International Journal for Housing Science and Its Applications
Publish August 6, 2025. Volume 46, Issue 3 Pages 8891-8899

https,//doi.org/10.70517/ijhsa463761

English Translation Retrieval Algorithm Based on Data Evaluation Depth Image and Fusion Differential Evolution Algorithm

Xiaojing Dong[1] and Li Yuan[2,*]
[1] Jilin Engineering Normal University, Changchun, Jilin, 130000, China
[2] Northeast Normal University, Changchun, Jilin, 130000, China
Corresponding authors: (e-mail: peteryuan2024@126.com).

Abstract International communication has become more and more frequent. English Translation (ET) retrieval can be used in various directions, providing people with more convenient communication, which is a very important way. However, the traditional ET retrieval is too complex, slow and inflexible, which makes it very inconvenient. The depth image was statistically analyzed by data analysis, and the accuracy of Differential Evolution (DE) algorithm was used for accurate translation retrieval. This article compared the ET retrieval based on data analysis depth image and fusion DE algorithm with the traditional ET retrieval. The results of the experiment showed that the average precision rates of the two literary ET retrieval methods were 76.8% and 69.8%, respectively; the average accuracy of the two non-literary ET retrieval methods was 71.3% and 63.1%. Therefore, depth image based on data analysis and fusion DE algorithm can enhance the accuracy of ET retrieval.

Index Terms English Translation, Data Analysis, Depth Image, Fusion Differential Evolution Algorithm

I. Introduction

The Internet has developed more rapidly. People can easily and effectively access information resources in various languages by using the Internet. Moreover, international trade has developed frequently. The circulation of people around the country has increased, and language exchange has become more important. The issue of ET and retrieval has gradually attracted people's attention. In the past ET retrieval methods, there are often many small problems. The translation content is too complex, not accurate, and slow, which brings people a bad sense of experience. These problems greatly affect people's communication and learning, so it is very important to optimize the translation retrieval algorithm. Therefore, this article focuses on the ET retrieval algorithm, and optimizes the ET retrieval algorithm through data analysis depth image and fusion DE algorithm, hoping to effectively improve the efficiency of ET retrieval, make it more accurate and flexible, and improve the shortcomings of previous methods.

The development of economic globalization has made multilingual communication more frequent. As an international language, translation has attracted more attention. More and more people have studied ET. Simanjuntak Marudut Bernadtua used ET technology to investigate a form of prayer. Translation technology is a method used by translators to solve the problem of transmitting messages from the mother tongue or first language to be translated. It can tell the essence of the native language or first language, and it is applied to the level of words, phrases, clauses or sentences [1]. Fan Angela has created a real many-to-many multi-language translation model, which can translate directly between any language. He has built and developed a training dataset, which was created by large-scale mining and contains parallel data in thousands of language directions [2]. De Vries evaluated the usefulness of machine translation for the word bag model (such as the topic model). He used the Europarl dataset to compare the terminology document matrix and the topic model results of the golden standard translation text and the machine translation text, and evaluated the results at the document and corpus level [3]. Ducar Cynthia found that Machine Translation (MT) is prevalent in language classrooms, but it is not popular. He discussed ongoing investigations into the usage of MT, highlighting the advantages and constraints of the technology. He also explored teaching solutions for the 21st century, and provided a place for future study to ensure that learners' academic growth conforms to the cross-cultural communication ability of ACTFL (American Council on the Teaching of Foreign Languages) [4]. Wu Di used a mixed-methods approach to collect both quantitative and qualitative data to survey the convictions and training behaviors of translator trainers across the Chinese setting. Analysis of questionnaire responses as well as interview and classroom observation data revealed differences in Chinese translator trainers' beliefs and training practices. The results found that translator trainees generally recognize the significance of all sub-competencies of translation competence [5]. Dijkstra T O N

has established a localization-connectism model, called Multilink. It integrated the basic assumptions of Bilingual Interactive Activation (BIA) plus and BIA+model (Revised hierarchical model), and simulated the recognition and production of homologous words (translation equivalents with similar forms) and non-homologous words of different length and frequency in tasks such as monolingual and bilingual vocabulary decision-making, word naming and word translation production. It also considered the influence of lexical similarity, homologous status, relative L2 proficiency and translation direction. Compared with BIA+model, Multilink has a higher correlation with empirical data [6]. These studies have enriched ET methods, but they have not yet been comprehensively studied.

