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Linguocultural Units in An Artificial Intelligence-Based Machine Translation System

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ABSTRACT

This article discusses the fact that the issue of using artificial intelligence to identify, describe, and interpret the linguocultural characteristics of linguistic units has not yet received a sufficiently developed conceptual and methodological solution in modern linguistics. Research devoted to the study of the national-cultural components of language through artificial intelligence, the adequate representation of national realia in other languages, and the possibilities of machine translation of texts containing linguocultural meaning remains relatively limited. It is observed that the number of scientific studies in this field is significantly lower, particularly in comparison with research devoted to examining the linguodidactic potential of artificial intelligence.

Keywords: Artificial intelligence, linguistic units, linguocultural characteristics, linguistic research, national realia, linguodidactic potential.

Introduction

The possibilities of artificial intelligence technologies in conducting linguistic research are also of particular scientific significance. In modern linguistics, the use of digital technologies for processing linguistic data, the analysis of language materials through automated methods, and the integration of machine translation systems into the research process are becoming increasingly widespread. Scientific studies conducted in this field demonstrate the scientific and practical potential of artificial intelligence tools in systematizing linguistic data, processing large text corpora, and identifying semantic relations between linguistic units. S. G. Sorokina identifies natural language processing, intelligent text analysis, machine translation technologies, semantic search, automatic text summarization, and content analysis as the main research areas of artificial intelligence directly related to linguistics. These areas expand the possibilities not only for the technical processing of linguistic material but also for investigating its semantic, meaningful, and

communicative characteristics through algorithmic tools [1]; [2]. In this process, the integration of computerized research methods, artificial intelligence algorithms, and digital technologies with traditional linguistic methods emerges as an important methodological factor [18]. As a result, the methodological apparatus of linguistic research is expanding, creating opportunities for the comprehensive study of linguistic phenomena at the intersection of different scientific paradigms.

Along with supplementing traditional scientific research activities in the humanities, digital technologies also make it possible to partially automate certain research processes or replace them with new methodological approaches. In particular, they support research methods with digital tools, facilitate the rapid processing, classification, and analysis of large volumes of linguistic data, systematize research results, and optimize the workflow of the linguist-researcher. In this respect, digitalization can be regarded as an important methodological tool that simplifies complex

stages of working with linguistic data and increases research efficiency.

Existing research results show that artificial intelligence systems still have limited capabilities in fully understanding national-cultural semantics, connotative meaning, pragmatic features, and specific linguocultural contexts contained in linguistic units. In particular, semantic and pragmatic inconsistencies may arise in the translation of culturally marked units, realia, phraseological units, metaphorical expressions, and implicit meanings. Such errors observed in machine translation results create the need for post-editing of the translation product according to linguistic and linguocultural criteria, that is, its revision and correction by a specialist.

Thus, the comprehensive study of the capabilities of artificial intelligence to identify linguocultural meaning, interpret it semantically and pragmatically, and adequately reproduce it in translation, as well as determining the degree to which national-cultural components are preserved in machine translation and systematizing existing linguistic errors, represents one of the current scientific directions of modern translation studies and computational linguistics. The insufficient investigation of these problems determines the need for specialized research in this field and substantiates the scientific relevance of the research topic.

LITERATURE REVIEW

Neural Machine Translation (NMT) has emerged as one of the effective technological tools in modern translation practice. The rapid development of digital technologies has fundamentally transformed the content and mechanisms of the translation process, significantly influencing not only how this activity is perceived by users but also the conceptual views of translation product creators and translation scholars [12]. Along with stimulating the development of translation activities and the translation services market, such technological transformations create new opportunities for users of translation products to access information and establish communicative interaction in different languages. The functional efficiency of neural machine translation is manifested primarily in the high speed of the translation process, the relatively high accuracy of results, the accessibility and widespread availability of translation resources, as well as the ability to work with several languages simultaneously

[13]; [15]. In addition, NMT significantly expands access to information resources in science, politics, mass media, technology, and other fields. Research and practical experience show that these systems are capable of identifying and selecting specialized equivalents that correspond to the standards and terminological norms of particular domains. Innovative advances in artificial intelligence technologies are improving the quality of machine translation and enhancing the semantic accuracy, grammatical correctness, and content correspondence of translated texts.

