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Intelligent Translation Method for English Multimedia Based on Blockchain

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Abstract: The increasing popularity of computers and the high development of network technology make the use of computer technology in English translation more and more widely, especially in language intelligent translation, the application of multimedia technology can accommodate multi-type and multi-capacity information. The English multimedia intelligent translation method makes full use of the latest computer technology, network technology, multimedia technology, etc., so that English translation can cross the constraints of time and space, with great flexibility and interactivity. Making the presentation of translated materials more flexible and vivid is the most powerful tool to support the new translation model. It fundamentally changes the traditional translation method and provides new and efficient technical means for modern language translation. Blockchain technology is a new type of technology, which brings new opportunities for intelligent translation. This paper combined intelligent semantic ranking management with semantic association rule mining method, and analyzed three interactive English intelligent translation methods in detail. And it emphasized the important goal of interactive design, fully considered user experience factors, and conducted performance tests in an interactive English translation system. The experimental results show that compared with the traditional English machine translation method, the accuracy and recall rate of the English multimedia intelligent translation method are relatively high. At 100 iterations, the accuracy rate reaches 100%, and the recall rate reaches 92%, showing good translation performance.

1. Introduction

With the rapid development of science and technology, modern society has entered the information age from the entrepreneurial age, and international exchanges and cooperation have become increasingly frequent. China's economy, culture and education are developing in the direction of internationalization and globalization. To achieve this goal, as an important medium or tool, it must rely on the communication role of foreign languages. Therefore, the English translation process is also a necessary key step. With the rapid growth of China's economy and the continuous enhancement of China's national strength, Chinese is becoming a powerful new language and has attracted worldwide attention. At present, the problems faced by Chinese information processing are not only the only common problems faced by any other natural language processing, such as

difficulty in recognizing new words and eliminating the possibility of polysemy. There are also individual concurrency issues with Chinese processing, such as automatic word segmentation as Chinese words. Therefore, in a sense, Chinese information processing is more difficult, and there are still many technical problems in Chinese-English machine translation research, which cannot meet people's needs at present.

This paper focuses on the user-centered human-computer interaction design principle, with blockchain technology, and highlights the "humanization" factor in the interaction design, with the leading idea of improving user experience. This paper analyzes the human-machine interactive English translation service process in detail, and adopts a hybrid translation method based on the rule-based machine translation method and the corpus-based machine translation method. Considering the accuracy of the translation results, we have added the C-value phrase table filtering method and the statistical-based manual scoring method to the translation model, so that the performance of the system has further evaluation criteria and room for improvement.

2. Related Work

Wei W's article focuses on situational awareness in intelligent human-computer interaction for critical decision-making (HCI). Human-computer interaction is considered an innovative field that focuses on various interactions between humans and machines. Human-computer interaction has been widely used in several fields, such as artificial intelligence, computer vision, image and multimedia analysis, and cognitive and behavioral sciences. The purpose of human-computer interaction is to make computers smart by receiving sufficient knowledge about the environment in which they are deployed, and to reduce human intervention in decision-making. This enabled the development of high-end computers to be aware of context and to make intelligent decisions based on the context. The situational awareness of intelligent human-computer interaction will determine the success and application of this solution in real-world settings. The aim is to provide a platform for situational awareness in intelligent human-computer interaction for time-critical decision-making [1]. Computer-aided translation (CAT) based on multimedia interaction is an efficient method for translating a large number of multimedia applications. Wu H proposed a semi-automatic evaluation method for machine translation systems based on fuzzy mathematics. Firstly, the characteristics of multimedia CAT software are discussed. Only by combining CAT teaching based on multimedia interaction with traditional translation teaching, can the purpose of translation teaching be better achieved and the quality and English level can be improved [2]. Lu L explored user interest inference by extracting effective browsing features from human-computer interactions scrolling on smartphones. Experimental results show that I^3 achieves an overall accuracy of 92.4% in terms of interest inference [3]. The extensive application of information technology and network technology in automobiles has brought about great changes in the way of human-computer interaction. Jianan L studied the impact of human-computer interaction modes based on physical interaction, touch screen control interaction, augmented reality, voice interaction and somatosensory interaction on driving safety, comfort and efficiency [4]. L Rodr ǵuez-Mazahua proposed an active set of rules for dynamic vertical partitioning in multimedia databases. The results show that DYMOND improves the query performance of multimedia databases [5]. Liu K introduced the general pipeline of AI-assisted tools. For the above applications, he introduced four representative tools used in Alibaba Group. Through these tools, the value brought by the combination of multimedia content design and artificial intelligence technology has been well proven in business. This reflects the huge role that artificial intelligence technology plays in facilitating the production of multimedia content [6]. Zhang X started from the influence of cultural background on Chinese-English translation, combined with practical work experience, discussed the

