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Translation Skills of Coordinate Structure Transposition in Semantic Translation of Cloud Edge Collaborative Computing

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Abstract The collaborative development of cloud computing and edge computing has become an important trend of future development. However, at present, cloud edge collaboration is in the initial stage of development. We should accelerate standardization construction, guide and improve the service level of cloud edge collaboration, and promote the healthy development of cloud edge collaboration. In natural language processing, the processing of coordinate structure is a very important work. However, the traditional parallel structure processing method is inefficient and complex. Based on Natural Language Processing (NLP) technology, this paper adopted Support Vector Machines (SVM), Decision Tree (DT) and Bayesian methods, and analyzed the effectiveness of the three methods. This paper proposed to improve the accuracy of parallel structure conversion by using the word order adjustment technology based on statistical model, which provided a certain reference for parallel structure translators. From the perspective of syntax and semantics, this paper analyzed the translation skills of coordinate structure and word order, and put forward corresponding translation strategies and rules. In the experimental analysis part, the accuracy of SVM, DT and Bayesian methods reached 97.65%, 88.94% and 90.64% respectively among all the tested data; the time spent by SVM, DT and Bayesian methods reached 9.21s, 10.84s and 10.33s respectively. To sum up, SVM outperformed the other two methods in terms of accuracy and time. English translation is difficult, so translators often use a lot of translation techniques. In the demonstration of the example sentence, examples without corresponding skills were also provided to illustrate the advantages of this method through comparison. In short, translation must meet the following three points: clear narrative logic, accurate technical content, and fluent language.

Index Terms English Translation, Natural Language Processing, Juxtaposition Structure, Transposition Word Order, Translation Skills, Cloud Edge Collaborative Computing

I. Introduction

Edge computing mainly refers to providing computing services nearby at the side close to the object or data source to generate faster network service response and meet the real-time application and data protection requirements. The traditional manual translation method is difficult to guarantee the authenticity of the translation. Therefore, people's research on NLP technology has gradually become the focus of attention. This paper made a study of English translation from the following aspects: parallel structure variation, transposition and conversion of word order. Although the word order of the coordinate structure in English translation is generally the same, it has great similarities and does not lack individual characteristics. The reasons for this difference in word order are not only related to semantics, but also to the way of thinking of the two cultures, as well as to the essential characteristics and pragmatic needs of the two languages. In the actual translation process, the original word order should be appropriately adjusted according to the language habits of the target language. However, when the word order contains obvious pragmatic intention, it can be considered to maintain the original word order.

With the continuous development of society, the study of English translation has gradually increased. Simanjuntak Marudut Bernardua used English translation technology to investigate a prayer form in Bataktoba language [1]. Most of Fan Angela's research is English-centered, and training is only conducted for data translated from English or translated into English [2]. Based on the preliminary research results of project-based flipped learning model in business English translation course, Deng Lijun designed a process-oriented evaluation model for the course [3]. De Vries Erik learned that some analysts suggested that Google Translate should be used to convert all texts into English before starting the analysis, but this might get lost in translation, so he evaluated the usefulness of machine translation for vocabulary bag models such as topic models [4]. Kane Vichard L believed that language understanding is a person's ability to correctly understand language to fully convey information and

details. When languages are different, problems arise. He found that the basic meaning of information and the background of using unknown dialects can be accurately seen in English [5]. Although these studies have promoted English translation to some extent, they have not been combined with the actual situation.

At the same time, NLP has gradually attracted widespread attention from the academic community. Omar Youssif Zaghwani tried to find out the influence of English teaching methods and grammar-translation methods on Libyan students' English performance in actual English communication. He used the qualitative research method to interview 10 Libyan English teachers based on the secondary resources in the literature review, which has a reference significance for the application of NLP [6]. Ducar Cynthia discussed a key teaching problem. Machine translation is widely used in language classes, but it is generally unpopular, which would make NLP have a corresponding contrast [7]. Dijkstra T O N considered that people have a strong need to achieve this goal by unifying bilingual word understanding, word semantic processing and word generation. He built a local connectionism model, and carried out research on monolingual and bilingual vocabulary decision-making, word translation and generation, which has a certain impact on the use of NLP [8]. Orang'i Douglas Ondara discussed the translation of taboo words in health care texts from English source text to Swahili, which expanded the use of NLP [9]. Although these research methods are very innovative, a large number of experimental data are needed to prove the reliability of the methods.

