LINGUISTIC MODELS OF GRAMMATICAL POS TAGGING OF PRONOUNS

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ABSTRACT

This article is devoted to the grammatical analysis of pronouns and explores the possibilities of using linguistic models in the process of POS (Part-of-Speech) tagging. This study reveals the importance of the pronoun vocabulary for linguistics and computational linguistics. Methods for determining the pronoun phrase using rule-based models, statistical models, and machine learning models were considered. The results of the study recommend new methodological approaches to working with the pronoun colloquence and serve as a basis for further scientific research.

Keywords: Pronouns, Grammatical POS(Part-of-Speech) tagging, linguistic models, analysis, statistics, machine learning models.

INTRODUCTION

Grammatical POS tagging (part-of-speech tagging, POS-tagging) is the process of marking each word according to its grammatical category (verb, noun, adjective, additional words, etc.). This process is a basic step not only in syntactic analysis, but also in semantic and morphological analysis. The goal is to place each word in the text correctly according to its grammatical function, i.e., a specific category. POS Tagging (Positive Organizational Scholarship, POS) is a scientific field that focuses on the study of positive events and processes in organizations. At the heart of POS are issues such as success, positive change, effective event performance, and employee motivation in organizations. Research in this area largely focuses on the positive development of relationships between organizations and their employees, creating a productive and favorable working environment.[1]

Even in world linguistics, several scientists have conducted fruitful research and research on POS tagging. Of these, Kim S. Cameron is one of the key leaders of Positive Organizational Scholarship: Foundations of a New Discipline, and she has written numerous scholarly articles on the creation and development of positive organizations. His writings include extensive analyses on the role of high productivity, teamwork, and positive psychology in organizations. Robert E. Quinn is one of the scholars who played an important role in the development of "Building the Bridge As You Walk on It: A Guide for Leading Change." In his research, he developed basic theories about organizational change and how to implement positive leadership. In her research, Quinn has an in-depth analysis of how positive change and innovation can be driven in organizations. She has a lot of work to do on leadership, positive structures, and making change. Jane Dutton is one of the scholars who contributed heavily to the research of Compassionate Love and Organizational Leadership. His work has been particularly explored in the context of leadership and team relations in organizations. Dutton

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[1] https://medium.com/@sujathamudadla1213/what-is-parts-of-speech-pos-tagging-natural-language-processing

explores how positive psychology works in organizations and how it can improve the performance of leaders[2].

The study of the field of computer linguistics in Uzbek linguistics began with the 21st century. To date, a lot of research is done on the area. POS tagging in the Uzbek language can clearly express the depth and breadth of the richness of the Uzbek language. Therefore, it is of great importance to study the issue of POS tagging and to develop software. The National Corpus of the Uzbek language was developed. Nevertheless, the fact that problems arise in the tagging process, the presence of shortcomings in this process determine the relevance of this area.

Part-of-Speech tagging of lexical units is an important area of research in linguistics related to the grammatical role of words, i.e. the definition of a word category. In this area, the study of Lexical Units and Grammatical POS Tagging is mainly based on computer linguistics, artificial intelligence, and natural language processing (NLP) technologies. Gulyamov Babur has published a number of studies on "Automatic analysis of Grammar and morphological system in the Uzbek language" on the field of POS tagging and morphological analysis. His research is mainly focused on the development of POS tagging algorithms for grammatical and morphological features in Uzbek language. In the research, the development and analysis of the necessary means for automatic recognition and correct definition of grammatical categories in the Uzbek language. In Gulyamov's work, the issues of taking into account morphological features and contextual meanings when creating POS tagging systems are important. Mirzazhanov Aziz "Automatic recognition of parts of speech and the application of tags in the Uzbek language and the definition of grammatical categories in the Uzbek language. His research focuses primarily on the analysis of lexical units and the automation of POS tagging. In his scientific works the methods and algorithms which apply in automatic determination of parts of Uzbek speech (for example, verb, noun, adjective, preposition). The study takes into account the morphological and syntactic features of the language while defining the grammatical functions of words. Saidova Malika conducted research on "Grammatical POS tagging systems based on artificial intelligence in Uzbek language" aimed at the automatic implementation of POS tagging in Uzbek language using artificial intelligence and machine learning technologies. His work is about the application of statistical and machine learning methods in determining speech groups. He created scientific developments on the application of artificial intelligence in the definition of lexical units in the Uzbek language. The study analyzes how machine learning algorithms and statistical methods can be applied to perform grammatical and morphological analysis efficiently.

