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"COMPARATIVE ANALYSIS OF VERB ASPECTS IN ENGLISH, KOREAN, AND UZBEK USING NLP TOOLS"

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ABSTRACT

This paper explores the systems of aspect of the verb in the English, Korean, and Uzbek languages within the framework of Natural Language Processing. The verb aspect serves as an important linguistic feature and translates into essential component in machine translation. In contrast to English that employs auxiliary verbs and periphrastic constructions to express aspects, Korean and Uzbek use morphological markers. This paper describes the implementation of many advanced techniques of NLP, such as POS tagging, dependency parsing, and classification based on machine learning algorithms, for studying representation of aspect in these languages. The comparison reveals both common tendencies and divergencies of the languages, pointing out the scope of the processing for different languages with different linguistics structures. The scope of this work is in cross-linguistics NLP whereas raises the prospects for further development of aspect detection systems for languages with scarce resources.

Keywords: English, Korean, Uzbek, verbs, comparison, linguistic structure.

Introduction

1. Background & Significance

Aspects of verbs are the internal temporal structure of events encoded by the language. While the Tense identifies the event's location in time, be it past, present or future, the aspect outlines an action as complete, on-going, repetitive or habitual. Different languages have different ways of representing aspects based on their morphosyntactic conventions. In the English language, aspects are differentiated using auxiliary verbs and periphrastic constructions. For instance, the speaker is

done with the action of eating is expressed in the perfect aspect (I have eaten) and She is running in the progressive aspect underscores an action in progress. Korean uses verb inflections and auxiliary inflections to express various aspects. For example, the auxiliary marker -고 있다 is typically used to express the progressive aspect: while the action of eating is being done, the speaker says 먹고 있다 (is eating), and perfective and habitual aspects use other morphological forms. Uzbek is an agglutinating language that employs additional inflections to express grammatical relationships. The verb root serves as a base for adding morphological markers such as -ayotgan, forming the progressive aspect (Men kitob o‘qiyotganman "I am reading a book"). In contrast, aspect in English is represented by auxiliary verbs, in Uzbek it is depicted through suffixes added to the verb stem.

1.1 Importance of Studying Aspect in NLP

The study of linguistics’ aspect is important for both theoretical work and for natural language processing (NLP). A consideration of aspects is necessary in machine translation, speech understanding, and automated summarization. However, a large number of NLP methodologies are developed for languages like English only leaving underexplored languages like Uzbek that are low-resource and morphologically complex. English linguistic analysis has been aided greatly with techniques like NLP with POS tagging, dependency parsing, and neural network based classification. The same could not be said for Korean or Uzbek that are meant to have highly agglutinative dominated languages. The computation difficulties of these languages arise from:

- Depth of morphology: Marking aspects on certain verbs in Korean and Uzbek can have a problem of over-marking, so to say, which breaks recognition algorithms in NLP.
- Lack of data: Annotated corpora available for the English language are plenty but for the two mentioned languages, there are only a few datasets.
- Differences in structure: The English language has auxiliary verbs to provide aspect, but Korean and Uzbek have a stronger reliance on inflection and

agglutination. This type of NLP modeling performed in English usually doesn't transfer well to these other languages.

The goal of this study is to develop methods that can take advantage of these NLP tools by examining their strengths and weaknesses in analyzing and classifying verb forms in three linguistically different languages and assessing the effectiveness of existing algorithms within the boundaries of these languages' complexities.

1.2 Research Questions

This study pursues to investigate questions such as the following:

What are the aspects of the verb that are similar and different in terms of system and structure as used in the English, Korean, and Uzbek languages? How well do the existing NLP tools perform on the classification and analysis of these aspects? What problems are presented the use of computational techniques on these morphologically rich languages?

Answering these questions will benefit both computational linguistics as well as general typological linguistics by becoming the foundation upon which NLP techniques can be applied for languages with limited resources.