In the translation of coordinate structure, adjusting the sentence content is a common and effective method. This paper first analyzed the transposition order of coordinate structure, and then introduced NLP technology, including model statistical method, SVM method, DT method and Bayesian method. The feature selection based on KL-Divergence (Kullback-Leibler Divergence) was also described in detail. The experimental part analyzed the English translation model from the perspective of accuracy and time cost, and drew the conclusion that the SVM method was superior to the other two methods based on the relevant data of the questionnaire. Finally, the analysis of translation skills was detailed.

II. NLP Method in English Translation

II. A. Coordinate Structure Transposition Word Order

The transposition word order of the coordinate structure is the syntactic structure of "the text structure in a sentence changes". There is often only one subject and one object in a sentence. Its feature is that there is an obvious connection between the subject part of the verb "past and present" and the object part of the predicate "future and present". This connection usually occurs in a sentence and forms a coherent whole with other phrases or words.

Transposition word order is to change the connection between the subject-predicate phrase or object in a sentence into a coordinate structure. Transposition word order is a common and effective translation technique, which is characterized by arranging all phrases or words in a sentence into a whole.

This method is also applicable to coordinate structure transformation grammar, that is, to express the connection between different predicates or between components and the same predicate by using the phenomenon of connection between different predicates and components in a sentence, rather than dividing the sentence into a single sentence for processing. Transposition word order is a flexible and effective way to express various grammatical changes in a sentence.

There are two basic features in the function of transposition word order: transposition word order can keep the structure of the sentence complete and make the meaning of the sentence more clear; transposition word order can make all the components in the sentence consistent, and thus more easily organize into a coherent whole. The functional features and points of attention of the transposition word order are shown in Figure 1.

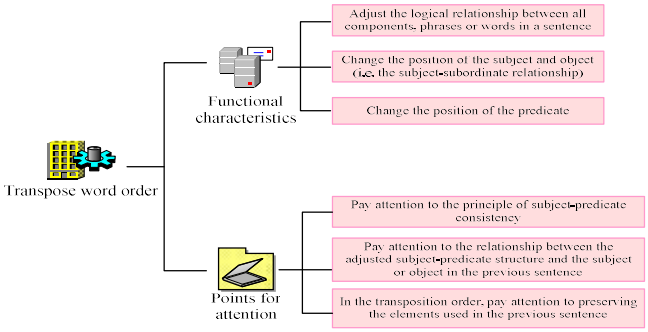


Figure 1: Functional features and points for attention of transposition word order

It can be seen from Figure 1 that according to the functional characteristics of the transposition word order, there are three functions: it can adjust the logical relationship between all elements, phrases or words in a sentence; it can change the position of the subject and the object (that is, the subject-subordinate relationship); it can change the position of the predicate. In the transposition order, special attention should be paid to the following three aspects: attention should be paid to the principle of subject-predicate consistency; attention should be paid to the relationship between the adjusted subject-predicate structure and the subject or object in the previous sentence; in the transposition order, it is necessary to keep the components used in the previous sentence.

Some studies have tried to develop translation as a language theory and explore the theoretical motivation and added value behind this concept. A special aspect of multilingual users' social interaction is its multimodal and multi-sensory characteristics [10]. In transposition word order, substitution is the main translation skill. It is not difficult to translate one sentence into another sentence, but it is not so easy to translate into a sentence, and there are many ways to replace word order. Therefore, the translation of alternative syntax must be flexibly applied in combination with specific situations.

II. B.NLP Technology

(1) Cloud edge collaborative computing

With massive devices accessing the Internet of Things system, various fields are also seeking more simple and effective ways to save costs, and the demand for edge computing is also growing. Edge computing places data calculation and analysis on the edge. Data consolidation and simplification can help reduce the pressure on server operation and the demand for network speed delay. Cloud computing can conduct more in-depth analysis to obtain more in-depth observation. Both are important components of the Internet of Things system and play an important role in intelligent management of devices.

Edge computing is a distributed processing and storage architecture, which is closer to the source of data. For example, cameras with visual processing functions, wearable medical devices that send data to mobile phones through Bluetooth, etc. all take advantage of edge computing. Compared with cloud computing, edge computing is closer to the terminal and has many excellent characteristics. Therefore, the mixed use of edge computing and cloud computing is generally considered as the best practice of building Internet of Things solutions.

(2) Natural language grammar analysis technology

In view of the recent improvement in the quality of machine translation (MT) output, some studies have investigated MT and proposed the risk of using MT in various clinical scenarios, which increases the diversity of algorithm training and evaluation; the performance differences between different MT algorithms are compared, and the results used in machine translation evaluation are expanded [11], [12]. In addition, NLP technology has also been widely developed in translation.

The development of NLP technology has provided great convenience for human daily life. Grammar analysis is a very mature research, and its research is based on rules.