LITERATURE REVIEW AND METHODOLOGY

In Uzbek linguistics, practical and theoretical work is carried out on the issue of tagging. A lot of work is being done on POS tagging by the teachers of the Department of Computer Linguistics of the Tashkent State University of Uzbek Language and Literature named after Alisher Navoi. In particular, the works of B.Elov, Sh.Khamroyeva, N.Khudoyberganov "Methods of POS tagging of the texts of the Uzbek language corpus", O.Abdullayeva Ўzbek tilining internet akhborot matnlari korpussini yaratishning nazariy va amaliy asoslari,

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[2] Jane Dutton["Compassionate Love and Organizational Leadership"]

D.Elova The principles and linguistic support of the creation of methodological tags of the Uzbek language corpus units, and others. POS tagging is the task of determining (tagging) each word form in a given sentence whether it belongs to the category (noun, verb, adjective, number, ravish or pronoun). POS tagging is one of the main tasks of the Natural Language Processing (NLP) field and is an important stage of the pipeline[3]. POS tagging involves grammatical category marking to each set in the corpus. That is, the use of this tagging is effective in determining the morphological properties of the tune. In this tagging, one can enter the tagging of nouns, verbs, adjectives, followed sentences, pronouns, connectives, pretensions, etc. POS marks help in analyzing sentence structures and conducting linguistic research[4]. Sh.Hamroyeva on the issue of compiling and tagging special linguistic corpora of the Uzbek language, Linguistic associations of the Uzbek language mualliflik corpus, Linguistic analysis of the morphological analyzer of the Uzbek language: N.Abdurahmonova Computer models of the electronic corpora of the Uzbek language, M.Abjalova Uzbek language matnlari taxrir va taxlil qiluvchi dasturning linguistic modules (Official va ilmiy uslubdagi matnlar taxriri dasturi uchun), A.Eshmo'minov Uzbek language milliy corpus synonymous words base, O'. Xoiyorov Uzbek language talim corpus tuzishning linguistic associations, Sh.Gulyamova Uzbek language semantic analyzer for linguistic ta'minot masalasi. Of particular importance are the research of O.Abdullayeva Ўzbek tilining internet akhborot matnlari korpussini yaratishning Nazariy va amaliy asoslari, D.Elova Principles and linguistic support of the Uzbek language corpus units.[5]

In the field of modern technologies, including computer linguistics, one of the urgent issues is the automatic recognition of the pronoun category. This process uses Part-of-Speech (POS) tagging algorithms. The process of POS tagging takes into account the specific morphological and syntactic features of the language, which requires the effective use of linguistic models[6].

 Parts of speech (POS) are one of the key concepts in linguistics that help us understand the grammatical system of a language. A pronoun (pronomial) vocabulary differs from other parts of speech in its grammatical function and structure. Pronouns are used to express a person, thing or situation, to replace a noun (noun), or to derive from a lexical context. And the automatic implementation of the grammatical tagging of pronouns is important in the analysis of the language, since this process is one of the main steps required to understand the syntactic

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[3] Elov B. Khudoyberganov N. Methods of POS tagging of the texts of the Uzbek language corpus

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[6] Jo'rayev, A. (2020). Lexic-semantic features of the Uzbek language. *Journal of Uzbek linguistics*.

and semantic structure of the language. The article discusses linguistic models of grammatical POS tagging of a pronoun phrase, their types and methodologies.

THE MAIN PART

Rule-based approaches for morphologically rich languages do not yield satisfactory results in most cases. In the field of computational linguistics, the development of neural networks and transformer models has allowed for deeper analysis of language properties (Jurafsky & Martin, 2021). In particular, models such as BERT and GPT have been proven to be able to work with high fidelity in many languages.

The context, syntactic role, and semantic meaning of the word are of great importance when performing POS tagging. For example, the word "she" can be used as an demonstrative pronoun, a personal pronoun, or a possessive pronoun, depending on its meaning.

Several linguistic models can be used for grammatical labeling of a pronoun phrase. The main ones are:

1. Rule-based Models

In rule-based models, linguists' predefined rules are consulted to determine the grammatical category of a word. For example, the grammatical category of pronouns is determined by their final suffixes or their position in a sentence. In this approach, for example, the word "i" is defined as a personal pronoun because it is used only in the first person. When using this model, well-structured rules have the advantage of giving clear and consistent results, and working efficiently in both simple and small databases. Alternatively, there are drawbacks such as being unsuitable for new or complex cases, there are limitations to taking into account contextual differences.