1.3 Hypothesis

Given the differentiation in grammatical structures of Korean and Uzbek and English, we expect low performance from these NLP tools trained on English. To illustrate: English comes out as an easy language to use and therefore should have higher performance NLP tools, while Korean is expected to fall within moderate ranges considering its inflectional structure, which is more complex than English, but not impossible to develop NLP tools for. Korean, like many other languages, has not trained complex deep learning models and therefore requires a more sophisticated structure to adequately perform multitasking. With Korean utilizing both inflectional and auxiliary markers, we expect the accuracy to fall at intermediate measures where existing NLP tools for Korean can perform semantic understanding, but not linguistic structure.

Uzbek, which is an agglutinative and low-resource language, is anticipated to show the lowest accuracy in NLP-based aspect detection because of limited data and its complex morphology. Given that Uzbek verbs can include several morphemes that convey various grammatical meanings, NLP models might find it challenging to accurately segment and classify aspect. This hypothesis will be evaluated through a comparative NLP-based analysis, focusing on how well machine learning algorithms can classify verb aspect in these three languages. The results will guide future enhancements in NLP models for languages that are typologically diverse and have limited resources.

2. Literature Review

2.1 Theoretical Framework on Verb Aspect

Aspect is a core component of linguistic theory that describes the internal temporal structure of an event. Linguists broadly categorize aspect into two main types:

Perfective Aspect – Represents completed actions or events viewed as a whole.
Imperfective Aspect – Describes actions that are ongoing, habitual, or incomplete.

While these categories are universal, their specific encoding differs across languages. Below is an illustration of perfective and imperfective aspect in English, Korean, and Uzbek:

Language	Perfective Example	Imperfective Example
English	"I have written"	"I am writing"
Korean	"썼다 (sseotda)"	"쓰고 있다 (sseugo itda)"
Uzbek	"Yozdim"	"Yozayotganman"

Several linguistic frameworks have been developed to analyze aspect. Bernard Comrie (1976) in Aspect: An Introduction to the Study of Verbal Aspect and Related Problems provided a typological approach to aspectual distinctions, emphasizing the

difference between perfective and imperfective. Carlota Smith (1997) in The Parameter of Aspect introduced a model that integrates lexical aspect (inherent properties of verbs) with grammatical aspect (morphosyntactic markers).

Applying these theoretical models to computational linguistics presents challenges, especially for languages with rich morphological structures. Many NLP models rely on predefined rules and statistical learning to classify aspect, but their effectiveness varies across languages due to differences in morphosyntactic encoding.

2.2 Cross-Linguistic Aspectual Comparisons

The encoding of aspect in English, Korean, and Uzbek highlights the diversity in linguistic structures:

- English primarily expresses aspect periphrastically (i.e., through multi-word constructions using auxiliary verbs such as have and be).
- Korean uses inflectional suffixes and auxiliary markers to distinguish between perfective and imperfective aspects.
- Uzbek, an agglutinative language, encodes aspect through suffixation, adding morphemes directly to the verb stem.

2.2.1 Korean Aspect

A study by Ryu (2022) analyzed the acquisition of tense-aspect markers in Korean-speaking children, focusing on how aspect is learned over time. Key markers in Korean include:

-었/았- (-eoss/-ass-) → Indicates completed actions (먹었다 – meogeotda "ate").

-고 있다 (-go itda) → Marks progressive or ongoing actions (먹고 있다 – meokgo itda "is eating").

Findings from the study supported the Aspect Hypothesis, which predicts that children acquire progressive aspect before perfective aspect due to its direct perceptual salience (Shirai & Andersen, 1995). This has implications for NLP models, as aspect classification in Korean must account for the sequence of aspect acquisition and its morphosyntactic properties.

2.2.2 Uzbek Aspect

A study by Buranov (1982) examined Uzbek verb forms and their interaction with tense and modality. Unlike English and Korean, Uzbek does not use auxiliary verbs to mark aspect. Instead, it employs suffixation.

For example, the progressive aspect is formed by adding -ayotgan to the verb root: yoz ("write") → yozayotganman ("I am writing").

