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LEXICAL AND SEMANTIC FEATURES OF ARTIFICIAL INTELLIGENCE AND DIGITAL TECHNOLOGY TERMINOLOGY

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Abstract
This article analyzes the lexical and semantic features of terminology related to artificial intelligence and digital technologies currently used in the Uzbek language. The aim of the study is to identify the sources of formation, mechanisms of semantic development, structural organization, and interrelationships of these terms within the terminological system. The research material comprises borrowed terms, calqued lexical units, and terminological combinations widely used in the fields of artificial intelligence and digital technologies. Descriptive, componential, comparative, and lexical-semantic methods of analysis are employed in the study. The analysis reveals the mechanisms underlying the formation of terminology through direct borrowing, calquing, semantic specialization, semantic extension, and metaphorical transfer. Particular attention is also given to the semantic characteristics of such terms as artificial intelligence, machine learning, neural network, big data, large language model, prompt, and generative artificial intelligence. The findings have both theoretical and practical significance for the systematization of artificial intelligence terminology in Uzbek, ensuring semantic precision, and improving national standards of terminological standardization.

Keywords: artificial intelligence, digital technologies, terminology, lexical-semantic analysis, borrowed terms, terminological calquing, semantic specialization, semantic extension, metaphorical transfer, terminological

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combinations, machine learning, neural network, big data, large language model, generative artificial intelligence, terminological standardization.

Introduction

The rapid development of information and communication technologies in the twenty-first century has brought about profound transformations in the economic, political, educational, scientific, and cultural spheres of society. These processes are primarily reflected in the lexical composition of language, since the emergence of new social phenomena, scientific discoveries, and technological innovations generates a corresponding need for their designation. Consequently, existing lexical units acquire new meanings, new words and terms are coined, and lexical items are borrowed from other languages.

The increasing prevalence of lexical units associated with scientific and technological advancement is not a new phenomenon in the Uzbek language. As science and technology have progressed, terms such as internet, monitor, printer, website, scanner, and file have become widely used in Uzbek. Certain general-language lexical units have also acquired additional semantic features through their application to emerging technological concepts. At present, these processes have intensified considerably, particularly with the growing incorporation of terminology related to artificial intelligence and digital technologies into the Uzbek language.

The development of artificial intelligence technologies has also become one of the priorities of state policy in Uzbekistan. In particular, the Strategy for the Development of Artificial Intelligence Technologies until 2030 was approved by Resolution No. PQ-358 of the President of the Republic of Uzbekistan, dated October 14, 2024. In this context, the linguistic investigation of terminology associated with artificial intelligence and digital technologies is of considerable relevance not only to applied terminology studies but also to identifying the patterns and mechanisms underlying the lexical-semantic development of contemporary Uzbek.

The aim of this study is to identify the lexical and semantic characteristics of artificial intelligence and digital technology terminology currently used in Uzbek and to describe the mechanisms of its formation and the relationships among terms within the terminological system. To achieve this aim, the study seeks to

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classify terms according to their sources of origin, examine the semantic structures of borrowed and calqued lexical units, analyze instances of semantic specialization and metaphorical transfer, and address issues related to terminological standardization.

The study employs descriptive, componential, comparative, and lexical-semantic methods of analysis. The research material comprises terminological units associated with artificial intelligence and digital technologies, including terms found in scholarly literature, terminological dictionaries, international standards, and official documents.

1. The terminological system and the formation of artificial intelligence terminology

A term is a linguistic unit that denotes a specialized concept within a particular field of science, technology, professional activity, or social practice. Terminological units differ from general-language vocabulary primarily in their specific relationship with clearly defined concepts and their functioning within an established terminological system.

The development of Uzbek terminology has been systematically examined by H. Dadaboyev in his work O‘zbek terminologiyasi (Uzbek Terminology). Research in this field focuses on the formation of terms, the stages of their historical development, their lexical-semantic characteristics, and their relationships with other linguistic units.

Artificial intelligence terminology constitutes one of the most rapidly developing components of contemporary terminological systems. At the international level, the need to standardize concepts and terminology in this field has led to the development of the international standard ISO/IEC 22989:2022, which establishes a systematic framework for artificial intelligence concepts and terminology. Furthermore, ISO/IEC 23053:2022 defines a general conceptual framework and associated terminology for artificial intelligence systems based on machine learning.

