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МАРКАЗИЙ ОСИЁ РЕНЕССАНСИ ЖУРНАЛИ  
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## THE IMPORTANCE OF THE PARALLEL CORPUS AS A LINGUISTIC BASE

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### ABSTRACT

This article is devoted to the analysis of research conducted in the field of computational linguistics worldwide and in Uzbekistan during the period from 2020 to 2025. The study covers theoretical frameworks of computational linguistics, artificial intelligence-based language models (GPT, BERT, LLaMA, and others), as well as the role of parallel corpora as a linguistic foundation. An analysis of international experience demonstrates that over the past five years, the priority areas in computational linguistics have included the training of linguistic models based on neural transformer architectures, the development of multilingual parallel corpora, and the improvement of machine translation systems.

In Uzbekistan, the field of computational linguistics is observed to be transitioning from a predominantly applied stage to a more scientific and analytical phase through projects such as the Uzbek language corpus ([uzbekcorpus.uz](http://uzbekcorpus.uz)) and Paratranslator. The research employs systematic analysis of scientific literature, comparative linguistic and corpus-based methods, as well as the analytical capabilities of artificial intelligence models.

**Keywords:** computational linguistics; parallel corpus; artificial intelligence; natural language processing (NLP); Uzbek language corpus; machine translation; GPT; BERT; corpus linguistics; linguistic database; transformative model; language modeling; translation technologies.

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## PARALLEL KORPUSNING LINGVISTIK BAZA SIFATIDAGI AHAMIYATI

### ANNOTATSIYA

Mazkur maqola 2020 – 2025 yillarda dunyoda va O‘zbekistonda kompyuter lingvistikasi sohasida olib borilgan tadqiqotlar tahlilga qaratilgan. Tadqiqot kompyuter lingvistikasi nazariyalarini, sun‘iy intellektga asoslangan til modellarini (GPT, BERT, LLaMA va boshqalar) va parallel korpuslarning lingvistik baza sifatidagi rolini qamrab oladi. Xalqaro tajriba tahlili shuni ko‘rsatadiki, so‘nggi besh yil ichida kompyuter lingvistikasida ustuvor yo‘nalishlar neyrotransformer arxitekturalariga asoslangan lingvistik modellarni o‘qitish, ko‘p tilli parallel korpuslarni yaratish va avtomatik tarjima tizimlarini takomillashtirish bo‘lib kelgan.

О‘zbekistonda kompyuter lingvistikasi sohasi o‘zbek tili korpusi (uzbekcorpus.uz) va paratranslator kabi loyihalar orqali amaliy bosqichdan ilmiy-tahliliy bosqichga o‘tayotgani kuzatilmoqda. Tadqiqotda ilmiy adabiyotlarning tizimli tahlili, qiyosiy lingvistik va korpus usullari, shuningdek, sun‘iy intellekt modellarining analitik imkoniyatlari qo‘llanildi.

**Kalit so‘zlar:** kompyuter lingvistikasi; parallel korpus; sun‘iy intellekt; tabiiy tilni qayta ishlash (NLP); o‘zbek tili korpusi; mashina tarjimasi; GPT; BERT; korpus lingvistikasi; lingvistik ma‘lumotlar bazasi; transformatsion model; til modellashtirish; tarjima texnologiyalari.

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## ЗНАЧЕНИЕ ПАРАЛЛЕЛЬНОГО КОРПУСА КАК ЛИНГВИСТИЧЕСКОЙ БАЗЫ

### АНОТАЦИЯ

Данная статья посвящена анализу исследований, проведённых в области компьютерной лингвистики в мире и в Узбекистане в период с 2020 по 2025 годы. В исследовании рассматриваются теоретические основы компьютерной лингвистики, языковые модели на основе искусственного интеллекта (GPT, BERT, LLaMA и др.), а также роль параллельных корпусов как лингвистической базы. Анализ международного опыта показывает, что в течение последних пяти лет приоритетными направлениями в компьютерной лингвистике стали обучение языковых моделей на основе нейронных трансформерных архитектур, создание многоязычных параллельных корпусов и совершенствование систем автоматического перевода.