cultural background in Chinese-English translation, as well as the understanding and practice of translation activities from the perspective of cultural translation [7]. The above studies have carried out a detailed analysis of the application of human-computer interaction technology and English translation. It is undeniable that these studies have greatly promoted the development of the corresponding fields. We can learn a lot from methodology and data analysis. However, there are relatively few studies on multimedia English translation in the field of intelligence, and it is necessary to fully apply these algorithms to the research in this field.

3. The Combination of Human-Computer Interaction and Intelligent Translation of English Multimedia under Blockchain

A smart contract is a type of computer code designed to digitally verify, facilitate, or achieve the negotiation and performance status of any contract. Smart contracts allow for trusted transactions without a third party. All transactions can be tracked, but cannot be reversed. In the future, smart contracts may be implemented in the translation industry.

With the advancement of computer technology and the rapid development of natural language processing technology, it is a general trend to use computer program translation instead of simple English translation to help people quickly acquire foreign language information [8]. In this case, the amount of data that needs to be translated is so large that it is necessary to switch to a machine translation program to ensure correct translation. In recent years, with the research of artificial intelligence and the widespread use of intelligent systems, the issue of machine translation technology has become a key factor in the entire research field.

Under the background of frequent international exchanges, based on the rapid development of computer and Internet-related technologies, the application of translation technology has also made great progress. Machine translation is the use of computers to translate between different languages. It is divided into rule-based machine translation method and text corpus-based rule machine translation method. The combination of the two methods is also a perfect match to complement each other's strengths [9].

An interactive machine translation system consists of a complete machine translation system and an interactive platform [10]. The system provides reference translations to translators before translation, and translators understand and analyze the source language according to their own language knowledge, and select and verify reference translations. If there is an error in the translation, the translator can directly modify it in the translation, and the system will re-decode according to the content modified by the translator and find a matching translation [11]. The system re-decodes the translation based on the modifications made by the translator and searches for compatible translations. Currently the most widely used interactive machine translation methods employ prefixes as unique constraints. This method allows the translator to choose the longest correct prefix to guide the translation and decode the input characters into new prefixes. The translation system looks for a new translation suffix based on the prefix, and the translator and the translation system continue to communicate with each other until the correct translation is obtained and the translation is complete [12].

Semantic features should be analyzed before English translation. Combining intelligent semantic ranking management with semantic association rule mining method improves the intelligence level of language translation [13]. Assuming that the text distribution matrix of the sentence to be translated is $T_{N+1}:T_{N+1}$, the semantic heterogeneity is characterized by the similarity representation method, and the similarity $Sim(X,Y)$ is calculated. The result is:

$$Sim(X,Y)=E_{Rx}(m)+mE \tag{1}$$

Among them, d is the correlation dimension information in the ontology map, the reliability confidence factor of multimedia intelligent translation is represented as E, and the ontology structure analysis is carried out.

Using the above results on the semantic features of translation in the case of non-regular inter-class evaluation, we assume that the language evaluation set $W \in [0,T]$ of the translation system is the set M that satisfies the rule vectors. The number of elements X of the two ontology segments represented by the evaluation set M: $C * C'$ (rel) the semantic feature vector W is represented by the following function Δ:

$$\Delta(W) = \begin{cases} m_k, K = round(W) \\ a_k = W - k, a_k \in [-0.5, 0.5) \end{cases} \tag{2}$$

In the above formula, round is the feature set of semantic mapping between ontologies, which is represented as BinarySplits vector. The semantic ontology structure mapping method is used to control the semantic information screening in the process of machine translation, build an expert semantic database, and combine the analysis of the semantic concept tree with the construction method of characteristic subject words [14].