Uzbek's agglutinative structure poses challenges for NLP models. Since multiple morphemes can be attached to a verb root, segmenting aspectual markers requires sophisticated morphological analysis. This complexity is a major factor limiting the performance of existing NLP tools on Uzbek.

2.3 NLP in Aspect Analysis

Aspect detection using Natural Language Processing (NLP) has been extensively researched in English but remains underexplored in morphologically complex languages such as Korean and Uzbek.

One of the most influential studies, Schneider & Smith (2020), used BERT-based NLP models to classify verb aspect in English. Their study achieved high accuracy in detecting aspectual distinctions using contextual embeddings. However, they noted that:

NLP models trained on English struggled with morphologically rich languages due to structural differences. The absence of large annotated datasets for non-English languages limited model performance. These findings underscore the importance of developing cross-linguistic NLP frameworks that can handle diverse morphological patterns.

2.3.2 Korean & Uzbek NLP Studies

Despite growing interest in NLP applications for Korean and Uzbek, research remains limited.

Korean NLP: Existing models, such as KcBERT (Lee et al., 2021), have been trained on large-scale Korean corpora, showing promising results in POS tagging and dependency parsing. However, their performance in aspect detection is still underexplored.

Uzbek NLP: Research on Uzbek remains scarce due to a lack of linguistic resources. A recent study by Nurmukhamedov (2023) developed a rule-based POS tagger for Uzbek, but aspectual classification remains an open challenge.

The challenges of aspect detection in NLP for Korean and Uzbek stem from:

- Morphological complexity – Both languages use rich inflectional and agglutinative structures, making it difficult for NLP models to segment and analyze aspectual markers.
- Data scarcity – English has large annotated corpora, whereas Korean and Uzbek lack sufficient labeled data for training aspect classifiers.
- Structural differences from English – Most NLP tools are trained on English, which relies on auxiliary verbs rather than morphological markers for aspect, leading to low transferability to other languages.

2.4 The Need for Cross-Linguistic NLP Studies

Given the limitations of existing NLP models in aspect classification, cross-linguistic studies are essential for:

- Developing multilingual NLP models that generalize across typologically different languages.
- Enhancing language-specific NLP tools by incorporating morphological and syntactic rules for Korean and Uzbek.
- Expanding linguistic resources by creating annotated corpora for underrepresented languages like Uzbek.

This research aims to bridge these gaps by analyzing how NLP tools process aspect across English, Korean, and Uzbek, providing insights into the computational challenges of typologically diverse languages.

3. Methodology

3.1 Data Collection

To conduct a comparative analysis of aspect classification in English, Korean, and Uzbek, a corpus was compiled from diverse linguistic sources:

English: The British National Corpus (BNC), a well-established linguistic dataset containing diverse written and spoken texts.

Korean: The Sejong Corpus, a large-scale Korean language corpus containing annotated syntactic and morphological information.

Uzbek: A manually compiled corpus consisting of texts from newspapers, books, and social media posts, as there is no publicly available large-scale corpus for Uzbek.

3.2 NLP Tools Used

Several NLP tools were utilized to process and analyze the corpus data, each chosen based on language compatibility and effectiveness in aspect classification.These tools were employed to extract verb phrases and identify their aspectual characteristics.

- Part-of-Speech (POS) Tagging:, SpaCy (English), KoNLPy (Korean), Stanza (Uzbek).
- Dependency Parsing:, UDPipe, SyntaxNet.
- Machine Learning Models:, BERT-based classifiers trained separately for each language using annotated datasets

A manual annotation process was conducted to ensure accurate aspect classification:
Identification of Verb Phrases: Each verb in the corpus was extracted and categorized.
Aspect Labeling: Annotators labeled each verb phrase according to aspect (Perfective, Imperfective, Progressive, Habitual, etc.).
Comparison with NLP Output: The aspectual classification generated by NLP models was compared against the manually annotated dataset to measure accuracy and performance.

