ISSN INTERNATIONAL STANDARD SERIAL NUMBER
ISSN 2782-4365
Проверить номер:

Научно-образовательный электронный журнал

ОБРАЗОВАНИЕ И НАУКА В XXI ВЕКЕ

Выпуск №61-1 (том 2)
(апрель, 2025)

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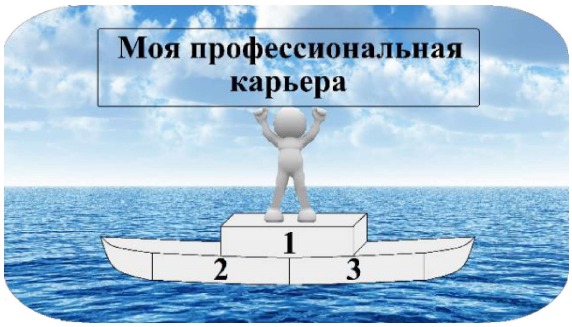

Международный научно-образовательный электронный журнал
«ОБРАЗОВАНИЕ И НАУКА В XXI ВЕКЕ»

ISSN 2782-4365
УДК 37
ББК 94

Международный научно-образовательный электронный журнал «ОБРАЗОВАНИЕ И НАУКА В XXI ВЕКЕ». Выпуск №61-1 (том 2) (апрель, 2025). Дата выхода в свет: 07.04.2025.

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Название публикации: «USAGE OF AI IN COMPUTATIONAL LINGUISTUICS»

Abstract

Artificial Intelligence (AI) has revolutionized computational linguistics, enabling advanced language processing, translation, and text generation. This article explores the key applications of AI in the field, including natural language processing (NLP), machine translation, speech recognition, and sentiment analysis. It highlights the role of deep learning models, such as transformers, in improving linguistic analysis and automation.

Additionally, the article discusses the challenges AI faces, such as bias in language models and the limitations of contextual understanding. The future prospects of AI-driven linguistic research and its implications for various industries are also examined. Through this analysis, the article aims to provide insights into the evolving relationship between AI and computational linguistics.

Keywords

Artificial Intelligence, Computational Linguistics, Natural Language Processing, Morphological Analysis

Introduction

Artificial Intelligence (AI) has become an essential tool in computational linguistics, reshaping the way machines interact with human language. From machine translation and speech recognition to text generation and sentiment analysis, AI-powered models have significantly improved the efficiency and accuracy of language processing. With the introduction of deep learning architectures such as transformers,

modern AI systems can analyze syntax, semantics, and even pragmatics with remarkable precision [1, p. 143-150].

However, despite its advancements, AI in computational linguistics still faces major challenges. Bias in language models, difficulties in understanding context, and ethical concerns related to automated text generation remain pressing issues. As researchers strive to develop more reliable and explainable AI models, the future of computational linguistics promises even deeper integration with AI-driven solutions.

This article explores the key applications of AI in computational linguistics, the underlying technologies driving these innovations, and the challenges that must be addressed for further progress.

AI-Powered Machine Translation: Breaking Language Barriers

Artificial Intelligence has revolutionized computational linguistics by enabling machines to process and understand human language with unprecedented accuracy. Traditional linguistic analysis relied heavily on rule-based systems, where predefined grammatical structures and vocabulary lists dictated how computers interpreted text [2, p. 167-172]. However, AI-driven approaches, particularly those based on machine learning and deep learning, have transformed this field by allowing models to learn language patterns directly from vast amounts of data.

One of the most significant breakthroughs has been the development of Neural Networks and Transformer Models, such as BERT and GPT. These models do not simply follow predefined linguistic rules; instead, they analyze billions of text samples to predict word meanings, identify syntactic structures, and generate coherent responses. This has led to substantial improvements in applications like machine translation, speech recognition, and automated text summarization.

Moreover, AI-powered linguistic tools are now being integrated into various industries. Virtual assistants, such as Siri and Google Assistant, rely on NLP to understand spoken commands, while chatbots in customer service use AI to provide human-like interactions. In academia, AI is helping researchers analyze linguistic patterns across different languages, contributing to fields like historical linguistics and sociolinguistics [3, p. 230-242].

Despite these advancements, AI in computational linguistics is far from perfect. Language models still struggle with ambiguity, sarcasm, and cultural nuances—elements that humans process intuitively. As AI continues to evolve, researchers are working on refining models to enhance their contextual understanding and ethical considerations in language processing.

AI-Powered Machine Translation: Breaking Language Barriers

One of the most impactful applications of AI in computational linguistics is machine translation (MT). In the past, translation systems relied on rule-based and statistical methods, which often produced rigid and inaccurate translations. However, with the rise of neural machine translation (NMT) and deep learning, AI has dramatically improved the accuracy, fluency, and contextual understanding of translated texts.

Modern AI-driven translation systems, such as Google Translate and DeepL, use advanced transformer-based models to analyze entire sentences rather than translating word by word. This approach allows them to capture contextual meaning, recognize idiomatic expressions, and generate more natural translations. For instance, while older translation methods struggled with complex sentence structures, neural models can now better understand grammatical dependencies and semantic relationships [4, p. 129-154].

AI-powered MT is not only beneficial for everyday users but also for businesses and researchers working in multilingual environments. Companies use AI-driven translation tools to expand their global reach, while institutions like the United Nations and the European Union rely on automated translation to streamline communication across different languages.

However, challenges remain. AI still struggles with low-resource languages—those with limited training data—leading to lower translation quality compared to widely spoken languages like English or Chinese. Additionally, cultural nuances, humor, and context-specific meanings can still pose difficulties for AI models. Researchers continue to improve AI-based translation by incorporating reinforcement

learning, multilingual training, and hybrid models that combine AI with human expertise.

As AI evolves, the future of machine translation looks promising, with the potential to create seamless cross-lingual communication and eliminate language barriers in a rapidly globalizing world.

Speech Recognition: Teaching AI to Understand Spoken Language

Another groundbreaking application of AI in computational linguistics is speech recognition, which enables machines to convert spoken language into text. This technology powers virtual assistants like Siri, Google Assistant, and Alexa, as well as automated transcription services such as Otter.ai and Google Speech-to-Text. Thanks to deep learning advancements, modern speech recognition systems can process various accents, dialects, and even background noise with impressive accuracy.

AI-driven speech recognition relies on Automatic Speech Recognition (ASR) systems, which analyze sound waves and match them to linguistic patterns. Traditional ASR models struggled with homophones (words that sound the same but have different meanings) and misinterpretations due to pronunciation variations. However, deep learning models, particularly Recurrent Neural Networks (RNNs) and Transformer-based architectures, have significantly improved the ability of AI to understand speech by learning from massive datasets [5, p. 243-252].

One of the key innovations in this field is the ability of AI to adapt to different speakers. Personalized speech models, used in smartphones and smart home devices, learn from a user's voice over time, refining their accuracy. Moreover, real-time speech translation—where AI not only transcribes but also translates spoken language on the fly—is making global communication more accessible than ever.

Despite these advancements, challenges persist. AI still struggles with languages that lack large datasets, and speech recognition systems can be biased toward certain accents or sociolects. Additionally, recognizing emotional tone and sarcasm remains a significant hurdle. Researchers are now working on emotion-aware AI and multi-modal learning, which integrates speech with visual and contextual cues to improve accuracy.

As AI-driven speech recognition continues to evolve, it is expected to transform industries such as healthcare, education, and customer service, making human-machine interactions more seamless and intuitive than ever before.

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