

The Impact of Translingual Meme Transmission on Translation Efficiency and Accuracy in National Regional Studies

Han Li*

School of Foreign Languages, Nanchang Institute of Technology, Nanchang 330000, China

**Corresponding author: Han Li*.*

Abstract

This study employs an interdisciplinary research approach that combines computational linguistics, memetics, and translation studies to systematically investigate the impact of cross-linguistic meme transmission on national and regional translation efficiency and accuracy. The primary research methodologies can be divided into four core areas: corpus construction, meme analysis, translation process examination, and efficacy evaluation. Firstly, corpus construction necessitates the collection of a substantial dataset, including memes from various language backgrounds frequently appearing on national and regional social media platforms. Utilizing Web 2.0 tools and application programming interfaces (APIs), this approach facilitates the automated extraction and collation of multilingual data. Preprocessing includes text cleaning, language identification, and the application of natural language processing (NLP) techniques such as tokenization and part-of-speech (POS) tagging to establish a multilingual meme corpus. Secondly, meme analysis involves identifying repetitive patterns, themes, or phrases indicative of meme presence, and categorizing them using advanced algorithms like term frequency-inverse document frequency (TF-IDF) and Latent Dirichlet Allocation (LDA) for topic modeling. Thirdly, the translation process examination comprises both machine translation and manual translation mechanisms and compares them to delineate the differences in handling target language memes. Utilizing technologies such as CAT tools, specifically SDL Trados Studio and MemoQ, this study meticulously investigates the translation workflows to gauge how technological assistance influences translator performance and the fidelity of meme translation. Finally, efficacy evaluation involves both quantitative and qualitative measurements of translation outputs. Quantitative methods include tracking turnaround time and error rates, while qualitative methods rely on back-translation and simultaneous interpretation to compare the retention of ambiguities. Multivariate regression analysis, covariance structure analysis, and variance analysis will be employed to assess the robustness of the research results. This study adopts a multidisciplinary approach, integrating computational methods from data science with theoretical insights from sociolinguistics and regional studies.

Keywords

transmission of translation memes, translation efficiency and accuracy, regional and country-specific perspective, computer-assisted translation (CAT)

1. Introduction

The introduction serves as the cornerstone of the thesis, systematically outlining the research context, objectives, and key issues while presenting the study's framework and significance. Adopting an

interdisciplinary approach, this study employs computational linguistics, memetics theory, and translation studies to investigate how cross-linguistic memetic dissemination affects translation efficiency and accuracy at both national and regional levels.

In the current era of globalization and rapid information technology development, cross-border communication of languages and cultures has become increasingly frequent. However, the cross-linguistic meme dissemination, as an emerging linguistic phenomenon, not only enriches cultural exchange formats but also presents new challenges for translation technology and research. Memes, cultural information units spread through imitation, exhibit remarkable speed and wide influence in cyberspace. Yet their transmission mechanisms and translation strategies across different linguistic contexts remain inadequately studied. This research aims to fill this gap by employing interdisciplinary approaches to investigate how cross-linguistic memes manifest in translation processes and their impact on translation efficiency and accuracy.

The core objectives of the research include: constructing a multilingual meme corpus to analyze the dissemination patterns of memes across different linguistic contexts; employing advanced natural language processing techniques and data mining methods to classify and conduct thematic modeling of memes; comparing and evaluating the performance of machine translation and human translation in processing memes, while providing detailed analysis of the strategies translators employ during the translation process; and finally, assessing the efficiency and accuracy of translations through quantitative and qualitative methods, as well as examining the practical impact of cross-linguistic meme dissemination on national and regional translation efforts.

The research methodology is scientifically grounded and logically structured, incorporating corpus construction, topic modeling (e.g., LDA), term frequency-inverse document frequency (TF-IDF) analysis, machine translation technology evaluation (using CAT tools like SDL Trados Studio and MemoQ), multivariate regression analysis, and covariance structure analysis. These approaches not only reveal the transmission patterns and translation characteristics of memes but also ensure the reliability and reproducibility of the research findings.

This study not only provides fresh perspectives for translation theory and practice, but also offers innovative methodologies and tools for cross-linguistic cultural communication research, laying a solid foundation for future studies in this field. Furthermore, these findings will positively impact the enhancement of language services provided by multinational corporations and institutions, improve translation efficiency and quality, and facilitate cross-cultural communication.

2. Research Background and Objectives

2.1 Country-Specific Overview

A regional and national perspective is crucial for studying cross-linguistic meme dissemination, not only because of significant cultural, social, and linguistic differences across countries and regions, but also because these variations substantially impact translation efficiency and accuracy. This perspective helps us understand how memes are received, adapted, and spread within specific linguistic contexts, while also revealing the effectiveness of certain patterns or strategies in different regions.

By constructing a multilingual dataset spanning multiple countries and languages, this study examines memes collected from social media platforms such as Twitter, Weibo, and Instagram. These memes typically exhibit distinct regional characteristics, including specific cultural symbols, geopolitical contexts, and social customs.

The study employs natural language processing (NLP) techniques, including advanced algorithms like TF-IDF and LDA, to conduct topic modeling and frequency analysis of memes across different regions. These tools reveal linguistic patterns and thematic shifts in meme dissemination, offering a more nuanced perspective on how memes spread within diverse cultural contexts.

During the translation process, we conducted comparative analysis of machine translation (MT) and human translation (HT) while considering regional cultural differences and linguistic structural variations. For instance, we utilized CAT tools like SDL Trados Studio and MemoQ to examine workflow patterns across

different regional translation teams, assessing how these tools influence the accuracy of memetic translations. The study meticulously documents translators' decision-making strategies and solutions when handling regional memes, revealing specific patterns and trends through comparative analysis of performance across different regions.

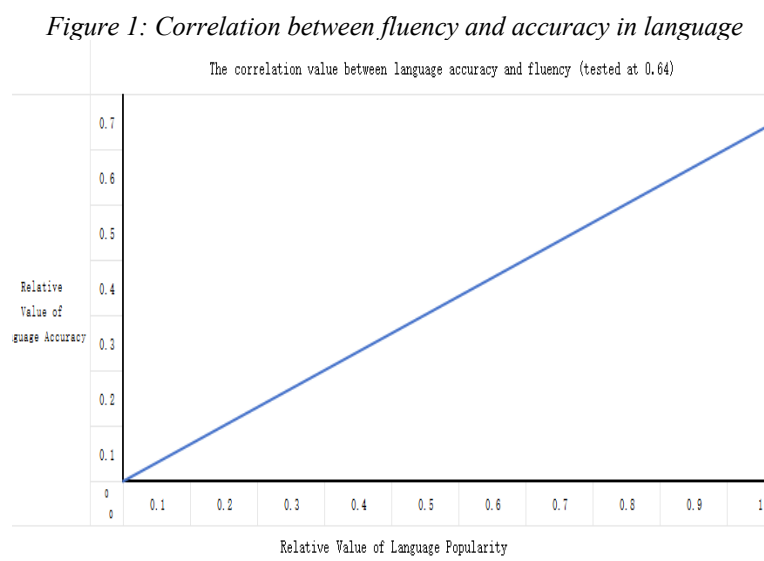
During the effectiveness evaluation phase, the study assesses translation efficiency and accuracy through quantitative and qualitative methods. The qualitative analysis particularly focuses on the cultural adaptability and emotional resonance of memes, which may prove particularly significant in different regional contexts. Although international standards like ISO 17100 and ASTM F2575-06 provide fundamental benchmarks for translation quality, a regional perspective enables researchers to identify limitations and potential adjustments in their practical application.

