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LEXICAL-SEMANTIC FIELDS IN ARTIFICIAL INTELLIGENCE TERMINOLOGY: "MACHINE LEARNING," "NEURAL NETWORKS," "DATA PROCESSING," AND THEIR UZBEK EQUIVALENTS

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Abstract: This article examines the lexical-semantic fields of key artificial intelligence (AI) terms such as machine learning, neural networks, and data processing, together with their Uzbek equivalents. The study analyzes the semantic structure, conceptual content, and translation strategies—including calquing and adaptation—used in rendering these units into Uzbek. It also highlights the systematic nature of borrowed technical terminology and its role in the standardization and development of AI discourse in Uzbek. The findings contribute to a deeper understanding of AI-related lexicography and translation studies.
Keywords: artificial intelligence, machine learning, neural networks, data processing, lexical-semantic field, terminology, translation, calquing, borrowing, Uzbek equivalents.

SUN'IY INTELLEKT TERMINOLOGIYASIDA LEKSIK-SEMANTIK MAYDONLAR: "MACHINE LEARNING", "NEURAL NETWORKS", "DATA PROCESSING" VA ULARNING O'ZBEKCHA IFODALARI

Annotatsiya: Ushbu maqolada sun'iy intellekt terminologiyasining muhim tarkibiy qismlari bo'lgan "machine learning", "neural networks" va "data processing" birliklarining leksik-semantik maydonlari hamda ularning o'zbek tilidagi ekvivalentlari tahlil qilinadi. Tadqiqotda mazkur terminlarning semantik tuzilishi, konseptual mazmuni, tarjima jarayoni, kalkalash va moslashtirish strategiyalari ilmiy asosda o'rganiladi. Shuningdek, ingliz tilidan o'zbek tiliga o'zlashgan texnik birliklarning tizimliligi, terminologik me'yoriylashuvi va ularning fan-texnika rivojiga ta'siri yoritiladi. Natijalar sun'iy intellekt bo'yicha lug'atshunoslik va tarjimashunoslik tadqiqotlarini chuqurlashtirishga xizmat qiladi.
Kalit so'zlar: sun'iy intellekt, machine learning, mashinali o'qitish, neural networks, neyron tarmoqlar, data processing, terminologiya, leksik-semantik maydon, tarjima, kalkalash, o'zlashma birliklar

ЛЕКСИКО-СЕМАНТИЧЕСКИЕ ПОЛЯ В ТЕРМИНОЛОГИИ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА: "MACHINE LEARNING", "NEURAL NETWORKS", "DATA PROCESSING" И ИХ УЗБЕКСКИЕ СООТВЕТСТВИЯ

Аннотация: В статье рассматриваются лексико-семантические поля основных терминов искусственного интеллекта — machine learning, neural networks и data processing, а также их узбекские соответствия. В исследовании анализируются семантическая структура, концептуальное содержание этих единиц и стратегии их перевода на узбекский язык, включая калькирование и адаптацию. Кроме того, освещается системность заимствованных технических терминов и их влияние на стандартизацию и развитие дискурса искусственного интеллекта в узбекском языке. Результаты способствуют дальнейшему развитию исследований в области лексикографии и перевода терминов ИИ.

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Ключевые слова: искусственный интеллект, machine learning, mashinali o‘qitish, neural networks, neyron tarmoqlar, data processing, терминология, лексико-семантическое поле, перевод, калькирование, заимствования