4.1 **Quantitative Findings**

The NLP models' performance was evaluated using Precision, Recall, and F1-Score, as shown in the table below:

Language	Precision	Recall	F1-Score
English	91.2%	89.7%	90.4%
Korean	84.5%	82.3%	83.4%
Uzbek	76.8%	74.2%	75.5%

English: The NLP models performed exceptionally well, largely due to the fixed aspectual structures in English, which are relatively easier to detect using standard POS tagging and dependency parsing.

Korean: The model struggled with implicit aspectual markers that require context-based interpretation. Korean often relies on auxiliary constructions (-고 있다) and tense-aspect markers, which created challenges in automatic classification.

Uzbek: The highest misclassification rate was observed in Uzbek, mainly due to data sparsity and agglutinative morphology. Since Uzbek verbs are highly inflected, segmentation errors led to inaccurate aspect classification.

4.3 Cross-Linguistic Insights

English, Korean, and Uzbek each present distinct challenges and opportunities when it comes to aspect detection in Natural Language Processing (NLP). English, with its reliance on auxiliary verbs (e.g., has written, is writing), offers a relatively simple and structured way of expressing aspect. This syntactic structure makes it easier for NLP models to detect and classify aspects, as the auxiliary verbs explicitly mark the tense and aspect of the action. This regularity is advantageous for machine learning algorithms, which can identify aspectual distinctions with relative ease, leveraging the fixed word order and auxiliary verb placement in English sentences.

In contrast, Korean and Uzbek utilize morphological markers to convey aspectual information, which introduces significant complexity for NLP models. Both languages are agglutinative, meaning they express grammatical relations through the addition of affixes to root words. These affixes can indicate various nuances of aspect, such as whether an action is completed, ongoing, or habitual. While this rich morphological system allows for greater flexibility and precision in expressing

meaning, it also creates challenges for aspect detection. Furthermore, low-resource languages like Uzbek face additional challenges in the NLP landscape. The absence of large, annotated datasets for training models severely impacts the accuracy and effectiveness of NLP tools. While languages like English benefit from extensive linguistic resources—such as vast corpora of annotated texts and pre-trained models—languages like Uzbek lack this advantage. The scarcity of training data means that NLP models for Uzbek struggle to generalize across different contexts and domains, resulting in poorer performance. This is especially true for tasks like aspect classification, which rely heavily on the availability of diverse, high-quality data to capture the nuances of aspectual meaning across various sentence structures.

4.4 Limitations

Despite the promising potential of NLP models in handling aspect detection, several limitations must be addressed to improve accuracy, particularly for languages like Uzbek and Korean. These limitations primarily stem from linguistic complexities and the lack of resources for low-resource languages.

- Limited NLP Tools for Uzbek: One of the main limitations identified in this study is the lack of robust NLP tools for Uzbek. While there has been significant progress in developing NLP tools for high-resource languages like English, similar tools for Uzbek remain underdeveloped. Existing models for Uzbek have limited support for key NLP tasks, including morphological analysis, part-of-speech tagging, and syntactic parsing. The absence of these foundational tools makes it difficult to achieve accurate aspect detection in Uzbek, as NLP models rely on accurate morphological and syntactic information to correctly identify aspectual markers.

- Difficulty in Segmenting Korean and Uzbek Verb Morphology: Both Korean and Uzbek are agglutinative languages, meaning they build word forms by attaching multiple morphemes to a root verb. This results in long and complex verb forms that can carry a variety of grammatical information, including tense, aspect, mood, and honorifics. Parsing these complex verb forms is a major challenge for NLP models. The difficulty in segmenting and correctly interpreting the individual morphemes in a verb form can lead to errors in aspect classification, as the model may fail to accurately parse or assign meaning to specific affixes.

- NLP Models Trained on English Do Not Generalize Well to Agglutinative Languages: A significant challenge in NLP research is the reliance on models that have been primarily trained on English or other Indo-European languages, which have different syntactic and morphological structures compared to agglutinative languages like Korean and Uzbek. English, with its reliance on auxiliary verbs and relatively simple verb morphology, is not representative of the complexities found in languages like Korean and Uzbek. Researchers must develop models that are explicitly designed to handle the complexities of verb morphology in languages like Korean and Uzbek, incorporating linguistic insights into agglutination and aspect marking to improve model performance.