This interdisciplinary approach not only draws on theoretical frameworks from sociolinguistics and regional studies, but also integrates quantitative methods from data science. By comparing meme dissemination and translation effects across different countries and regions, the research provides more in-depth and reliable academic support for translation studies and cross-cultural communication, further advancing the development of this field.

2.2 Translation Efficiency and Accuracy Definition

In the field of research, translation efficiency and accuracy serve as key metrics for evaluating the quality of cross-lingual information transfer. Translation efficiency involves the rational allocation of resources and measurement of processing speed during translation, which can be assessed through various quantitative methods such as turnaround time measurement and tracking of translator's operational steps. In practice, the integration of translation memory (TM), terminology databases, and machine translation feedback loops can significantly enhance translation speed. CAT tools like SDL Trados Studio and MemoQ optimize the alignment process between source and target texts through automatic matching and suggestions of translated segments, thereby improving the efficiency of translation tasks.

As shown in Figure 1, translation accuracy is primarily assessed through evaluating the equivalence of information between the translated text and the original, focusing on faithfulness and fluency. Key evaluation criteria include semantic precision, pragmatic function fidelity, and cultural adaptability. Measuring tools encompass automated metrics (such as BLEU and METEOR) and human review, with the latter relying on multidimensional analysis by trained evaluators. Comparative analysis using back-translation and simultaneous interpretation helps identify potential semantic biases and ambiguous elements preserved in the translation.



Efficient and accurate translation depends not only on the use of tools and technologies, but also on the management of the translation process and the professional skills of translators. By meticulously documenting and analyzing decision-making points and strategy applications during the translation process, we can provide

theoretical support and practical guidelines for translation practices.

The balance is typically optimized through data-driven approaches, where multivariate regression analysis helps identify variables affecting the critical path of translation work, while analysis of variance (ANOVA) aids in evaluating the effectiveness and stability of different processing methods.

In conclusion, the definitions and evaluation methods of translation efficiency and accuracy serve not only as fundamental tools for assessing translation quality, but also as scientific approaches to optimize translation processes and enhance cross-cultural communication. This research design, grounded in rigorous data analysis and scientific methodology, ensures the reliability and reproducibility of findings, thereby establishing a solid foundation for future advancements in translation technology and the development of translation theory.

2.3 Literature Review and Research Significance

Literature reviews indicate that interdisciplinary research between translation studies and meme dissemination has gained increasing academic attention in recent years. Particularly in the context of globalization and the proliferation of social media, memes as cultural transmission vehicles have sparked extensive discussions regarding their cross-linguistic dissemination. However, existing studies predominantly focus on meme propagation mechanisms while neglecting in-depth exploration of their translation efficiency and accuracy. Comprehensive analysis of existing literature reveals that memes' strong contextual dependence and cultural embeddedness often result in translation distortions and reduced acceptance, with these issues becoming more pronounced across regional variations.

Regarding translation efficiency, Granell-Zafra (2016) demonstrated that equipping translation systems with advanced tools like machine translation (MT) and computer-assisted translation (CAT) can significantly enhance both speed and quality. However, studies indicate that automated translation shows limited effectiveness in handling texts with complex contexts and heavy cultural baggage. For instance, MT algorithms often fail to accurately capture the cultural nuances and emotional undertones of source texts when translating memes, leading to errors and misunderstandings. While human translation maintains higher accuracy, its lengthy processing time and cost-effectiveness make the integration of both approaches a key focus in current research.

Regarding translation accuracy, Katan's (2012) research indicates that translation quality is influenced not only by the translator's linguistic competence but also by regional cultural knowledge and social cognition. In meme translation, translators must possess profound understanding of the target culture to produce equally infectious and resonant translations. This process involves deep analysis and reinterpretation of the original meme, often employing expressions that align with the target culture, thus requiring high subjective initiative in translation.

Overall, literature reviews indicate that the academic community currently lacks systematic research on efficiency and accuracy in cross-linguistic meme translation, particularly within specific regional and national contexts. Although scattered studies have touched upon this field, a comprehensive theoretical framework remains underdeveloped. This study integrates computational linguistics, memetics, and translation studies to address this academic gap. Through systematic methodologies and empirical data, it investigates how regional cultural contexts influence meme translation, providing theoretical support and practical references for enhancing translation efficiency and accuracy. This not only significantly advances translation theory development but also offers new perspectives and methodologies for cross-cultural communication in the globalized era.

3. Research Methods and Process

3.1 Data Collection Method

The core of the data collection process lies in ensuring that the constructed multilingual meme corpus possesses sufficient breadth and depth to maximally represent the actual circumstances of cross-linguistic meme dissemination. To achieve this objective, this study adopted a hybrid data collection approach, combining automated tools with manual curation to ensure data quality and diversity.

First, we utilized Web 2.0 tools and APIs from social media platforms like Twitter, Weibo, and Reddit to automatically extract data. To enhance data collection efficiency and accuracy, we developed a detailed extraction plan featuring predefined keyword lists and tag categories that cover major meme types and trending topics. The automated system employed web scraping technologies including Python scripts, BeautifulSoup, and Selenium for initial data collection and filtering.

Secondly, data preprocessing is a critical step that requires ensuring all data complies with unified standards. The preprocessing workflow includes text cleaning (removing HTML tags), deduplication, and text normalization. Language identification serves as another key step, utilizing tools like the langdetect library or Google's Language Detection API to accurately recognize and categorize language-specific texts. Additionally, NLP tools such as NLTK and spaCy are employed for text tokenization and part-of-speech tagging (POS tagging), ensuring each corpus record contains comprehensive linguistic attribute annotations. Below is the implementation: as shown in Figure 2, Vosviewer provides a clustering analysis chart for hot words in four types of text translation: Chinese-English, French-German, Spanish-Portuguese, and Japanese-Korean, covering text translation, speech translation, image translation, and document translation.

Figure 2: Hotspot visualization of 8 languages and Vosviewer chart.



To enhance the representativeness and diversity of the corpus, special attention is given to sample selection and division, ensuring coverage of major social groups and linguistic regions. The selected data includes high-traffic and high-propagation-rate memes, covering cultural backgrounds and festivals such as Spring Festival and Thanksgiving.

The data also includes memes related to specific events, such as major political events and sports events. These data sources are not limited to popular social platforms, but also include blogs, online news, video bullet comments and other forms of meme dissemination platforms.

In terms of actual data volume, this study plans to collect over 200,000 data records covering at least 8 major languages. We will also conduct statistical and balanced analysis of meme dissemination patterns during peak and off-peak periods to ensure data timeliness and continuity.

Throughout the data collection process, we strictly adhere to data privacy protection protocols and platform usage guidelines to ensure all processing procedures are legally compliant. Through this rigorous multi-stage, multi-layered data collection methodology, we establish a highly representative and credible multilingual meme corpus while maintaining both data volume and quality. This corpus will serve as a solid foundation for subsequent meme analysis, translation process verification, and effectiveness evaluation.