В Узбекистане сфера компьютерной лингвистики демонстрирует переход от преимущественно прикладного этапа к научно-аналитическому, что отражается в реализации таких проектов, как корпус узбекского языка (uzbekcorpus.uz) и Paratranslator. В исследовании использованы методы системного анализа научной литературы, сравнительно-лингвистические и корпусные методы, а также аналитические возможности моделей искусственного интеллекта.

**Ключевые слова:** компьютерная лингвистика; параллельный корпус; искусственный интеллект; обработка естественного языка (NLP); корпус узбекского языка; машинный перевод; GPT; BERT; корпусная лингвистика; лингвистическая база данных; трансформационная модель; моделирование языка; технологии перевода.

**Introduction.** In the last decade, the integration between linguistics and technology has been developing rapidly. This direction is called computational linguistics, and it has emerged as an interdisciplinary field that performs tasks such as automatic natural language processing, text analysis, machine translation, speech recognition, and synthetic speech generation. At the heart of computational linguistics there are corpus linguistics, artificial intelligence, statistical modeling, and neural networks.

The relevance of computational linguistics lies in its ability to analyze language not only theoretically, but also through practical digital systems. Today, models such as GPT, BERT, T5, LLaMA, and DeepL, developed in the direction of automatic language processing (Natural Language Processing, NLP), are making significant progress in representing the semantic, syntactic and pragmatic layers of human language in digital form [1, 2]. Parallel corpora and multilingual databases, which underlie these models and systems, have opened the way to a new stage in language learning.

At the same time, parallel corpora are recognized as the most important linguistic base of computational linguistics. They are a set of compatible translations of texts in two or more languages. Such corpora serve as a basic resource for translation studies, linguistic typology, machine translation and contrastive analysis [3,4].

Research in the field of computational linguistics worldwide is mainly concentrated in the following areas:

1. Language modeling based on artificial intelligence (based on transformer architecture).
2. Creation of multilingual parallel corpora and training of automatic translation systems.
3. Methodological integration between linguistics and machine learning.
4. Digitization of linguistic resources and their presentation in open sources.

For example, parallel corpora such as Common Crawl, EuroParl, WMT (Workshop on Machine Translation), InterCorp, and OpenSubtitles serve as the basis for many machine translation systems [5,6].

The purpose of this study is to analyze the latest achievements in the field of computational linguistics and scientific developments carried out in Uzbekistan, and to determine the place of parallel corpora as a linguistic base.

**Research methodology.** This study is based on a theoretical-analytical approach, which aims to analyze the latest achievements of computational linguistics (2020–2025), the role of parallel corpora as a linguistic base and research directions in the scientific environment of Uzbekistan in an interconnected manner. The research methodology is based on the theory of systematic analysis of scientific literature, comparative linguistic analysis, and corpus-based modeling. Through this approach, global and national experiences are compared, and the dynamics of the development of modern computational linguistics are determined.

#### *Data Sources*

The data used for the analysis consists of two main groups of sources:

1. International scientific sources (2020–2025)
  - Computational Linguistics Journal (MIT Press)
  - Natural Language Engineering (Cambridge University Press)
  - Transactions of the Association for Computational Linguistics (TACL)
  - ACL Anthology – <https://aclanthology.org>
  - Journal of Natural Language Processing
  - SpringerLink – Artificial Intelligence Review

Also, the following major studies published in recent years were included in the analysis:

- Brown et al. [2] substantiated the neurotransformer architecture of GPT models in language learning.
  - Devlin et al. [1] revealed the possibilities of the BERT model for analyzing language based on a two-way context.
  - Zanettin [5] covered the design and methodological issues of parallel corpora for translation research.
  - Čermák and Rosen [4] developed linguistic analysis models based on multilingual corpora.
2. Open databases and corpus resources
    - International parallel corpora such as Common Crawl, WMT, EuroParl, InterCorp, OpenSubtitles, OPUS.

