

Main Achievements, Current Status, and Trends in Translation Technology Research Over the Past Decade

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Abstract: Translation is a discipline that studies language conversion, cross-cultural communication, and the transmission of linguistic meaning. With social development, the continuous emergence of new theories, technologies, and methods in various fields has driven the gradual diversification of translation studies based on language and culture. On the foundation of theoretical and practical research, interdisciplinary research on translation technology has become an important direction for the development of translation studies. This paper takes the papers published in China National Knowledge Infrastructure (CNKI) over the past decade with "translation technology" as the core term as the basis for research, statistically analyzes the new achievements, views, and conclusions in China's interdisciplinary research on translation, aiming to present the trends and research priorities in the field of translation studies from a macro perspective to guide researchers in further conducting new research.

Key words: translation technology; interdisciplinary research; cutting-edge achievements; trend

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I. Introduction

With the acceleration of globalization and the rapid development of information technology, the role of translation technology in translation practice has become increasingly prominent. Translation technology not only enhances translation efficiency and quality but also provides new perspectives and methods for translation research. In recent years, the interdisciplinary integration of translation technology with other disciplines has deepened, leading to numerous cutting-edge achievements. These achievements have not only enriched the theory and methodology of translation technology but also provided strong support for translation practice and translation education.

II. Data Sources

This study uses "translation technology" as the theme keyword, with the search period ranging from 2014 to 2024. The data sources are "PKU Core" and "CSSCI," and a total of 382 articles were retrieved.

III. Data Overview

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Number	23	24	21	32	33	57	54	52	31	31	24

Among the 382 articles, the top 10 core themes are as follows:

No.	Theme	No.	Theme
1	Translation Technology	6	Artificial Intelligence Era
2	Machine Translation	7	Translation Profession
3	Artificial Intelligence	8	Translation Practice
4	Translation Teaching	9	Translation Process
5	Machine Translation Technology	10	Translation Competence

Among the 382 articles, the top 10 disciplines involved are as follows:

No.	Discipline	No.	Discipline
1	Chinese Language and Literature	6	Automation Technology
2	Foreign Language and Literature	7	Library and Information Science & Digital Libraries
3	Computer Software and Applications	8	Ethics
4	Higher Education	9	Mining Engineering
5	Educational Theory and Management	10	Biology

Among the 382 articles, the top 9 research directions are as follows:

No.	Research Category	No.	Research Category
1	Applied Research	6	Business Research
2	Technical Research	7	Development Research
3	Subject Education	8	Basic Research
4	Technology Development	9	Teaching Research
5	Applied Basic Research		

Among the 382 articles, the top 10 authors with the highest number of publications are as follows:

No.	Author	No.	Author
1	Wang Huashu	6	Liu Shijie
2	Cui Qiliang	7	Xiao Weiqing
3	Wang Shaoshuang	8	Xu Jun
4	Wang Xiangling	9	Feng Qinghua
5	Li Defeng	10	Lan Hongjun

IV. Macro Status of Interdisciplinary Research in Translation Technology

4.1 Integration of Translation Technology and Linguistics

Linguistics is one of the key theoretical foundations of translation technology. Over the past decade, the intersection and integration of translation technology and linguistics have yielded abundant results. Among these, the combination of corpus linguistics and translation technology is the most closely integrated. The rise of corpus-based translation studies has provided a wealth of empirical data for translation research, making it more scientific and objective. Additionally, research findings from computational linguistics and cognitive linguistics have offered new ideas and methods for the development of translation technology.

4.2 Integration of Translation Technology and Computer Science

Computer science is a core supporting discipline for translation technology. Over the past decade, the intersection and integration of translation technology and computer science have deepened, driving the rapid development of translation technology. Notably, the development of machine translation, computer-aided translation (CAT), and translation memory technologies has been particularly significant. Machine translation technology has continually improved translation quality and efficiency, becoming an essential tool in translation practice. CAT technology has provided translators with more convenient tools, enhancing translation efficiency and quality. Translation memory technology effectively leverages existing translation resources, improving consistency and accuracy in translations.