Statistical machine translation refers to the use of statistical knowledge to find the best translation C with the highest probability in the target language given the source language E. Its expression is shown in formula (3).

$$\hat{C} = \arg\max_{C} \Pr(C \mid E) \tag{3}$$

Formula (3) is transformed via Bayes' rule into:

$$\hat{C} = \arg\max_{C} \Pr(C) \cdot \Pr(C \mid E) \tag{4}$$

Among them, $f_i(C, E)$ represents a model, N is the number of all models, and α_i is the weight of the model. Using a log-linear model can improve the translation quality of the translated text by assigning different weights to the sub-models to adjust the contributions of different models. At the same time, the structure of the log-linear model does not limit the number of sub-models, and the sub-models can be added, deleted or modified at any time according to the needs [15]. Interactive machine translation is based on machine translation. The translation system searches for qualified translation suffixes according to the source language and the prefix constraints specified by the translator. The framework of interactive machine translation can be obtained by making appropriate changes to the machine translation framework. Its formula is shown in formula (5) [16].

$$\hat{C}_E = \arg\max_{C_E} \Pr(C_E \mid C_m, E) \tag{5}$$

Meanwhile formula (5) can be written as:

$$\hat{C}_E = \arg\max_{C_E} \Pr(C_m, C_E \mid E) \tag{6}$$

After Bayes rule, it can be converted to

$$\hat{C}_E = \arg\max_{C_E} \Pr(E \mid C_m, C_E) \cdot \Pr(C_E \mid C_m) \tag{7}$$

In the above formula, $\Pr(C_m)$ is input by the translator and does not depend on C_E, so it is omitted [17]. Compared with statistical machine translation, the prefix-based interactive machine translation method allows translators to participate in guiding machine translation decoding through the interactive interface between the translator and the system. It makes full use of the translator's linguistic knowledge and combines the translator's accuracy with the high efficiency of the machine translation system [18].

(1) Interactive English translation method based on word graph

The word graph, the word hypothesis graph, is a directed acyclic graph composed of all possible translations corresponding to the source language, consisting of nodes and edges. Multiple nodes in the graph represent different translation hypotheses, and the edges between nodes represent all possible words in the target language. The translation probability computed from the language model and translation model is the weight on each edge [19].

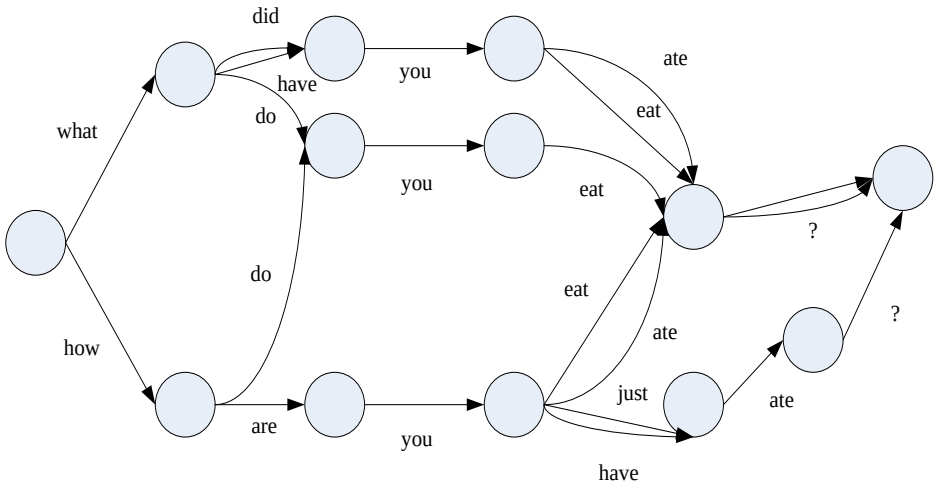

Figure 1: Example of word map-based interactive English translation

Figure 1 is a complete example of translation based on word graph. At the beginning of translation, the system loads all possible target translations for each word in the source language "What did you just eat?", and generates a word graph of the sentence [20]. The translator accepts or modifies the translation during the interaction with the system, and the system expands the nodes in the word graph and re-searches the path according to the translator's operation. The path with the highest score among the matching paths is selected as the new target translation, and the translation ends when all translation options are covered. Figure 2 shows the interactive English translation service process [21]. In the search process based on word graph, the system needs to use a heuristic function to calculate the scores of the expanded nodes and nodes to be expanded, and select the translation path with the highest score [22].

