

# Exploring the Applications and Advancements of Artificial Intelligence in Computational Linguistics

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**Abstract:** Artificial Intelligence (AI) has become a prominent field of study in recent years, with many researchers exploring its potential applications in various domains. In particular, the use of AI in computational linguistics has gained significant attention due to its ability to process natural language and improve language processing. This paper aims to explore the applications and advancements of AI in computational linguistics, with a focus on how AI is used to process natural language, its potential applications and advantages in computational linguistics, and the recent advancements in AI. Additionally, this paper discusses the challenges associated with developing advanced AI systems and the future directions for research on AI in computational linguistics. The findings of this study have important implications for the field of computational linguistics, as it provides insights into the potential of AI to improve language processing and natural language understanding.

**Keywords:** Artificial Intelligence, Natural Language Processing, Computational Linguistics, Machine Learning, Natural Language Understanding.

## 1. Introduction

Artificial intelligence (AI) has been one of the most talked about topics in recent years. Its potential to change the world as we know it is both exciting and scary at the same time. While there are many different applications for artificial intelligence, one area that is particularly interesting is its potential to help with computational linguistics. Artificial intelligence (AI) in computational linguistics refers to the use of machine learning, natural language processing, and other AI techniques to enable computers to understand, interpret, and generate human language. AI algorithms are used to analyze and model human language in order to build computational systems that can perform tasks such as language translation, sentiment analysis, and speech recognition. The ultimate goal of AI in computational linguistics is to create machines that can communicate and interact with humans in a natural and intelligent way.

Computational linguistics is the study of how computers can be used to process and understand human language. It is a relatively new field, and so there is a lot of work still to be done in terms of developing effective algorithms and models. However, artificial intelligence could play a big role in helping to improve the state of computational linguistics. For example, machine learning algorithms could be used to develop better models for understanding human language. In addition, artificial intelligence could also be used to help create more effective natural language processing tools. Natural language processing is a subfield of computational linguistics that deals with making computers able to understand human language. It is a very difficult task, as human language is notoriously ambiguous and complex. However, with the help of artificial intelligence, it may become possible to create more accurate and effective natural language processing tools.

## 2. Natural Language Processing

Natural language processing (NLP) is a branch of artificial intelligence (AI) that focuses on the interaction between computers and human language. It involves developing algorithms and computational models that enable

machines to understand, interpret, and generate human language. NLP is used to analyze, manipulate, and transform natural language data in order to extract useful information, such as sentiment, intent, and context. Overall, NLP aims to bridge the gap between human language and machine language, enabling more effective communication between humans and computers.

### **3. Applications of Natural Language Processing (NLP) in Computational Linguistics**

Natural Language Processing (NLP) has numerous applications in computational linguistics, including:

- **Sentiment Analysis:** NLP can be used to analyze text and identify the sentiment or emotion expressed within it. This is useful for understanding public opinion on a particular topic, monitoring customer feedback, and gauging reactions to marketing campaigns.
- **Speech Recognition:** NLP algorithms can be used to convert speech into text, enabling computers to understand and respond to spoken language. This is useful for virtual assistants, chatbots, and other voice-activated systems.
- **Machine Translation:** NLP is used to develop machine translation systems that can automatically translate text from one language to another. This is useful for communication across languages and for making information accessible to people who do not speak the same language.
- **Text Summarization:** NLP can be used to automatically summarize long documents or articles into shorter versions, making it easier for people to digest information quickly.
- **Named Entity Recognition:** NLP can identify, and extract named entities such as people, organizations, and locations within a text, which is useful for tasks such as information extraction and entity linking.
- **Language Generation:** NLP can be used to generate natural language text, such as news articles, product descriptions, and social media posts.
- **Information Retrieval:** NLP algorithms can be used to search and retrieve relevant information from large amounts of text, such as web pages and databases.