Among translation tools based on artificial intelligence algorithms, platforms such as Google Translate, Yandex Translate, Reverso, Bing Microsoft Translator, and DeepL Translate are widely used. In particular, it is emphasized that modern neural networks used on the DeepL platform are capable of reproducing the meaning of the source text more accurately in the target language and selecting linguistic units that correspond to the requirements of professional discourse [3]; [5]. The strategic objective of developing such systems is to reduce linguistic barriers at the global level, optimize interlingual communication, and strengthen interaction between representatives of different cultures.

Artificial intelligence-based translation technologies are expanding the boundaries of communicative space and increasing access to information sources that were previously difficult to use because of language barriers. In this respect, the concepts of artificial intelligence-based translation and neural machine translation may be interpreted as closely related technological phenomena that serve the rapid transfer of information from one language to another. The informational function of these technologies is particularly important in science, technology, business, and other areas of professional activity where rapid acquisition of new knowledge is essential.

From the functional-pragmatic perspective of translation activity, the translator's main task is to create a functionally useful text that serves the needs of the target audience within a particular sphere of activity. In turn, the primary communicative objective of the recipient of the translated text is to extract from it the information required for their subject-specific or professional activity. Within this approach, the neutralization of linguocultural markers in certain communicative situations is also considered a functionally justified translation strategy. Such a strategy

is particularly important in the creation of multilingual websites and digital resources intended for an international audience.

However, limiting the communication process solely to the transmission of factual information is methodologically insufficient. During a communicative act, along with information, the subject's attitude, emotional state, evaluation, communicative intention, and pragmatic position are also expressed. Therefore, in translating literary works, film texts, and samples of political and media discourse, the adequate representation of these components in the target language is one of the important problems of translation studies. In particular, since the mass media simultaneously perform informative and persuasive functions, the translation of media texts requires preserving, as far as possible, the stylistic features, emotional-expressive colouring, evaluative units, and pragmatic meanings of the original text.

Within the framework of this study, the selection of the interview, one of the important genres of media discourse, as the research material is explained by a number of scientific and methodological factors. First, as a communicative genre based on spoken discourse, the interview reflects active linguistic processes observed in the development of modern language, and this feature creates certain difficulties in its translation. Such processes include the democratization of language, changes in the functions of lexical units, structural transformation of word combinations and sentences, the strengthening of the subjective component of textual meaning in mass communication, and the approximation of speech to evaluative, expressive, and emotional conversational elements. In addition, the intellectualization of the text, that is, the author's appeal to the audience's background knowledge, sociocultural experience, and presuppositional knowledge, is also among the factors that increase the complexity of the translation process.

Second, the interview, while being a form of interpersonal verbal communication aimed at obtaining information and generating new knowledge in order to satisfy society's information needs, also performs the function of influencing the addressee. In a political interview in particular, communicative influence is directed not only at the immediate participants in the conversation but also at the broader audience, which acts as a third communicative subject. Since this influence is often realized through implicit linguistic and pragmatic means, their adequate

reproduction in the target language constitutes one of the complex aspects of translation.

From this perspective, determining the extent to which neural machine translation systems are able to adequately convey the semantic, stylistic, emotional-expressive, and pragmatic components characteristic of media discourse is defined as an important scientific task in this study. Particular attention is paid to determining the extent to which NMT systems can overcome linguistic and extralinguistic difficulties arising in interview translation, as well as to identifying and systematizing semantic-pragmatic losses observed in the translation process and the weaknesses of neural machine translation.

DISCUSSION

The analysis of the research materials shows that neural machine translation (NMT) systems encounter problems related to semantic adequacy when translating lexical units used in the original text in figurative, metaphorical, or contextual meanings [7]; [8]. In particular, in some cases, instead of identifying the meaning of a lexeme activated in a given context, the neural translation model selects an equivalent based on its dictionary or literal meaning. Such an approach leads to semantic shifts in the translated text and, in some situations, to a significant distortion of the original meaning.