Several principal sources and mechanisms can be identified in the formation of artificial intelligence terminology in the Uzbek language:

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1. Direct borrowing of international terms.
2. Translation of foreign terminology into Uzbek through lexical and structural calquing.
3. Formation of new terms through the existing lexical resources and word-formation mechanisms of Uzbek.
4. Terminologization of general-language lexical units through the acquisition of specialized meanings.
5. Formation of multiword terminological units and their subsequent semantic integration.

For instance, algorithm, chatbot, and prompt are employed as international technological terms. The Uzbek expressions sun'iy intellekt (artificial intelligence) and mashinaviy o'rganish (machine learning) represent Uzbek equivalents of international terminology and illustrate processes associated with terminological calquing. The expression neyron tarmoq (neural network), in turn, demonstrates not only structural and semantic calquing but also metaphorical nomination based on analogies with biological neural systems.

Thus, artificial intelligence terminology in contemporary Uzbek is developing through the interaction of lexical borrowing, terminological calquing, semantic development, and the productive word-formation resources of the national language.

2. Lexical characteristics of artificial intelligence terminology

The lexical characteristics of terminology related to artificial intelligence and digital technologies are determined by the origin, structural composition, degree of linguistic integration, and domains of usage of the respective terms.

2.1. Borrowed Terms

Lexical units borrowed from English through international scientific and technological communication occupy a significant position within artificial intelligence terminology. Such terms include chatbot, prompt, server, interface, token, blockchain, metaverse, and deepfake.

The linguistic status of borrowed terms in Uzbek is not uniform. While certain lexical units have been used extensively over a considerable period and have

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gradually become integrated into general-language vocabulary, others represent relatively recent additions to the terminological system.

For instance, the term algorithm is currently employed not only in mathematics and computer science but also in education and everyday communication. By contrast, terms such as prompt, token, and deepfake have gained wider currency alongside the increasing adoption of artificial intelligence technologies.

Identifying appropriate Uzbek equivalents, providing precise definitions, and establishing consistent conventions for the usage of these terms constitute important objectives of terminological research. These processes demonstrate the dynamic nature of contemporary terminological systems and their responsiveness to scientific and technological developments.

2.2. Terminological Calquing

One of the distinguishing features of artificial intelligence terminology is the reproduction of the semantic content and structural patterns of foreign terms through the linguistic resources of Uzbek. This process is referred to as terminological calquing.

Examples include:

Artificial intelligence — sun'iy intellekt.

Machine learning — mashinaviy o'rganish.

Neural network — neyron tarmoq.

Digital technology — raqamli texnologiya.

Large language model — katta til modeli.

In these examples, the structural and semantic models of foreign terminological units are reproduced through the lexical and grammatical resources of Uzbek. Calquing facilitates the designation of internationally recognized scientific concepts by utilizing the expressive potential of the national language.

At the same time, the successful adoption and widespread use of calqued terms depend on several factors, including semantic precision, structural conciseness, ease of pronunciation, and suitability for practical communication.

In certain cases, the international form of a term may coexist with its Uzbek equivalent. Such terminological variation necessitates a clear determination of semantic equivalence, conceptual correspondence, and the respective domains of

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usage. Ensuring consistency in these areas is essential for the systematic development and standardization of artificial intelligence terminology in Uzbek.

3. Lexical-semantic characteristics of artificial intelligence terminology

The study of artificial intelligence terminology should not be limited to identifying the formal and structural characteristics of terminological units. It is equally important to examine the concepts these terms designate, the semantic relationships they establish with other terms, and the ways in which their meanings evolve in response to technological advancements.

3.1. Terminological Precision and Polysemy

Terminological precision requires a term to consistently designate a clearly defined concept within a particular field and context. Nevertheless, a single term may convey different meanings across various scientific disciplines.

For instance, the term model is employed to denote different concepts in mathematics, statistics, economics, and artificial intelligence. Within the field of artificial intelligence, a model may refer to a mathematical or computational representation of a system designed to learn from data or perform specific tasks. Consequently, the meaning of a term is determined and clarified by its disciplinary context, communicative environment, and semantic relationships with other terminological units.

3.2. Semantic Specialization

Semantic specialization is characterized by the acquisition of a specialized meaning by a lexical unit originally belonging to general-language vocabulary.