### **4. Applications of Natural Language Processing (NLP) in Computational Linguistics**

There are various techniques used in Natural Language Processing (NLP). Some of the most commonly used techniques are:

- **Morphological analysis:** It is the process of breaking down a word into its component parts (morphemes). This helps identify the root form of a word and any inflections (grammatical endings) that have been added to it. This information can be used to determine the part of speech of a word (e.g., noun, verb, adjective) and its grammatical role in a sentence (e.g., subject, object, direct object).
- **Part-of-speech tagging:** This is the process of assigning each word in a text corpus with a part-of-speech tag (e.g., noun, verb, adjective). This information can be used to determine the syntactic function of words in sentences (e.g., subject, object, direct object) and can also be used for named entity recognition.
- **Named Entity Recognition:** Named entity recognition (NER) is the process of identifying and extracting named entities from a text, such as names of people, organizations, locations, and dates. NER is a crucial component in many NLP applications, including question-answering systems, sentiment analysis, and information extraction.
- **Sentiment Analysis:** Sentiment analysis is the process of analyzing the emotions, attitudes, and opinions expressed in a text. It involves identifying the polarity of a text, such as whether it expresses a positive, negative, or neutral sentiment. Sentiment analysis is used in many applications, including social media analysis, customer feedback analysis, and market research.
- **Language Modeling:** Language modeling is the process of predicting the likelihood of a sequence of words in a language. It involves building a statistical model of the language, based on the frequency and distribution of words in a large corpus of text. Language modeling is used in many NLP applications, including speech recognition, machine translation, and text generation.
- **Machine Translation:** Machine translation is the process of automatically translating text from one language to another. It involves analyzing the structure and meaning of a sentence in the source language and generating

a corresponding sentence in the target language. Machine translation is one of the most challenging tasks in NLP, and involves many techniques, including machine learning, statistical models, and neural networks.

## **5. Machine Learning**

Machine Learning (ML) is a branch of Artificial Intelligence (AI) that involves developing algorithms that can learn patterns and relationships in data and use that knowledge to make predictions or decisions about new data. The algorithms are designed to automatically improve their performance over time by learning from the data they are exposed to.

In other words, machine learning is the process of training computers to recognize patterns in data, without being explicitly programmed for every possible input or outcome. It involves creating models and algorithms that can learn from and make predictions on new data based on patterns found in historical data.

There are various types of machine learning, such as supervised learning, unsupervised learning, and reinforcement learning, each with their own unique characteristics and applications. Machine learning has a wide range of applications, including image recognition, natural language processing, fraud detection, recommendation systems, and autonomous vehicles, to name a few.

## **6. Applications of ML in computational linguistics**

Machine learning has been increasingly used in computational linguistics to build models that can help us better understand and analyze human language. Here are some common applications of machine learning in computational linguistics:

- Text classification and sentiment analysis: Machine learning models can be trained to classify text into categories or analyze the sentiment expressed in it. This is useful in tasks such as spam filtering, sentiment analysis of product reviews, and identifying hate speech or abusive language.
- Named entity recognition: Machine learning can be used to identify named entities such as people, organizations, and locations in text. This is useful for tasks such as information extraction and text summarization.
- Part-of-speech tagging: Machine learning can be used to automatically assign parts of speech to each word in a sentence. This is useful for tasks such as natural language understanding and machine translation.
- Machine translation: Machine learning models can be trained to translate text from one language to another. This involves using large amounts of parallel data to train models to understand the nuances of each language and how they relate to each other.
- Speech recognition: Machine learning can be used to train models to recognize speech and transcribe it into text. This is useful for tasks such as automatic transcription of audio recordings or real-time captioning of live events.
- Question answering: Machine learning models can be used to answer questions posed in natural language. This involves understanding the meaning of the question and using a knowledge base to generate an appropriate answer.

As machine learning algorithms continue to improve, we can expect to see even more powerful tools and applications for analyzing human language.

## **7. Techniques used in Machine Learning (ML)**

There are many different techniques used in Machine Learning (ML), including:

- Supervised learning: This technique involves training a model on a labeled dataset, where each data point is associated with a known output value. The goal is to learn a mapping between inputs and outputs, so that the model can predict the output for new, unseen inputs.
- Unsupervised learning: This technique involves training a model on an unlabeled dataset, where there is no known output value. The goal is to learn the underlying structure of the data, such as patterns or clusters.

- **Semi-supervised learning:** This technique involves training a model on a combination of labeled and unlabeled data. The goal is to leverage the available labeled data to improve the model's performance on the unlabeled data.
- **Reinforcement learning:** This technique involves training a model to make decisions based on feedback from a reward signal. The model learns to take actions that maximize the reward, and can be used for tasks such as game playing or robotics.
- **Deep learning:** This technique involves training neural networks with multiple layers of processing units. Deep learning models have shown impressive performance on tasks such as image recognition, natural language processing, and speech recognition.
- **Transfer learning:** This technique involves using a pre-trained model as a starting point for a new task. By reusing the knowledge from the pre-trained model, the new model can often learn more quickly and with less data.
- **Ensemble learning:** This technique involves combining the predictions of multiple models to improve overall performance. Ensemble methods can be used with any type of ML algorithm and can often achieve better results than any single model on its own.

