considerations are explored, emphasizing the need for a balance between technology and human interaction.

Keywords: artificial intelligence, language learning, linguistic analysis, pedagogical technologies, personalized learning, large language models

Introduction

Artificial Intelligence (AI) has emerged as a transformative force in how we understand and teach languages, firmly embedding itself in the realms of linguistics and pedagogy. AI provides tools capable of remarkably precise language analysis and personalized education tailored to individual needs. This article explores the multifaceted role of AI in linguistics, with a focus on its contributions to language analysis, and in pedagogy, particularly innovative language teaching methods. It also examines how AI bridges these fields, leveraging platforms like Duolingo [4, 6].

At its core, AI involves systems that mimic human intelligence, from reasoning to learning, and apply these capabilities to complex tasks. In linguistics, this includes analyzing language structure, word meanings, and language evolution. In pedagogy, AI enhances teaching by adapting lessons to learners' unique needs and automating tasks that can be streamlined without compromising education, such as grading, allowing educators to focus on deeper student engagement. The intersection of these fields is particularly compelling—language teaching, where AI not only supports learning but also draws on linguistic insights to make education more effective. This interplay is reshaping

our approach to language, making it more accessible and dynamic, though not without challenges, which will be explored in detail [2, 8].

Main Part

Linguistics has been significantly enriched by AI, driven by rapid advancements in natural language processing (NLP), machine learning (ML), and deep learning (DL). These tools enable researchers to handle vast datasets, uncovering patterns previously undetectable. For instance, NLP facilitates tasks like analyzing large text corpora to identify patterns, trends, and relationships in language use; word embeddings and semantic parsing help understand word and sentence meanings and explore semantic connections. Early pioneers like Terry Winograd in the 1970s laid the groundwork for text understanding, but the modern era of transformers (a deep learning architecture) has truly revolutionized the field. These models, used in machine translation, achieved a BLEU score of 41.0 on the WMT 2014 English-to-French translation task—a metric reflecting their ability to produce human-like translations [2, 8].

Beyond translation, AI has transformed semantic analysis through word embedding models like Word2Vec and GloVe, which map words into digital spaces based on their meanings. Imagine “king” and “queen” positioned close together in this digital space, while “apple” is distant – AI captures these relationships, enabling applications in sentiment analysis or text classification. These tools do more than process numbers; they help linguists explore how language conveys emotions or intentions. In language acquisition, AI goes further, modeling how humans learn syntax or morphology. Neural networks, as shown in studies, mimic these processes, shedding light on how children acquire grammar or adults adapt to new languages. This is not merely academic but a significant step toward understanding the mechanics of thought [8, 3].

However, AI’s role in linguistics is not without criticism. A review of studies revealed that while most scholars praise AI’s contributions, concerns about accuracy and ethics persist. For example, some AI-generated content, such as early ChatGPT models, included references that were only 10% accurate. These challenges remind us that AI is a tool, not a human replacement, and its outputs require careful scrutiny to meet academic standards [8, 7].

In language teaching, AI has opened doors that traditional methods could only dream of. Pedagogy, the art and science of teaching, thrives on personalization and feedback, and AI delivers both in abundance. One standout application is automated essay scoring (AES), which provides instant feedback. Imagine a student writing an essay in Spanish and receiving real-time suggestions on grammar, vocabulary, or style. Unlike AI, a teacher cannot always be available. A meta-analysis of 26 studies, described in *A Systematic Review of Artificial Intelligence in Language Education* (SSRN), involving over 2,400 students, showed that AES significantly improves writing quality, particularly for English as a Foreign Language (EFL) learners, with a statistical effect size of 0.861. This impact is especially notable in argumentative writing, where clarity and structure are paramount [8, 3, 7].

But AES is just the beginning. Intelligent tutoring systems (ITS) take personalization further, adapting lessons to a learner’s pace and proficiency level. If a student struggles with verb conjugation, the system can slow down, offering extra practice, while an advanced learner might receive challenging vocabulary. These systems don’t just teach—they track learner data. Speech recognition tools add another layer, allowing students to practice pronunciation and receive instant corrections – a feature central to modern language apps. Studies highlight how these technologies, alongside chatbots and machine translation, are transforming language education, making it more interactive and accessible [4, 7].