Due to the increasingly rich corpus, the statistics-based method plays an important role in the research of NLP. Through a large number of experiments, the effectiveness and robustness of this algorithm are proved. So far, statistical methods have been widely used.

During statistical analysis, there are two important problems to be solved, as shown in Figure 2.

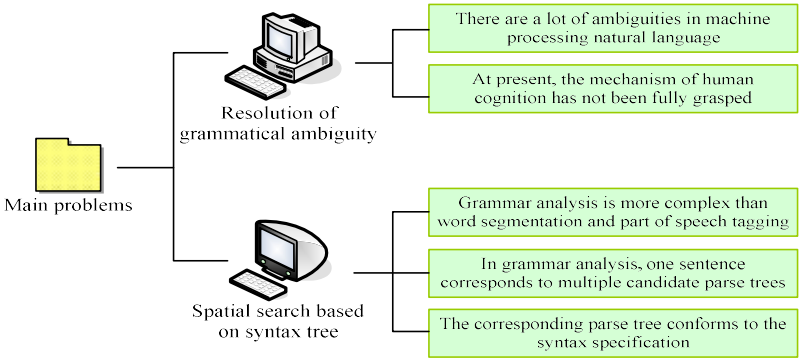


Figure 2: Main problems in statistical analysis

It can be seen from Figure 2 that one of the problems is how to eliminate grammatical ambiguity. Compared with human understanding of language, machine processing of natural language has an obvious feature, that is, there are many fuzziness in machine processing of natural language. People can understand it through their vast

knowledge, thus effectively solving the problem of ambiguity in grammar. However, people have not fully grasped the cognitive mechanism of language, and there are many defects in expressing and acquiring knowledge.

Another problem involves spatial search based on syntax tree. In the design of the grammar analysis model, it is important to ensure both the disambiguation of the model and the fact that the decoder can find the best grammar analysis tree in the shortest possible time.

(3) Model statistical method

The basic concept of generating model is to use joint probability $Score(x, y/\varphi)$ to determine probability function $Score(x, y)$, so that the objective function is:

$$\prod_{o=1}^{m} Score(x_o, y_o, \varphi) \tag{1}$$

Among these parameters, the maximum φ value represents the model parameters, while *x* and *y* represent a known sequence and a target sequence, respectively. In English translation, the coordinate structure is used to change the word order. It is suppose there is a sentence A, $S = u_1, u_2, ..., u_m$ represents *m* words in the sentence; its output is a syntax tree composed of *T*. The goal of this model is to extract the optimal syntax analysis tree of maximum joint probability $P(S,T)$ from the training corpus by obtaining parameter φ, which is expressed as t^*:

$$t^* = \arg\max_{t \in T} P(S,T) \tag{2}$$

In English translation, in order to reduce the sparsity and simplification of data, it is necessary to carry out syntax analysis to facilitate the calculation of joint probability $P(S,T)$.

The objective function of the discrimination model is:

$$\prod_{o=1}^{m} Score(x_o | y_o, \varphi) \tag{3}$$

In the identification model, the log-linear model is generally used to describe, and it has more characteristics than the production model. In English translation, a classifier is usually used to analyze the word order of coordinate structure transformation. First, the word order of coordinate structure transformation in English is decomposed into a group of operations, and then the classifier determines the current action. Among them, SVM method, DT method and Bayesian method are the most widely used methods, as shown in Figure 3.

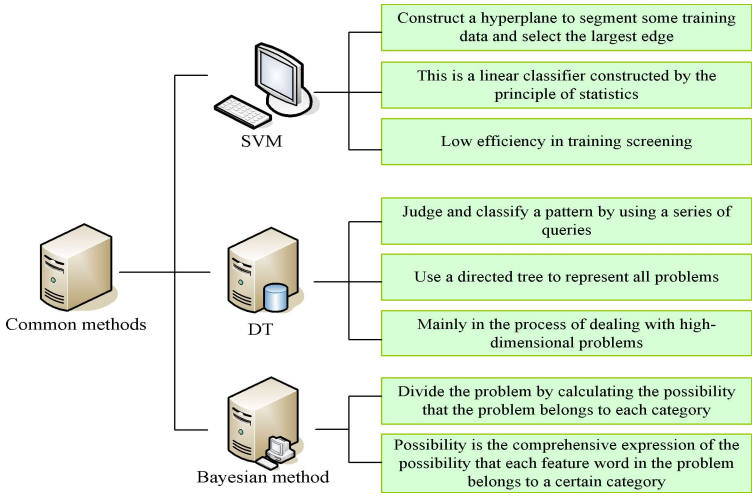


Figure 3: The most widely used method at present

a) SVM method

The basic concept of SVM is to construct a hyperplane to segment the training data, and to select the largest boundary from it, which is a linear classifier based on statistical principles. This method is perfect and practical, so it is often used to deal with multiple natural languages.

