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ARTIFICIAL INTELLIGENCE TERMINOLOGY IN ENGLISH AND UZBEK: LINGUISTIC AND TRANSLATION PERSPECTIVES

Farhodiy Karalina Farhod qizi
Master's student at Karshi University of Economics and Pedagogy
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Abstract. The rapid advancement of artificial intelligence (AI) has significantly influenced the development of specialized terminology in contemporary languages. English has become the primary language for introducing and disseminating AI-related concepts, while other languages, including Uzbek, face the challenge of adapting these terms to their linguistic and cultural systems. This article examines the lexical, morphological, semantic, and structural characteristics of artificial intelligence terminology in English and investigates the principal strategies employed in translating these terms into Uzbek. The study applies descriptive, comparative, componential, and translation-oriented analysis to a purposively selected sample of 40 English AI terms and their proposed or commonly encountered Uzbek equivalents. Particular attention is devoted to lexical borrowing, calquing, hybrid term formation, descriptive translation, semantic specialization, and metaphorical conceptualization. The findings demonstrate that English AI terminology frequently relies on nominal compounding, abbreviation, and semantic extension, whereas Uzbek equivalents employ native grammatical structures, international borrowings, and explanatory constructions. The analysis also identifies terminological variation, partial semantic equivalence, and the absence of standardized translations for emerging AI concepts as significant challenges. The article proposes a conceptual framework for evaluating English–Uzbek AI terminology based on semantic accuracy, linguistic naturalness, consistency, and communicative accessibility. The findings contribute to comparative terminology research and offer practical recommendations for technical translation, scientific communication, and the development of Uzbek-language AI educational resources.

Keywords: artificial intelligence, terminology, English, Uzbek, comparative linguistics, technical translation, lexical borrowing, calquing, semantic equivalence, terminology standardization, neologisms.

Introduction.

The rapid development of artificial intelligence has transformed numerous areas of human activity, including education, healthcare, scientific research, economics, engineering, and communication. Alongside technological innovation, artificial intelligence has generated an extensive system of specialized terms that reflect newly developed concepts, computational methods, and technological processes. Terminology plays a fundamental role in scientific communication because it provides linguistic representations of specialized knowledge. The development of new scientific disciplines is frequently accompanied by the emergence of technical expressions, abbreviations, and conceptual

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categories. Artificial intelligence represents a particularly dynamic field in which terminological innovation occurs continuously. English occupies a prominent position in the international development and dissemination of AI terminology. Foundational concepts such as machine learning, neural networks, deep learning, natural language processing, transformer architecture, and large language models have become established through English-language scientific publications and technological documentation. The growing integration of AI technologies into Uzbekistan's educational, economic, and administrative systems has increased the demand for accurate Uzbek equivalents of these terms. However, translating AI terminology from English into Uzbek involves linguistic challenges related to morphological differences, semantic complexity, lexical borrowing, and terminological inconsistency.

English and Uzbek belong to different language families and demonstrate distinct grammatical structures. English is a Germanic language with relatively limited inflectional morphology, whereas Uzbek is a Turkic language characterized by agglutinative morphology and productive suffixation. These structural differences influence the formation and translation of specialized terminology. For instance, the English expression natural language processing is translated into Uzbek as tabiiy tilni qayta ishlash. Although both expressions represent the same technical concept, their grammatical organization differs considerably. Similarly, the English term fine-tuning may be translated as nozik sozlash or explained as oldindan o‘qitilgan modelni qo‘shimcha moslashtirish, depending on the communicative context. The absence of universally established Uzbek equivalents for certain emerging AI terms creates additional difficulties for translators, researchers, educators, and technology specialists. Therefore, the comparative study of artificial intelligence terminology in English and Uzbek is relevant not only to theoretical linguistics but also to practical translation, terminology management, and the development of scientific communication.

Literature Review.