2. Statistik modellar (Statistical Models)

In statistical models, the POS tagging process is based on probabilities. One of the most popular statistical models is the Hidden Markov Model (HMM). HMM determines the grammatical constellation of words, taking into account probability associations between words. In this model, the phrase of each word can be linked to the previous word. This approach is advantageous in that it works well in a wide range of texts, and is effective in analyzing complex and ambiguous cases. There are drawbacks in calculating probabilities, such as the need for a large database, the inability to fully take into account contextual connections with other words.

3. Machine Learning Models

In machine learning models, a set of pronouns and other words is determined on the basis of certain features (e.g., morphological form of a word, surrounding words). Naive Bayes, support Vector Machines (SVM), and algorithms such as Support Vector Machines (SVM) are used to break words into speech categories. These algorithms learn the connections between words and their grammatical categories by selecting certain properties. The model has some disadvantages such as better adaptation to new words and contextual changes, the use of large

datasets to train the models, but also the fact that the learning process requires more time and resources, the model is complex and the need for large [7]databases.

4. Deep Learning Models

In recent years, Deep Learning models, especially Recurrent Neural Networks (RNN) and Long Short-Term Memory (LSTM) networks, have become widely used in grammatical POS tagging. These models analyze words not only by their shape, but also by their contextual position in a sentence. These techniques allow for a deeper analysis of the meaning and syntactic role of words. The advantages of this method are its high efficiency in working with a wide and complex text, as well as a good assimilation of contextual information. The disadvantages are that large amounts of computing power are required to train the model, and a lot of data and resources are required in the learning process.

5. Transformer Based Models

Transformer models such as BERT and GPT are widely used in modern grammatical POS tagging. In transformer models, a contextual analysis of each word is performed, that is, the role of the word and its relationship with other words is fully considered. These models show a high degree of efficiency in language comprehension and analysis, meaning that the contextual meaning of words is fully taken into account, effective when working in multilingualism. The disadvantage is that it requires large computational resources to train and run the model.

Transformer models are very effective at determining the grammatical functions of pronouns to fit the context. The variable role and syntactic roles of pronouns in different contexts are accurately and accurately analyzed using transformer models. The main advantage of these models is that they provide more accurate results by considering the twofold context of the words (the before and the next words).[8]

In grammatical tagging, the grammatical category of each word is defined. In carrying out this process, the morphological features, context and syntactic role of words are taken into account. For example, in the sentence "I read the book," the word "I" is a personal pronoun that is used as the subject of the verb. For proper analysis of pronouns, the following main steps are performed in grammatical pos tagging:

Morphological analysis: Analysis of the form, suffixes and variations of a word.

Syntactic analysis: The role of a word in a sentence and its relationship with other words.

Semantic analysis: The meaning of a word and how it relates to surrounding words.

The process of grammatical post-tagging involves tagging each word in the text with a specific grammatical category (e.g., noun, verb, adjective, pronoun). There are several steps in this process:

Word form definition: Morphological analysis of a word, that is, identify its suffixes and its root.

Definition of syntactic task: Determining the place of a word in a sentence and its relationship with other words related to it.

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[7] https://courses.grainger.illinois.edu/cs447/sp2023/
5. https://www.geeksforgeeks.org/nlp-part-of-speech-default-tagging/

Semantic analysis: The meaning of a word and its interactions, its correspondence with the general meaning in a sentence[9]. When implementing POS tagging, grammar rules, statistical methods or machine learning models are used.