Using the algorithm can better promote the efficiency of ET, and relevant researchers can use the algorithm to better solve ET retrieval problems. Xiaohui Tang has conducted in-depth research and analysis on the background elimination of English text using adaptive genetic algorithm, and designed the corresponding model. The curve result after initial characterization was bent and transformed by adaptive genetic algorithm [7]. Gu Shan has optimized the current computer-aided ET teaching. According to the cloud computing model, a new computer-aided translation system was designed to optimize English teaching. The experimental results showed that the new computer-aided translation system proposed in this article can not only achieve better translation performance, but also effectively and quickly realize the intelligent translation of memory-assisted long character English, with the characteristics of high data recall, high accuracy and high reliability. The system has good compatibility and can provide students with a better English teaching translation system, which is worthy of promotion and application [8]. Gusenbauer Michael investigated and compared the system search quality of 28 widely used academic search systems, including Google Scholar, PubMed and Web of Science. The research results were designed to support researchers to conduct better search to obtain better evidence synthesis [9]. These studies can provide some theoretical support for ET retrieval, but due to the complexity of the algorithm, there are still many algorithms that have not been studied.

In this article, the English retrieval is studied through the fusion DE algorithm based on the data analysis image. It is feasible to apply the data analysis depth image and the fusion DE algorithm to the ET retrieval. The text can be quickly recognized through the data analysis depth image, which is of great help to the research of the ET retrieval algorithm.

II. ET Retrieval Algorithm

ET has certain particularity and complexity. It is not a simple process of language conversion, but requires a deep understanding of local culture. In translation studies, academic research focuses on two aspects to deal with the concept of intertextuality: translation as intertextuality and intertextuality [10]. The structure of the translation flow chart is shown in Figure 1.

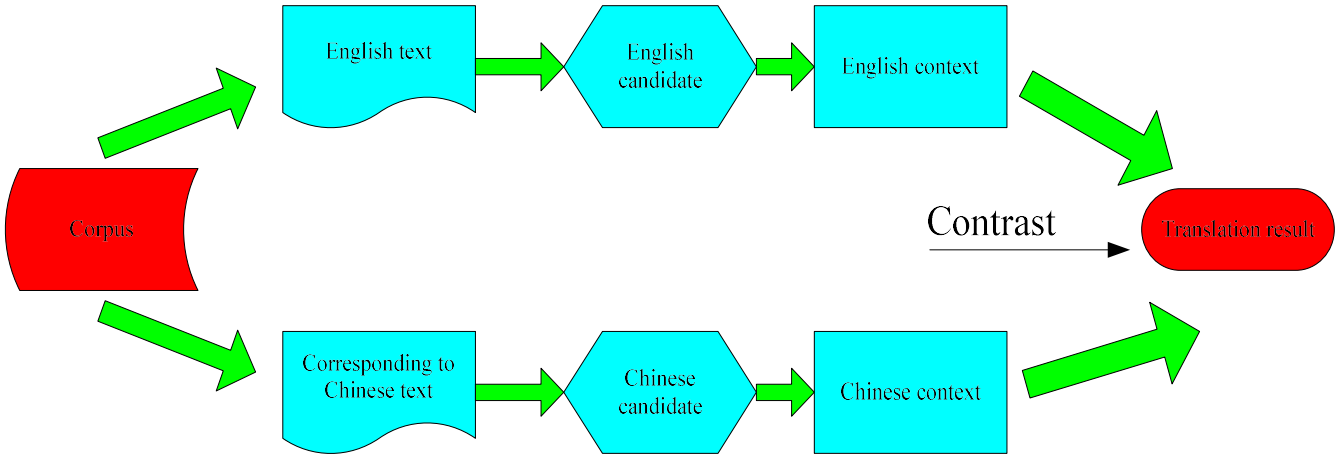


Figure 1: Translation flow chart

In Figure 1, the structural flow chart of ET is described. First, the relevant knowledge of translation is extracted from the aligned corpus, and then the corresponding language text is selected for candidate. Finally, the final translation result is output by calculating the similarity of context. This is a common process in knowledge ET.

After a long time of development and progress, ET has more and more methods, and the available tools are also improving. However, no matter how developed, its essence is to accurately translate English into other language expressions.

II. A.ET Retrieval

ET retrieval is to search out the translation results. Synonyms and polysemy are obstacles to retrieving relevant information, which reduce the recall rate and accuracy rate [11]. Accurate data analysis can make the retrieval more flexible, avoid the interference of synonyms and polysemy, and make the results more efficient. The structure of the retrieval flow chart is shown in Figure 2.