b) DT method

DT is another representative discriminative learning algorithm. DT uses a series of questions to judge and classify a model. The answer of the former is directly related to the following questions, while DT uses a directed tree to express the whole question.

c) Bayesian method

The basic idea of this classification method is to divide the problem into different types of probabilities. This possibility is a comprehensive expression, that is, every feature word in the problem belongs to a specific category. The first step is to obtain the probability vector of the feature word of each classification, which is derived from Formula (4):

$$b_l = P(b_l \left| d_k \right.) = \frac{1 + \sum_{o=1}^{|A|} N(b_l, a_o)}{|W| + \sum_{l=1}^{|W|} \sum_{o=1}^{|A|} N(b_l, a_o)} \tag{4}$$

In classification, $P(b_l \left| d_k \right.)$ is the weight of feature word b_l in classification d_k, and $|A|$ is the number of examples in this classification; $N(b_l, a_o)$ is the frequency of words b_l in a_o, and $|W|$ is the total number of words; $\sum_{l=1}^{|W|} \sum_{o=1}^{|A|} N(b_l, a_o)$ is the total number of occurrences of all words in category d_k. When a problem occurs, it is classified into different types of possibilities, and then the problem is classified into the largest category.

II. C.Feature Selection based on KL-Divergence

Due to translation knowledge transfer (transfer learning), multilingual neural machine translation is very useful in improving translation quality [13]. Feature selection is a key step in translation text classification and also a current research field. It acts as a bridge between text samples and classification. Its function is to eliminate words that cannot be given different types through the analysis of corpus, so as to build a new feature set.

When classifying text, it is necessary to select the feature extraction algorithm reasonably, and fully consider the complexity of the algorithm used and the effectiveness of feature extraction. This paper proposes a method of feature extraction using Kullback-Leibler Divergence (KL-Divergence), and combines it with the weight of word frequency-inverse document frequency algorithm of feature items, thus greatly improving the efficiency of recognition.

KL-Divergence's feature selection method is in text classification. When there is a specific word, the probability distribution of text classification has a certain relationship with the distribution of text type. According to KL-Divergence, the distance between these two distributions can be expressed by Formula (5):

$$KL(P(w \left| d \right.), P(w \left| c_k \right.)) \tag{5}$$

The feature item *w* is selected according to KL-Divergence's feature selection evaluation function, and can be correctly expressed by Formula (5).

In each category, each category would use the word list according to its distribution to eliminate the attributes with smaller scores, so that classification and classification, training text, etc. have more similarities, which would make the attributes of each category more prominent. If the distribution of training text and test text is the same, the similarity between the test text and its corresponding categories would increase, so as to obtain more accurate classification results.

In this paper, an approximate simplification is made for KL-Divergence, that is, the average distance between text sets and text categories is averaged, so that the average distance obtained is more objective, more realistic, and less error.

There is training text set $S = \{d_1, d_2, ..., d_s\}$, and d_o is the text category. After that, according to the feature word w_t, the average value of KL variation between the training text group and the category to which each text belongs is:

$$KL_t(S) = \frac{1}{|S|} \sum_{d_o} KL\left((P(w_t \left| d_o \right.), P(w_t \left| c(d_o) \right.)) \right) \tag{6}$$

The test index of KL-Divergence's feature selection method is mainly based on the degree of dispersion of feature extraction. The selected features are words evenly distributed in a specific category. In practical applications, when attribute weights are combined with attributes, it is necessary to filter out some attributes with weaker attributes, and then extract attributes according to their frequency, distribution and concentration.

The basic principles of constructing class model are: to train the existing classification manually and classify it; after that the class model is constructed by feature selection, which lays the foundation for automatic classification. In the construction of class model, vector is usually composed of attribute words and corresponding weights.

In this algorithm, feature extraction refers to merging the training files in each file category into a category file. The algorithm in this paper focuses on the consideration of weight value when constructing class model to further improve.

III. English Translation Model Performance Evaluation Experiment

III. A. Model Experiment Evaluation

Based on the NLP and feature extraction process described above, this paper selected SVM, DT and Bayesian methods for comparative analysis to determine which algorithm has better classification effect. At the same time, a more practical algorithm was selected from multiple perspectives.