For example, the Russian verb *заиграться* in a particular context expresses the meaning "to go beyond the permissible limit" or "to overstep the bounds." However, artificial intelligence translated this unit into English as *play the game*. This English phrase usually means "to follow the rules" or "to act according to the established procedure." As a result, the pragmatic and connotative meaning of the original text is not fully reflected in the translation. A similar semantic mismatch is also observed in the translation of the phrase *перебить электорат*. In this context, the verb *перебить* is used in the sense of "to change someone's opinion" or "to persuade someone to adopt another position." Artificial intelligence, however, rendered it using the lexeme *outbid*. In English, *outbid* primarily means "to offer a higher price than others" in an auction or trading process. Therefore, this equivalent does not correspond to the communicative meaning of the context. The phrase *dissuade this electorate*, used in the professional translation, expresses this semantic function relatively adequately.

In neural machine translation, the interpretation of figurative meaning directly on the basis of nominative meaning is also evident in the phrase *влисть в состав*. In this construction, the verb *влисть* does not mean physically “to pour a liquid,” but rather “to incorporate or include into a particular structure or territory.” However, artificial intelligence relied on the primary sense of the verb and translated it as *pour*. As a result, the political-territorial meaning of the context was not naturally expressed in English. The results of the analysis also show that neural translation systems experience difficulties in identifying differences in the semantic scope and boundaries of meaning of lexical units in different languages. For example, the Russian verb *залезть* can, depending on context, express movement in different directions—upward, downward, or inward. The English verb *climb*, however, primarily carries the semantics of upward movement. Nevertheless, artificial intelligence translated the phrase *залезть на дно Балтийского моря* as *climb to the bottom of the Baltic Sea*. In this case, the incorrect interpretation of the semantic feature of direction resulted in logical inconsistency and a comic effect. The phrase *sink to the bottom*, used by the professional translator, more accurately conveys the intended meaning of “to descend to the bottom of the sea” in the given context.

The materials examined within the study also showed that neural machine translation systems face difficulties in identifying low-frequency and narrowly specialized terminological units and selecting functional equivalents for them. The term *коренизация* can serve as an example. Artificial intelligence rendered this unit as *korenization*, using a method close to transliteration and calquing. However, in English scientific and historical-political discourse, *indigenization* is used as the corresponding terminological equivalent for this concept. As researchers note, certain lexical units that have terminological status or occur with low frequency in the processed text collections and corpora may not be sufficiently represented in the lexical base of neural systems.

In general, according to the results of the comparative translation analysis conducted, the main lexical-semantic problems in neural machine translation are characterized by the incorrect identification of figurative meaning, insufficient consideration of contextual semantics, limitations in distinguishing differences in semantic scope across languages, and difficulties in selecting adequate equivalents for low-frequency terms. In this respect, the professional translator’s comprehensive consideration of

context, pragmatic purpose, terminological norms, and discourse-specific features emerges as an important factor in ensuring the semantic and communicative adequacy of translation.

The translation of phraseological units (hereinafter referred to as PUs) appears to be an even more complex linguistic problem. In particular, when no direct equivalent exists in the target language, artificial intelligence systems often resort to a literal translation strategy for such units. As a result, the translated text fails to fully convey the semantic-pragmatic meaning of the phraseological unit in the source text. For example, the Russian phraseological unit «*серая кошка пробежала*» denotes the unexpected emergence of disagreement, conflict, or deterioration of relations between individuals. The translation of this unit by artificial intelligence as “a gray cat ran” through calquing does not convey its original phraseological meaning to an English-speaking audience. Placing the unit in quotation marks does not eliminate this semantic mismatch either, because the English phraseological system does not contain a fixed expression with exactly the same meaning and imagery.

In addition, in this case, linguocultural differences also play an important role in the interlingual translation process. While the image of a gray cat in this Russian phraseological unit is associated with a negative communicative situation, namely conflict between people, in the English linguocultural worldview the image of a gray cat may be associated with such positive semantic features as independence, freedom, protection, spiritual renewal, intuition, balance, and hope. Therefore, literal translation not only results in the loss of phraseological meaning but may also lead to misinterpretation of the content because of differences between the figurative-associative systems of the source and target languages. A professional translator, however, selects the functionally and semantically appropriate variant “a certain rift started growing between us,” meaning “a certain rupture began to emerge between us.” Such a translation adequately reproduces the sense of deteriorating relations contained in the source text.

Source text: Moreover, I have spoken about this publicly before as well—let us now take the Yeltsin period; there was a time when “a gray cat ran between us.”