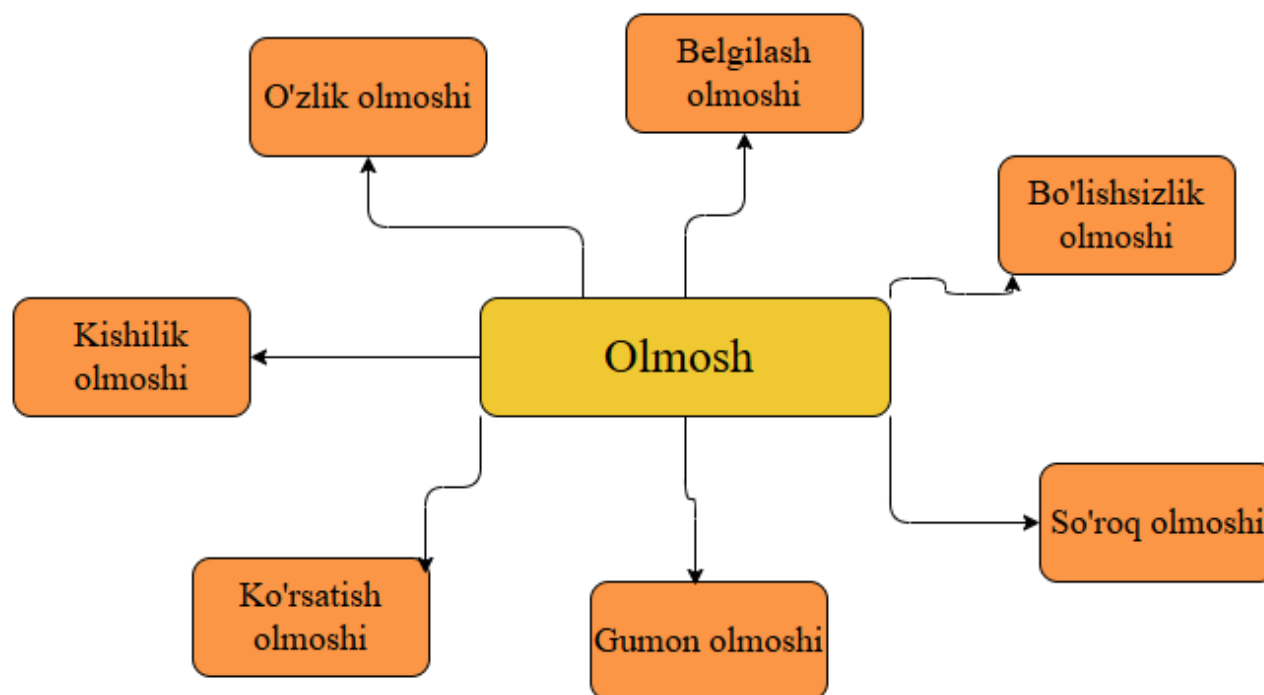The types of meaning of the pronoun are as follows:

Figure 1: Variants of the pronoun syndicate

According to the nature of the meaning of the pronoun, the pronoun is divided into 7 types:

1.Personal pronouns are words that refer to a person and thing that was involved or mentioned at the time of speech. Person pronouns are mainly used in place of nouns and represent three persons: the 1st person (I) is the speaker, the 2nd person (you) is the listener, and the 3rd person (he) is the person or thing mentioned by the speaker and the listener, who does not participate in the process of speech. In the plural, the 1st person (we) represents the speaker and other persons, the 2nd person (you) represents the listener and other persons, and the 3rd person (they) represent more than one person or thing that does not participate in the speech process[10].

Table 1: Distribution of personal pronouns

Personality	Unity	Plurality
1st person	I am	We are
Person 2	You	You are
Person 3	He is	They are

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6. https://www.shiksha.com/online-courses/articles/pos-tagging-in-nlp/
seven. Toshpulatov Z. Contemporary Uzbek literary language

Personal pronouns are often used both in speech and in written sources:

1.I have relied on the opinions of scholars in the field in my research.

2.Remember that your duty is more responsible than anyone else's.

3.He will never forget what you did.

4.Take our word for it!

2. **The demonstrative pronoun** is used to indicate, emphasize, a person, thing or character. This type of pronoun includes words such as: he, this, this, usha, this, this, this. According to the structure, demonstrative pronouns are of two types:

1) simple demonstrative pronouns: he, this, that, that;

2) Joint demonstrative pronouns: this, this, this, this, this (that).

Here's an account of what has been done.

In this sentence, the word has been a demonstrative pronoun.

3. **Interrogative pronouns**: Words used to recognize something that is not known to those involved in the process of speech. Interrogative pronouns differ according to their relation to a person (whom), to a thing (what), to a sign (which, how), to quantity (how much), to time (when), to purpose and reason (why, why), and to place (where).

Who knocked on the door in a **hurry?**

In this sentence, the word kim has been an interrogative pronoun.

4. **The self-pronoun** serves to distinguish, denote and indicate definite singularity. This type of pronoun is its own pronoun. The proper pronoun is used in place of the personal pronouns in all three persons, singular, and plural, often indicating a person, sometimes a thing.

1.I did this work myself.

2.O'z uyim — o'lan to'shagim.

In the first of these two sentences, the pronoun of the self indicates a person, and in the second, a thing. In the above sentences, we present the linguistic model of the proper pronoun as follows:

Olmosh+{fe'l}

Olmosh+ot

5. **Declarative pronouns** denote a swarm, total, or substitution of things and individuals. Accordingly, they can be divided into two subgroups, namely the summing and marking pronouns. Pronouns belonging to the first group express totality, while pronouns belonging to the second group indicate the object by emphasizing, marking and clarifying things along with partial summation.**Designation pronouns**include all, all, total, all, whole, gross.By adding the words who, what, interrogative pronouns to each word, a marking pronoun is formed.