The data selected in the experiment were from three corpus databases, namely database 1, database 2, and database 3. The data set contained manually annotated parts of speech, word segmentation and complete phrase structure tree.

In the experiment, this paper randomly selected 20% of the samples as the test set, and 80% of the samples as the experimental training set. Table 1 shows the dataset information. Before training, all data should be preprocessed: idioms, consecutive English or numbers were changed to *.

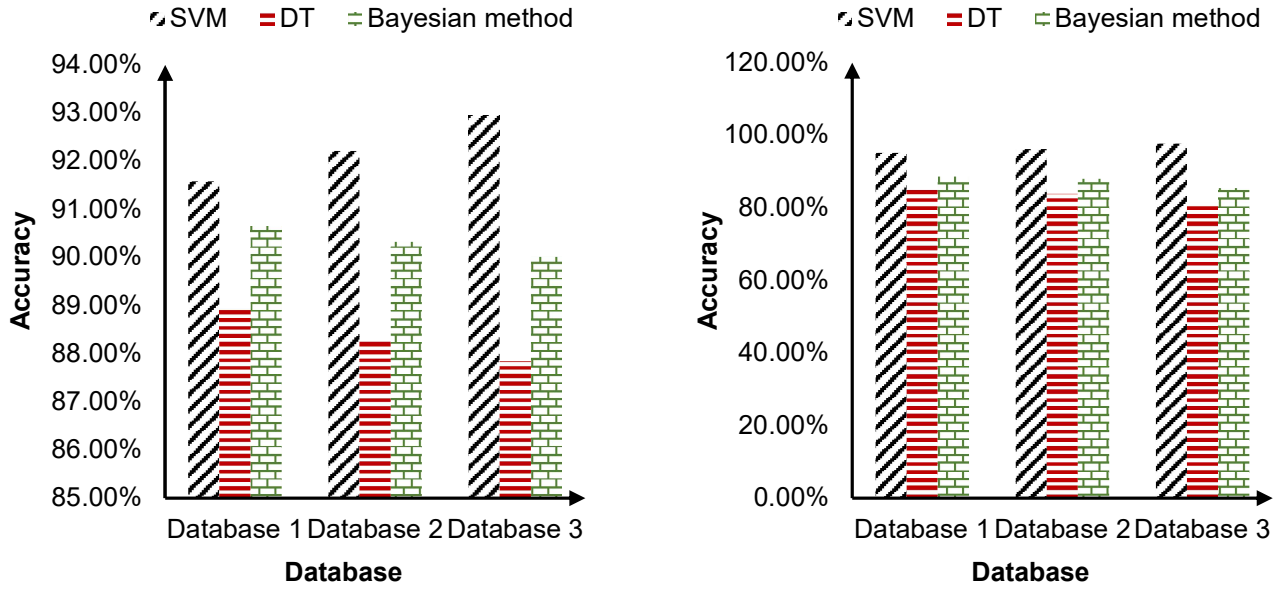
Table 1: Dataset information

Database	Number of sentences		Total
	Training Set	Test Set	
Database 1	1316	329	1645
Database 2	2040	510	2550
Database 3	2924	731	3655

From Table 1, there were 1645 sentences in database 1, including 1316 training sets and 329 test sets. In database 2, there were 2550 sentences in total, including 2040 training sets and 510 test sets. In database 3, there were 3655 sentences in total, including 2924 training sets and 731 test sets.

In order to ensure the reliability of the experimental comparison, the parameters of the experimental environment were set uniformly, and the same parameters were used for all network models.

Figure 4 shows the comparison results of accuracy of different methods in different databases.