In the word graph-based interactive machine translation method, the system does not need to regenerate a new word graph according to each feedback from the translator, but only needs to generate a word graph for the source language once at the beginning of translation. Every subsequent interaction is performed on this word graph [23]. Word graphs are easy to obtain and only need to be generated once, so the search efficiency achieved by word graphs in interactive machine translation is very high. At the same time, each calculation result in this method can be used directly in subsequent calculations, so the computational cost is very small [24].

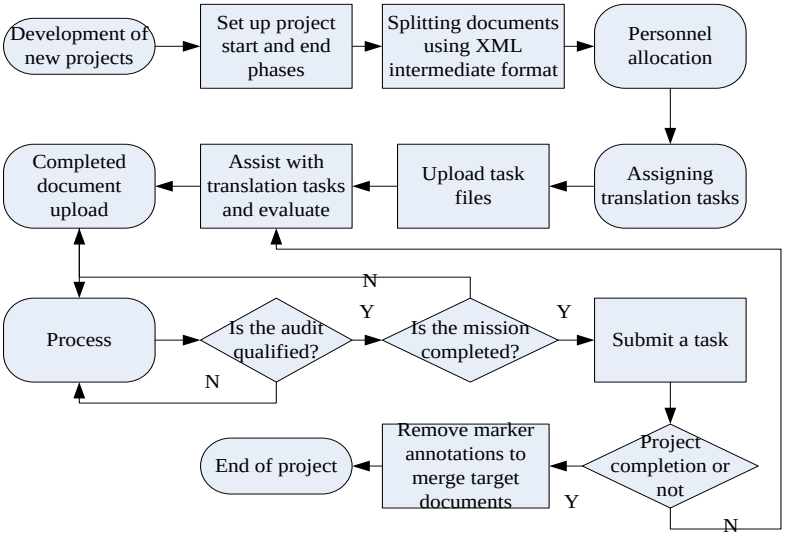

Figure 2: Interactive English translation service flow

(2) Interactive English translation method based on finite state transition machine

The stochastic finite state transition machine is a finite state network marked by the source string, the target string and the transition probability. The goal of machine translation is to find a target language sentence with the highest probability given the source language [25].

$$\hat{C} = \arg\max_{C} \Pr(C \mid E) = \arg\max_{C} \Pr(C, E) \tag{8}$$

The joint probability distribution $\Pr(C, E)$ in it can be modeled using a finite state machine:

$$\hat{C} = \arg\max_{C} \Pr(C, E) \approx \arg\max_{C} \Pr_{T}(C, E) \tag{9}$$

At present, the application of finite state transition machine has been very mature, and it can be effectively used in various machine translation tasks. In finite state transition machines, the more common optimal path search problems are Viterbi algorithm and recursive enumeration algorithm. By appropriately modifying the search strategy in statistical machine translation, stochastic finite state machines can be applied to interactive machine translation. The variable C_m is introduced to represent the prefix fed back to the machine translation system by the translator, and under the action of the stochastic finite state transition machine T, an optimal translation suffix C_E that matches the prefix C_m is searched.

$$\hat{C}_E = \arg\max_{C_E} \Pr(C_E \mid E, C_m) = \arg\max_{C_E} \Pr(C_E C_m, E) \approx \arg\max_{C_E} \Pr_{T}(C_m C_E, E) \tag{10}$$

4. Experimental Study on Intelligent English Multimedia Translation Method Based on Blockchain and Human Machine Interaction

Blockchain technology can record transaction information and historical data by creating a jointly maintained, untampered database that is distributed, open and transparent, and does not require a central trust authority.

Table 1 is the running environment configuration of the experiment in this paper.

Table 1: Experimental environment configuration

Hardware System	CPU	I5-2400 3.1 GHz
	Memory	6G
	Hard Disk	500G
Software Environment	Operating System	Windows7
	C/C++ Compilers	VS2010

This paper uses a multimedia intelligent translation system for human-computer interaction in embedded industrial control systems. The system is mainly composed of information processing module, AD module, DMA controller and output module.