## **8. Natural Language Understanding**

Natural language understanding (NLU) is a branch of artificial intelligence that deals with the ability of computers to interpret and understand human language. NLU is used in a variety of applications, such as voice assistants, chatbots, and machine translation.

NLU systems are designed to parse and interpret human language in order to extract meaning from it. This can be a difficult task, as human language is often ambiguous and can be interpreted in multiple ways. To overcome these challenges, NLU systems rely on a variety of techniques, including natural language processing (NLP) and machine learning.

NLP is a field of computer science that deals with the manipulation and analysis of human language. NLP techniques are used to pre-process and clean up text data before it is fed into an NLU system. This can involve tasks such as tokenization, lemmatization, and Named Entity Recognition (NER). Machine learning is then used to train models that can interpret the text data.

There are many different approaches to NLU, each with its own strengths and weaknesses. Some of the most popular approaches include rule-based systems, statistical models, and neural networks. Rule-based systems use a set of rules or heuristics to interpret text data. Statistical models rely on probabilities and statistics to make predictions about the meaning of text data. Neural networks are a type of machine learning algorithm that are able to learn complex patterns from data.

## **9. Applications of Natural Language Understanding (NLU) in Computational Linguistics**

NLU has a wide range of applications in various areas of computational linguistics, some of which include:

- **Text Classification:** NLU techniques can be used to automatically classify text documents based on their content. This is useful in applications such as spam filtering, sentiment analysis, and topic classification.
- **Named Entity Recognition (NER):** NER involves identifying and extracting named entities from text, such as people, organizations, and locations. NLU techniques can be used to develop NER systems that can accurately identify and extract these entities from large volumes of text data.
- **Sentiment Analysis:** NLU techniques can be used to analyze the sentiment of text data, such as product reviews or social media posts. This can be useful for businesses to understand how their products or services are perceived by customers.
- **Machine Translation:** NLU techniques are used in machine translation systems to automatically translate text from one language to another. These systems use complex algorithms to analyze and interpret the meaning of the source text and generate a corresponding translation in the target language.

- **Question Answering:** NLU techniques can be used to develop question-answering systems that can answer questions posed by users in natural language. These systems analyze the question and search for relevant information in a database or on the internet to generate a response.
- **Information Retrieval:** NLU techniques can be used to develop information retrieval systems that can retrieve relevant information from large volumes of text data. These systems use complex algorithms to analyze the meaning of the query and search for relevant information in the text data.
- **Text Summarization:** NLU techniques can be used to automatically summarize large volumes of text data, such as news articles or research papers. These systems analyze the text data and generate a summary that captures the most important information.

#### **10. Techniques used in Natural Language Understanding (NLU)**

NLU techniques use various methods and approaches to analyze and understand natural language data. Some of the commonly used techniques in NLU include:

- **Semantic Analysis:** Semantic analysis involves understanding the meaning of words and phrases in context. This technique is used to identify the relationships between words and extract the meaning of the text. It can also involve identifying synonyms, antonyms, and other types of semantic relationships between words.
- **Discourse Analysis:** Discourse analysis involves understanding how language is used in context to convey meaning. This technique is used to analyze the structure of sentences and how they relate to each other to extract the overall meaning of the text.
- **Pragmatics:** Pragmatics involves understanding the intent behind the words used in natural language. This technique is used to analyze the context and infer the speaker's intended meaning, including implied meanings and cultural references.
- **Textual Entailment:** Textual entailment involves determining whether one sentence can logically follow from another. This technique is used to understand the relationships between sentences and can be used in applications such as question answering and text summarization.

#### **11. Conversational AI**

Conversational AI, also known as chatbot technology, refers to the use of artificial intelligence (AI), natural language processing (NLP), and machine learning (ML) techniques to create virtual agents that can converse with humans in a natural language interface. Conversational AI systems are designed to understand and interpret human language and respond appropriately to requests or queries in real-time. They can be integrated into various platforms, including messaging apps, websites, and voice assistants, to provide personalized and interactive experiences for users. Conversational AI is used in a variety of applications, including customer service, healthcare, education, and entertainment, and is rapidly advancing with the help of machine learning and natural language processing techniques.