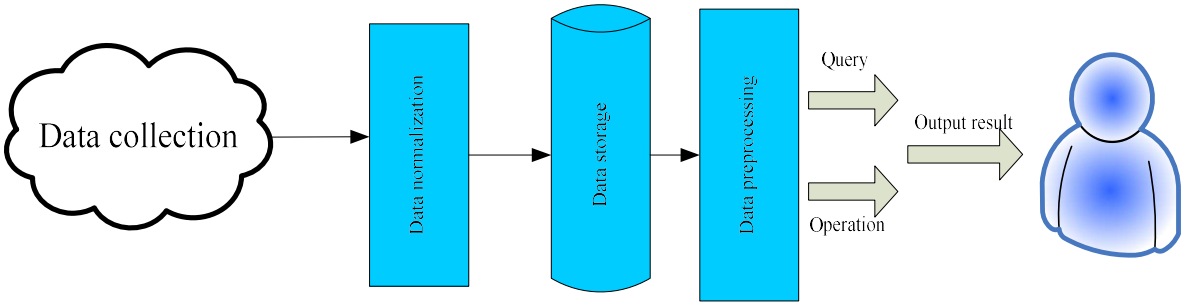


Figure 2: Retrieval flow chart

In Figure 2, the basic process of retrieval is described. At first, relevant data is integrated through data collection, and then normalized to compress space and reduce capacity. Then, the storage pretreatment is performed, and then the operation and query are performed to output the results to the user.

Search is to find out the relevant information needed from the specific demand information by using certain methods and means. ET search is to find out the results people need better and faster.

II. B.Data Evaluation Depth Image

Data analysis refers to the analysis and understanding of a large amount of data with appropriate methods, so as to play its maximum role. Many of the most popular data processing technologies include big data technology, including data mining, machine learning, artificial intelligence, data fusion, social networks, etc. Many people use big data analysis in various fields and have achieved great success. With the successful application of big data analysis in many fields, ET retrieval can also be carried out through big data [12].

A depth image can also be called a distance image. It is an image that can take the distance (depth) value of each point in the scene collected by the image collector as the pixel value. Through it, some problems in 3D object description can be solved easily and quickly. Some difficult to distinguish and extremely complex things in ET and retrieval can be identified using depth images.

The combination of data analysis depth image can analyze the relevant content data of the required text faster, and more convenient and efficient, and then conduct accurate data analysis and recognition, which can make ET retrieval more efficient and convenient.

II. C.Fusion DE Algorithm

DE is a population-based evolutionary algorithm. It has been used to solve diverse and exciting optimization problems in a variety of scientific and engineering subjects [13]. DE originates from genetic annealing algorithm and is also a very efficient global optimization algorithm. The flow chart structure of DE algorithm is shown in Figure 3.

As shown in Figure 3, the operation flow of DE algorithm is described in detail. After the initialization of parameters, the population can be initialized. If the conditions are met, the optimal solution would be output. If the conditions are not met, the three steps of mutation, crossover and selection would be carried out until the conditions are met.

DE algorithm is simple and effective. Since DE was proposed, it has been widely used to solve various complex optimization problems [14]. It has the advantages of high robustness and wide applicability. DE is not limited by the nature of the problem.

DE has many characteristics, such as simple structure, superior performance, strong adaptability, inherent parallelism and other advantages.

(1) The structure is simple and easy to implement. It is easy to carry out genetic operation mainly through differential mutation operator.

(2) The algorithm has good performance and high accuracy. It has good reliability, high robustness and efficiency.

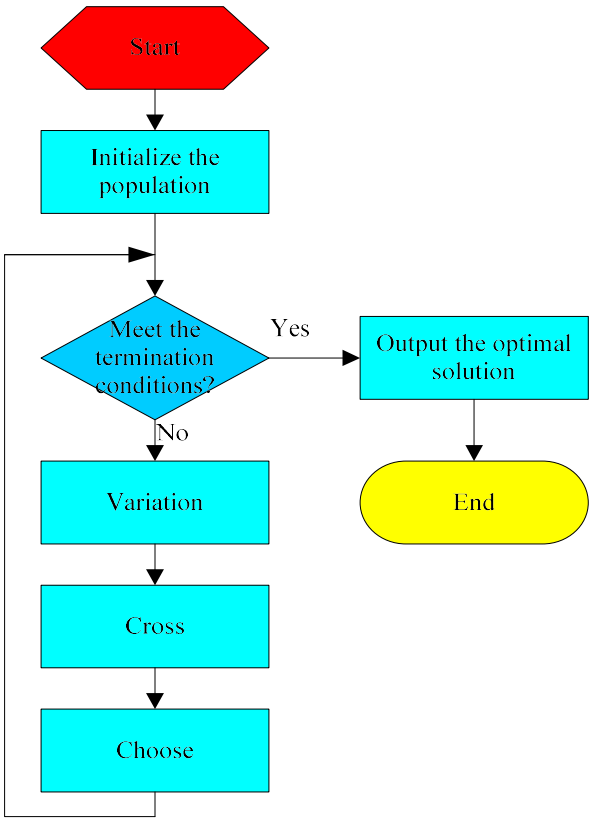


Figure 3: Flow chart of DE algorithm

(3) Strong adaptability: the difference mutation operator can be a constant or an adaptive ability with mutation step size and search direction, which can be unlimited.