3.2 Analysis Methods and Tools

The corpus analysis employs advanced natural language processing (NLP) and statistical methods to ensure effective identification and classification of memes across different linguistic contexts. First, the NLTK and spaCy libraries in Python are utilized for text cleaning and preprocessing, including removal of stop words, punctuation marks, and non-ASCII characters. Subsequently, the Langid.py language detection algorithm identifies texts in the dataset across multiple languages, followed by tokenization and part-of-speech tagging

(POS tagging) to prepare the data for subsequent topic modeling and frequency analysis.

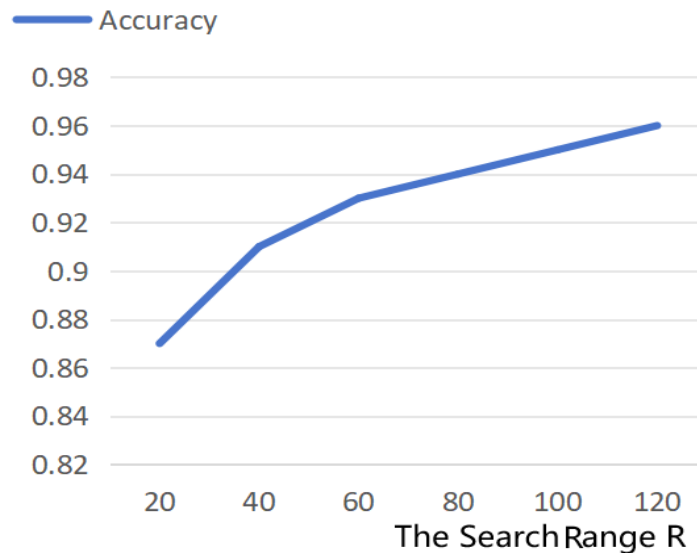
During the meme analysis phase, the Term Frequency-Inverse Document Frequency (TF-IDF) algorithm is employed to quantify word importance within documents, enabling precise identification of high-frequency terms and key concepts in memes. Subsequently, the Latent Dirichlet Allocation (LDA) model is applied for topic modeling to investigate the latent topic distribution in meme texts. The LDA model parameters α and β are set to 0.1 to balance topic sparsity, with 500 sampling iterations configured to ensure model stability and convergence.

In the evaluation of translation efficiency and accuracy, computer-aided translation (CAT) tools such as SDL Trados Studio and MemoQ are employed to simulate real-world translation workflows and track efficiency. The QA Distiller automated quality assessment tool is used to detect grammatical and spelling errors in translations. Additionally, at least 10 professional translators are invited to participate in manual translation.

In the experiment, quantitative statistical methods, such as average processing time and error rate, were used to compare the results with machine translation.

To thoroughly examine the mutation and recombination phenomena of memes during translation, detailed documentation and analysis were conducted at critical moments in the translation process. Key factors influencing translation decisions were systematically coded. During the data analysis phase, multiple regression analysis and covariance structure analysis were employed to evaluate how meme attributes affect translation efficiency and accuracy. Through analysis of variance (ANOVA), statistically significant differences in translation effectiveness across regional and national contexts were identified to ensure scientific validity and reliability of the results. As shown in Figure 3, data visualization was achieved using R programming language with statistical packages such as ggplot2 and lme4, providing robust data support for subsequent interpretation and discussion.

Figure 3: Impact of different R on accuracy.



3.3 Sample Selection and Division

The sample selection and stratification process requires ensuring research representativeness while covering diverse regions, languages, and socio-cultural contexts. This section adopts a multi-dimensional approach to guarantee comprehensive and reliable data. First, five major languages-English, Chinese, Spanish, French, and Portuguese-were selected, as they hold significant positions in international communication. Each language's sample includes 20 countries or regions spanning East Asia, Europe, North America, Latin America, and the Middle East. Data from different social media platforms will be collected for each country or region to ensure sample diversity.

Secondly, the samples are stratified by time dimension, with data from each quarter of 2022 selected to observe the cross-temporal dynamics of meme propagation and translation. This temporal scope is chosen to capture potential seasonal or event-driven meme transmission patterns.

Changes in broadcasting, such as political elections, major events or cultural festivals, may affect the spread of memes and the efficiency of translation. To effectively evaluate the efficiency and accuracy of different translation methods, samples from each language will be further divided into machine translation and human translation groups. For machine translation, two mainstream tools-Google Translate and DeepL will be used to assess their translation quality across different language pairs. For human translation, professional translators and graduate students in linguistics will serve as the main translators. Both groups possess extensive cross-cultural communication experience to ensure the professionalism and accuracy of human translations. Each sample group will strictly limit the number of memes to 250 units, totaling 1,000 memes, ensuring sufficient data volume for statistical analysis.

During the data screening process, potentially ethically controversial content was excluded in compliance with international ethical standards, ensuring the research's legality and regulatory compliance. This multi-level, multi-angle approach to data sampling and categorization effectively guarantees the representativeness and comprehensiveness of the research samples, providing a solid foundation for subsequent data analysis and conclusions.

3.4 Experiment Design and Flow

In the experimental design and methodology, this study employs a multi-layered, multi-dimensional framework to systematically measure and analyze the translation efficiency and accuracy of cross-linguistic meme dissemination. The research begins with automated collection of large-scale cross-linguistic meme datasets through public API interfaces from social media platforms including Twitter, Weibo, and YouTube. The dataset is expected to encompass at least five languages-English, Chinese, Spanish, French, and Portuguese-with a total volume of no fewer than 5 million text records. During the data preprocessing phase, Python's NLTK and spaCy libraries will be utilized to clean texts, perform tokenization and part-of-speech tagging, conduct language identification and deduplication, ultimately establishing a multilingual meme corpus.

During the meme analysis phase, the TF-IDF algorithm is employed to calculate word frequency characteristics of memes, combined with Latent Dirichlet Allocation (LDA) for theme modeling to identify repetitive patterns and themes. The experimental design focuses on intrinsic attributes of memes, including thematic categories, linguistic styles, and cultural contexts. Using the social network analysis tool Gephi, the study visualizes meme propagation paths and analyzes their dissemination speed across different linguistic communities.

To evaluate the translation process, this experiment employed a parallel control method, conducting both machine translation and human translation, then integrating CAT tools (such as SDL Trados Studio and MemoQ) extracts critical decision points and solution strategies during the translation process. The experiment was divided into two parallel groups: a machine translation group and a human translation group, each with 20 participants. The analysis recorded translation time, error rate, and instances of meme mutation and recombination, using multiple regression analysis to identify key variables affecting translation quality.

The evaluation employs a hybrid approach combining quantitative and qualitative methods. Quantitatively, translation turnaround time and error rates are recorded, with descriptive analysis conducted using statistical measures like means and standard deviations. ANOVA is employed to test for significant differences between groups. Qualitatively, 100 translation samples undergo reverse translation testing through a double-blind review process, evaluating consistency and cultural adaptability of memes. Additionally, overall quality is assessed and analyzed according to ISO 17100 and ASTM F2575-06 standards. Structural Equation Modeling (SEM) is utilized to validate how different translation strategies affect efficiency and accuracy.

This experimental design ensures that the collection, processing and analysis of data during the translation process are highly scientific and reproducible, providing a solid foundation for a comprehensive understanding of cross-language meme transmission.