Terminology studies have developed as an interdisciplinary field connecting linguistics, cognitive science, translation studies, and specialized communication. One of the foundational approaches to terminology was developed by Eugen Wüster, whose work contributed to the establishment of systematic principles for organizing scientific and technical concepts. Traditional terminology theory emphasized the relationship between concepts and their designations, as well as the importance of consistency in specialized communication. Cabré (1999) expanded the understanding of terminology by emphasizing its communicative, cognitive, and linguistic dimensions. According to this perspective, specialized terms function within particular communicative contexts and cannot be analyzed exclusively as isolated lexical units [1]. Sager (1990) examined terminology processing as a practical activity involving concept analysis, term formation, documentation, and translation. His work demonstrates the importance of systematic terminology management in multilingual scientific communication [2]. Temmerman (2000) proposed a sociocognitive approach to terminology, emphasizing the role of categorization, conceptual development, and linguistic variation. This perspective is particularly relevant to AI terminology because many AI concepts evolve rapidly and acquire new meanings as

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technologies develop [3]. From a translation perspective, Newmark (1988) distinguished between semantic and communicative translation strategies, providing a theoretical foundation for analyzing the relationship between conceptual accuracy and target-language accessibility [4]. Baker (2018) further demonstrated that translation equivalence involves several linguistic levels, including lexical, grammatical, textual, and pragmatic correspondence [5]. The development of artificial intelligence terminology is closely associated with the evolution of computer science. Russell and Norvig (2021) provide a systematic explanation of fundamental AI concepts, including intelligent agents, machine learning, knowledge representation, and computational reasoning [6]. The introduction of transformer architectures by Vaswani et al. (2017) contributed to the emergence and wider use of terms such as self-attention, multi-head attention, and transformer model [7]. More recently, Bommasani et al. (2021) examined the concept of foundation models, demonstrating how technological innovation contributes to the emergence of new conceptual categories and terminology [8]. In Uzbek linguistics, the works of A. Hojiyev on linguistic terminology and word formation provide a useful theoretical foundation for examining the morphological integration of borrowed technical vocabulary [9, 10]. The reviewed literature establishes a strong theoretical basis for terminology analysis. However, English–Uzbek AI terminology requires further systematic investigation, particularly regarding the translation of emerging technical concepts and the relationship between international borrowing and native word formation.

Materials and Methods.

The present study adopts a qualitative descriptive and comparative research design. The analytical material consists of 40 English AI terms selected purposively from established scientific literature and technical discourse. The selection includes fundamental AI concepts, machine learning terminology, natural language processing expressions, and terms associated with generative AI. The English terms were compared with Uzbek equivalents used in educational and technical contexts or proposed through linguistic translation. The sample was constructed to illustrate different linguistic structures and translation challenges rather than to represent the statistical distribution of AI terminology.

The research employed four complementary analytical methods.

Descriptive analysis was used to identify the lexical and grammatical characteristics of English AI terms.

Morphological and structural analysis examined compounding, derivation, abbreviation, and the integration of borrowed terms into Uzbek grammatical patterns.

Componential semantic analysis investigated the conceptual relationships between English terms and their Uzbek equivalents.

Translation analysis classified the principal strategies used to transfer AI terminology into Uzbek, including borrowing, calquing, hybrid formation, and descriptive translation. For analytical purposes, the selected terms were grouped into four categories: fundamental AI terminology, machine learning terminology, neural network terminology, and generative AI terminology. The study does not claim that

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the selected terms constitute a representative corpus of all AI terminology. No frequency-based conclusions are drawn from the sample.

Results

Lexical and Morphological Characteristics of English AI Terminology. The analysis demonstrates that English AI terminology is characterized by productive compounding, derivation, abbreviation, and semantic specialization. Compounding is particularly common in the formation of technical noun phrases. Expressions such as machine learning, neural network, computer vision, and language model combine existing lexical units to designate specialized concepts. Derivation also plays an important role. Terms such as classification, optimization, tokenization, and generalization are formed through morphological processes involving suffixation. Abbreviation contributes to linguistic economy. Expressions such as AI, ML, NLP, CNN, RNN, and LLM allow complex technical concepts to be represented concisely. Semantic specialization occurs when familiar lexical items acquire specific technical meanings. For example, training refers to the process of adjusting model parameters, while attention denotes a computational mechanism for processing relationships between elements of input data. These mechanisms demonstrate the capacity of English to generate specialized terminology through the adaptation and recombination of existing linguistic resources.

Comparative Analysis of English and Uzbek AI Terms**.** The translation of English AI terminology into Uzbek involves several structural and semantic transformations.