(4) It has inherent parallelism and can be used for collaborative search. Under the same condition, the DE algorithm can have faster convergence accuracy.

In the DE algorithm, several parameters are more important. *F* represents mutation parameter; *Cr* represents cross probability; population size represents Np-th low-dimensional vector, and *D* represents individual dimension.

The text object that needs to be translated performs the steps of initializing parameters. During the initialization parameter processing, there are $\{M_x(0) \mid m_{x,y}^L \le m_{x,y}(0) \le m_{x,y}^K; x = 1,2,3...,NP; y = 1,2,3...D\}$. Among them, $M_x(0)$ is the x-th individual and y is the y-th dimension.

After that, the population is initialized, and the input text content to be translated and retrieved is processed. The processing process can be expressed as follows:

$$m_{x,y}(0) \mid= m_{x,y}^L + (m_{x,y}^K - m_{x,y}^L) \bullet rand(0,1) \tag{1}$$

Among them, $m_{x,y}^K; m_{x,y}^L$ represent the upper and lower bound, and $rand(0,1)$ represents the random number.

DE algorithm realizes individual mutation through differential strategy. After the text content initializes the population, the population mutation should be carried out. The specific mutation operation expression is as follows:

$$V_x(g+1) = M_{r1}(g) + F \bullet (M_{r2}(g) - M_{r3}(g)) \tag{2}$$

Among them, $r1 \ne r2 \ne r3$. They are random numbers, and the interval is $[1,\ NP]$.

The population crossover operation is to increase the diversity of the population, randomly select individuals, and generate them by probability. The expression is as follows:

$$U_{x,y}(g+1) = \begin{cases} V_{x,y}(g+1) & if rand(0,1) \le Cr \\ m_{x,y}(g) & otherwise \end{cases} \tag{3}$$

The greedy selection algorithm is used for population selection of mutated individuals [15]. When selecting individuals, people need to make the best choice in the current view, and choose the best one. The specific expression is as follows:

$$M_x(g+1) = \begin{cases} U_x(g+1) & if\ f(U_x(g+1)) \le f(M_x(g)) \\ M_x(g) \end{cases} \tag{4}$$

III. ET Retrieval Algorithm Experiment

III. A. Data Source

ET methods determine the accuracy of translation results to a large extent, so it is necessary to analyze the methods of ET. This article analyzed the factors affecting the development process of ET through online database. In order to make the survey data authoritative and accurate, the relevant methods in the database were statistically analyzed, mainly the main machine translation methods so far. The survey results of English machine translation methods are shown in Table 1.

Table 1: Methods of English machine translation

Serial number	ET method	TIME
1	Statistical machine translation	Before 2014
2	Neural network machine translation	After 2015

In Table 1, there were two indicators of the usage time of English machine translation methods, of which the statistical time of machine translation was 2014 and before, while the neural network machine translation was popular after 2015 and developed rapidly.

The use of retrieval algorithms has a very important impact on the efficiency of ET retrieval, so it is necessary to train and compare several methods of retrieval algorithms. In order to effectively analyze the help of various retrieval algorithms for ET retrieval, this article compared them through several experimental data. It mainly counted several common retrieval algorithms, and the survey results of ET retrieval methods are shown in Table 2.

Table 2: Comparison of retrieval algorithms

Serial number	Retrieval algorithm	Error rate
1	DE algorithm	0.2
2	Support vector machine	0.6
3	Simple Bayesian	0.8

In Table 2, the DE algorithm, support vector machine and naive Bayes were mainly compared. The error rate of DE algorithm was 0.2, and that of naive Bayes was 0.8. Therefore, DE algorithm was of great help to improve the efficiency of ET retrieval algorithm.

III. B. Experimental Design of ET Retrieval Algorithm

The ultimate purpose of using ET retrieval algorithms is to improve the efficiency of translation. Therefore, using algorithms for ET retrieval is beneficial to improve the use of ET retrieval. In order to accurately analyze the effect of depth image based on data analysis and fusion DE algorithm, this article would compare and analyze with traditional ET retrieval methods.

The ET retrieval method based on the depth image of data analysis and the fusion of DE algorithm recognizes the text through the depth image of data analysis, and uses the characteristics of DE algorithm to accurately perform translation retrieval, which is recorded as DE algorithm. The traditional ET retrieval method is recorded as the traditional method.