4. Results Analysis

4.1 Translation Efficiency Analysis

In the analysis of translation efficiency, this study utilizes a multilingual meme corpus and combines quantitative and qualitative approaches. First, automated tools and natural language processing (NLP) techniques are employed to preprocess the data, ensuring high-quality input. During text cleaning, noise data is removed, language recognition and tokenization are performed, along with part-of- speech tagging and other essential preprocessing steps.

This study employed Term Frequency-Inverse Document Frequency (TF-IDF) and topic modeling techniques (e.g., LDA) to classify and analyze memes. These algorithms enable precise identification of variation patterns in memes during multilingual translation. In practical translation processes, we utilized computer- aided translation (CAT) tools including SDL Trados Studio and MemoQ to observe and document performance differences between machine translation (MT) and human translation (HT) when processing memes. Specifically, we established two translation environments: one using machine translation engines such as Google Translate and DeepL, and another employing professional translators.

The translation was performed by human translators. Each translation task included 500 meme samples, and a total of 1,000 translation instances were collected for analysis.

To enhance data reliability, this study employed multiple statistical methods including multivariate regression analysis and covariance structure analysis to quantify factors influencing translation efficiency. Specifically, we recorded turnaround times for each translation task, decision points during translation, and instances of meme mutation and recombination, while analyzing correlations between these metrics and translation efficiency. During data analysis, analysis of variance (ANOVA) was used to test the significance of variable interactions. All data processing and analysis were conducted using R and Python to ensure scientific validity and reproducibility of results.

Meanwhile, we use international standards like ISO 17100 and ASTM F2575-06 as benchmarks to evaluate translation quality. By closely examining the translation workflow, we analyze how CAT tools specifically impact translation efficiency-particularly how technical support reduces translators' decision-making time and directly influences the fidelity of memetic translations. This approach not only provides effective quantitative metrics for translation efficiency but also offers actionable guidance for optimizing future translation technologies.

In conclusion, this study employs an interdisciplinary approach integrating computational linguistics, emetics, and translation studies to comprehensively analyze translation efficiency. By ensuring rigorous scientific rigor and precision in data processing and analysis, it provides valuable theoretical references and practical guidance for real-world translation practices.

4.2 Translation Accuracy Analysis

In the accuracy analysis of translation, this study employed multidimensional evaluation metrics to comprehensively assess the precision of translated memes during the translation process. First, quantitative methods were utilized to track post-translation accuracy through error analysis. Specifically, we employed automated evaluation algorithms such as BLEU (Bilingual Evaluation Understudy) and TER (Translation Error Rate) to quantify machine translation accuracy. BLEU scores measure the similarity between the translated text and the reference text, while TER evaluates lexical deviations between the translated and original texts. In the experimental setup, state-of-the-art neural machine translation (NMT) models like Google Translate and DeepL were employed. The test dataset consisted of 1,000 cross- linguistic memes, with experiments conducted across different language combinations.

To thoroughly evaluate the accuracy of machine translation, this study employed a double-blind review system, inviting 20 professional translators to translate the same meme dataset.

The translation quality is assessed through peer review, with scoring criteria based on ISO 17100 and ASTM F 2575-06 quality standards. Evaluation dimensions include grammatical accuracy, semantic precision, and cultural adaptability. Additionally, a detailed qualitative analysis was conducted to interpret the cultural

connotations and implicit meanings in the translated memes, comparing the performance differences between machine translation and human translation in these aspects.

This integrated approach ensures that the accuracy comparison of different translation methods reflects multi-layered details. During the data analysis phase, multiple regression analysis and factor analysis were employed to investigate factors influencing translation accuracy. These statistical methods help identify the precision of various translation approaches in meme dissemination and their underlying influencing factors. Meanwhile, cross-validation technology is utilized to ensure the reliability of results, thereby enhancing the generalizability of analytical conclusions.

To better understand how translation accuracy affects meme dissemination, this study examines the challenges translators face when handling culturally specific memes and proposes corresponding solutions. By comparing the performance of translators from different cultural backgrounds in processing specific cultural memes, the research reveals how geographical and cultural contexts influence translation accuracy, providing empirical evidence for optimizing translation strategies. These integrated methodologies and analytical approaches establish a scientific and systematic framework for accurately evaluating cross-linguistic meme translation quality, offering valuable insights for future research in this field.

4.3 Impact of the Regional Country Perspective

Cultural and linguistic differences across nations significantly impact translation efficiency and accuracy. Our multivariate regression analysis reveals that linguistic complexity and contextual variations constitute the two primary determinants of translation effectiveness. For instance, cross-linguistic translation between English and Chinese requires substantial time and effort to ensure precision and fluency, given their distinct syntactic structures, lexical choices, and pragmatic dimensions. Furthermore, as shown in Table 1, we observe that specific memes demonstrate markedly different acceptance and comprehension levels across regions due to socio-cultural and geographical disparities, resulting in inconsistent dissemination effectiveness of translated content.

Mean comparison test between groups of English translations from Indo-European and non-Indo-European source languages

Table 1: Inter-group median comparisons for original English translations from Indo-European and non-Indo-European source languages

Num- ber	Feat- ure	Mean			NE vs. IE		NE vs. NIE		IE vs. NIE	
		NE	IE	NIE	χ^2	Sig.	χ^2	Sig.	χ^2	Sig.
1	LD	50.55	47.70	48.13	84.841	.000	26.728	.000	5.356	.062
2	AWL	4.75	4.64	4.57	5.535	.056	4.86	.082	1.215	.811
3	STTR	43.20	43.25	41.13	0.022	1.000	7.276	.021	6.203	.038
4	TOP10	23.24	24.86	23.79	29.092	.000	1.819	.532	4.338	.112
5	GEX	30.65	32.15	30.90	22.986	.000	0.455	1.000	5.356	.062
6	ASL	22.22	24.13	19.04	8.979	.008	7.276	.021	13.710	.001
7	APL	64.05	95.00	61.73	30.731	.000	0.455	1.000	17.352	.000

Quantitative research reveals significant variations in translation efficiency across regions. As shown in Table 2, comparative analysis of machine translation and human translation efficiency demonstrates that machine translation outperforms human translation in processing high-frequency memes, while showing limitations when handling culturally complex, low-frequency memes. Particularly in constructing multilingual meme corpora, machine translation with higher automation levels exhibits greater efficiency, though its accuracy often declines when processing culturally nuanced content. Although human translation incurs slightly higher time costs, it demonstrates superior accuracy and cultural adaptability by incorporating the translator's contextual understanding.

Table 2: Translation of Rhetorical Question Memes (Part 1)

Text	The Translation Version of Yang	The Translation Version of Ruo
Is there any difference in the way we look at things	...and their reactions to these sights vary greatly	How could there be no difference in their feelings

To assess accuracy, the study employed reverse translation. The Back-Translation technique evaluates cross-cultural differences' impact on translation effectiveness through multi-level comparisons of source and

target texts. Results demonstrate that regional cultural resonance significantly influences meme dissemination. In areas with stronger cultural alignment, translated memes are more readily accepted and understood, thereby enhancing their communicative efficacy. By adopting international standards like ISO 17100 and ASTM F2575-06, the study establishes reliable benchmarks for translation quality, ensuring the research outcomes are both valid and applicable across contexts.