(a) Test set (b) Training set

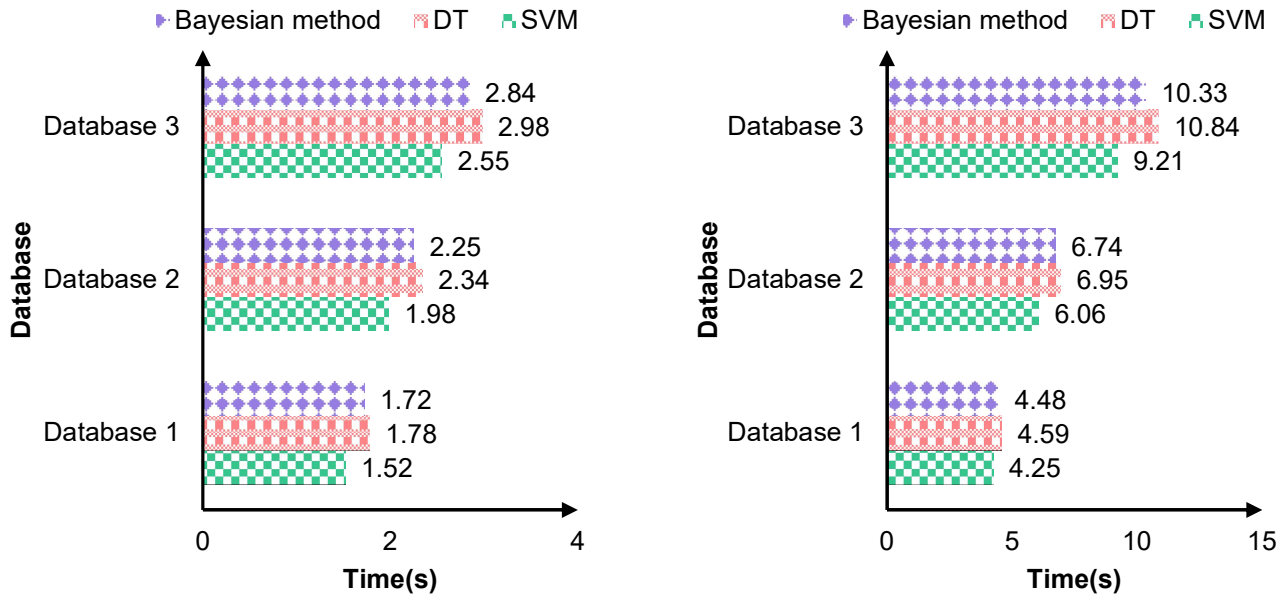
Figure 4: Accuracy comparison

It can be seen from Figure 4 (a) that on the test set, the accuracy rates of SVM in database 1, database 2 and database 3 were 91.58%, 92.21% and 92.95% respectively; the accuracy rates of DT in database 1, database 2 and database 3 were 88.94%, 88.26% and 87.84% respectively; the accuracy rates of Bayesian method in database 1, database 2 and database 3 were 90.64%, 90.32% and 90.01% respectively.

It can be seen from Figure 4 (b) that on the training set, the accuracy rates of SVM in database 1, database 2 and database 3 were 95.09%, 96.18% and 97.65% respectively; the accuracy rates of DT in database 1, database 2 and database 3 were 85.12%, 83.84% and 81.33% respectively; the accuracy rates of Bayesian method in database 1, database 2 and database 3 were 88.55%, 87.98% and 85.41% respectively.

According to the data, the accuracy of SVM was higher than DT and Bayesian methods in both test sets and training sets. The accuracy of SVM increased with the increase of the data set, while DT and Bayesian rule decreased with the increase of the data set.

Figure 5 shows the comparison results of time spent by different methods in different databases.



(a) In the test set (b) In the training set

Figure 5: Comparison of time spent

According to Figure 5 (a), on the test set, the time spent by SVM in database 1, database 2 and database 3 was 1.52s, 1.98s and 2.55s respectively; the time spent by DT in database 1, database 2 and database 3 was 1.78s, 2.34s and 2.98s respectively; the time spent by Bayesian method in database 1, database 2 and database 3 was 1.72s, 2.25s and 2.84s respectively.

It can be seen from Figure 5 (b) that on the training set, the time spent by SVM in database 1, database 2 and database 3 was 4.25s, 6.06s and 9.21s respectively; the time spent by DT in database 1, database 2 and database 3 was 4.59s, 6.95s and 10.84s respectively; the time spent by Bayesian method in database 1, database 2 and database 3 was 4.48s, 6.74s and 10.33s respectively.

According to the data, SVM took less time than DT and Bayesian methods in both test sets and training sets, and DT took the most time.

III. B. Questionnaire Evaluation

In this paper, 200 junior English majors from a university were selected, and 200 questionnaires were distributed, retrieved and valid.

Table 2 is the relevant survey data on the evaluation of the subjects' English translation ability.

Table 2: Evaluation of their English translation ability

Capability evaluation	Number of people	Percentage
Very strong	12	6.00%
Relatively strong	35	17.50%
Commonly	85	42.50%
A little weak	42	21.00%
Very weak	26	13.00%

Table 2 shows that 12 students thought their English translation ability was very strong, accounting for 6.00%; there were 35 students who thought their English translation ability was relatively strong, accounting for 17.50%; 85 students thought their English translation ability was average, accounting for 42.50%; 42 students thought their English translation ability was a little weak, accounting for 21.00%; there were 26 students who thought their English translation ability was very weak, accounting for 13.00%. It can be concluded from the data that the overall English translation ability of the subjects investigated in this paper was not quite strong. It can be seen that the skills of English translation can be further studied.