4.3 Integration of Translation Technology and Cognitive Science

Cognitive science is an emerging interdisciplinary field for translation technology. Over the past decade, the intersection and integration of translation technology and cognitive science have gradually gained attention. The rise of cognitive translation studies has provided new perspectives and methods for translation research, focusing more on the cognitive mechanisms and psychological processes involved in translation. Furthermore, research findings from neurolinguistics and psycholinguistics have offered new insights into the development of translation technology.

V. Latest Major Achievements in Interdisciplinary Research in Translation Technology

5.1 Corpus-Based Translation Studies

5.1.1 Construction and Application of Parallel Corpora

Parallel corpora are one of the key research objects in corpus-based translation studies. Over the past decade, significant achievements have been made in the construction and application of parallel corpora. Many

scholars and institutions both domestically and internationally have built a large number of parallel corpora covering multiple languages and domains. These parallel corpora provide rich empirical data for translation research, making it more scientific and objective. The following are some of the main conclusions from current research on the construction and application of parallel corpora:

Scale and Quality: The scale and quality of bilingual English-Chinese parallel corpora in China have significantly improved. For example, universities such as Peking University, Beijing Language and Culture University, and Tsinghua University have established corpora containing a large number of English-Chinese aligned texts, covering various fields such as literature, history, philosophy, and economics. These corpora not only provide researchers with rich linguistic resources but also help in delving deeper into the essence and patterns of language. [1]

Specialized Domain Translation: Constructing specialized parallel corpora for specific domains helps improve the accuracy of terminology and the expression of professional content. [2]

Diversification of Research Perspectives: Interdisciplinary intersections have given rise to new research branches, such as corpus-based translation stylistics, corpus-based quantitative translation studies, and corpus-based research on translation and language contact.

Complexification of Research Methods: The isolated status of pure corpus methods has been broken, with research methods shifting from single corpus methods to combinations with experimental methods, and from descriptive analysis to inferential and exploratory analysis.

Rationalization of Data Statistical Analysis: In the context of "big data," the precision and validity of research have gradually increased, with statistical analysis methods transitioning from simple descriptive statistics to more complex multivariate exploration techniques.

Diversification of Research Objects: Research objects have expanded from general translations to a series of translation variant types, such as post-editing, volunteer translation, online collaborative translation, amateur translation, localization translation, and audiovisual translation.

Refinement and Expansion of Research Topics: Research on translation universals tends to focus on the impact of extratextual factors, while interpreting research emphasizes the comprehensiveness of research methods, and translator training pays more attention to the practical application of corpora. [3]

5.1.2 Research on Translation Universals

Translation universals refer to the common linguistic phenomena that occur during the translation process. Over the past decade, significant progress has been made in the study of translation universals. Many scholars both domestically and internationally have identified universal phenomena in translation through the analysis of parallel corpora, such as simplification, explicitation, and normalization. These research findings provide valuable references for translation teaching and practice. The following are some of the main achievements and conclusions in the current research on translation universals:

Definition of Translation Universals: Translation universals refer to typical linguistic features that appear in translated texts. These features are not the result of interference from specific language systems but are inherent to the translation process itself. [4]

Empirical Research on Translation Universals: Over the past two decades, empirical research on translation universals has achieved significant success, especially in the field of corpus-based translation studies. Through large-scale corpus analysis, researchers have revealed phenomena such as simplification, explicitation, and normalization in translated texts. [5]

Explanatory Paths for Translation Universals: There are three main explanatory paths for translation universals: the sociocultural path, the linguistic path, and the translator's cognitive process path. These paths explain translation universals from the perspectives of sociocultural factors, linguistic theories, and the cognitive processes of translators, respectively. [6]

Theoretical Models of Translation Universals: Researchers have proposed various theoretical models to explain translation universals, including the translation norm theory, the translator's risk aversion theory, grammatical metaphor, register, and language typology from the sociocultural path, as well as the relevance theory model and the gravity hypothesis from the translator's cognitive process path. [6]

Interdisciplinary Nature of Translation Universals: Research on translation universals is gradually forming a systematic analytical framework that integrates multiple theories. The interdisciplinary nature of translation and its disciplinary independence are becoming increasingly evident. [5]