#### **12. Applications of conversational AI in computational linguistics**

Applications of conversational AI in computational linguistics can be divided into two main categories: speech recognition and machine translation.

- **Speech recognition** involves the use of computers to convert spoken words into text. This technology is used in a variety of settings, such as dictation software and voice-controlled assistants.
- **Machine translation** is the use of computers to translate text from one language to another. This technology is used in a variety of settings, such as online translation services and multilingual chatbots.

#### **13. Techniques used in conversational AI**

Conversational AI utilizes different techniques to interact with users in natural language which include:

- **Chatbots:** Chatbots are computer programs that use natural language processing (NLP) and machine learning (ML) algorithms to simulate human conversation. Chatbots can be designed to respond to user inputs in a conversational manner and can be deployed on messaging platforms, websites, and mobile applications.

- Virtual assistants: Virtual assistants are conversational agents that use a combination of natural language processing, machine learning, and other AI techniques to understand and respond to user requests. Virtual assistants can perform a variety of tasks, such as scheduling appointments, setting reminders, and providing recommendations.
- Dialogue systems: Dialogue systems are conversational agents that use natural language processing, machine learning, and other AI techniques to maintain a coherent and engaging conversation with users. Dialogue systems can be designed to handle complex conversations and tasks, such as booking a flight or ordering food.

Some of the specific techniques used in conversational AI for chatbots, virtual assistants, and dialogue systems include:

- Intent recognition: Intent recognition algorithms are used to identify the user's intention or purpose behind their input, enabling the conversational agent to provide relevant responses.
- Entity recognition: Entity recognition algorithms are used to identify specific objects, people, or places mentioned in the user's input, enabling the conversational agent to provide more personalized responses.
- Context awareness: Context awareness techniques are used to enable conversational agents to understand the context of the user's input, including their location, time, and previous interactions.
- Reinforcement learning: Reinforcement learning algorithms are used to enable conversational agents to learn from user feedback and improve their responses over time.
- Natural language generation: Natural language generation techniques are used to enable conversational agents to generate natural-sounding responses that are grammatically correct and contextually relevant.
- Speech recognition: Speech recognition algorithms are used to enable conversational agents to understand and respond to spoken input.
- Emotion recognition: Emotion recognition techniques are used to enable conversational agents to detect and respond appropriately to the user's emotional state.

#### 14. Challenges in AI for Computational Linguistics

AI for Computational Linguistics faces several challenges, some of which include:

- Ambiguity: Natural language is often ambiguous and can be interpreted in multiple ways. This poses a challenge for AI systems, which must be able to understand the intended meaning of the language and provide appropriate responses.
- Context: Natural language is heavily dependent on context, including the user's background knowledge and the current situation. AI systems must be able to interpret language in the appropriate context to provide accurate responses.
- Multilingualism: Natural language is not limited to one language or dialect, making it a challenge for AI systems to understand and interpret multiple languages and dialects.
- Data quality: AI systems for computational linguistics rely heavily on high-quality training data to learn and improve. However, data quality can be a challenge, as data can be biased or incomplete, which can lead to inaccurate results.
- Idioms and metaphors: Natural language often includes idiomatic expressions and metaphors that can be difficult for AI systems to interpret and understand.
- Speech recognition accuracy: Speech recognition is an essential component of computational linguistics, but it can be challenging to accurately recognize and transcribe speech, particularly in noisy or complex environments.
- Computing power: AI systems for computational linguistics require significant computing power and resources to process large amounts of data and improve accuracy.
- Ethics and bias: As AI systems are developed for computational linguistics, it is essential to consider ethical issues such as bias, privacy, and data security, particularly as these systems are integrated into everyday life.



## **15. Future of AI in Computational Linguistics**

The future of AI in computational linguistics holds significant promise and will likely see numerous advancements and applications. Computational linguistics is a field at the intersection of linguistics and computer science, and AI plays a pivotal role in automating language-related tasks, understanding human language, and improving communication between humans and machines. Some key trends and developments to expect in the future are as follows:

- **Natural Language Understanding:** AI systems will continue to advance in their ability to understand and interpret human language. This includes improved sentiment analysis, entity recognition, and understanding context, making AI more conversational and context-aware.
- **Multilingual and Cross-lingual Capabilities:** AI models will become more proficient in handling multiple languages and understanding the nuances of different languages. Cross-lingual models will enable more effective communication across language barriers.
- **Enhanced Language Generation:** AI will become more skilled in generating human-like text. This will have applications in content generation, creative writing, and automated storytelling, among others.
- **Conversational AI:** Conversational agents or chatbots will become more sophisticated, allowing for more natural and context-aware interactions. They will play a more significant role in customer support, virtual assistants, and various other applications.
- **AI in Language Translation:** Machine translation will continue to improve, breaking down language barriers and facilitating global communication. Neural machine translation models will dominate this space.
- **AI Ethics and Bias Mitigation:** As AI becomes more deeply integrated into language-related tasks, there will be a growing emphasis on addressing bias, fairness, and ethical concerns in AI systems to ensure they are inclusive and do not perpetuate harmful stereotypes.
- **Healthcare and Clinical Applications:** AI will assist in clinical settings, helping with medical transcription, diagnosis, and patient interaction. It can also aid in processing vast amounts of medical literature and patient records.
- **Language Learning and Education:** AI-powered language learning tools will become more personalized and effective, offering individualized language courses and assistance to learners. These tools will adapt to learners' needs and styles.
- **Content Moderation and Safety:** AI will continue to play a significant role in content moderation on online platforms, identifying and removing harmful or inappropriate content. This is particularly relevant in the context of social media and online communities.
- **AI in Research:** Computational linguistics and AI will further research in linguistics itself. AI models can be used to analyze linguistic data at an unprecedented scale, potentially leading to new linguistic discoveries and insights.
- **Emotion Recognition:** AI will improve its ability to recognize and respond to human emotions in text, enabling more empathetic and emotionally intelligent interactions.
- **Customization and Personalization:** AI systems will become better at tailoring content and responses to individual user preferences, creating a more personalized and engaging user experience.
- **Low-Resource Languages:** Efforts to develop AI models and applications for low-resource languages will increase, helping preserve linguistic diversity and enabling communication in marginalized communities.
- **Neuro-linguistic Programming:** Advancements in AI may lead to more sophisticated applications of neuro-linguistic programming (NLP), potentially impacting areas like therapy and personal development.

## **16. Potential impact on society and industry**

The future of AI in computational linguistics holds great potential for impacting society and industry in several ways. Here are a few potential impacts:

- Improved Natural Language Processing (NLP): With the advancements in AI and machine learning, NLP models are becoming more accurate and efficient, enabling machines to understand and process human language better. This can have a significant impact on industries such as healthcare, finance, and customer service, where understanding and analysing large amounts of text data is critical.
- Multilingual Communication: AI-powered NLP models can help break down language barriers and enable communication between people who speak different languages. This can have a significant impact on industries such as international trade, tourism, and diplomacy.
- Personalized Content Creation: AI-powered NLP models can generate personalized content, such as news articles or marketing messages, based on individual preferences and interests. This can have a significant impact on the media and advertising industries, enabling them to create more engaging and relevant content for their audience.
- Automation of Language-related Tasks: AI-powered computational linguistics can automate several language-related tasks, such as translation, summarization, and sentiment analysis, which can save time and improve efficiency across industries.

## **17. Conclusion**

In conclusion, AI has been instrumental in advancing computational linguistics, enabling researchers to develop models and algorithms that can understand, generate, and manipulate human language. AI has facilitated significant progress in several areas of computational linguistics, including natural language processing, machine translation, speech recognition, sentiment analysis, and text mining, among others.

Looking towards the future, there are several exciting opportunities and challenges in the field of AI and computational linguistics. Some of the potential opportunities include the development of more sophisticated language models that can understand and generate language in context, the creation of more effective and accurate machine translation systems, and the use of AI to enhance communication and collaboration between humans and machines.