Table 1. Comparative analysis of English AI terms and Uzbek equivalents

English term	Uzbek equivalent	Translation strategy
Artificial intelligence	Sun’iy intellekt	Calquing
Machine learning	Mashinaviy o‘rganish	Calquing
Deep learning	Chuqur o‘rganish	Calquing
Neural network	Neyron tarmoq	Hybrid formation
Computer vision	Kompyuter ko‘rishi	Hybrid calque
Natural language processing	Tabiiy tilni qayta ishlash	Structural calque
Large language model	Katta til modeli	Calquing
Generative AI	Generativ sun’iy intellekt	Hybrid formation
Reinforcement learning	Mustahkamlash orqali o‘rganish	Descriptive translation
Supervised learning	Nazorat ostida o‘rganish	Calquing
Unsupervised learning	Nazoratsiz o‘rganish	Calquing
Speech recognition	Nutqni tanib olish	Structural transformation
Image classification	Tasvirlarni tasniflash	Semantic translation
Training dataset	O‘qitish ma’lumotlari to‘plami	Descriptive translation
Fine-tuning	Nozik sozlash	Semantic calque
Prompt engineering	Prompt muhandisligi	Hybrid formation

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Tokenization	Tokenizatsiya	Borrowing
Transformer model	Transformer modeli	Hybrid formation
Foundation model	Poydevor model	Calquing
Artificial neural network	Sun'iy neyron tarmoq	Hybrid formation

The results indicate that calquing is a productive strategy for translating transparent English compounds, while borrowing is often preferred for internationally recognized technical units. Hybrid formation is especially relevant when borrowed lexical elements are combined with Uzbek grammatical structures.

Translation Strategies in English–Uzbek AI Terminology. The analysis identifies four principal translation strategies.

Lexical borrowing. This strategy involves adopting a foreign technical term with limited modification. Examples include algoritm, model, token, and transformer. Borrowing helps preserve international terminological compatibility.

Calquing. This strategy involves translating the semantic components of a technical expression. Examples include artificial intelligence — sun'iy intellekt and deep learning — chuqur o'rganish.

Hybrid formation. This process combines borrowed elements with Uzbek lexical or grammatical components. Examples include neyron tarmoq, generativ sun'iy intellekt, and transformer modeli.

Descriptive translation. This approach is applied when a concise equivalent may not adequately communicate a technical concept. For example, retrieval-augmented generation may be explained as axborotni qidirib topish bilan boyitilgan generatsiya. These strategies are not mutually exclusive. A single term may combine borrowing, calquing, and grammatical adaptation.

Semantic Challenges in Translating AI Terminology. Semantic equivalence is a central issue in technical translation. Several AI terms originate from everyday vocabulary but acquire specialized meanings in computational contexts. The English word attention, for example, refers to concentration in ordinary language. In transformer-based neural networks, it denotes a mathematical mechanism used to calculate relationships between representations. The Uzbek expression diqqat mexanizmi preserves the metaphorical connection while providing a technical designation. Similarly, hallucination in generative AI refers to the production of unsupported or unreliable information. A direct borrowing such as gallyutsinatsiya may be familiar to specialists, but explanatory translation can improve comprehension among general audiences. The term bias also presents translation difficulties because it may refer to statistical bias, systematic model errors, unfair treatment of demographic groups, or an additive parameter in a computational model. Consequently, a single Uzbek equivalent cannot always represent every technical meaning of an English term.

Table 2. Semantic variation in selected AI terms

English term	**Possible Uzbek translation**	**Translation challenge**
Bias	Og'ish, tarafkashlik, siljish parametri	Context-dependent meaning

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Hallucination	Gallyutsinatsiya, asossiz ma'lumot yaratish	Metaphorical meaning
Fine-tuning	Nozik sozlash, qo'shimcha moslashtirish	Technical specificity
Prompt	Prompt, so'rov, ko'rsatma	Partial equivalence
Attention	Diqqat mexanizmi	Metaphorical specialization
Alignment	Moslashtirish, maqsadlarga muvofiqlashtirish	Conceptual ambiguity
Embedding	Vektorli ifodalash, embedding	Lack of a concise universal equivalent
Inference	Inferensiya, modeldan natija olish	Multiple disciplinary meanings

These examples demonstrate that technical translation requires conceptual analysis rather than direct word-for-word substitution.

Morphological Adaptation of Borrowed AI Terms in Uzbek. One of the distinctive characteristics of Uzbek AI terminology is the morphological integration of international technical vocabulary. Uzbek is an agglutinative language in which grammatical relationships are frequently expressed through suffixation. Borrowed AI terms can therefore acquire Uzbek plural, possessive, and case suffixes.

