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Research on artificial intelligence machine translation based on BP neural algorithm

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Abstract

The primary focus of artificial intelligence advancement is in machine translation; nonetheless, a prevalent issue persists in the form of imprecise translation. The current challenge faced by artificial intelligence is to effectively executing machine translation from extensive datasets. This research presents a BP neural method that aims to repeatedly analyse translation data and achieve optimisation in machine translation. The findings indicate that the use of BP neural network may enhance the dependability and precision of machine translation, with an accuracy rate over 84%. This performance surpasses that of the online translation approach. Hence, it can be inferred that the use of BP neural algorithms has the potential to fulfil the requirements of machine translation and enhance the precision of online translation conducted by humans.

Keywords: BP nerve; algorithms; machine translation; Artificial intelligence

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1. Introduction

Certain researchers argue that machine translation represents a significant advancement in the field of artificial intelligence [1]. They contend that a thorough examination of machine translation material is crucial in order to facilitate the conversion of text across various linguistic styles [2]. Historically, the translation process had challenges like the presence of illogical translation material and a high frequency of error signals [3]. Currently, the field of artificial intelligence faces many challenges in the development of machine translation, including issues related to poor accuracy [4], significant discrepancies in translation content, and incomplete translation methodologies. Hence, several researchers advocate for the use of intelligent algorithms in the field of machine translation, with the aim of identifying mistake sources and enhancing the process of selecting the most optimal translation technique [5]. Intelligent algorithms are used to analyse machine translation and develop coherent translation schemes in order to enhance the efficacy of machine translation [6]. Hence, using the BP neural network method, this study examines the crucial elements inside machine translation in order to enhance the stability, dependability, and logic of the translation process.

2. Machine translation analysis

Machine translation is capable of facilitating the conversion between several languages and fulfilling the need for automated translation. Machine translation is a field that combines information, algorithms, and computer technology in order to facilitate the process of translation. The BP neural network technique is used to do a comprehensive study of linguistic data, including thresholds, weights, and data extraction. Its primary objective is to accomplish full machine translation and conduct multi-dimensional analysis of the resulting translations. Machine translation requires three distinct definitions, which are delineated as follows. Definition 1: Machine translation data is y_i, translation scheme selection function is $k(y_i)$, translation collection is s_i, and translation volume is tol_i . Well, the calculation process is shown in Equation (1).

$$k(y_i) = \sum_{s_i} tol_i \cdot y_i \quad (1)$$

Definition 2: The translation result judgment function is $f(x)$, Ya is the translation standard, Yb is the reading judgment result, and Yc is the phrase judgment result. Well, the calculation process is shown in Equation (2).

$$f(y,P) = y_i \cdot \sqrt{(Ya^2 + Yb)} \cdot Yc \quad (2)$$

Definition 3: Translation result judgment function is $Y(x_i)$, translation deviation is Δx_i, result set is $\sum S_i$, and adjustment number is Δc_i . Well, the calculation process is shown in Equation (3).

$$Y(x_i) = \sum S_i \cdot \Delta x_i \cdot c_i \quad (3)$$

3. Choice of machine translation solutions

During the machine translation process, the translated text undergoes a detailed calculation in order to minimise the error rate of translation. This task involves the identification and adjustment of differences in translation solutions, specifically focusing on transliteration norms. Simultaneously, the selection of a translation system is both arbitrary and rational.

Definition 4: The recording function of the best translation scheme is that when the record data reaches the maximum $f(x_i, S_i)$, the random scheme $\max[f(x_i,S_i)]$ $rand[f(x_i, S_i)]$ is calculated as shown in Equation (4).

$$f(x_i) = k^2 \cdot (x_i^2) \cdot S_i \quad (4)$$

Formula: If, there is a best record, $\max[f(x_i,S_i)] \approx 1.5$ if there is no best $\min[f(x_i,S_i)] \approx 2.6$ record, adjust the translation scheme.