## **References**

- [1] Texes (n.d.). Machine learning. <https://medium.com/@dnyaneshwalwadkar/the-power-of-machine-learning-transformative-applications-and-techniques-6c8da614c980>
- [2] Cyber Tech Feed (n.d.). Natural Language Processing: Understanding the Components. <https://www.cybertechfeed.com/2023/03/natural-language-processing-understanding-the-components.html>
- [3] Crescendo Global (2023, February 17). Machine Learning: Skills and Careers. LinkedIn. Retrieved March 8, 2023, from <https://www.linkedin.com/pulse/machine-learning-skills-careers-crescendo-global/?trk=pulse-article>
- [4] (2020, December 26). Natural Language Understanding for Chatbots. Medium. Retrieved March 8, 2023, from <https://medium.com/neuralspace/natural-language-understanding-for-chatbots-2eb7a81b9390>
- [5] (2023, March 8). OpenAI ChatGPT: Ways AI Chatbots Are Revolutionising Research. Educationsinbd.com. Retrieved March 8, 2023, from <https://educationsinbd.com/openai-chatgpt-ways-ai-chatbots-are-revolutionising-research/>
- [6] (2023, February 22). NATURAL LANGUAGE PROCESSING (NLP) – SPEAKING THE SAME LANGUAGE: THE ADVANCEMENTS AND CHALLENGES OF NATURAL LANGUAGE PROCESSING IN AI. Infotechys.com. Retrieved March 8, 2023, from <https://infotechys.com/natural-language-processing-nlp-speaking-the-same-language-the-advancements-and-challenges-of-natural-language-processing-in-ai/>
- [7] (2023, March 6). What is natural language processing (NLP). Medium. Retrieved March 8, 2023, from <https://levelup.gitconnected.com/what-is-natural-language-processing-nlp-80d6b6490d2b>
- [8] (2022, September 16). How Can We Make Chatbots Intelligent? Artificial Intelligence +. Retrieved March 8, 2023, from <https://www.aiplusinfo.com/blog/how-can-we-make-chatbots-intelligent/>



- [9] (2023, March 5). What is NLP Tasks? 10 Example. Digital Talk Article. Retrieved March 8, 2023, from <https://digitaltalkarticle.blogspot.com/2023/03/what-is-nlp-tasks-10-example.html?m=1>
- [10] (2023, March 8). What is Natural Language Processing? Mindsdb. Retrieved March 8, 2023, from <https://docs.mindsdb.com/nlp/what-is-nlp>
- [11] (n.d.). Advantages and Disadvantages of Machine Translation. Java T Point. Retrieved March 8, 2023, from <https://www.javatpoint.com/advantages-and-disadvantages-of-machine-translation>
- [12] Walwadkar, D., Mr. (2022, December 25). The Power of Machine Learning: Transformative Applications and Techniques PART — I : Diving Deep into Machine Learning: From Basics to Advanced introduction—Dnyanesh Walwadkar. Medium. Retrieved March 8, 2023, from <https://medium.com/@dnyaneshwalwadkar/the-power-of-machine-learning-transformative-applications-and-techniques-6c8da614c980>
- [13] Kumar, H., Mr. (2023, February 9). The Ultimate Guide to Everything You Need to Know About ChatAthena. Retrieved March 8, 2023, from <https://crawlq.ai/blog/the-ultimate-guide-to-everything-you-need-to-know-about-chatathena/>
- [14] P, H., Mr. (2023, February 15). What is conversational AI? What it is and how it works. Retrieved March 8, 2023, from <https://www.mindstick.com/blog/301834/what-is-conversational-ai-what-it-is-and-how-it-works>
- [15] Nur Fitria, Tira. (2021). The Use Technology Based on Artificial Intelligence in English Teaching and Learning. 6. 213-223. 10.24235/eltecho.v6i2.9299.
- [16] Holmes, W., Mr, Persson, J., Ms., Chounta, I. A., Ms., Wasson, B., Ms., & Dimitrova, V., Ms. (2022). ARTIFICIAL INTELLIGENCE AND EDUCATION A critical view through the lens of human rights, democracy and the rule of law. Council of Europe Publishing F-67075 Strasbourg Cedex. <https://rm.coe.int/artificial-intelligence-and-education-a-critical-view-through-the-lens/1680a886bd>
- [17] Sujatha, M. M., Dr (2021). A Study On Artificial Intelligence behind Natural Language Processing. International Journal of Creative Research Thoughts, 9(1), 1128-1131.
- [18] Ali, M. A. (2018). The Human Intelligence vs. Artificial Intelligence: Issues and Challenges in Computer Assisted Language Learning. International Journal of English Linguistics, 8(5), 259-271. <https://doi.org/10.5539/ijel.v8n5p259>
- [19] Osmolovskaya, A. B., Ms., Lyashevskaya, O., Ms., & Toldova, S., Ms. (2019, April 4). Learning Computational Linguistics through NLP Evaluation Events: The experience of Russian evaluation initiative [Proceedings of the Fourth Workshop on Teaching Natural Language Processing]. Association for Computational Linguistics.