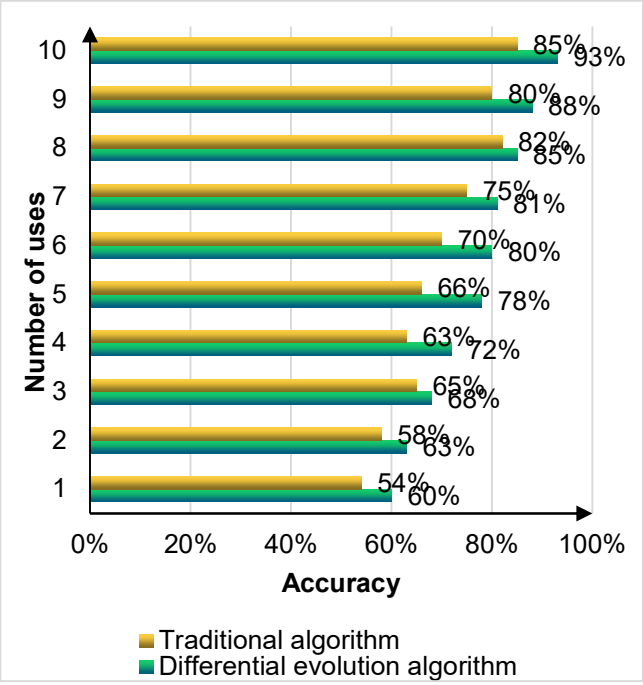
In order to make a comprehensive comparison between the two kinds of ET retrieval, several tests would be conducted to obtain the result data of ET retrieval after use. The test set different times of use, and the times of use would increase by 10 times from 1 time. Different types of ET retrieval require different methods. This article selected literary ET retrieval and non-literary ET retrieval for experimental analysis.

IV. ET Retrieval Algorithm Results

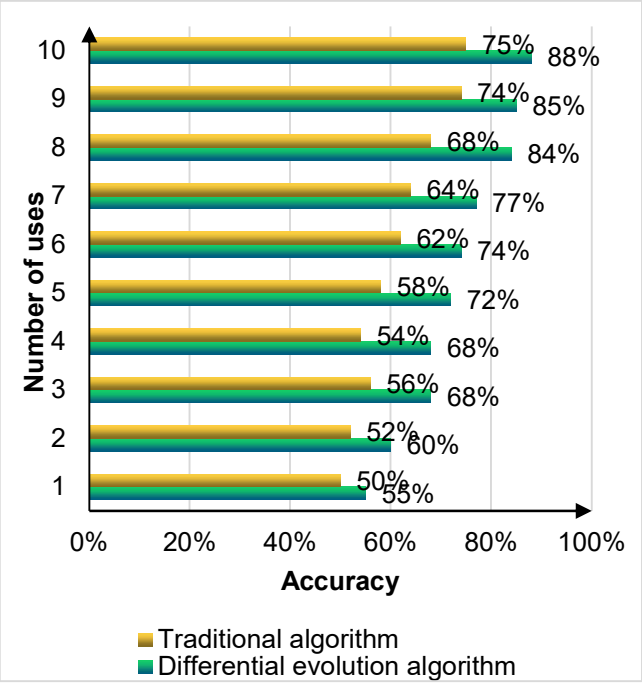
IV. A. Result Accuracy

ET retrieval algorithm is to better improve the accuracy of translation retrieval. When using this translation retrieval algorithm, people can get more accurate answers. The traditional ET retrieval method and the ET retrieval method

based on the depth image of data analysis and the fusion DE algorithm were compared and analyzed. Each time they were used, the accuracy of the answers would be calculated and compared. The accuracy of the two kinds of ET retrieval is shown in Figure 4.