#### *Research Methods*

The study was carried out based on the following scientific methods:

1. Corpus analysis method

The method was used to automatically process language units by computer, analyze frequency, collocation, and semantic connections. Through this approach, the level of syntactic compatibility and semantic consistency between parallel corpora in different languages was studied.

2. Comparative-linguistic analysis method

The stages of development of computational linguistics on a global scale and in the Uzbek context were compared. For example, the functional differences between the EuroParl corpus in Europe and the Uzbek National Corpus in Uzbekistan were analyzed.

3. Analysis based on statistics and artificial intelligence

In recent years, machine learning processes based on transformer architectures (GPT, BERT, LLaMA) used in NLP models have been analyzed. Using this method, the dependence of language learning algorithms on the size of the corpus was assessed (Lefer, 2021).

#### 4. Literature review and systematization

Global scientific trends in computational linguistics were identified and their impact on Uzbek linguistics was systematized based on scientific sources.

##### *Scientific foundations of the study*

Methodologically, the study was based on the theories of corpus linguistics, translation technologies, and language models based on artificial intelligence.

In this process, the parallel corpus methodology presented in the works of R. Zanettin [5], F. Čermák [4], and M.M. Kenning [3] was adopted as the basis.

**Results.** The results of this study were formed on the basis of global and local development trends in computational linguistics over the past five years (2020–2025), the role of parallel corpora as a linguistic base, and research conducted in the context of Uzbekistan. These results are analytically presented below.

##### Recent achievements in computational linguistics worldwide (2020–2025)

In the past five years, artificial intelligence and deep learning technologies have played a decisive role in the development of computational linguistics.

The most significant scientific results were observed in the following areas:

##### 1. Development of transformer architectures

Since 2020, transformer-based models — GPT (OpenAI), BERT (Google), RoBERTa (Meta), T5 (Google), LLaMA (Meta AI), Falcon, etc. — have achieved revolutionary results in natural language analysis. These models learn language based on secondary contextual semantics, achieving high accuracy in tasks such as translation, question-answering, text generation, and automatic inference [1,2].

##### 2. Exponential growth of corpus sizes

The size and quality of parallel corpora have increased significantly. For example, resources such as OPUS, Common Crawl, EuroParl, WMT, and UN Parallel Corpus have become databases of hundreds of millions of sentences. These resources serve as the main source for training multilingual models (e.g., mBERT, XLM-R, GPT-4 Multilingual).

##### 3. Linguistic theories and AI integration

Computational linguistics is improving not only as a technical direction, but also as a discipline aimed at automating linguistic theory. For example, Lefer [7] proposes a re-modeling of contrastive analysis and translation semantics based on parallel corpora, which provides an important conceptual basis for AI-based translation systems.

##### 4. Machine translation based on parallel corpora

In the works of Zanettin [5] and Doval and Nieto [6], parallel corpora are considered as the necessary language base for neural machine translation systems (NMT). As a result of this approach, systems such as DeepL, Google Translate, Baidu Translate, and Meta NLLB (No Language Left Behind) began to support hundreds of languages.

##### 5. Multimodal language analysis

In 2023–2025, multimodal models (text + image + sound) were also introduced into linguistic analysis. Systems such as GPT-4, Gemini, and Claude 3 were able to analyze text in conjunction with contextual visual information. This gave rise to a new subfield of computational linguistics - multimodal semantic analysis.

##### *Development of computational linguistics in Uzbekistan*

Computational linguistics in Uzbekistan moved from a practical stage to an innovative analytical stage in the period 2020–2025. The following results were observed in this area:

1. The National Corpus of the Uzbek language – The National Corpus of the Uzbek language - [uzbekcorpus.uz](http://uzbekcorpus.uz) was created.