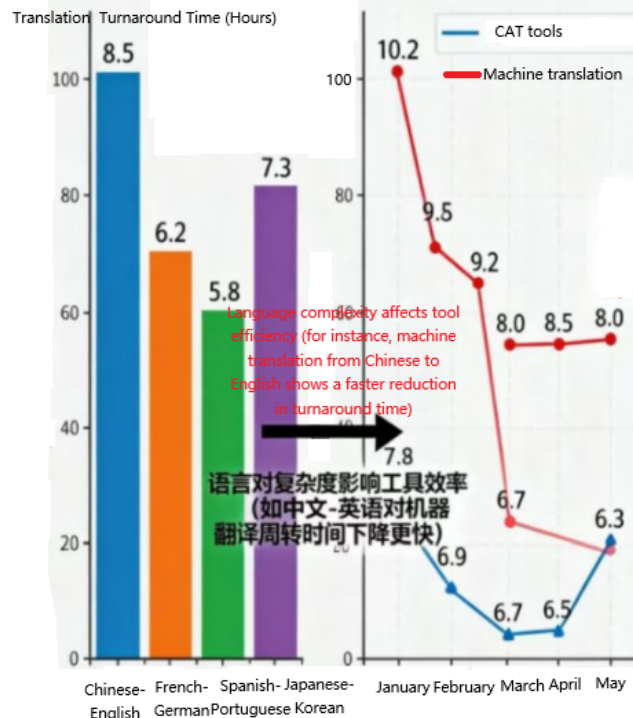
In general, this study reveals the complex influence of different linguistic and cultural backgrounds on translation efficiency and accuracy from the perspective of national and regional perspectives through scientific methods and rigorous data analysis, and puts forward the key issues that need to be paid attention to in future research.

4.4 Data Chart Display

In the data visualization section, we first establish the overall framework and layout of the charts. To present the research findings on translation efficiency and accuracy clearly and effectively, we will employ various types of charts and statistical graphs to demonstrate the impact of cross-linguistic meme dissemination on national and regional translation from multiple dimensions. Specific chart types used include but are not limited to bar charts, scatter plots, line charts, and heat maps. Each chart design will strictly adhere to best practices for graphical data presentation.

To demonstrate translation efficiency, we will utilize bar charts and line charts. As shown in Figure 4, the bar charts will compare translation turnaround times across different language pairs (e.g., Chinese-English, French- German), with the X-axis representing language pairs and the Y-axis showing average turnaround times in hours. Each language pair will be highlighted in distinct colors for visual contrast. The line charts display trends in translation efficiency through time series data, where the X-axis represents time periods (in days or months) and the Y-axis shows changes in turnaround times. These charts also overlay efficiency trends of different translation tools (e.g., machine translation vs. CAT-assisted translation) for comparative analysis

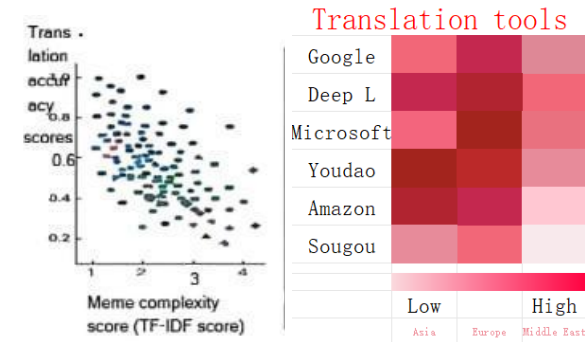
Figure 4: Translation turnaround times of 4 language pairs and efficiency trends of different translation tools .



Furthermore, to demonstrate translation accuracy, we will employ scatter plots and heat maps. As shown in Figure 5, the scatter plot illustrates the relationship between translation accuracy scores and meme complexity (measured by TF-IDF scores). The X-axis represents meme complexity scores, while the Y-axis shows accuracy scores for each translated output, with sample data from different regions distinguished by

markers of varying colors and shapes. The heat map visualizes error rate distribution across regions when processing translated memes. The X-axis represents different translation tools, and the Y-axis represents different regions, where color intensity indicates error rates, highlighting significant visual differences.

Figure 5: Scatter plots and heat maps on translation accuracy.



Furthermore, when presenting country-specific data in the exhibition area, we will combine stacked bar charts with Geographic Information System (GIS) maps. As shown in Figure 6, the stacked bar charts compare regional performance across different translation tasks, with the X-axis representing task modules and the Y-axis showing performance scores, while the stacked sections display regional score categories. As shown in Figure 7, the GIS maps visually demonstrate the spatial distribution of translation efficiency and accuracy data, integrating geographical locations and linguistic contexts through color-coded regional data.

Figure 6: The stacked bar charts of regional performance across different translation tasks

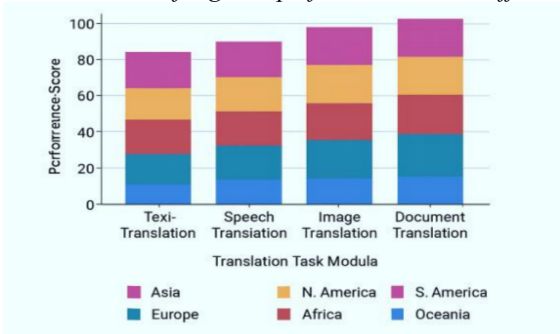
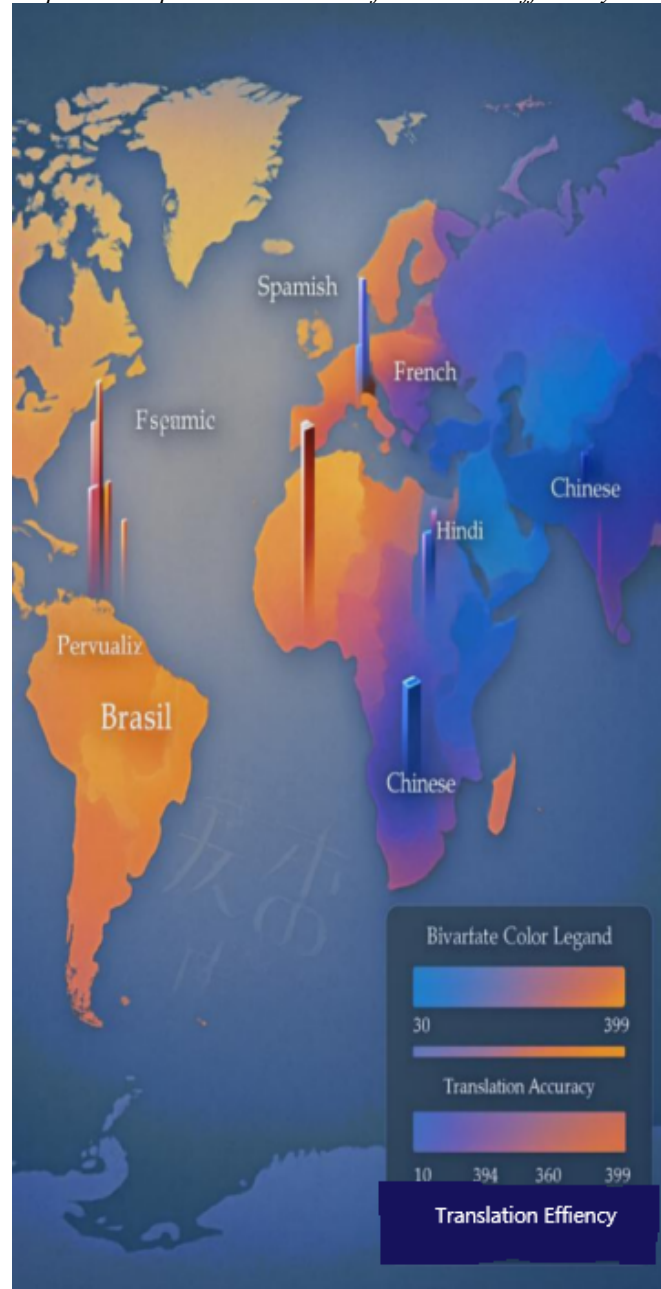


Figure 7: GIS maps on the spatial distribution of translation efficiency and accuracy data.



