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THE IMPACT OF AL ON TRANSLATION STUDIES: CHARACTERISTICS, FIELDS AND SIGNIFICANCE

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Abstract
With the developing of artificial intelligence in translation research, a new perspective has emerged—examining translation studies through the lens of artificial intelligence. This approach is fundamentally rooted in AI and is distinguished by its intelligence, contextual awareness, and integration. The key research areas within this field include assessing translation quality and effectiveness, analyzing translation processes, and exploring translation pedagogy. The rise of AI-driven translation studies not only encourages a reassessment of theoretical models but also drives methodological transformation, broadening and deepening both translation research and teaching.

Keywords: Artificial Intelligence; Translation Studies; Neural Networks.

Introduction

Artificial intelligence pertains to the utilization of manual operations to facilitate intelligent evolution in machines, thereby enhancing their capacity for automation. Since the advent of the twenty-first century, human society has progressively entered the era of artificial intelligence, with emerging technologies such as machine learning, natural language processing, visual perception, and pattern recognition permeating various domains of education and research. The continuous advancement of artificial intelligence has significantly propelled the development of the translation field, giving rise to numerous innovations, including terminology management, translation memory, and neural network-based machine translation, thereby instigating transformative shifts in translation research.

The academic community has actively integrated artificial intelligence technologies—exemplified by deep learning, machine learning, and neural networks—into translation studies, with the expectation of establishing an entirely new research paradigm: translation studies through the lens of artificial intelligence. However, the precise definition and implications of translation research from this perspective remain ambiguous. Therefore, this paper aims to examine the origins of translation studies within the framework of artificial intelligence and to analyze its essence, characteristics, principal research domains, and overall significance. To this end, the study will address the following key research questions:

What historical and technological contexts have contributed to the emergence of translation studies from the perspective of artificial intelligence?

What are the fundamental attributes and defining characteristics of translation research within the domain of artificial intelligence?

What are the primary research areas encompassed by translation studies in the field of artificial intelligence?
What is the broader significance of translation research within the realm of artificial intelligence?
Researching the background of translation research from the perspective of artificial intelligence

Artificial Intelligence

Artificial Intelligence (AI) employs anthropomorphic technologies and logical frameworks to construct intelligent operational systems, thereby ensuring the systematic advancement of intelligent technologies. As an interdisciplinary frontier, AI integrates computer science with intelligent systems, constituting a fundamental aspect of both computer science and intelligence research. AI can be conceptualized from two distinct perspectives. First, it encompasses a machine's ability to learn and replicate human behaviors in everyday life, thereby enabling it to engage in intelligent cognitive processes and activities—a capability that underpins the development of the Turing test. Second, AI is founded upon a rigorous theoretical framework and has emerged as a distinct academic discipline. In 2018, the Ministry of Education formally recognized its structured body of knowledge, further facilitating the refinement and expansion of AI as a scholarly field.

The origin of translation research from the perspective of artificial intelligence

Translation research, in the perspective of artificial intelligence, is essentially a fusion of artificial intelligence and translation research, formed in the development of artificial intelligence research and the rise of empirical translation research.

1.2.1 Development of Artificial Intelligence Research

The rapid advancement of Artificial Intelligence (AI) has brought about significant and swift transformations in translation technology, which is now extensively applied in translation practices. Consequently, the academic community has shown considerable interest in machine translation and related technologies. Early research in machine translation primarily centered on computer-aided translation (CAT). Over time, the focus expanded to include machine translation post-editing (MTPE) and interactive machine translation (IMT). Interactive machine translation, also referred to as interactive machine prediction or target text-mediated interactive machine translation, was first introduced by Church and Hovy (1993). The core concept of interactive machine translation is to combine the accuracy of human translation with the efficiency of machine translation through seamless interaction between the user and the machine translation engine (Church & Hovy, 1993).