Figure 6 shows the relevant data survey of satisfaction with the use of SVM, DT and Bayesian methods.

(a) SVM

(b) DT

(c) Bayesian method

Figure 6: Satisfaction with use evaluation

According to Figure 6 (a), 38 students were very satisfied with SVM, accounting for 19.00%; 142 students expressed satisfaction, accounting for 71.00%; 18 students expressed dissatisfaction, accounting for 9.00%; 2 students were very dissatisfied with the method, accounting for 1.00%.

According to Figure 6 (b), 17 students were very satisfied with DT, accounting for 8.50%; 108 students expressed satisfaction, accounting for 54.00%; 60 students expressed dissatisfaction, accounting for 30.00%; 15 students said they were very dissatisfied, accounting for 7.50%.

According to Figure 6 (c), 21 students were very satisfied with Bayesian method, accounting for 10.5%; 116 students expressed satisfaction, accounting for 58.00%; 52 students expressed dissatisfaction, accounting for 26.00%; 11 students said they were very dissatisfied, accounting for 5.50%.

To sum up, the research objects surveyed in this paper had the highest satisfaction with SVM, followed by Bayesian method, and finally DT. This is consistent with the experimental data. It can be seen that the English translation based on SVM is effective.

III. C. Exploration of Translation Skills

Relevant studies have shown that bilingualism would bring costs to language processing, but it is good for word learning. The advantages of bilingualism in vocabulary learning depend on the learning of the dominant language, because the learning of the dominant language can enable bilinguals to master the regulatory skills conducive to learning [14]. It can be seen that bilingual learning also has an impact on English learning and translation. The selection of language translation tools is also very important. A correct translation tool is very helpful for English translation [15].

Translation is a kind of language practice that reappears another language form in one language form. Most of the sentences in the English translation are long sentences, and the sentence structure is relatively complex. Therefore, attention should be paid to the differences of languages in the translation process to achieve the purpose of translation and transmission. If translator only pursue the correspondence in the meaning of words, and translate verbatim or hard, the translation would become rigid.

The translation skills of English coordinate structure transposition word order can start from the following points shown in Figure 7.