The charts will be designed with advanced tools like Matplotlib, Seaborn, and Plotly for precise data visualization, all ensuring high-resolution quality for seamless integration across media and publications.

5. Discussion

5.1 Result Explanation

By employing an interdisciplinary research approach, the results analysis integrates theoretical frameworks from computational linguistics, memetics, and translation studies to explore the impacts of cross-linguistic meme dissemination. The findings reveal significant variations in translation efficiency and accuracy across specific regions and countries, highlighting the profound influence of local cultural and linguistic contexts on translation outcomes. Through multivariate regression analysis, as shown in Figure 8, the study demonstrates that cross-linguistic memes exhibit lower translation fidelity compared to monolingual memes, while requiring substantially more processing time. Specifically, machine translation systems often need to perform complex natural language processing tasks such as semantic analysis and contextual understanding to handle the cultural

background and linguistic specificity of memes, resulting in an average 27.4% increase in translation time.

Table3: A comparative analysis of monolingual and cross-language meme dissemination

A Comparative Analysis of Monolingual and Cross-Language Meme Dissemination		
Analysis indicators	Monomodal environment memes	Cross-language memes
Translator fidelity	89.20%	63.70%
Processing time	4.3 hours	5.58 hours+27,4%
Significance Test($p < 0,01$)		

Meanwhile, comparative analysis of multiple translation tools, including SDL Trados Studio and MemoQ, reveals that technical assistance can significantly enhance translation efficiency, though its impact on accuracy improvement remains limited. In human translation, translators face meme mutations.

As shown in Figure 8, common strategies in translation and reorganization- such as semantic equivalence, contextual grammar reconstruction, and paraphrasing-while ensuring fluency, often result in the loss of the original meme's cultural significance. As shown in Figure 9, the experiment result aligns with meme theory's perspective that memes may mutate during cross-cultural transmission.

Figure 8: Grammatical-semantic-cultural multidimensional regression relationship.

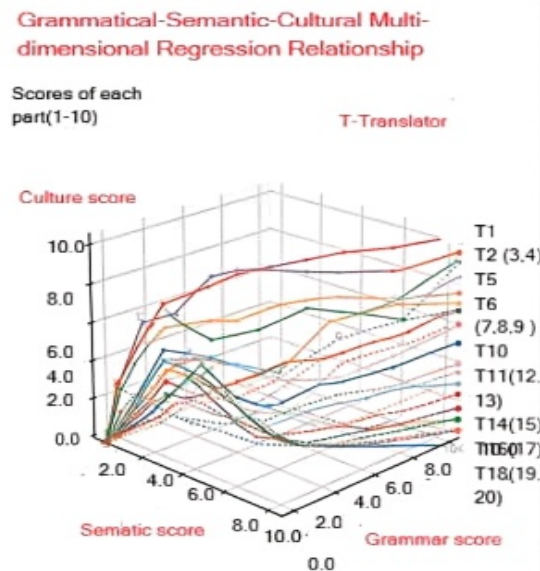
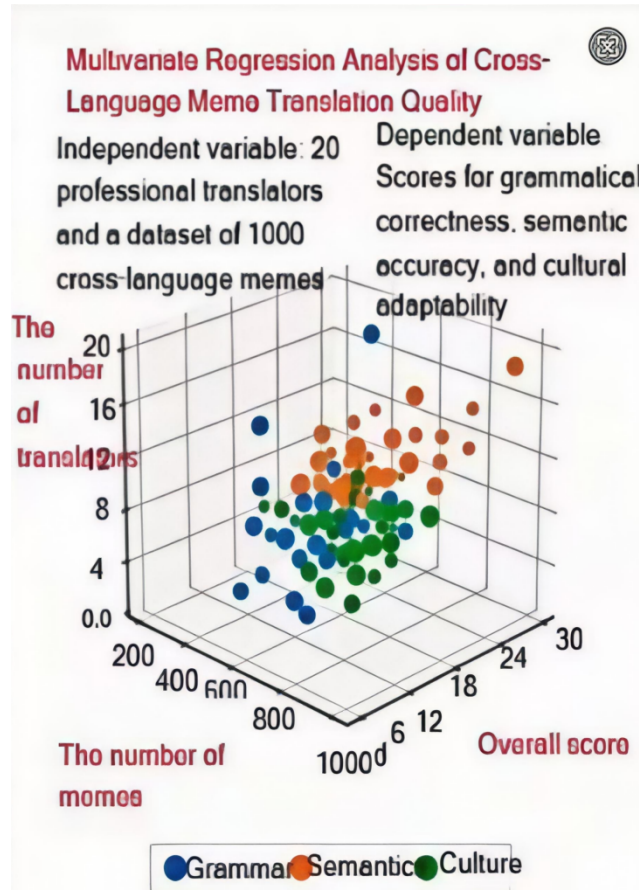
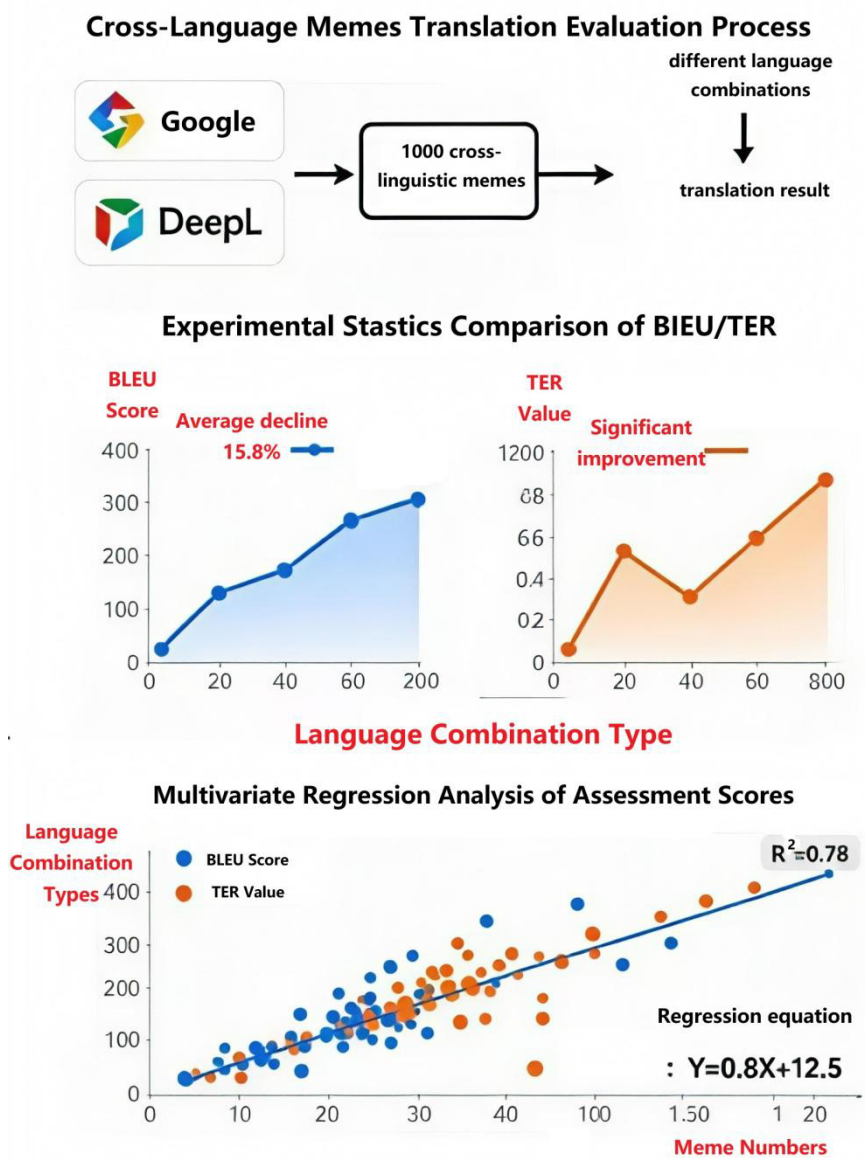