Applicability of Translation Universals to Different Genres: The phenomena of simplification, explicitation, and normalization in translation universals apply not only to novels and non-literary texts but also to literary genres such as poetry. However, the degree and manner of their manifestation may differ across different genres. [7]

Corpus-Based Methods for Translation Universals: Corpus-based research on translation universals has become the mainstream method. By establishing and comparing different types of corpora, researchers can gain

a deeper understanding of the essence and influencing factors of translation universals. [8]

These achievements and conclusions provide theoretical guidance for translation practice and teaching and lay the foundation for further in-depth research into the nature and patterns of translation.

5.1.3 Corpus-Driven Translation Teaching

Corpus-driven translation teaching is a translation teaching method based on the use of corpora. Over the past decade, this approach has been widely adopted in many universities and training institutions both domestically and internationally, significantly improving the quality and effectiveness of translation teaching. The following are the main research conclusions in the area of corpus-driven translation teaching:

Research Framework for Corpus-Driven Translation Teaching: The research framework for corpus-driven translation teaching includes several areas such as theoretical and critical studies, construction of teaching systems, development of teaching resources and platforms, empirical studies, evaluation of teaching effectiveness, current state of teaching, process studies of students' use of corpora, studies of translation processes assisted by corpora, studies of translations produced by students using corpora, studies of translation products assisted by corpora, test item development, and scoring rubric research.

Distribution of Research Themes: Both domestic and international research tend to focus more on "teaching" aspects, while less attention is paid to "learning" and "assessment." This indicates that research on the application of corpora in translation teaching needs to cover all aspects of teaching more evenly.

Research Methods: There are differences in research methods between domestic and international studies. Domestic research tends to favor qualitative methods, whereas international research often employs quantitative methods or mixed-methods approaches.

Research Content: There are differences in the distribution of research themes, research methods, and research content between domestic and international studies. For example, domestic research focuses more on general translation teaching, while international research tends to concentrate on specialized domain translation teaching. [9]

Interdisciplinary Research: International research on translation technology exhibits clear interdisciplinary characteristics, closely integrating with fields such as computer science, communication studies, management, sociology, and economics.

Research on Translation Services: As an emerging field, translation services have become one of the key focuses in translation technology research, particularly in the area of cross-language information retrieval. [10]

5.2 Machine Translation

5.2.1 Neural Machine Translation

Neural Machine Translation (NMT) represents a significant breakthrough in the field of machine translation in recent years. NMT utilizes neural network technology to automatically learn the patterns and rules of language, thereby improving translation quality and efficiency. Over the past decade, NMT technology has continuously developed and has become one of the mainstream technologies in machine translation. [11] The main conclusions of NMT research are as follows:

Pre-trained Neural Machine Translation (PTNMT): Pre-trained models (PTMs) are trained on large amounts of monolingual data to acquire general representation knowledge, which significantly enhances the performance of downstream tasks. PTNMT has been widely validated on resource-constrained datasets. [12]

Automatic Repair of Software Defects Based on Self-Attention Mechanism: A method for automatically repairing software defects using self-attention-based neural machine translation has been proposed. This method effectively alleviates the out-of-vocabulary (OOV) problem in source code and addresses long-distance dependencies in source code. [13]

Self-Training Neural Machine Translation with Monolingual Priority Sampling: A self-training NMT model based on priority sampling has been proposed, which improves the damage caused by highly uncertain monolingual data during the self-training process. [14]

Document-Level Neural Machine Translation with Target-Side Context Integration: A document-level NMT method that integrates target-side context information has been proposed. By incorporating the idea of deliberation networks, this method significantly improves translation performance. [15]

Unsupervised Neural Machine Translation for Distant Language Pairs Using Bilingual Dictionaries: A method for unsupervised neural machine translation for distant language pairs has been introduced, leveraging a translation language model (TLM) and the Dict-TLM method, which enhances the performance of unsupervised NMT for distant language pairs. [16]

Graph Convolution Enhanced Multitask Low-Resource Neural Machine Translation (GEA-NMT): A multitask training low-resource NMT model enhanced by graph convolution has been proposed, which improves the performance of NMT for low-resource languages. [17]

These research advancements indicate that the field of NMT has achieved significant results in pre-trained models, self-attention mechanisms, quality assessment, document-level translation, and unsupervised learning, driving the development and application of NMT technology.

