WEP Warwick Evans Publishing

Transactions on Social Science, Education and Humanities Research
ISSN: 2960-1770, eISSN: 2960-2262 | Volume 10
HADC 2024

Research on Optimized Path of Machine Translation from the Perspective of Cognitive Approach - Collaborative Development of Human Translation and Machine Translation

Gou Si

Changchun Guanghua University, 130033 Changchun, 130033, China

Abstract. This study, starting from the cognitive perspective, delves into the optimized paths for machine translation and focuses on the coordinated development strategies between human translation and machine translation. By analyzing the application of cognitive approach in translation activities, this paper proposes methods such as enhancing the cognitive mechanisms of understanding and expression in machine translation, optimizing algorithms, and improving translation quality using cognitive feedback loops. Additionally, this paper also explores collaborative development strategies including human-machine interaction interface design, collaborative translation process management, translation quality control and evaluation mechanisms, as well as translator training and education based on cognitive approach. These strategies aim to improve the accuracy and efficiency of translation, meet the personalized needs of users, and promote the deep integration and development of human translation and machine translation.

Keywords: cognitive approach; machine translation; human translation; coordinated development.

1. Introduction

With the increasing frequency of international exchanges, the demand for translation is constantly growing. Although traditional human translation has high accuracy, its efficiency is low and difficult to meet large-scale and immediate translation needs. The rise of machine translation technology has greatly improved translation efficiency, but its accuracy and contextual understanding ability still need to be improved. Therefore, this study aims to combine the advantages of human translation and machine translation to explore the possibility of their coordinated development, in order to maximize translation efficiency while ensuring translation quality.

2. Theoretical Framework

2.1. Basis of Cognitive Approach

Translation is not just a simple conversion of languages, but involves complex cognitive processes. Understanding the original text and accurately expressing it in another language require the translator to engage in deep cognitive processing. The theory of cognitive load reminds us that during the translation process, the translator's cognitive resources are limited and thus need to be allocated reasonably to ensure the quality and efficiency of the translation.

2.2. Overview of Machine Translation Technology

Machine translation technology has evolved from statistical machine translation to neural machine translation. Statistical machine translation relies on statistical models and trains on large bilingual corpora to find the best translation. In contrast, neural machine translation utilizes deep learning techniques to mimic the working of the human brain and performs translation at the semantic level, greatly improving the fluency and accuracy of translations.

2.3. Theoretical Model of Human-Machine Collaboration

Human-machine collaboration is an important development direction in the field of translation in the future. The theoretical model emphasizes the complementarity and collaboration between humans and machines. Machines can quickly process a large amount of information and provide initial translation drafts, while human translators can refine and optimize the machine translations using their profound linguistic and cultural knowledge, thereby ensuring the quality and accuracy of the translations. This human-machine collaboration model can not only improve translation efficiency but also continuously expand and enrich the content and depth of translation.

3. The Optimized Path of Machine Translation from the Perspective of Cognitive Approach

3.1. Enhancing the Cognitive Mechanisms of Understanding and Expression

In the process of human translation, understanding is not merely decoding the source language text, but also capturing and interpreting its deep meanings. This process involves a comprehensive grasp of context, culture, and social background. To enhance the understanding capabilities of machine translation, we need to construct a comprehensive understanding model that can integrate multi-dimensional information, such as semantics, syntax, pragmatics, and related world knowledge.

Similarly, expression is not just encoding the understood content into target language text, but also selecting the most appropriate vocabulary and sentence patterns for expression based on the habits and cultural background of the target language. This requires machine translation systems to have not only rich language resources but also flexible generation strategies that can produce natural and fluent translations based on context and user needs.

3.2. Optimizing Algorithms to Simulate Human Cognitive Processing

Current neural network machine translation models have made significant progress in performance, but there is still much room for optimization. Human cognitive processes involve many unique mechanisms, such as attention allocation, memory access, and logical reasoning, which provide new ideas for the optimization of machine translation.

For example, we can draw on human attention mechanisms to design more sophisticated attention models, enabling machines to more accurately capture key information in the original text during the translation process. At the same time, by introducing memory networks, we can help machines better handle long-distance dependency issues, thereby improving the coherence and accuracy of translations. Additionally, by incorporating reasoning mechanisms, we can enable machines to perform necessary logical reasoning during the translation process to address complex sentence structures that require a deep understanding of the original text's meaning for accurate translation.

3.3. Improving Translation Quality through Cognitive Feedback Loops

Similar to the translation process of humans, machine translation should also be a continuous process of revision and improvement. To achieve this, we can build a cognitive feedback loop that allows the machine to self-evaluate and correct itself after each translation is completed. Specifically, we can use various evaluation methods to comprehensively assess the translation results, including manual evaluation, automatic evaluation metrics, and user feedback. Then, these evaluation results can be fed back to the machine translation system for self-learning and adjustment. Through this continuous optimization approach, we can gradually improve the overall performance and quality of machine translation.