Definition 5: The translation fusion function is calculated as shown in Equation (6). $F(k)$

$$F(k) = \left(\overleftrightarrow{AB}\right) \cdot k(x_i, y_i) \cdot E_i \cdot f(\tfrac{p}{x}) \quad (5)$$

4. Steps to choose a machine translation solution

In order to mitigate the occurrence of erroneous outcomes, machine translation systems must engage in sample analysis of translation outputs, including several characteristics such as phraseology, comprehension, colloquialisms, and other pertinent factors. The accuracy study of various translation schemes is conducted based on the BP neural network algorithm in order to reject any schemes that are deemed inappropriate.

The first stage involves gathering all the necessary data for machine translation, afterwards selecting the data with high validity, and subsequently establishing the thresholds and weights for this data.

In the second step, the BP neural network algorithm is applied to each data point, and the translated material is continually analysed.

In the third step of the process, it is essential to do a comparative analysis of various translation solutions. This involves assessing the accuracy and comprehensiveness of the machine translation outcomes. Furthermore, it is crucial to compile a comprehensive set of translation results.

In the fourth step, the translation plan undergoes a cumulative calculation. If all translated material has been analysed, the analysis process is concluded. However, if there is remaining content that requires translation, an iterative calculation is conducted.

5. Practical examples of machine translation

The specific parameters are shown in Table 1 to verify the effect of the BP neural network algorithm.

Table 1. Machine translation content (unit: %)

parameter	Normality	effectiveness
phrase	75.70	73.10
Read	75.77	75.95
paragraph	73.75	73.20
Image	73.11	77.04
audio	73.19	74.83

Based on the characteristics outlined in Table 1, it can be concluded that there is no statistically significant variation across all aspects. This suggests that the state of machine translation data does not exhibit any notable differences, hence satisfying the analytical criteria of the BP neural network algorithm and enabling the performance of machine translation analysis. The distribution of machine translation data is seen in Figure 1.

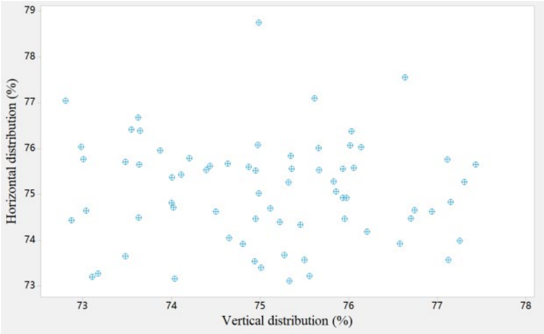

Figure 1. Distribution of machine translation data

As seen in Figure 1, the distribution of data status in translation exhibits a rather clear pattern. The translated material is observed to be independent of one another, with no discernible variations. Consequently, the subsequent data may be compared and analysed.

The accuracy and completeness of machine translation.

It is important to preserve the integrity of machine translation in order to avoid compromising the accuracy of the translation outcomes. Furthermore, it is crucial to evaluate the comprehensiveness and validity of the translation results. The particular translation approach is outlined in Table 2.

Table 2. Comparative translation scheme for completeness and validity (unit: %)

algorithm	parameter	Effectiveness	completeness	Average magnitude of change
BP neural network algorithm	phrase	85.32	85.67	4.63
	paragraph	84.37	84.33	5.45
	Read	85.81	84.62	6.93
	Image	81.55	85.83	1.34
Human online translation method	phrase	72.92	74.18	7.21
	paragraph	76.45	73.21	7.56
	Read	77.52	75.51	7.95
	Image	75.07	74.92	7.97
	phrase	75.47	73.65	4.93
Comparison of translation solutions	X2=9.36, P<0.41			

The data shown in Table 2 demonstrates that the BP neural network method exhibits completeness and efficacy over 80%. Additionally, the mode change is seen to be less than 7, indicating a substantial difference. Simultaneously, it can be seen that the variation in terms of words, reading, and images is very limited, so leading to an enhanced overall translation outcome of the BP neural network method. Nevertheless, the efficacy and comprehensiveness of the manual online translation approach exhibit significant variations, ranging from 8. Furthermore, the translation's completeness and validity fall below 80%, indicating a pretty poor performance. Figure 2 demonstrates the efficacy and comprehensiveness of the BP neural network algorithm's machine translation during the specified timeframe.