INTRODUCTION

The rapid advancement of artificial intelligence (AI) technologies has significantly transformed the linguistic landscape of many world languages, giving rise to new terminological systems and semantic structures. As AI becomes increasingly integrated into science, education, industry, and everyday life, the need for precise, standardized, and conceptually coherent terminology has grown accordingly. English, as the dominant language of technological innovation, has served as the primary source of AI-related lexical units across numerous languages, including Uzbek. This linguistic influence has generated an active process of borrowing, semantic adaptation, calquing, and terminological restructuring within the Uzbek lexicon. Among the core terminological clusters of AI, the concepts machine learning, neural networks, and data processing represent foundational components that shape both theoretical and applied aspects of the field. These units form distinct yet interconnected lexical-semantic fields that reflect the cognitive, functional, and technological dimensions of AI. Their Uzbek equivalents—mashinali o‘qitish, neyron tarmoqlar, and ma’lumotlarni qayta ishlash—illustrate how global scientific concepts are linguistically reconstructed through translation, morphological adaptation, and semantic narrowing or broadening. The study of these terminological units is particularly relevant for Uzbek linguistics, as the language continues to expand its scientific and technological vocabulary in response to global digitalization. Understanding how AI terms are conceptualized and integrated into Uzbek not only enhances terminological accuracy but also contributes to the broader development of scientific discourse, lexicography, and translation studies. Furthermore, the comparative analysis of the English originals and their Uzbek counterparts reveals the dynamics of linguistic innovation, the interaction between donor and recipient languages, and the mechanisms through which specialized knowledge is localized. Therefore, this article investigates the lexical-semantic fields of selected AI terms, focusing on their semantic structures, conceptual relationships, translation patterns, and functional roles in the emerging Uzbek AI terminology system. By examining these linguistic processes, the study aims to provide insights into the evolving nature of technological lexicon formation and to contribute to the scholarly discourse on modern terminography and cross-linguistic terminology standardization.

LITERATURE REVIEW AND METHODOLOGY

Research on artificial intelligence terminology has expanded significantly in recent decades, reflecting the growing influence of digital technologies on linguistic systems. Scholars such as Jurafsky & Martin (2023), Nadkarni (2021), and Floridi (2019) highlight that AI concepts form complex semantic networks that evolve alongside technological innovation. Their works demonstrate that terms like machine learning, neural networks, and data processing represent not only technical processes but also conceptual frameworks that organize human understanding of computational intelligence. Linguistic studies on terminology development emphasize the interplay between cognitive models and lexical structures. Cabré (1999) and Temmerman (2018) argue that terminologies are shaped by conceptual categorization, domain-specific knowledge, and socio-technological context. This view is supported by comparative terminological research across languages, where scholars such as Grinev (2008) and Picht

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(2015) examine the mechanisms of borrowing, calquing, hybrid formation, and semantic adaptation in multilingual environments. In the context of Turkic languages, including Uzbek, recent studies by local scholars (e.g., Madvaliev 2020; Abdurahmonov 2021; Shonazarov 2019) show that scientific and technical terminology is undergoing rapid expansion driven by globalization and technological import. These researchers note that English remains the primary donor language in fields such as information technology, AI, and computational sciences. Consequently, Uzbek terminographers face challenges in ensuring terminological consistency, avoiding ambiguity, and selecting appropriate translation strategies. AI-related lexical units have also been widely studied within translation studies. Venuti (2017) and Baker (2018) emphasize that translating technological terminology requires balancing accuracy, linguistic naturalness, and cultural relevance. For languages with emerging technological lexicons, such as Uzbek, scholars like Karimov (2022) and Hayitova (2023) highlight the importance of calquing and semantic restructuring to avoid overreliance on foreign borrowings. Their findings reveal that machine learning → mashinali o‘qitish, neural networks → neyron tarmoqlar, and data processing → ma’lumotlarni qayta ishlash represent successful cases of structural and semantic calques. Thus, the existing literature indicates that AI terminology develops through dynamic linguistic, cognitive, and sociocultural interactions. Yet, comparative studies that specifically examine the lexical-semantic fields of these core AI terms in English and Uzbek remain limited, making the present research both timely and necessary.

This study employs a descriptive and comparative linguistic methodology to analyze the lexical-semantic fields of the terms machine learning, neural networks, and data processing and their Uzbek equivalents. The research data were collected from English academic sources, IEEE and ACM glossaries, as well as Uzbek scientific dictionaries and the Uzbek National Corpus.

The analysis focuses on three main procedures:

1. **Semantic analysis** – examining core meanings, conceptual structures, and semantic extensions of the terms in both languages.
2. **Lexical and morphological comparison** – assessing compound formation, morphemic structure, calquing patterns, and adaptation strategies used in creating the Uzbek equivalents.
3. **Cross-linguistic evaluation** – comparing English originals with Uzbek translations in terms of accuracy, terminological consistency, and functional equivalence in academic and technical discourse.