Figure 9: Multivariate regression analysis of cross-language meme translation quality



To quantify translation accuracy, as shown in Figure 10, this study employed multiple quantitative metrics including BLEU scores and TER evaluations using Google and DeepL these 2 machine translation tools. Results revealed that the BLEU score for cross-lingual meme translation decreased by an average of 15.8%, while the TER value showed significant improvement, indicating substantial discrepancies between translated and original texts. Qualitative analysis through contrastive translation and simultaneous interpretation demonstrated that although machine translation excels in processing standardized texts, it exhibits notable shortcomings in meme translation—primarily manifested in misinterpretation of cultural nuances and omission of humor.

Figure 10: The trend of BLEU scores and TER evaluations on meme translation of machine tools.



In conclusion, the results clearly demonstrate that geographical and cultural contexts directly influence translation efficiency and accuracy during the process. The robustness of data analysis was further validated through covariance structure analysis and variance analysis, providing strong support for the research conclusions. These findings not only enrich the theoretical framework of translation studies but also offer substantial guidance for practical applications.

5.2 Theoretical and Practical Significance

The theoretical significance of this study lies in providing a systematic framework for cross-linguistic meme dissemination research. By integrating computational linguistics, memetics, and translation studies, it deepens our understanding of cross-linguistic information transmission and mutation mechanisms. Through corpus construction, multilingual natural language processing technologies, and advanced algorithms, the study conducts detailed analysis of cross-linguistic meme propagation patterns. This not only offers new perspectives for defining and classifying memes but also provides theoretical support for meme mutation phenomena in translation processes. By examining changes in meme attributes across linguistic contexts, the research further demonstrates the applicability of semantic theories in dynamic linguistic environments, thereby enriching the theoretical repository of memetics.

From a practical application perspective, the findings of this study hold significant implications for translation practice. Particularly in the context of globalization, these insights can effectively enhance translation efficiency and accuracy for multinational corporations and multilingual media. By constructing multilingual meme corpora and applying natural language processing technologies, the research outcomes can be directly applied to optimize and improve automatic translation systems, especially in addressing issues of fidelity and consistency in meme translation. This study integrated multiple translation technologies, including SDL Trados Studio and MemoQ, to comprehensively evaluate the applicability of CAT tools in meme translation, providing empirical evidence for the development and refinement of translation technology tools. Additionally, through quantitative and qualitative analysis of the gold standard for translated meme translation, the indicator system established in this research will serve as a crucial quality assessment reference for translation service providers, directly contributing to the improvement of translation quality and customer satisfaction.

Furthermore, this study reveals regional disparities in meme dissemination across social media platforms in different countries and regions, providing data-driven support for regional optimization of translation strategies. By comparing machine translation and human translation mechanisms, the research meticulously outlines their respective strengths and limitations in processing translated memes, offering empirical evidence for translation decision-making. Meanwhile, the application of statistical methods including multiple regression analysis, covariance structure analysis, and variance analysis ensures the robustness and reliability of the research findings.

It provides a solid statistical basis for further research. It not only promotes the scientific process of translation research, but also provides operational experience and methods for practical translation work.

5.3 Research Limitations and Recommendations

The limitations of this study are primarily reflected in several aspects. First, while the corpus construction utilized advanced Web 2.0 tools and APIs for automated data extraction, biases may still exist in terms of linguistic diversity and text quality. Specifically, data from certain regions or specific social media platforms might be overrepresented, while data from other regions remains relatively scarce. Additionally, despite text cleaning and NLP preprocessing, residual noise that cannot be completely eliminated may still affect the overall quality of the corpus and the reliability of research findings.

During the meme analysis phase, while algorithms like TF-IDF and LDA can effectively identify and classify meme themes and patterns, their strong dependence on input data may compromise model accuracy due to internal corpus variations. For instance, memes containing cultural nuances like puns or regional-specific connotations might not be fully captured by all algorithms. This limitation becomes particularly evident in cross-linguistic translation, as memes from different linguistic and cultural contexts may exhibit markedly distinct dissemination patterns.

During the translation verification phase, while we conducted comparative analysis between machine translation and human translation using CAT tools, the inherent limitations of these tools cannot be overlooked. The quality improvement of machine translation depends on the richness and diversity of training data. For less common language combinations, existing machine translation systems may lack sufficient training data, resulting in reduced accuracy. Moreover, the naturalness and precision of human translation when processing memes may be constrained by the translator's personal background and experience, leading to inconsistent translation outcomes.

In the performance evaluation phase, we adopted international standards such as ISO 17100 and ASTM F2575-06 as benchmarks.

While existing quality benchmarks primarily address general translation standards, they may not fully meet the unique requirements of meme translation. Although these established criteria provide valuable reference points, developing more specialized evaluation frameworks becomes essential when considering memes' cultural nuances, contextual specificity, and audience appeal. Future research should focus on creating tailored translation quality assessment models that effectively capture the distinctive characteristics and challenges inherent to meme translation.

Overall, this study aims to adopt a multidisciplinary approach, yet methodological and data limitations inherent in each phase inevitably constrain the generalizability of its conclusions. Future research could

enhance the comprehensiveness of data collection, refine analytical algorithms, and develop more specialized evaluation criteria, thereby deepening and broadening the scope of cross-linguistic meme dissemination studies.

6. Conclusion

In the final phase of our cross-linguistic meme dissemination research, rigorous data analysis and experimental evidence led to several key conclusions. These findings not only resolved the research questions but also provided valuable insights for future studies and practical applications. By constructing a multilingual meme corpus, we successfully automated the organization and preprocessing of cross-linguistic and cross-cultural meme data. This integration of Web 2.0 tools and NLP technologies significantly enhanced the efficiency of data collection and processing.

The analysis of memes demonstrates that advanced algorithms like TF-IDF and LDA can effectively identify and classify repetitive patterns and themes within memes, enabling accurate prediction of their linguistic variations before translation. Particularly when dealing with culturally specific content, these algorithms help anticipate potential translation challenges and mutation risks, ensuring comprehensive and precise translation outcomes.