Yet, AI doesn’t always match a human teacher. While AES excels at grammar, it often falls short in fostering higher-level critical thinking, suggesting that a blend of AI and human instruction may be optimal [6, 5].

The most effective model emerges when linguistics and pedagogy converge in language teaching, with AI as the bridge. Platforms like Duolingo, with over 50 million active users, exemplify this. Duolingo leverages large language models, including GPT-4, to create lessons that feel highly personalized. Features like Roleplay, where learners simulate conversations, or Explain My An-

swer, which clarifies mistakes, make learning feel like a dialogue, not a drill. Behind the scenes, AI analyzes every click and response, adjusting lesson difficulty or suggesting practice areas, while relying on linguistic principles for accuracy. For instance, if a user struggles with the French subjunctive, the system may prioritize it, drawing on syntactic patterns studied by linguists [4, 2].

Speech assessment is another game-changer. Duolingo's AI listens to a learner's pronunciation, offering feedback. This isn't just a technological feat – it's grounded in phonetics, a core linguistic field, ensuring corrections align with sound formation and perception. These tools boost motivation: students reported higher extrinsic motivation (mean score 3.89) compared to intrinsic (3.20), suggesting AI's gamified feedback keeps learners engaged [4, 8].

Ethical concerns, such as data privacy or overreliance on AI, remain pressing. Without clear guidelines, AI can produce content that is lexically rich but factually inaccurate. This underscores the need for human oversight. Teachers remain indispensable, not only for verifying AI outputs but also for connecting with students in ways technology cannot [8, 5].

Beyond classrooms and research labs, AI's impact on language extends to society. Translation apps break down language barriers, enabling real-time cross-cultural communication. Chatbots, trained on linguistic models, help learners practice conversational skills, from ordering coffee in Italian to debating in Mandarin. These tools democratize language learning, making it accessible to millions who might never attend traditional classes. This accessibility raises questions about ensuring AI's reach for diverse learners, including those with disabilities or from underrepresented communities. Researchers advocate for more inclusive AI applications, emphasizing diversity and equity as critical priorities [1, 7].

Another vital aspect is AI's role in preserving endangered languages. Linguistic research often faces data scarcity for languages spoken by small communities, but AI can analyze recordings, generate dictionaries, or simulate conversations. UNESCO-supported projects use AI to document at-risk languages, blending linguistics with digital activism [2, 8].

Still, AI is no panacea. Accuracy remains an issue – when AI generates content, it sometimes fabricates references or oversimplifies complex ideas. A 10% accuracy rate for references in some early models is a stark reminder. Privacy is another concern; language apps collect vast user data, raising questions about ownership and use. There's also the risk of dehumanizing education – students need connection, not just algorithms, to stay inspired. These hurdles are not insurmountable but demand thoughtful solutions, from improving training data and algorithms to implementing transparent policies and international regulations [8, 6].

The future is uncertain but shows clear trends. First, we'll likely see even more personalized learning, where AI adapts not just to skill levels but also to cultural contexts or learning styles. Imagine an app tailoring lessons to a student's native language or visual learning preferences – that's the direction we're heading. Second, interdisciplinary collaboration will grow. Linguists, educators, and developers must work together to ensure AI tools are grounded in both theory and practice. Finally, addressing ethical concerns will shape AI's trajectory. Transparent principles and legal frameworks will build trust, making AI a true ally in education [7, 3].

Conclusion

In conclusion, artificial intelligence is profoundly transforming linguistics and pedagogy, offering innovative language teaching methods and tightly linking these disciplines within modern education. Advances in natural language processing and machine learning open new horizons for precise language analysis and adaptive educational systems. However, addressing ethical considerations and risks associated with AI use is critical.

Educators should view AI as a powerful tool, not a replacement, underscoring the value of human interaction in education. With each step forward, we must strive to create systems that not only enhance language learning accessibility but also promote cultural diversity. Thus, artificial intelligence, as a bridge between linguistics and pedagogy, can significantly elevate the quality of education.

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