(a) Comparison of literary translation accuracy



(b) Comparison of non-literary translation accuracy

Figure 4: Comparison of retrieval accuracy of ET

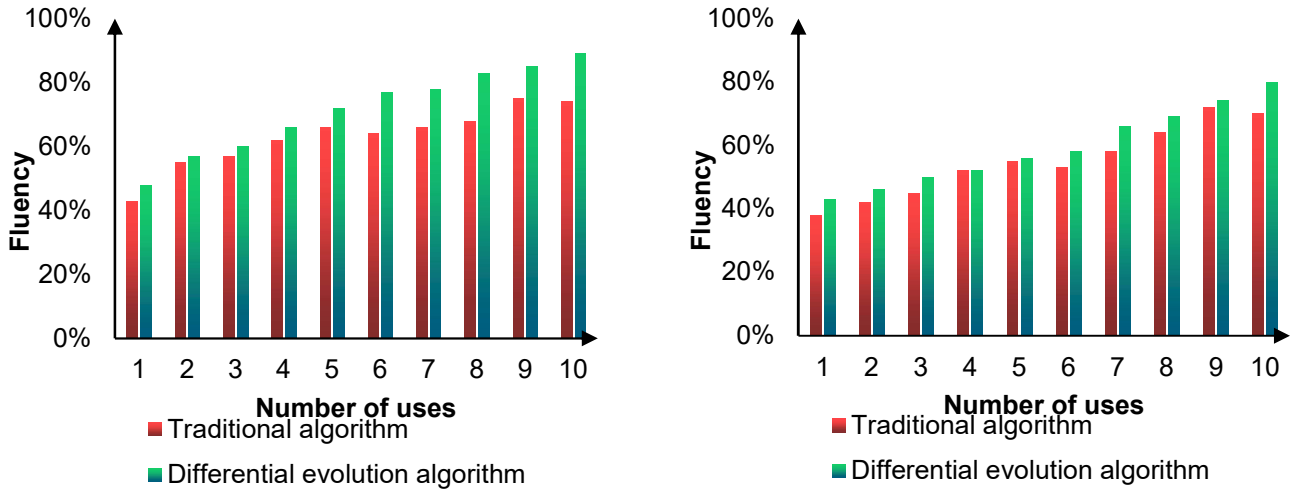
In Figure 4 (a), the comparison of the accuracy of the answers to literary translation retrieval between two ET retrieval methods was described. The traditional method grew slowly, with the highest accuracy of 85% at the 10th time and the lowest accuracy of 54% at the 1st time. Overall, the accuracy rate fluctuated. The accuracy rate of ET retrieval based on data analysis depth image and fusion DE algorithm was steadily improving, and the overall trend was increasing. At the 10th time, the accuracy rate reached 93%, and at the first time, it was the lowest, which was 60%.

In Figure 4 (b), the accuracy of non-literary translation was compared. Although the accuracy of traditional methods fluctuated, the overall accuracy was rising, with an average accuracy of 61.3%. In ET retrieval based on data analysis depth image and fusion DE algorithm, the accuracy rate of the answer was steadily improving, with an average accuracy rate of 73.1%. Therefore, the ET retrieval method based on data analysis depth image and fusion DE algorithm had higher accuracy.

IV. B. Use Fluency

When people use ET retrieval, they would first pay attention to fluency. ET retrieval can improve fluency in use through various methods. The fluency of literary ET retrieval and non-literary ET retrieval was compared, and the comparison results are shown in Figure 5.

In Figure 5 (a), the comparison results of two ET retrieval literature categories were described. Among them, the traditional method of ET retrieval fluctuated, reaching the highest when the number of times was 9, and the fluency was 75% at this time. The minimum fluency was 43% when the number of times was 1. In the depth image based on data analysis and the fusion DE algorithm, the smoothness was continuously improved. The fluency was the lowest when the number of times was 1, which was 48%; when the number of times of use was 10, the smoothness reached a maximum of 89%. In Figure 5 (b), the comparison results of the two ET searches in non-literature category were statistically analyzed. The smoothness of the traditional method was 38% at the lowest, and reached the highest when the number of times of use was 9. At this time, the interface beauty was 72%. In the depth image based on data analysis and the fusion DE algorithm, the smoothness has been improving, reaching a maximum of 80% when the number of uses was 10. Therefore, ET retrieval based on data analysis depth image and fusion DE algorithm can improve the smoothness of use.