Professional translation: Moreover, I have also said this publicly before (let’s look at Yeltsin’s times now), there

was a moment when a certain rift started growing between us.

Artificial intelligence translation: Moreover, I have also said this publicly — let's take Yeltsin's time now — there was a moment when “a gray cat ran”.

A similar translation problem is also observed in the phraseological unit «хвосты заносить». In Russian, this expression conveys such pragmatic-semantic meanings as “to try to win someone's favour,” “to flatter,” and “to fawn.” Because of the difficulty of finding a phraseological equivalent fully corresponding to the context in the target language, the professional translator uses the omission method and preserves the main communicative meaning of the sentence. Artificial intelligence, however, instead of identifying the integral semantics of the phraseological unit, selects an incorrect lexical unit on the basis of its constituent components. In particular, the use of the lexeme *tailspin* causes a semantic error because this English unit means “a sharp decline,” “loss of control,” or “rapid deterioration of a situation” and does not establish semantic equivalence with the phraseological meaning of the source text.

Source text: But they made the wrong decision, and now are we supposed to look for a way out of this wrong decision, flatter them, and correct their mistakes?

Professional translation: However, they made the wrong decision and now we have to look for a way out of this situation, to correct their mistakes.

Artificial intelligence translation: But they made a bad decision, now we have to look for a way out of that bad decision, *tailspin*, correct their mistakes?

The incorrect contextual identification of the semantics of fixed expressions by artificial intelligence systems is also clearly manifested in the example of the phraseological construction «и близко не было». In Russian, this unit is used not to express real space or distance between objects, but as a means of pragmatically intensifying negation. Its semantic function consists in actualizing such categorical negative meanings as “absolutely absent,” “never existed,” and “did not exist at all.” Nevertheless, artificial intelligence fails to sufficiently identify the phraseological nature of this unit, translating it as “even close to it” and thereby activating the sense of spatial proximity. As a result, the logical-semantic relation of the source text is

disrupted and the pragmatic adequacy of the translation decreases [18]. In particular, in fixed expressions that have no direct equivalent in the target language, the automatic application of a literal translation strategy may cause semantic deformation, pragmatic mismatch, and logical distortion. In professional translation, however, the use of transformational techniques such as phraseological equivalence, contextual substitution, descriptive translation, compensation, or omission where necessary makes it possible to preserve the communicative purpose and semantic-pragmatic content of the source text relatively fully in the target language.

CONCLUSION

In general, it may be concluded that, unlike human translators, artificial intelligence-based translation systems do not fully encompass all the semantic, pragmatic, and stylistic possibilities of language, but operate mainly within its formal and surface linguistic layers. Such systems have not yet developed sufficient capabilities for the comprehensive interpretation of various communicative situations in which linguistic units are used, extralinguistic factors, and complex contextual relations. As a result, the adequate identification and reproduction in translation of context-dependent lexical-semantic variants of polysemous lexemes, figurative and connotative meanings, phraseological units, emotional-expressive means, functional-stylistic features, and the pragmatic meaning of speech units remain problematic aspects for artificial intelligence.

From this perspective, despite the rapid development of machine translation technologies and the significant improvement in translation quality, at the present stage neural machine translation cannot be regarded as a universal tool capable of fully replacing the professional activity of a human translator. In particular, cognitive operations such as understanding context, identifying implicit meanings, interpreting communicative intention, taking cultural components into account, and selecting a translation strategy appropriate to a particular situation determine the advantage of the human translator. Therefore, under conditions of neural machine translation, the translator's cognitive potential emerges as an important intellectual resource that complements the capabilities of artificial intelligence and ensures the semantic-pragmatic adequacy of translation.

The cases identified during the study show that the existing

limitations of artificial intelligence-based translation models are primarily associated with the algorithmic processing of the polysemantic nature of natural language, its contextual variability, pragmatic multilayeredness, and national-cultural characteristics. These problems remain complex scientific and practical tasks for neural translation systems at the current stage of technological development. The obtained results may provide a theoretical and methodological basis for further research within neurolinguistics, computational linguistics, and translation studies, as well as define prospects for further improving the quality indicators of neural machine translation through the deeper integration of contextual-semantic analysis, pragmatic interpretation, and cognitive modelling mechanisms into neural machine translation architecture.

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