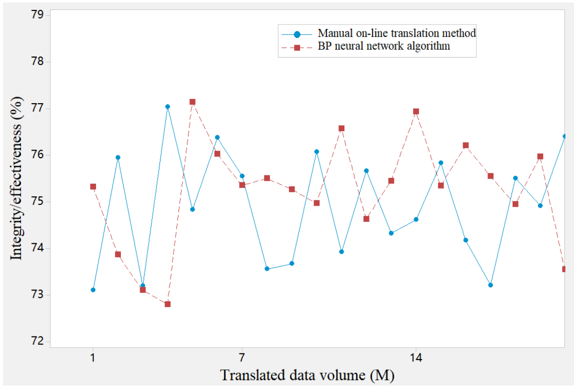

Figure 2. Comparison of completeness and effectiveness of different translations

The findings depicted in Figure 2 indicate that the sampling of translation results reveals a higher concentration of effectiveness and completeness in machine translation utilising the BP neural network algorithm. Conversely, the effectiveness and completeness of manual translation in online translation exhibit a more dispersed pattern, aligning with the research outcomes presented in Table 2. The rationale for using the BP neural network approach is in its ability to assess the soundness of the design of the machine translation scheme and compute the values of convex functions for various parameters, hence facilitating the simplification of extended positions and other qualities.

B. Translation Time

The translation time includes phrases, readings, audio, pictures, etc., as shown in Table 3.

Table 3. Machine Translation Time (unit: seconds).

algorithm	Phrase translation	Audio and pictures	Read the translation
BP neural network algorithm	4.29	5.77	2.35
	4.65	4.49	4.03
	5.98	7.09	5.14
Human translation method in the online process	7.86	7.65	7.07
	7.52	7.71	7.55
	7.46	7.59	7.97

Based on the findings shown in Table 3, it can be seen that the use of the BP neural network algorithm in the context of machine translation yields a reasonably short and efficient project time. Moreover, the observed variation range falls within the interval of 0.21 to 1, with a minimum value of 0 and a maximum value of 1. The total duration of the translation process is considered optimal. In contrast to the BP neural network technique, the conventional scheme exhibits a comparatively lengthy computation time, with a time variation range of 0.19 to 0.11. BP's neural network algorithms are founded on the advancement of artificial intelligence, enabling them to systematically analyse phrases, textual content, audio, and video translations in order to expedite the process of translation. The translation time for all cases is presented in Table 3.

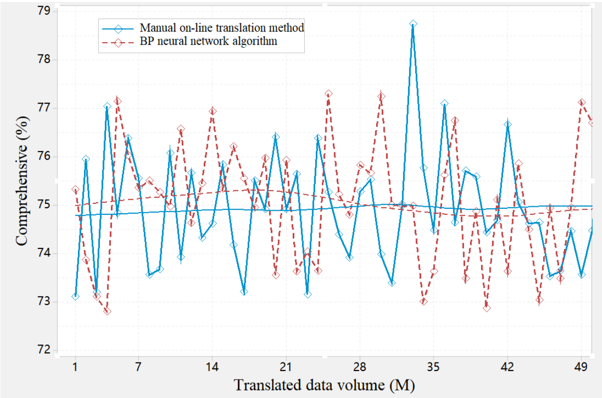

Figure 3. Comprehensive-time Comparison of Different Methods

The analysis of Figure 3 shows that the ample time of the BP neural network algorithm is short, the overall change is relatively stable, and the ordinary translation time changes considerably.

6. Conclusion

During the machine translation process, it is seen that human online translation fails to achieve correct translation. This research presents a novel approach that utilises a Backpropagation (BP) neural network method to conduct a full evaluation of translation content, including phrases, reading material, visuals, and audio. The proposed algorithm aims to identify the most suitable translation scheme based on the evaluation results. The BP neural network technique has the capability to do extensive computations on translated text, hence reducing the complexity associated with translation. The findings indicate that the BP neural network algorithm exhibits a higher level of completeness and efficacy, surpassing 80%. Additionally, the translation time is less than 3, outperforming human online translation and demonstrating considerable disparities. Hence, the total translation efficacy of the BP neural network technique is superior. Nevertheless, the manual online technique has a somewhat subpar machine translation impact, falling short of the BP neural network methodology. Hence, the machine translation efficacy of the BP neural network method suggested in this study is superior, hence enhancing the precision of translation outcomes and catering to the practical requirements of translation.

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