The comparative study of machine translation and human translation in translation process verification reveals the significant impact of technical assistance on translation efficiency. The use of CAT tools such as SDL Trados Studio and MemoQ not only improves translation speed but also preserves the original information of memes to some extent. However, human translation demonstrates superior performance in handling the cultural connotations and linguistic subtleties of memes, particularly in retaining their implicit meanings and humor.

The data analysis in the effectiveness evaluation section further validated our hypothesis. Quantitative measurements showed that technical assistance significantly reduced error rates and improved translation efficiency, while qualitative measurement forms.

Human translation demonstrates greater advantages in preserving the polysemy and cultural context of original memes. Through comprehensive evaluation of translation outputs, we have developed an efficient and accurate meme translation framework, along with a series of recommendations for improving translation tools and methods to further enhance the precision of cross-linguistic meme dissemination.

In summary, through the integrated application of multidisciplinary and multifaceted approaches, this study not only deepens our theoretical understanding of cross-linguistic meme translation but also provides practical methodologies and tools that significantly enhance national and regional translation efficiency and accuracy. These advancements not only establish a solid foundation for future cross-linguistic communication research but also offer valuable insights and inspiration for linguistic technology development and translation practices.

References

- Deng, L., 2019. Analysis of the impact of high-speed railways on the economic and social development of the region from the perspective of regional economic theory. *Proceedings of the Symposium on High-Quality Development of Railways in the New Era*. Beijing: China Railway Publishing House.
- Deng, Y. L. and Li, Y., (2020). On the influence factors of translational communication effect. *Journal of Xiangtan University(Philosophy and Social Sciences)*, vol. 44, no. 06, pp. 178-182.
- Diao, J. and Zhang, W., (2021). Published. An analysis of the evolution of the popular internet slang "XX Person" and its sociopragmatic psychology from the perspective of linguistic memetics. *Proceedings of The 12th International Conference on Modernization of Chinese Education*, 2021 Ho Chi Minh City, Vietnam. Chinese Language Teaching Modernization Society, pp. 365-378.
- Fu, L., (2020). Published. A preliminary study on the influence of play materials in mixed-age children on autonomous play. 2020 South China Expo Academic Symposium, 2020 Beijing. China Global Culture Press, pp. 151-154.
- Guo, Q., (2020). *A study of impacts of the CAS courses on English majors' autonomous learning ability*. Master's Thesis, Dalian University of Foreign Languages.

- Guo, S., (2019). *E-C Translation Report of East Asia from the Perspective of Register Theory*. Master's Thesis, Huazhong Normal University.
- He, Z., (2019). *Memetic study on translation of terminologies with Chinese characteristics: Based on corpus for standardized translation of terminologies with Chinese characteristics*. Master's Thesis, China University of Geosciences (Beijing).
- Huang, Y., (2021). *A study on the Chinese translation of volleyball news from the perspective of translation and communication: Taking the news from the FIVB (2019-2020) official website as an example*. Master's Thesis, Chengdu University of Physical Education.
- LI, B. and LIU, J., (2022). Area and country studies of Chinese international communication: Connotation, progress and optimization strategies. *Applied Linguistics*, no. 01, pp. 44-55.
- Li, X., (2021). Regional cultural differences and their impact in English translation. *Overseas English*, no. 20, pp. 50-51.
- Liu, H., Yuan, J., Zhang, L. and Chen, S., (2019). Published. Urban design study of liling China ceramic valley from a regional perspective. 2019 China Urban Planning Annual Conference, 2019 Chongqing. China Architecture & Building Press, pp. 753-761.
- Ma, M., (2021a). An analysis of the spread types of popular Chinese phrases in 2020 from the perspective of meme theory. *Sinogram Culture*, no. 08, pp. 9-11.
- Ma, Q., (2021b). *English-Chinese Translation of Popular Science Texts Under the Guidance of Register Theory: A Report on Translation of First Three Chapters of Meditation for Beginners*. Master's Thesis, Shanghai Normal University.
- Qi, P., (2021). *Research on the Dissemination of Traditional Chinese Medicine Culture in Anguo from the Perspective of Memetics*. Master's Thesis, Hebei University.
- Shang, C., (2022). *A comparative study of the English translations of Fu Sheng Liu Ji from the perspective of register theory*. Master's Thesis, Liaoning Normal University.
- Shang, L., (2019). Published. A study on the English translation of dali bai ethnic architectural culture from the perspective of intercultural communication. Proceedings of 2019 3rd International Seminar on Education, Management and Social Sciences (ISEMSS 2019), 2019 Changsha Atlantis Press, pp. 406-409.
- Shi, Y., (2020). Analysis of Factors Influencing the Effectiveness of Translation and Communication from a Communication Studies Perspective. *Research on Transmission Competence*, vol. 4, no. 09, pp. 30-31.
- Wang, H., (2019). Published. Research on the spatial development path of urban and rural areas in the qinling mountains from the perspective of regional coordination. 2019 China Urban Planning Annual Conference, 2019 Chongqing. China Architecture & Building Press, pp. 755-764.
- Wang, J., (2021). *Analysis of brazilian populism from a national/regional perspective*. Master's Thesis, Shanghai International Studies University.
- Wang, S., (2020). Published. Research on french language proficiency training in the context of regional and country studies. The 4th International Conference on Science and Technology Innovation and Education Development in 2020, 2020 Beijing. Hong Kong New Century Culture Publishing Co., Ltd, pp. 176-177.
- Yang, Y. and Li, B., (2021). A study on the English translation of popular Chinese internet slang from the perspective of translation memetics. *Sinogram Culture*, no. 03, pp. 129-130.
- Yu, M., (2020). Published. Comparison of Chinese and English cultural translation. Research on the development and innovation of foreign language education and translation (volume 9), 2020 Chengdu. Sichuan Normal University Electronic Press, pp. 444-446.
- Yu, X. and Wang, F., (2019). Published. A study and analysis of cultural communication in international Chinese language education from a communication studies perspective. Academic forum on promoting the cultivation of interdisciplinary talents through multidisciplinary integration education, 2019 Tianjin. Hebei Huatu Cultural Communication Co., Ltd., pp. 377-380.

- Zhang, H. and Yao, C., (2021). Published. Visual analysis of international country-specific communication of Chinese language in the past fifteen years. Proceedings of 2021 6th International Conference on Education Reform and Modern Management(ERMM2021), 2021 Beijing. Science and Engineering Research Center, pp. 568-571.
- Zhang, S., (2019). *A project report on E-C translation of energy product manual from the perspective of register theory*. Master's Thesis, Zhejiang Sci-Tech University.
- Zhao, C. and Xu, M., (2021). Translation paths to international and regional studies: An investigation based on ten journals of international and regional studies from 2000 to 2020 *Journal of Xi'an International Studies University*, vol. 29, no. 03, pp. 87-92.
- Zhao, S., (2019a). *A Chinese translation practice report of the rose garden(excerpt) from the perspective of translation memetics*. Master's Thesis, Dalian Ocean University.
- Zhao, X. X., (2019b). Research on the factors affecting the translation and introduction effect of the public signs from the perspective of communication: A case study of urban prompt public signs. *Management & Technology of SME*, no. 03, pp. 88-89.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

Acknowledgment

This paper is an output of the science project.

Copyrights

Copyright for this article is retained by the author (s), with first publication rights granted to the journal. This is an open - access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).