5. Conclusion & Future Work

5.1 Summary of Findings

The study reveals significant linguistic and computational challenges across three languages—English, Korean, and Uzbek—in the context of aspect classification in Natural Language Processing (NLP). English, with its use of auxiliary verbs like "has written" and "is writing," offers a relatively straightforward method for detecting aspect. This simplicity allows NLP models to effectively identify aspectual distinctions with high accuracy. However, when shifting to Korean and Uzbek, which are both agglutinative languages, the task becomes much more complex due to their reliance on morphological markers to convey aspectual information.

In particular, the intricacy of Korean and Uzbek verb morphology demands more sophisticated parsing techniques. These languages exhibit a greater range of inflections, suffixes, and combinations, requiring more advanced morphological analysis to accurately capture aspect. Uzbek, as a low-resource language, faces an additional challenge: the absence of large annotated corpora significantly hinders the performance of NLP models, making it difficult to achieve high levels of accuracy.

This study highlights that while English performs well in aspect classification due to its syntactic structure, both Korean and Uzbek require more specialized NLP approaches to address their unique morphological challenges. Additionally, the lack of comprehensive linguistic resources for Uzbek limits the effectiveness of NLP

tools in that language, further emphasizing the need for dedicated research and development.

5.2 Theoretical & Practical Implications

Linguistic Contribution: This research contributes to the theoretical understanding of aspectual marking in typologically different languages. By examining English, Korean, and Uzbek, the study explores the diverse ways in which languages encode aspect and highlights the varying levels of complexity involved in different linguistic systems. This knowledge is crucial for developing more nuanced models of aspect classification that account for both typological variation and the richness of verb morphology across languages.

Computational Impact: From a computational standpoint, the findings offer valuable insights for improving machine translation systems. Aspectual distinctions play a critical role in ensuring accurate translations, and understanding how these distinctions are conveyed across languages can significantly enhance the preservation of meaning in machine translation outputs. The study underscores the importance of incorporating language-specific characteristics into NLP models, particularly when dealing with morphologically complex languages like Korean and Uzbek.

NLP Development: In terms of NLP development, this research emphasizes the need for tailored solutions that address the unique challenges of agglutinative languages. Current models trained predominantly on English fail to generalize effectively to languages with rich morphology. Thus, there is a pressing need to develop NLP tools and models that are specifically designed to handle the intricacies of languages like Uzbek and Korean. By focusing on morphological parsing and incorporating language-specific data, future models can achieve better performance in these languages.

5.3 Future Research

The study opens several avenues for future research, particularly in the areas of dataset expansion, model development, and unsupervised learning techniques. Below are key directions for future work:

Expanding Datasets for Uzbek and Korean: One of the primary limitations identified in this study is the lack of large, annotated datasets for Uzbek and Korean. Expanding these datasets is essential for improving the accuracy and reliability of NLP models. This can be achieved through the development of comprehensive corpora that capture a wide range of syntactic and morphological structures, as well as aspectual distinctions in both languages. Collaboration with native speakers, linguists, and language experts will be critical in curating such resources. Developing NLP Models Tailored to Agglutinative Languages: Given the complexities of agglutinative languages, future research should focus on developing NLP models that integrate sophisticated morphological parsing techniques. These models would need to handle the inflectional richness and agglutination in Korean and Uzbek, offering more precise analyses of verb morphology. Approaches such as morpheme segmentation and dependency parsing could be particularly effective in parsing agglutinative structures and enhancing aspect classification accuracy.

In conclusion, while the challenges presented by Korean and Uzbek aspect classification are significant, they also provide valuable opportunities for advancing the field of NLP. By developing language-specific models, expanding linguistic resources, and exploring new computational techniques, we can move closer to achieving more accurate and efficient NLP systems that accommodate the diverse ways in which aspect is marked in different languages.

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