5. Results of English Multimedia Intelligent Translation System

Using 10,000 sentence pairs of Chinese-English training corpus and 500 sentence pairs of test corpus, GIZA++ is used to train bidirectional word alignment and translation models. The SRILM tool builds a tri-gram grammar language model, the Moses toolkit trains and decodes the generative model, and the mtwval toolkit performs BLEU scoring on the experimental results. We incorporate a C-value phrase table filtering method and a statistical-based manual scoring method into the translation model. The traditional Chinese-English machine translation system without manual scoring and the experimental results after the system improvement are shown in Table 2:

Table 2: Comparison of experimental results

Translation System	Conventional machine translation systems	Multimedia Intelligent Translation
Number of phrases(million)	132	125
Number of long sentences(million)	110	92
BLEU-4	0.23	0.35

Experiments show that, to improve the traditional statistical machine translation system, a translation model is constructed by combining the C-value algorithm based on phrase statistics machine translation phrase pair list filtering and the statistical method of manually scoring candidate translations. Considering the reliability of phrases, and due to the influence of subjective and objective factors in manual evaluation, the evaluation is often unreasonable, and statistical methods are used to make the translation quality higher and closer to the level of human translation. The number of people evaluated determines the fluctuation of translation quality. The more number of people, the more accurate the quality of translation.

As shown in Figure 3 and Figure 4, the test results of the accuracy and recall rate of the system designed in this paper in the realization of multimedia intelligent translation.