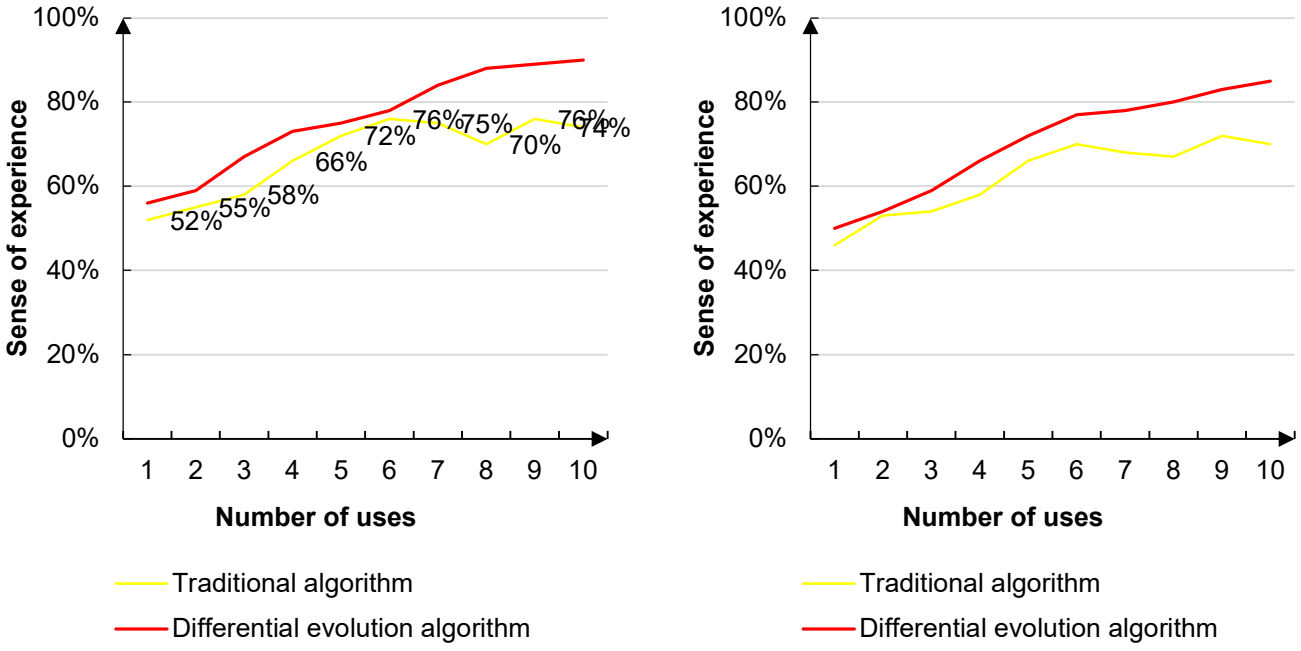
(a) Comparison of literary fluency

(b) Comparison of non-literary fluency

Figure 5: Comparison of ET and retrieval fluency

IV. C. Use Experience

In addition to providing people with correct results, the use of ET also needs to pay attention to the sense of experience when people use it. The higher the sense of experience when using ET retrieval, the better it is for people to use it. A comparative analysis of the experience of the two ET retrieval systems was carried out. The detailed comparison results are shown in Figure 6.



(a) Comparison of literary experience

(b) Comparison of non-literary experience

Figure 6: Comparison of ET and retrieval experience

In Figure 6 (a), the comparison of the use experience of literature in ET retrieval was described. Among them, the traditional method fluctuated greatly, and the sense of use experience reached the highest when the number of times of use was the sixth and ninth, which was 76%. The average sense of use experience during the experimental period was 67.4%. In the depth image based on data analysis and the fusion DE algorithm, the user

experience reached the highest when the number of times of use was 10. The user experience was 90%, and the average user experience was 75.9%. In Figure 6 (b), the comparison of the use experience of non-literary categories of two ET retrieval methods was analyzed. Among them, the use experience of the traditional method reached the highest when the number of times of use was 9. At this time, the use experience was 72%, and the average user experience was 62.4%. In the depth image based on data analysis and fusion DE algorithm, the average sense of use experience was 70.4%. Therefore, ET retrieval based on data analysis depth image and fusion DE algorithm can improve the experience of use.

IV. D. Method Practicability

ET and retrieval methods should be as practical as possible to reduce information that is not useful. ET retrieval should be concise, simple and intelligent. The practicability of the two methods of ET retrieval is compared and analyzed. During the experiment, the practicability is recorded with the increasing number of times, and the data highlights the comparison results of ET retrieval under the two methods. The practical comparison results of the two ET retrieval methods are shown in Figure 7.

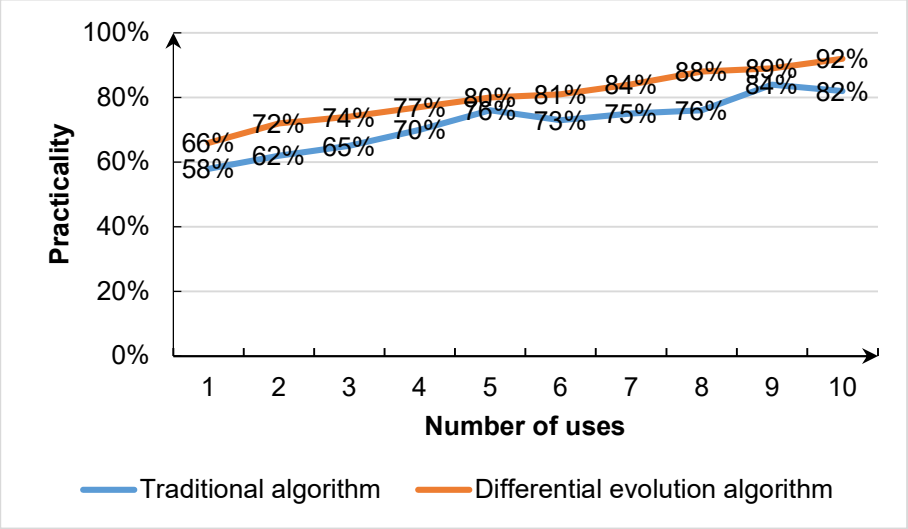


Figure 7: Comparison of the practicability of ET retrieval

In Figure 7, the comparison results of the practicability of the two ET retrieval methods were statistically analyzed. Among them, the practicability of the traditional method was the lowest when the number of times of use was 1. At this time, the practicability was 58%, reaching the highest level when the user used it 9 times, which was 84%; the average practicability was 72.1%. Generally speaking, the practicability was not stable. In the depth image based on data analysis and the fusion DE algorithm, the practicability was continuously improved, reaching the maximum of 92% when the number of times of use was 10, and the average interface practicability was 80.3%. Therefore, the practicability of ET retrieval can be improved through depth image analysis based on data and fusion DE algorithm.