2. A multilingual electronic contextual translation platform called “Paratranslator”, based on a parallel corpus, was developed. This platform allows users to provide highly accurate, meaningful,

and realistic translation options based on the context of the text. This approach has been implemented in recent years based on hierarchical attention models aimed at improving the quality of translation at the document level and maintaining logical connections between languages .

Currently, the “Paratranslator” platform is successfully operating at the stage of practical use. This system, which has been positively evaluated by users and is in wide demand, is recognized as an important innovative step towards the formation of a modern digital translation infrastructure for the Uzbek language. [8]

### 3. Integration of language and artificial intelligence

Within the framework of the Uzbekistan AI Strategy (2022–2025), a scientific concept for training artificial intelligence in the Uzbek language has been developed. In this process, corpus linguistics, neural networks, and parallel translation databases are considered as the main sources.

#### *The role of parallel corpora as a linguistic base*

Parallel corpora are not only an empirical basis for translation studies, but also for linguistic analysis. The following results have been achieved through them:

- Determining syntactic correspondence: The ability to analyze how the structure of a sentence changes between two languages.
- Measuring semantic equivalence: The semantic correspondence of words and phrases in translation is determined in statistical models.
- Translation quality control: Allows the use of real parallel pairs to evaluate machine translation systems.
- A knowledge base for language models: Models such as GPT, BERT learn from parallel corpora.

Parallel corpora in the Uzbek language serve as the main linguistic base for linguistics, translation technologies, and artificial intelligence.

#### *General scientific results*

- Over the past five years, computational linguistics has become the science of analyzing language using automated systems.
- Parallel corpora have become an indispensable resource for training AI models as a linguistic empirical base.
- Corpus linguistics in the Uzbek language is emerging as an independent scientific direction.
- The integration of global and Uzbek experience has made it possible to create multilingual artificial intelligence systems.

**Discussion.** Computational linguistics is one of the most actively developing areas of linguistics today. Since its methodology and practical approaches increasingly integrate linguistic theory with artificial intelligence technologies, the current state of this field requires a thorough analysis not only from a technical, but also from a linguistic perspective.

The most important feature of computational linguistics is its interdisciplinary integration. The convergence of the fields of linguistics, computer science, mathematics, statistics, and neural networks has taken language modeling within this discipline to a completely new level.

The BERT model developed by Devlin et al. [1] allowed for a deeper interpretation of semantics by identifying bidirectional contextual connections between language units. At the same time, GPT-3, developed by Brown et al. [2] and its subsequent generations, introduced an autonomous neuro-learning approach to language learning.

Through these technologies, concepts previously analyzed theoretically in linguistics — meaning, context, synonymy, pragmatics, discourse — are now being modeled empirically, digitally. This has created a new “experimental laboratory” for the science of linguistics.

Parallel corpora are the main empirical support point of computational linguistics. Since they contain equivalent forms of texts created in two or more languages, they allow for the analysis of linguistic compatibility, translation compatibility, and lexical-semiotic devices.

Kenning [3] called parallel corpora an “experimental platform” for translation research, while Zanettin [5] described them as an empirical base in language learning.

The discussion shows that parallel corpora:

- Are a key resource in training artificial intelligence models;
- Enable the automation of language teaching methodologies;
- Help determine syntactic and semantic equivalence in translation analysis.

Thus, parallel corpora serve as a bridge between theory and practice in modern linguistics.

In world science, computational linguistics is based on the modeling of language through artificial intelligence. The main goal of this approach is the computational understanding of language, that is, the study of human language through machine logic.

Lefer [7] proposes the development of multilingual semantic analysis models using parallel corpora. For example, neural translation systems have been developed for more than 30 European languages using the EuroParl and OPUS corpora.

At the domestic level, computational linguistics is still mainly at the practical stage - in translation systems, morphological analyzers, and corpus construction. However, in recent years, Uzbek scientists have also been moving to a scientific-theoretical approach.