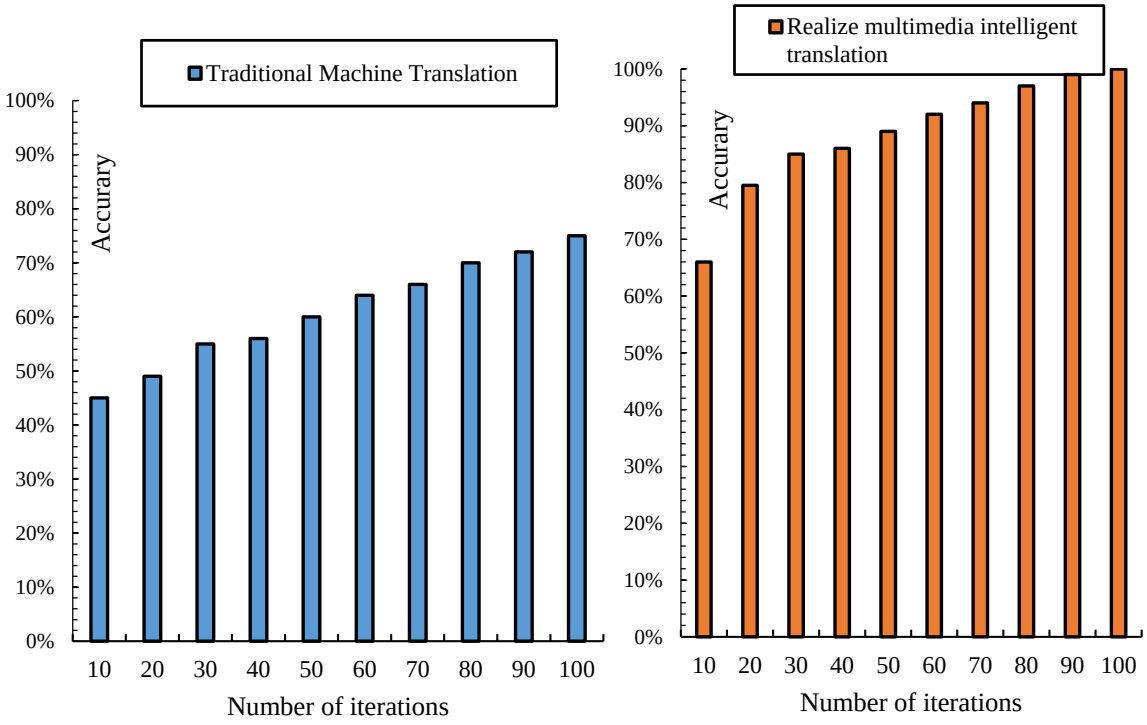

Figure 3: Accuracy in the system's English multimedia intelligent translation

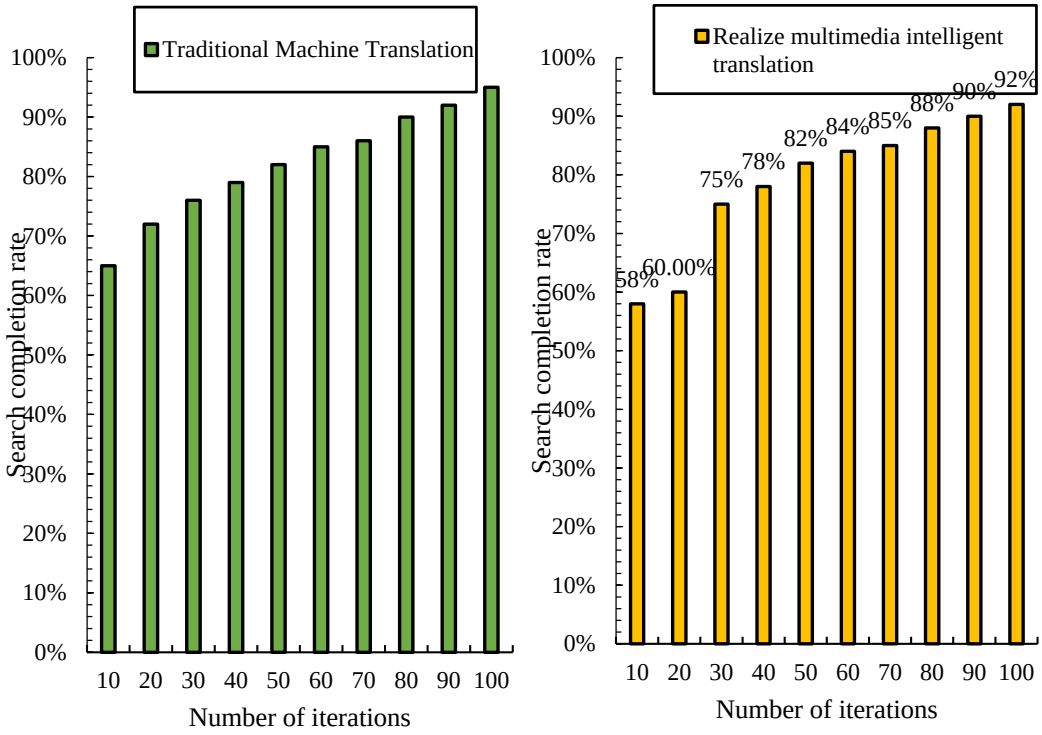

Figure 4: Check-all rate in the system's English multimedia intelligent translation

It can be seen from Figure 3 and Figure 4 that the accuracy and recall rate of multimedia intelligent translation using the system in this paper increases with the increase of the number of iterations, and the highest reaches 100% when the iteration is 100 times. And the accuracy rate of intelligent translation of multimedia is always higher than that of human translation. Although the

recall rate of multimedia intelligent translation is lower than that of human translation, the gap between the two translation methods is relatively small, always maintained between 0-12%. Therefore, it can be considered that the system performance of multimedia intelligent translation is better.

Table 3 is the recall rate in English multimedia intelligent translation for different types of articles.

Table 3: Checking rate in English multimedia intelligent translation for different types of the articles

	Technology Articles	Literary works	Entertainment Articles	Travel Articles
50	59%	60%	60%	65%
60	66%	68%	67%	71%
70	70%	69%	75%	78%
80	72%	75%	84%	85%
90	73%	76%	86%	89%
100	84%	79%	89%	90%

It can be seen from Table 3 that the recall rate of text translation for tourism is the highest overall, and the recall rate reaches 90% when iterating 100 times.

6. Conclusion

Blockchain has the characteristics of responsibility traceability, information fidelity, confidentiality protection, group response, and distributed decision-making, which is highly consistent with the logical scenario of English multimedia intelligent translation. With the advent of the information age, the way of communicating information in English has become more flexible and richer. Furthermore, the dynamics of global communication and the development of information exchange have allowed to manage good translation between languages in the general demands of time. Future computer systems will further emphasize the importance of "people-oriented" and "cultural collision" to achieve effective human-computer interaction and collaboration. The translation problem is a visionary and intellectual one. Simply put, translation is the practice of using one language to provide a complete and accurate translation of content in another language. Translation, whether it is Chinese to foreign language or foreign language to Chinese, is inseparable from two basic factors, namely understanding and expression. Therefore, both the human evaluation of the translation process and the testing of the translation results are necessary. The interaction of human intervention and machine translation, to varying degrees and places, can reduce the bounding space of translation and grammar, and greatly improve the reliability and efficiency of machine translation results.

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