They all laugh loudly.

In this sentence, the word is all forming the descriptive pronoun. Based on the above data, we present the linguistic model of the nominative pronoun as follows:

Pronoun+{interrogative pronouns,person,thing}

6. Pronouns of non-being mean denial in relation to a thing or sign. These pronouns come in the form without being a cross-section of the sentence involved, and denial is meaningful. Indivisibility pronouns are of two types according to their structure: a) the pronoun of non-abundance in the root form; b) a pronoun of non-singularity in the form of a compound word. The pronoun of non-abundance, which is used in the form of a root word, includes the word no. Even though her mother is very happy, she can't sleep at all.

And non-indivisibility pronouns in the form of a compound word are formed by the addition of interrogative pronouns such as who, what, when, or the words one, something. We can cite the linguistic model of the pronoun non-indivisibility as follows:

<p style="text-align:center">Pronouns+{interrogative pronouns,one, thing}</p>

7. Suspect pronouns. Suspect pronouns refer to a vague idea of a thing, character, or event. These pronouns are mainly used in place of noun and adjective, and are formed as follows: **the** suffix alla– forms suspect pronouns together with some interrogative pronouns: a) allanima, allakim pronouns are often used in place of nouns and take various concordant affixes, possessive and plural suffixes:

My grandfather whispers all the unconscious allanimas.

The linguistic model of the suspect pronoun is as follows:

{alla}+interrogative pronouns

Suspect pronouns are also formed by adding the assistant -dir to interrogative pronouns. a) Who, by adding what pronouns, indicates an ambiguous person or thing: At this moment someone's crying sound was heard; Interrogative Pronouns+{dir}

A word can sometimes be involved in the formation of suspect pronouns . This word comes along with the interrogative pronoun what it is, indicating something vague:

Something appeared to me//Something appeared to my eyes.

<p style="text-align:center">A+{person, thing, what}</p>

Although the word 'birov' is considered to be a word specific to the suffix formed by the addition **of the affix** -ov **to the singular**, it almost always denotes an ambiguous person. That is why the word is also used as a suspect pronoun. The word someone often means "stranger", "other", "stranger", "someone":

Someone knocked on the door //Someone knocked on the door[11].

 Pronouns are divided into 4 groups according to their structure:

1)   Soda
2)   child
3)   pair,
4)   to repetitive pronouns

Simple pronouns are composed of a syllable and can be suburb or artificial. Root pronouns are made up of one basic morpheme: I, you, she, this, who, this, what, etc. Artificial pronouns:– cha, -day, -dek move to another part of the word:buncha, uncha, such, un, such, such, un, such, menday, uziday, sizcha, sizday, sizsira(moq). The linguistic model of simple pronouns is as follows:

<p style="text-align:center">Pronouns+{-cha, -dek, -day, -sira}</p>

8.Wikipedia

Compound pronouns are formed on the basis of the accumulation of more than one adjective. Such pronouns consist of: a) one is a pronoun and the other is from a different category: this, this, this, when, such, allaqaysi; b) both are pronouns: anyone, any, any,

Pair pronouns are formed from the fact that different pronouns are connected on the basis of an equal connection. In speech, predominantly personal, demonstrative pronouns are used in pairs: you-we,he-this, uni-that.

Repetitive pronouns are made up of the repetition of pronouns with the same vowels on the basis of equal connection. Repetitive pronouns are used to enhance meaning, to emphasize. In speech, the pronouns indicated, interrogative, self, sign-lash are used repeatedly. In this, they are a) repeated in the form of one basic morpheme without any affixes: shu-shu, self, who-who, many, many-few; b) one of them is repeated with the addition of constructive or inflectional affixes: spontaneous, spontaneous, manmanlik (man-manlik)

Determining the grammatical tags of pronouns is one of the important considerations in natural language processing. It is possible to identify the tags of pronouns using a variety of linguistic models, such as rule-based, stochastic, machine learning, and transformer networks. Each method has its own advantages and disadvantages, and combined approaches are often used in modern NLP systems. And the development of transformer models opens up new opportunities for the accurate and effective implementation of grammatical tagging of pronouns.

CONCLUSION

Effective implementation of grammatical pos tagging of pronouns is important not only in linguistics, but also in the field of artificial intelligence and natural language processing. A variety of linguistic models can be used to carry out this process, including rule-based, statistical, machine learning, and deep learning models. Each model has its own advantages and limitations, and modern transformer-based models help achieve the highest results. Thereby, introducing new and more advanced technologies is needed to further perfect the grammatical pos tagging of pronouns.

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