Thus, a comparison of global and Uzbek experiences shows that Uzbekistan still needs to expand the scope of empirical analysis, use parallel corpora more widely, and adapt the results to international standards.

Parallel corpora provide a fundamental basis for various branches of linguistics. Their prospects are defined as follows:

1. Creation of morphosyntactic models based on the corpus:

Allows automatic processing of data at the lemma, tag, and dependency levels for the Uzbek language.

2. Analysis of language typology:

Allows the identification of morphological similarities between Turkic languages using statistical models.

3. Assessment of the quality of automatic translation:

Allows the scientific measurement of the quality of Uzbek machine translation using indicators such as BLEU, TER, and METEOR.

4. Interactive approach to language learning:

Learning platforms developed based on parallel corpora (for example, ParTextLearn or Lingtrain) provide students with natural translation pairs.

The analysis of this research shows that the success of computational linguistics directly depends on the quality of linguistic corpora.

Many issues previously discussed theoretically in linguistics — semantic variation, contextual synonymy, translation variability — are now being measured experimentally using parallel corpora.

In the experience of Uzbekistan, the following factors are important for the development of computational linguistics:

- Expanding the size of corpora;
- Integrating Uzbek-language resources into international open databases;
- Strengthening the training of scientific personnel in computational linguistics at Uzbek universities.

Thus, computational linguistics is not only a technological breakthrough, but also a new paradigm for scientific modeling of language.

**Conclusion.** The development of computational linguistics over the past five years (2020–2025) has shown that this field of science has brought modern linguistics to a new - digital, empirical, and modeled - stage. The main achievement of computational linguistics is that it allows not only to analyze language, but also to reconstruct language mechanisms through machine logic.

Based on the results of this study, the following conclusions were drawn:

Computational linguistics today is formed as an integral combination of linguistics, computer science, mathematics, and artificial intelligence.

This science allows you to model not only the structure of language, but also deep semantic processes such as meaning, context, pragmatics, and discourse. Neurotransformers (GPT, BERT, LLaMA, etc.) have become the most effective means of automating this process [1,2].

Parallel corpora are the main empirical resource for computational linguistics. With their help, semantic and syntactic changes of the language are studied on a clear statistical basis.

In recent years, interest in computational linguistics has been growing in the scientific environment of Uzbekistan. Projects such as the Uzbek Language Corpus ([uzbekcorpus.uz](http://uzbekcorpus.uz)), Paratranslator are creating a solid scientific foundation in this area. However, it is necessary to strengthen work in the following areas:

1. Expand the size and types of parallel corpora in the Uzbek language;
2. Integrate the Uzbek language into international corpora (for example, OPUS, WMT);
3. Introduce computational linguistics as an independent direction in the system of academic disciplines;
4. Establish special resource centers for training artificial intelligence models in the Uzbek language.

The success of computational linguistics is directly related to the quality of linguistic corpora, the volume of data, and the training strategy of AI models. For Uzbekistan, the formation of parallel corpora in this direction as a national base based on scientific analysis is a strategic task for future linguistics.

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# МАРКАЗИЙ ОСИЁ РЕНЕССАНСИ ЖУРНАЛИ

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**AL-9224104729 “JADIDCHILIK TA’LIMOTI MILLIY STRATEGIK G‘OYALARINI OMMALASHTIRISHNING KONSTRUKTIV TRANSDITSIPLINAR MODELINI YARATISH” AMALIY LOYIHASI ASOSIDA TAYYORLANDI.**

**ПОДГОТОВЛЕНО В РАМКАХ ПРИКЛАДНОГО ПРОЕКТА AL-9224104729 “СОЗДАНИЕ КОНСТРУКТИВНОЙ ТРАНСДИСЦИПЛИНАРНОЙ МОДЕЛИ ПОПУЛЯРИЗАЦИИ НАЦИОНАЛЬНЫХ СТРАТЕГИЧЕСКИХ ИДЕЙ ДЖАДИДИЗМА”.**

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