For example:

Algoritm → algoritmlar → algoritmlarning.

Model → modellar → modellarni.

Token → tokenlar → tokenlarni.

Transformer → transformerlar → transformerlarning.

These examples illustrate how international technical vocabulary becomes integrated into Uzbek grammatical structures. Furthermore, Uzbek frequently employs verbal constructions to express computational operations. For example, model training may be translated as modelni o'qitish, while data preprocessing may be expressed as ma'lumotlarga dastlabki ishlov berish. Such constructions demonstrate the productive role of Uzbek syntax and morphology in adapting specialized technological concepts.

Discussion.

The findings indicate that English and Uzbek AI terminology develop through interconnected but structurally different linguistic processes. English functions as a major source language for internationally disseminated AI terminology. Its productive use of nominal compounding, abbreviation, and semantic extension contributes to the rapid formation of new technical expressions. Uzbek, in contrast, frequently adapts these expressions through a combination of borrowing, calquing, grammatical integration, and explanatory translation. This difference reflects the linguistic characteristics of the two languages rather than unequal capacities for scientific communication. The findings are consistent with Cabré's communicative approach to terminology, which emphasizes that technical terms function within specific linguistic and professional contexts [1]. They also support Temmerman's sociocognitive perspective, according to which terminology is influenced by conceptual

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development and variation [3]. From a translation perspective, the results demonstrate that formal similarity does not necessarily guarantee semantic equivalence. A technically accurate translation must preserve the concept represented by the original term, even when structural transformations are necessary. For example, reinforcement learning cannot be adequately interpreted solely through the everyday meaning of reinforcement. Its Uzbek equivalent should reflect the computational learning paradigm in which an agent learns through interactions and reward signals. Similarly, the term foundation model requires careful translation because the concept refers to models trained on broad data and adaptable to multiple downstream tasks, rather than merely to a model that forms the physical or structural foundation of a system [8].

The analysis also highlights the importance of terminological standardization.

Without systematic coordination, different translations may coexist in scientific publications, textbooks, and technological documentation. Although linguistic variation is natural during the early development of terminology, excessive inconsistency can complicate education and interdisciplinary communication. The development of an English–Uzbek AI terminology database could help address these challenges. Such a resource should include English terms, Uzbek equivalents, definitions, grammatical information, contextual examples, and references to authoritative scientific sources. In addition, the standardization process should involve both linguists and AI specialists to ensure linguistic naturalness and technical accuracy.

Proposed Criteria for Evaluating Uzbek AI Equivalents. Based on the qualitative analysis, four evaluation criteria can be proposed.

Semantic accuracy refers to the degree to which the Uzbek equivalent preserves the technical meaning of the English term.

Linguistic naturalness concerns compatibility with Uzbek grammatical, morphological, and lexical patterns.

Terminological consistency refers to the stable use of equivalent expressions across scientific and educational contexts.

Communicative accessibility concerns the ability of the selected expression to communicate the intended concept clearly to its target audience.

These criteria can serve as a conceptual framework for future expert evaluation and terminology standardization. However, they require empirical testing before being adopted as a validated assessment instrument.

Conclusion.

The comparative investigation of artificial intelligence terminology in English and Uzbek reveals important lexical, morphological, semantic, and translational characteristics. English AI terminology is characterized by productive compounding, derivation, abbreviation, and semantic specialization. These mechanisms facilitate the formation of concise expressions for complex technological concepts. Uzbek AI terminology develops through lexical borrowing, calquing, hybrid formation, descriptive translation,

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and morphological adaptation. The study demonstrates that linguistic equivalence between English and Uzbek AI terms depends not only on lexical correspondence but also on conceptual precision and grammatical compatibility. One of the principal challenges in translating AI terminology is the coexistence of alternative Uzbek equivalents, particularly for emerging concepts associated with generative AI and large language models. The proposed evaluation framework emphasizes semantic accuracy, linguistic naturalness, terminological consistency, and communicative accessibility as important principles of technical translation. The practical significance of the research lies in its potential application to bilingual terminology databases, scientific translation, university teaching materials, and Uzbek-language technological documentation. Further studies should employ larger parallel corpora, frequency-based analysis, and expert assessments to determine the actual distribution and acceptance of competing Uzbek equivalents. Ultimately, systematic linguistic research and interdisciplinary cooperation can contribute to the development of a consistent and conceptually accurate Uzbek AI terminological system.

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