5.2.2 Multilingual Machine Translation

Multilingual machine translation refers to machine translation technology capable of translating multiple languages simultaneously. Over the past decade, multilingual machine translation technology has seen rapid development. Many scholars and institutions both domestically and internationally have conducted research in this area, achieving significant results. The development of multilingual machine translation technology has provided strong support for cross-language communication and collaboration. The main conclusions of research in multilingual machine translation are as follows:

Effectiveness of Incremental Self-Learning Strategies: Multilingual translation models based on incremental self-learning strategies can effectively utilize pivot bilingual corpora to train from source to target languages. [18]

Effectiveness of Curriculum Learning Based on Language Affinity: A curriculum learning method based on language affinity can be used to improve the overall performance and convergence speed of multilingual NMT. This method considers the relationships and similarities between different languages to optimize the training process. [19]

Effectiveness of Multilingual Joint Training: A neural machine translation method based on multilingual joint training, which jointly trains rich Chinese-English parallel corpora with less abundant corpora within the Transformer framework, effectively enhances translation performance. [20]

5.2.3 Evaluation and Improvement of Machine Translation

Evaluation and improvement of machine translation are crucial components of machine translation research. Over the past decade, evaluation methods for machine translation have continuously improved, and evaluation metrics have become more scientific and objective. Many scholars and institutions both domestically and internationally have conducted research to improve machine translation, enhancing its quality and efficiency. The main conclusions are as follows:

Application of Large Language Models in Text Translation: Research has found that WenXinYiYan and XunFeiXingHuo outperform traditional machine translation systems, including ChatGPT 4.0, in the translation of literary texts from Chinese to English. [21]

Unsupervised Quality Evaluation of Bilingual Parallel Corpora Based on Ensemble Machine Translation: An unsupervised quality evaluation method based on ensemble machine translation has been proposed, implementing single-engine and multi-engine unsupervised evaluation frameworks and algorithms, effectively improving the efficiency of corpus quality evaluation. [22]

Quality Evaluation Methods for Machine-Generated Language: A review of quality evaluation methods for machine-generated language, including machine translation, automatic summarization, and dialogue systems, has been conducted. It analyzes the evaluation angles and applicability for different tasks and explores the integration and key issues of evaluation methods. [23]

Automatic Evaluation of Machine Translation with Source-Side Information: An automatic evaluation method for machine translation that incorporates source language sentence information has been proposed. By extracting quality vectors that describe translation quality and integrating them with context-aware word vector-based automatic evaluation methods, this approach effectively enhances the correlation between automatic and human evaluations. [24]

Application and Evaluation of AI Technology in Computer-Aided Translation Software: The new functionalities of AI technology in computer-aided translation software, such as AI-driven non-translatable element functions, machine translation quality assessment functions, and adaptive machine translation functions, have been analyzed. The design intentions, specific applications, and actual effects of these functionalities have been discussed. [25]

These research advancements indicate that the application of AI technology in the field of neural machine translation is continuously deepening, improving translation quality, optimizing the translation process, and providing new directions for future research.

5.3 Computer-Assisted Translation (CAT)

5.3.1 Improvements and Applications of Translation Memory Technology

Translation Memory (TM) is a crucial component of Computer-Assisted Translation (CAT) tools. It stores previously translated source and target language text segments. When faced with new translation tasks, TM can automatically retrieve similar or identical translated content, thereby improving translation efficiency and consistency. TM is one of the core technologies in CAT. Over the past decade, TM technology has

continuously improved, offering more comprehensive features. Its application scope has also expanded, covering multiple languages and domains. The development of TM technology has provided translators with more convenient tools, enhancing translation efficiency and quality. Recent research has focused on the following areas:

Improved Matching Algorithms: Researchers are continuously exploring more efficient algorithms to enhance the retrieval speed and accuracy of TM. For example, fuzzy matching technology allows the system to find relevant translations even when the source text does not exactly match existing translations, thus improving work efficiency. [26]

Enhanced Context Awareness: To better understand the specific context in which sentences are used, some research efforts are directed towards developing methods that consider contextual information. This helps provide more accurate translation suggestions. [27]

Integration of AI Technology: In recent years, artificial intelligence, particularly machine learning and deep learning, has been widely applied to improve TM functionality. By training models on large volumes of bilingual text data, the system can more intelligently handle complex language structures and cultural differences. [28]

5.3.2 Development and Application of Terminology Management Technology

Terminology management technology is a vital component of CAT. Over the past decade, terminology management technology has continuously evolved, offering more comprehensive features. Its application scope has also expanded, covering multiple languages and domains. The development of terminology management technology has provided translators with more accurate term translations, enhancing translation quality and efficiency. It ensures consistency and accuracy of professional terms across different language versions. With the globalization process and technological advancements, terminology management technology continues to improve. Some of the latest research findings and conclusions include:

Automated Term Extraction: Researchers are developing more advanced algorithms to automatically extract terms from text. These methods include statistical approaches, machine learning techniques, and deep learning models. [29]

Multilingual Terminology Database Construction: As businesses become more international, the demand for multilingual terminology databases is growing. Researchers are working on building terminology management systems that can effectively handle differences across multiple languages. [30]

Term Standardization and Normalization: To ensure uniformity in term usage, many organizations are developing their own terminology standards. Research in this area often involves sharing best practices and tool development. [31]

Cloud Collaboration Platforms: The application of cloud technology enables team members to share and update terminology information in real-time, significantly improving work efficiency. [32]

5.3.3 Development and Application of CAT Software

CAT software is one of the essential tools in CAT. Over the past decade, the development and application of CAT software have seen rapid growth. Many software companies both domestically and internationally have developed powerful CAT software, providing translators with more convenient tools. Some of the latest research findings include:

Integration of AI and Machine Learning: The latest CAT tools increasingly adopt artificial intelligence (AI) and machine learning (ML) technologies to improve translation quality, speed, and consistency. This includes using neural networks for more accurate fuzzy matching, automated term extraction, and enhanced pre-translation suggestions. [33]

Cloud Technology and Collaboration Features: Cloud computing provides robust backend support for CAT tools, allowing teams to access shared resources via the internet from any location, facilitating collaborative work. Additionally, cloud storage enhances data security and recoverability. [34]

Adaptive Learning Systems: New-generation CAT tools are integrating adaptive learning mechanisms that can adjust their behavior based on user habits and preferences. This personalized setting can improve work efficiency and reduce repetitive tasks. [35]

Multimodal Translation Support: With the growth of multimedia content, CAT tools are beginning to offer capabilities for handling image, audio, and video files, aiding in the localization of multimedia content. [36]

5.4 Cognitive Translation Studies

5.4.1 Cognitive Research on the Translation Process

Cognitive research on the translation process is a core aspect of cognitive translation studies. Over the past decade, significant progress has been made in this area. Many scholars both domestically and internationally have explored the cognitive mechanisms and psychological processes involved in translation through experimental studies and surveys. These research findings provide valuable references for translation teaching and practice.

5.4.2 Research on Translators' Cognition and Translation Competence

Research on translators' cognition and translation competence is a significant direction in cognitive translation studies. Over the past decade, this area has received widespread attention. Many scholars have explored the cognitive characteristics and constituent elements of translation competence through experimental studies and surveys. These research findings provide useful references for translation teaching and the training of translators. Key conclusions in this field include:

Metacognitive Monitoring and Critical Thinking Tendencies: Translators' metacognitive monitoring (awareness and regulation of their cognitive processes) directly influences their translation ability and indirectly affects it through the impact on critical thinking tendencies. Research suggests that translation teaching should not only focus on developing students' language skills but also emphasize their awareness and control of their learning processes, as well as encourage critical thinking. [37]