V. Conclusions

English is used more frequently, and ET and retrieval is a very important method of communication, which is extremely important for people. In this article, data analysis depth image was used for statistical analysis of data, and it was accurately identified under the fusion DE algorithm. The main research direction of this article is the ET retrieval algorithm based on data analysis depth image and fusion DE algorithm, which compares and analyzes the traditional methods with it. The experimental results showed that the ET retrieval algorithm based on data analysis depth image and fusion DE algorithm can obtain more accurate, fluent, highly experienced and practical results. The optimization of ET retrieval algorithm can help people better communicate and learn. However, this article only compared the two kinds of ET retrieval in literature and non-literature, and the analysis of these fields was not comprehensive enough. Therefore, expanding the comparison in other fields would be the direction of future research.

Funding

A study on the path of college English Curriculum ideology and politics. Doctoral research start-up fund project of Jilin Engineering Normal University.(Project number: BSSK202301.)

References

[1] Simanjuntak, Marudut Bernadtua, Marthin Steven Lumingkewas, and Sutrisno Sutrisno. "ANALYSIS OF TANGIANG ALE AMANAMI (OUR FATHER) USING THE TECHNIQUES OF TRANSLATION." JOURNAL OF ADVANCED ENGLISH STUDIES 4.2 (2021): 70-75.

[2] Fan, Angela. "Beyond english-centric multilingual machine translation." The Journal of Machine Learning Research 22.1 (2021): 4839-4886.

[3] De Vries, Erik, Martijn Schoonvelde, and Gijs Schumacher. "No longer lost in translation: Evidence that Google Translate works for comparative bag-of-words text applications." Political Analysis 26.4 (2018): 417-430.

[4] Ducar, Cynthia, and Deborah Houk Schocket. "Machine translation and the L2 classroom: Pedagogical solutions for making peace with Google translate." Foreign Language Annals 51.4 (2018): 779-795.

[5] Wu, Di, Lawrence Jun Zhang, and Lan Wei. "Developing translator competence: understanding trainers' beliefs and training practices." The Interpreter and Translator Trainer 13.3 (2019): 233-254.

[6] Dijkstra, T. O. N., "Multilink: a computational model for bilingual word recognition and word translation." Bilingualism: Language and Cognition 22.4 (2019): 657-679.

[7] Xiaohui, Tang. "An adaptive genetic algorithm-based background elimination model for English text." Soft Computing 26.16 (2022): 8133-8143.

[8] Gu, Shan, and Xun Li. "Optimization of computer-aided English translation teaching based on network teaching platform." Computer-Aided Design and Applications 19.S1 (2021): 151-160.

[9] Gusenbauer, Michael, and Neal R. Haddaway. "Which academic search systems are suitable for systematic reviews or meta-analyses? Evaluating retrieval qualities of Google Scholar, PubMed, and 26 other resources." Research synthesis methods 11.2 (2020): 181-217.

[10] Aziza, Mirzaeva. "THE THEORY OF INTERTEXTUALITY AS A PARADIGM AND THE IMPACT OF THIS THEORY ON TRANSLATION." Eurasian Journal of Academic Research 2.5 (2022): 990-995.

[11] Azad, Hiteshwar Kumar, and Akshay Deepak. "Query expansion techniques for information retrieval: a survey." Information Processing & Management 56.5 (2019): 1698-1735.

[12] Zhu, Li. "Big data analytics in intelligent transportation systems: A survey." IEEE Transactions on Intelligent Transportation Systems 20.1 (2018): 383-398.

[13] Rauf, Hafiz Tayyab, Waqas Haider Khan Bangyal, and M. Ikramullah Lali. "An adaptive hybrid differential evolution algorithm for continuous optimization and classification problems." Neural Computing and Applications 33.17 (2021): 10841-10867.

[14] Li, Jiayi. "A simple but efficient ranking-based differential evolution." IEICE TRANSACTIONS on Information and Systems 105.1 (2022): 189-192.

[15] Binev, Peter. "Greedy algorithms for optimal measurements selection in state estimation using reduced models." SIAM/ASA Journal on Uncertainty Quantification 6.3 (2018): 1101-1126.