For example, the Uzbek word o‘rganish (learning) generally denotes the acquisition of knowledge, the gathering of information, or the process of becoming familiar with a particular phenomenon. However, within the terminological expression mashinaviy o‘rganish (machine learning), it designates a specialized concept associated with the ability of computational systems to identify patterns in data and improve their performance in carrying out specific tasks.

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Similarly, the word tarmoq (network) may refer, in general-language usage, to interconnected objects or systems. In the term neyron tarmoq (neural network), however, this lexical component denotes a computational model consisting of interconnected processing units.

These examples demonstrate that the development of terminological systems is closely associated with the semantic resources of general-language vocabulary and the specialization of existing lexical meanings.

3.3. Semantic Extension

Semantic extension refers to the process whereby a lexical unit acquires additional meanings or expands its range of usage while retaining its previously established meanings.

For instance, the word platforma (platform) originally denoted a physical base, an area, or a structure intended for a particular activity. With the development of digital technologies, however, it has increasingly been employed in terminological combinations such as raqamli platforma (digital platform), onlayn platforma (online platform), and bulutli platforma (cloud platform).

Within these terminological combinations, the component platform refers to a technological environment that enables the provision of digital services, the operation of software applications, or interactions among users. As a result, the semantic scope of the lexical unit expands, allowing it to designate new concepts associated with emerging technological environments.

Thus, technological advancement constitutes one of the significant factors contributing to the acquisition of new terminological meanings by existing lexical units and to the continuous development of their semantic potential.

4. Metaphorization and term formation

Metaphorical transfer plays a significant role in the formation of artificial intelligence terminology. In order to designate complex technological processes through accessible and comprehensible expressions, lexical units originating from everyday language or other scientific disciplines are frequently employed. Examples include neyron tarmoq (neural network), bulutli texnologiya (cloud

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technology), ma'lumotlar ombori (data warehouse), and mashina ko'rishi (machine vision).

In the term bulutli texnologiya (cloud technology), the component bulut (cloud) does not refer to a meteorological phenomenon but rather denotes computing and data storage infrastructure that can be accessed remotely via the internet. This metaphorical designation reflects the conceptual association between a cloud and technological infrastructure that is physically remote from the user but accessible through network connectivity.

In the term neyron tarmoq (neural network), metaphorical nomination is based on a functional analogy between the interconnected structure of biological neurons and the computational units operating within an artificial neural network. Similarly, the expression mashina ko'rishi (machine vision) reflects a conceptual analogy between human visual perception and the capacity of computational systems to process and analyze visual information.

Although such terms originate from metaphorical conceptualization, they designate specific and clearly defined concepts within specialized terminological systems. Their meanings differ from the figurative interpretations associated with general-language usage and acquire terminological precision through their application in scientific and technological contexts.

5. The semantic structure of multiword terminological units

In the terminology of artificial intelligence and digital technologies, multiword terminological units consisting of two or more components are widely used alongside single-word terms.

Table 1. Structural and Semantic Characteristics of Selected Multiword Terms in Artificial Intelligence Terminology

Terminological Unit	Structural Composition	Semantic Characteristics
Artificial intelligence	Adjective + noun	A field of technology concerned with systems designed to perform certain tasks associated with human intelligence.
Digital technology	Adjective + noun	Technology based on the processing and transmission of digital data.
Machine learning	Modifier + verbal noun	A set of methods based on identifying and learning patterns from data.

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Neural network	Adjective + noun	A computational model consisting of interconnected processing units.
Big data	Adjective + noun	Datasets that require specialized processing methods due to their volume, velocity, or variety.
Large language model	Adjective + noun + noun	A language model trained on large volumes of textual data.
Digital platform	Adjective + noun	A technological environment integrating digital services and applications.
Natural language processing	Complex multiword terminological unit	A field concerned with the computational analysis and processing of human language data.
Generative artificial intelligence	Adjective + multiword terminological unit	A concept referring to artificial intelligence systems and methods designed to generate new content.

A significant characteristic of the terminological units presented in the table is that their overall meanings cannot always be reduced to the simple sum of the meanings of their constituent components. For instance, in the term big data, the component big refers not merely to the physical size of datasets but also to characteristics associated with data volume, variety, and the complexity of data processing.

Similarly, in the terminological expression large language model, the component large may refer not only to the size of the model itself but also to the volume of data used during its training and the scale of its parameters. Therefore, the analysis of multiword terminological units should take into account not only their structural composition but also the integrated specialized concepts they designate within a particular scientific or technological domain.