3.4. Cognitive Adaptability to Users' Personalized Needs

With the deepening development of globalization, the needs and preferences of different users for translation are becoming increasingly diversified. To meet these personalized needs, we need to

endow the machine translation system with stronger cognitive adaptability. This means that the system should not only be able to accurately understand the user's intentions and needs, but also be able to flexibly adjust and optimize based on user feedback and preferences. By collecting and analyzing user feedback data, usage habits, and other information, we can inject more user preference information into the machine translation system to enable it to generate translation results that are more aligned with user expectations. At the same time, leveraging user profiles and big data technology, we can provide users with more personalized translation services, such as customized term translation and industry-specific translation styles. This user-centered optimization strategy will help improve user satisfaction and loyalty towards machine translation, thereby driving the widespread application and development of machine translation technology.

4. Collaborative Development Strategies for Human Translation and Machine Translation

4.1. Design Principles for Human-Machine Interaction Interface

The human-machine interaction interface is the key to the collaborative work between human translation and machine translation. When designing, emphasis should be placed on intuitiveness, ease of use, and flexibility. For example, the interface should provide real-time translation previews and editing functions so that translators can adjust machine-generated translations immediately. Additionally, the interface should support translation needs for multiple language pairs and professional fields to meet the diverse working scenarios of translators.

Table 1. Design Elements of Human-Computer Interaction Interface

Design elements	Explanation
Intuitiveness	The interface layout is clear and the operation is intuitive and easy to understand
Ease of use	Provide user-friendly operation prompts and help documents
Flexibility	Support rapid switching between multiple language pairs and professional fields

4.2. Construction and Management of Collaborative Translation Process

The construction of a collaborative translation process should focus on improving efficiency and quality. This includes clarifying the division of labor between humans and machines, such as having machines perform initial translations while humans conduct reviews and enhancements. At the same time, establishing effective communication mechanisms ensures real-time feedback and adjustments to translation strategies between humans and machines. Additionally, process management should include continuously updating and maintaining translation memory and term databases.

4.3. Translation Quality Control and Evaluation Mechanisms

To ensure translation quality, a comprehensive quality control and evaluation mechanism is necessary. This includes automatic evaluation of machine translation results and regular assessments of human reviews. Automatic evaluation can utilize objective evaluation metrics such as BLEU and NIST, while human reviews should focus on the accuracy, fluency, and cultural appropriateness of the translation. Furthermore, establishing a user feedback system allows for timely collection and processing of user opinions and suggestions on the translation.

Table 2. Key Points of Translation Quality Control

Key points of control	Implementation measures
Machine translation quality	Automatic evaluation using metrics such as BLEU
Quality of manual review	Regular translator training and assessment
Handling user feedback	Establish a user feedback system to respond in a timely manner and make improvements.

4.4. Translator Training and Education Based on Cognitive approach

Improving translators' professional literacy and translation skills is the key to achieving the coordinated development of human translation and machine translation. Translator training and education based on cognitive approach should focus on cultivating translators' cognitive abilities, language abilities, and cross-cultural communication abilities. Through practical case analysis and simulated practical exercises, translators' understanding and expression abilities of the source language and the target language can be improved, enabling them to cooperate more effectively with machines in the collaborative translation process and enhance the overall translation quality.

5. Conclusion

This article explores the optimized path of machine translation from the perspective of cognitive approach and proposes strategies for the coordinated development of human translation and machine translation. By integrating theories and practices in multiple areas such as human-machine interaction, quality control, and translator training, we aim to promote continuous innovation and development in the translation industry. In the future, with the continuous advancement of technology and the deepening of translation theories, the collaboration between human translation and machine translation will become an important development direction in the field of translation, promising to provide users with more accurate and efficient translation services.

Acknowledgments

Social Science Research Planning Project of Education Department of Jilin Province

Optimized Path of Machine Translation Under Cognitive Approach: The Collaborative Development of Human Translation and Machine Translation

(Project No.: JJKH20241639SK)

References

[1] Huang Yongzhong. A Comparative Analysis of Machine Translation and Human Translation from the Perspective of Translation Shift Theory [J]. English Square. 2022(09):6-8.

[2] Liang Junying, Liu Yiguang. The Advantages of Human Intelligence in Translation Abilities: A Corpus-Based Comparative Study of Human-Machine Translation [J]. Foreign Languages and Their Teaching. 2023(03):74-84+147-148.

[3] Song Chunhua. Optimization of English Machine Translation Based on Artificial Intelligence Deep Neural Networks [J]. Modern Electronic Technique. 2024,47(03):80-84.