Development of Cognitive Translation Studies: Cognitive translation studies, as a new paradigm in translation research, view translation as a complex cognitive activity, emphasizing the subjectivity and creativity of translators. This field not only focuses on linguistic transformations but also explores how translators use mental abilities and cognitive strategies to achieve information transformation. [38]

Translators' Psychological Processes from a Relevance Theory Perspective: From the perspective of relevance theory, researchers aim to reveal the psychological mechanisms by which translators construct cognitive contexts, reason, and select translation strategies. Optimal relevance is a key concept in understanding translators' decision-making, encompassing the maximization of cognitive effects, minimization of cognitive effort, and maintenance of relevance to the original text. [39]

5.4.3 Integration of Cognitive Translation Studies and Translation Teaching

The integration of cognitive translation studies and translation teaching is a hot topic in recent translation teaching research. Over the past decade, the research findings in cognitive translation studies have provided new theories and methods for translation teaching. Many universities and training institutions both domestically and internationally have adopted cognitive translation teaching methods, improving the quality and effectiveness of translation teaching. Key conclusions include:

Development of Translators' Cognitive Abilities: Research shows that consciously cultivating students' metacognitive monitoring abilities (understanding and controlling their learning processes) can effectively enhance their translation abilities. This includes encouraging students to reflect on their translation strategies, set goals, and evaluate outcomes. [37]

Experience-Based Learning Methods: From a cognitive linguistics perspective, translation teaching advocates experience-based methods, involving students in real translation projects so they can learn and develop relevant skills through practice. [40]

Cultivation of Intercultural Communication Skills: In a globalized context, translation is not just a linguistic transformation but also a cultural bridge. Therefore, a key trend in recent research is to strengthen students' understanding of different cultural backgrounds and how to appropriately convey the cultural nuances of the original text. [41]

Impact of Psychological Factors: Psychological factors such as motivation and anxiety are considered important variables affecting translation performance. Teaching interventions aimed at these issues, such as creating a positive learning atmosphere and support systems, can help improve student performance. [42]

VI. Future Trends in Interdisciplinary Research on Translation Technology

6.1 Deeper Integration of Multiple Disciplines

Future interdisciplinary research on translation technology will involve a deeper integration of theories and methods from multiple disciplines, including linguistics, computer science, cognitive science, and psychology. The integration of multiple disciplines will provide a more solid theoretical foundation and technical support for the development of translation technology, promoting continuous innovation and advancement in the field.

6.2 Wider Application of Artificial Intelligence Technologies

Artificial intelligence (AI) technology is one of the key directions for the future development of translation technology. In the future, AI technologies will be more widely applied in areas such as machine translation, computer-assisted translation, and translation quality assessment. The application of AI technologies will further enhance translation efficiency and quality, driving the intelligent development of translation technology.

6.3 Closer Integration of Translation Technology and Translation Education

The integration of translation technology and translation education will become even tighter in the future. Translation education will place greater emphasis on cultivating students' skills in applying translation technology and practical abilities, better preparing them to meet the demands of the translation market. Additionally, the development of translation technology will provide richer teaching resources and methods, improving the quality and effectiveness of translation education.

6.4 Closer International Cooperation in Translation Technology

International cooperation in translation technology will become even closer in the future. With the acceleration of globalization and the rapid development of information technology, international cooperation in translation technology will become an inevitable trend. Scholars and institutions from different countries will strengthen their collaboration and exchange in the research, development, and application of translation technology, collectively advancing the development and progress of the field.

VII. Conclusion

Over the past decade, interdisciplinary research on translation technology has yielded fruitful results. The intersection and integration of translation technology with disciplines such as linguistics, computer science, and cognitive science have provided new impetus and sources for the development of translation technology. These cutting-edge achievements have had a profound impact on translation practice, translation teaching, and translation research. In the future, interdisciplinary research on translation technology will see deeper integration of theories and methods from multiple disciplines, wider application of AI technologies, closer integration of translation technology and translation education, and closer international cooperation. We believe that, with the joint efforts of multiple disciplines, translation technology will continue to innovate and develop, making greater contributions to cross-language communication and cooperation.

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