To ensure validity, the Uzbek terminology was cross-checked with official educational and linguistic resources, while the English terms were verified through authoritative AI and computational linguistics references. This concise methodological framework allows for a systematic and reliable examination of how AI terminology is integrated into the Uzbek linguistic system.

RESULTS AND DISCUSSION

The results of the study demonstrate that the Uzbek equivalents “mashinali o‘qitish,” “neyron tarmoqlar,” and “ma’lumotlarni qayta ishlash” provide semantically accurate and functionally appropriate representations of the English terms machine learning, neural networks, and data

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processing. The use of structural calquing ensures that the conceptual content is preserved while the terms remain accessible to Uzbek-speaking users. This approach supports both terminological transparency and linguistic authenticity. The comparative analysis reveals that Uzbek effectively adapts multi-component English terms through its agglutinative morphological system. This allows compound expressions to be integrated smoothly without significant distortion of meaning. For example, the components in machine learning and neural networks map clearly onto Uzbek equivalents, demonstrating high levels of morphological compatibility. Such adaptations contribute to the formation of a coherent and systematic AI terminology in Uzbek. The findings also highlight ongoing **semantic expansion** within the Uzbek lexicon. Words such as tarmoq and o‘qitish, previously used in broader or non-technical contexts, have acquired domain-specific meanings in the AI field. While this enriches the semantic capacity of the language, it simultaneously necessitates careful standardization to prevent ambiguity or semantic overlap in different communication settings. From a functional perspective, the Uzbek terms show strong pragmatic equivalence with their English originals. They are increasingly used in academic publications, textbooks, and technology-related discourse, indicating a growing degree of acceptance and stability. However, the study also identifies several challenges, including occasional inconsistencies in translation across institutions and the need for ongoing terminological updates as AI concepts continue to evolve rapidly. In general, the results suggest that the Uzbek language is successfully building a modern AI terminology system through a combination of calquing, selective borrowing, morphological adaptation, and semantic refinement. This dynamic process strengthens the linguistic capacity of Uzbek to engage with global scientific and technological developments.

CONCLUSION

The study of the lexical-semantic fields of key artificial intelligence terms—machine learning, neural networks, and data processing—and their Uzbek equivalents demonstrates that the Uzbek language possesses strong linguistic potential to accommodate rapidly evolving technological concepts. Through calquing, semantic adaptation, and morphological restructuring, Uzbek has successfully integrated these units into its scientific and educational discourse without compromising conceptual precision or linguistic identity. The analysis confirms that the Uzbek terms “mashinali o‘qitish,” “neyron tarmoqlar,” and “ma’lumotlarni qayta ishlash” provide clear and accurate reflections of their English originals. Their transparent internal structure makes them easy to interpret, while their compatibility with Uzbek morphology ensures natural usage across academic, pedagogical, and technological contexts. This demonstrates that native linguistic resources can effectively convey highly specialized scientific meanings when supported by systematic terminological planning. The expansion of AI terminology in Uzbek also illustrates broader processes of semantic enrichment and lexical development. Traditional words such as tarmoq, o‘qitish, and ma’lumot have acquired new technical functions, which not only enhance the expressive range of the language but also align it with global scientific communication standards. However, this semantic growth requires consistent standardization to prevent ambiguity and to ensure uniform usage across institutions, textbooks, and professional fields. The findings further highlight that the successful localization of AI terminology in Uzbek depends not only on linguistic strategies but also on interdisciplinary cooperation among linguists, translators, educators, and technology specialists. As AI continues to evolve, the need for continuous terminology development, corpus-based monitoring, and authoritative terminological guidelines becomes increasingly important.

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Without such efforts, inconsistencies and unnecessary borrowings may hinder the formation of a stable and unified terminological system. Overall, this research demonstrates that Uzbek is actively developing a modern, coherent, and scientifically grounded AI terminological framework. By carefully balancing semantic fidelity, linguistic naturalness, and international compatibility, Uzbek can continue to strengthen its role in global technological discourse. The findings underscore the importance of ongoing lexicographic work, translation research, and terminological standardization to ensure that the language keeps pace with the rapid advances in artificial intelligence and digital innovation.

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