6. Semantic relationships in artificial intelligence terminology

Within artificial intelligence terminology, synonymic, antonymic, hyponymic–hypernymic, and paradigmatic relationships can be identified. These relationships enable terms to function not merely as isolated lexical units but as integral components of an interconnected conceptual system. For instance, a hierarchical relationship exists among the terms artificial intelligence, machine learning, and deep learning. Artificial intelligence represents a broad conceptual domain, while

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machine learning constitutes one of its major subfields. Deep learning, in turn, is a subfield of machine learning based on multilayer neural networks.

This hierarchical relationship can be represented as follows:

Artificial Intelligence

↓

Machine Learning

↓

Deep Learning

The terms generative artificial intelligence and large language model are also conceptually related; however, they do not denote concepts at the same hierarchical level. Generative artificial intelligence refers to technologies and methods designed to produce new content, whereas a large language model denotes a type of model trained to process linguistic data. Text generation, in contrast, refers to the process of producing textual content using a computational model. Therefore, a systematic description of artificial intelligence terminology requires a clear distinction among hierarchical conceptual relationships, types of computational models, and technological processes.

7. The emerging layer of generative artificial intelligence terminology

In recent years, terminological units associated with generative models have acquired particular significance within artificial intelligence terminology. Terms such as generative artificial intelligence, large language model, prompt, prompt engineering, token, chatbot, text generation, image generation, multimodal model, artificial intelligence agent, and deepfake have become increasingly prevalent in scientific, technological, and professional discourse. While some of these terms have entered the Uzbek language through international scientific and technological communication, others have emerged as terminological expressions formed through the lexical and grammatical resources of Uzbek. The term prompt refers to an instruction, query, or input text provided to an artificial intelligence model. Prompt engineering, in turn, denotes the methods and practices involved in designing, structuring, and refining prompts to obtain desired outputs from a model. Depending on the context, the term token may refer to a unit used in computational text processing. A multimodal model denotes a

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computational model capable of processing different types of data, including text, images, audio, and other modalities. The term deepfake refers to synthetic or manipulated audio, images, or videos generated or modified using artificial intelligence, often designed to resemble real individuals or authentic events. Ensuring the consistent use of these terms in Uzbek, identifying appropriate national-language equivalents, and establishing clear boundaries between their meanings constitute important objectives of contemporary terminological research. Efforts to systematize terminology associated with generative artificial intelligence are also continuing at the international level. The development of a supplement to ISO/IEC 23053:2022 devoted to generative artificial intelligence illustrates the ongoing refinement of terminology in response to technological advancements in this field.

Conclusion

The lexical-semantic analysis conducted in this study demonstrates that terminology related to artificial intelligence and digital technologies constitutes a dynamically developing segment of the terminological system of contemporary Uzbek. The formation of this terminological layer is associated with linguistic processes such as the borrowing of international terms, terminological calquing, semantic specialization of existing lexical units, and metaphorical transfer.

The findings highlight the necessity of examining the origins and semantic development of terms according to distinct analytical criteria. A particular term may simultaneously exhibit characteristics of lexical borrowing or calquing, metaphorical nomination, and semantic specialization. Therefore, in classifying artificial intelligence terminology, it is essential to distinguish among the sources of term formation, structural composition, and underlying semantic mechanisms. The acquisition of specialized meanings by lexical units such as model, platform, network, and learning demonstrates the close relationship between general-language vocabulary and specialized terminological systems. Meanwhile, terms such as neural network and cloud technology illustrate the potential of metaphorical nomination to designate complex technological concepts. The increasingly widespread use of expressions such as large language model, generative artificial intelligence, and prompt engineering further indicates the

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emergence and consolidation of a new terminological layer. The standardization of artificial intelligence terminology in Uzbek requires consideration of international terminological standards, the word-formation resources of the national language, semantic precision, and the functional characteristics of terms in actual usage. Furthermore, particular importance should be attached to the compilation of explanatory and bilingual terminological dictionaries, the comparative examination of alternative terminological forms, and the harmonization of terminology employed in official documents with that established in scientific discourse. Thus, the lexical-semantic investigation of terminology related to artificial intelligence and digital technologies contributes not only to understanding the patterns and mechanisms of lexical development in contemporary Uzbek but also to ensuring the accurate, consistent, and comprehensible representation of scientific and technological information in the national language.

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