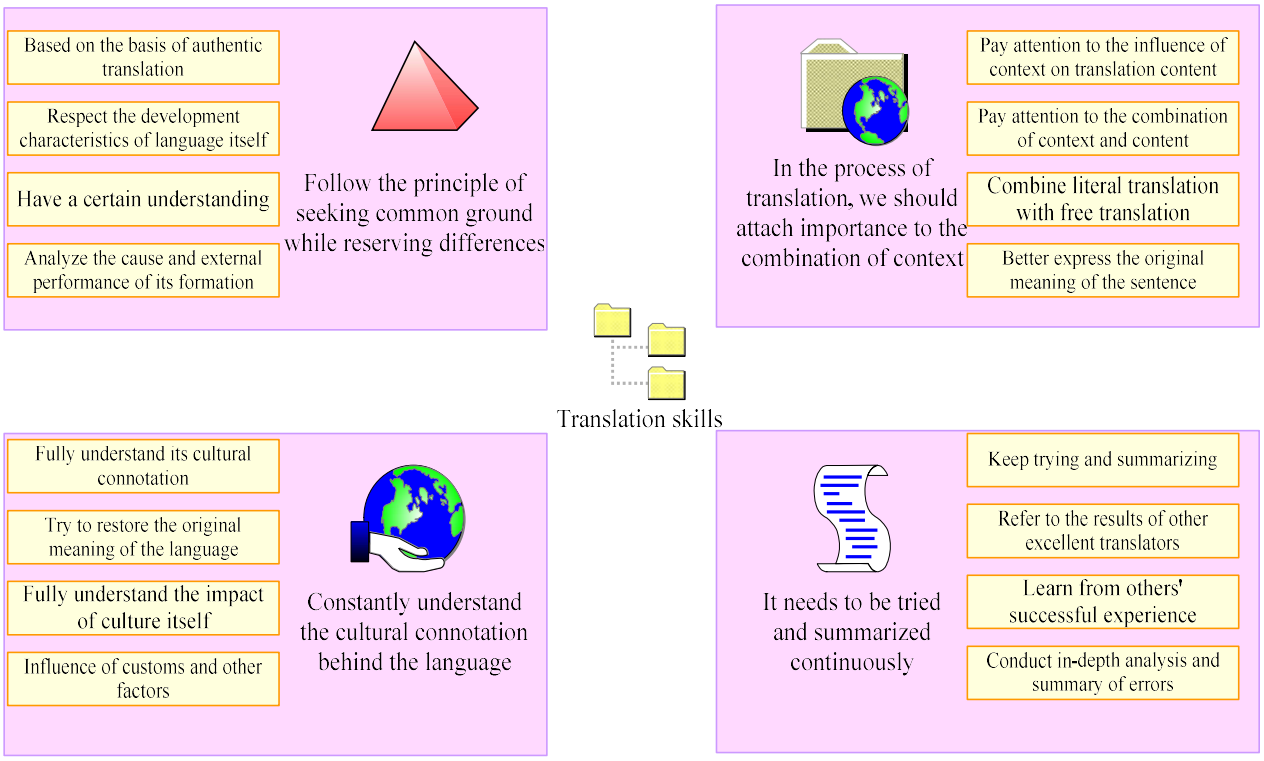


Figure 7: Translation skills of English coordinate structure transposition word order

(1) Following the principle of seeking common ground while reserving differences

No matter which language it is, it has gone through a long development and has formed distinctive characteristics. Therefore, in English translation, these characteristics must be understood and respected, especially in word order translation, the principle of “seeking common ground while preserving differences” needs to be followed. To achieve this goal, the following measures can be taken: first, the principle of “authenticity” should

be followed in English translation. However, in order to correctly understand the juxtaposition of different language sequences, it is necessary to better respect their own developmental characteristics under the premise of "authenticity", so as to truly achieve the purpose of translation. Secondly, before English translation, it is necessary to have a basic understanding of the word order of the coordinate structure, and make a thorough analysis of its causes and external manifestations, so as to better deal with similar problems in the process of translation and better complete English translation.

(2) Constantly understanding the cultural connotation behind the language

As far as English is concerned, because language is gradually developed in the process of continuous development, many languages have certain cultural significance. A deep understanding of the cultural meaning behind the juxtaposition structure is necessary for better translation. To achieve this goal, it is first necessary to conduct an in-depth analysis, which requires not only a comprehensive dissection of its grammar and semantics, but also a deep understanding of the cultural connotations it contains. This would enable them to be better integrated into the culture of the language itself when translated, and to restore the meaning of the original as much as possible. Secondly, to better understand the juxtaposition structure in English translation, it is necessary to have a comprehensive understanding of its implications, which should take into account both cultural influences and customs, etc.

(3) Paying attention to the integration with the context in the process of translation

No language can be isolated, and it must have a specific linguistic context. Therefore, in English translation, to better realize the sequence of parallel structure, it is necessary to pay attention to the influence of the context on the translation. To achieve this goal, attention must first be paid to combining the content of the text and the content of the translation, so that they become an organic whole. Secondly, the translation of parallel structure in English should achieve the organic unity of direct translation and meaning translation, so as to make the translation fluent and to make the original meaning of the sentence fully expressed.

(4) Need for continuous experimentation and summary

Translation of English parallel structure is an experienced and fundamental task, so it should be constantly summarized and tried in translation. First of all, in English translation, one should fully refer to the achievements of other excellent translators and learn from the successful experiences of others. This is a good guide for translators' translation work, and it promotes the parallel structure in English translation. Secondly, there are some mistakes in the translation of English coordinate structures. The juxtaposition structure in English should not be avoided, but should be deeply analyzed and summarized. It is necessary to find out the reasons for their creation and record them carefully, so that such problems can be avoided to be repeated in future translations. By practicing and summarizing over a long period of time, translators can accumulate more experience in translating parallel structures in English, so that they can better complete the corresponding translation tasks.

IV. Conclusions

With edge computing, related efforts can process data faster, eliminate delays, and provide information that helps make better maintenance decisions. In this case, the integration of edge computing will help organizations more actively ensure the efficiency of their systems and greatly reduce maintenance costs. In the cloud computing center, it can provide more powerful data analysis support, such as predictive maintenance support, and take the initiative to carry out equipment maintenance in advance. In recent years, due to the rapid development of NLP technology and its various advantages in real life, many researchers are trying to apply it to translation. The coordinate structure transposition word order in this paper is a good attempt in this respect. This paper held that it is a common phenomenon for coordinate structure transposition word order in the process of translation. There are also some defects in this paper. For example, in the analysis of the coordinate structure transposition word order, there is no detailed study on the transformation of coordinate structure into sentence patterns of common language. In the field of NLP, the quality of translation can be effectively improved by adjusting the parallel structure with statistical models. However, since this paper only analyzed from the perspective of NLP, there are still some deficiencies in the source of corpus and sample size. At the same time, due to the complexity of the parallel structure, its particularity should be fully considered, and its advantages should be fully played in the analysis.

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