1.2.2 The Emergence of Empirical Translation Studies

Traditionally, translation studies have been predominantly discursive, relying on logical deduction, conceptual analysis, and subjective judgment to identify common characteristics

and the fundamental nature of translation phenomena. However, since the 1980s, empirical translation research has emerged as a significant methodological approach, attracting increasing scholarly attention within the field of translation studies. Empirical translation research involves systematically observing and analyzing translation products and processes through corpus-based studies, collecting empirical data using experimental methodologies, and formulating or testing theoretical hypotheses based on the collected evidence (Hu, 2020). This research framework operates on two distinct levels. First, it utilizes experimental psychological data gathered through methodologies such as think-aloud protocols, behavioral data captured via keyboard logging and eye-tracking, and neuroscientific data obtained through Event-Related Potentials (ERP) and functional Magnetic Resonance Imaging (fMRI) to investigate the cognitive and psychological processes involved in translation practice. Second, it explores the shared features of translated texts and their functional properties through employing corpus-based analysis.

In light of these methodological principles, there is an inherent synergy between artificial intelligence (AI) and empirical translation research. Both approaches emphasize the importance of observing and analyzing extensive datasets to uncover patterns and extract generalizable insights into specific phenomena. Additionally, they share a commitment to relying on concrete, data-driven evidence within the field of translation studies. Nevertheless, the two diverge in their methodological approaches: whereas empirical translation research incorporates AI techniques, it also integrates methods from experimental psychology, situational behavioral analysis, and neuroscientific investigations.

The alignment between AI research and empirical translation studies presents a promising avenue for academic convergence, potentially giving rise to a novel research framework—translation studies viewed through the lens of artificial intelligence. This integration could foster the development of an innovative paradigm that bridges computational methodologies with traditional empirical approaches, enriching the field with new perspectives and insights.

2. The Essence and Characteristics of Translation Research from the lens of Artificial Intelligence

viability of pursuing and conducting translation research from an artificial intelligence (AI) perspective stem from the inherent synergy between AI research and empirical translation research. This interdisciplinary approach combines the core characteristics of both fields, integrating the data-driven, analytical methodologies of AI with the observational and experimental techniques of empirical translation studies. In essence, it represents a fusion of disciplines, leveraging the strengths of each to create a unified framework for exploring translation phenomena.

2.1 The Nature of Translation Research from the Perspective of Artificial Intelligence

Translation research from the perspective of artificial intelligence (AI) is rooted in the application of AI technologies and draws on theories from translation studies, linguistics, literature, socio-cultural studies, psychology, and cognitive science. It seeks to describe the essence of translation, identify common characteristics of translation phenomena, explain the causes of specific translation behaviors, and predict future translation trends. As such, it is

inherently interdisciplinary. On one hand, translation research itself intersects with linguistics, literature, cultural studies, sociology, psychology, neuroscience, cognitive science, and computer science. On the other hand, AI research relies on big data, autonomous learning, deep learning, and cognitive intelligence, connecting it to statistics, mathematics, computer science, and information science. To summarize all the above, AI-driven translation research tackles translation-related problems by exploring, explaining, and predicting translation phenomena within AI. It breaks down disciplinary barriers, fostering interdisciplinary, multidimensional, and collaborative approaches.

Moreover, artificial intelligence (AI) offers a revolutionary perspective to translation research, presenting theoretical frameworks that depart from traditional methodologies. it harmonizes connectionism—which relies on linguistic big data—with symbolism—which is based on linguistic rules and common sense—to forge a unified model that significantly enriches the theoretical landscape of the discipline. This approach utilizes cutting-edge research techniques, harnessing intelligent tools, AI-powered technologies, and sophisticated data analytics to delve into unexplored domains, such as the cognitive processes involved in neural network-based machine translation.

By systematically observing, analyzing, and extracting insights from translation data within AI-enhanced environments, AI-enabled environments, this paradigm reveals hidden patterns and unique characteristics, elucidating the fundamental principles that shape translation phenomena. In contrast to conventional methods, its findings are not merely derived from observation and inductive reasoning but are also validated by data-driven evidence, thereby bolstering the objectivity and scientific credibility of the results. In this manner, AI not only specify the methodological and theoretical frontiers of translation research but also positions itself as an innovative framework for exploring and comprehending the intricate dynamics of translation.

Research Perspectives in Translation Studies

Translation research embraces several perspectives:

Philological framework: emphases on translation strategies and techniques, focusing on fidelity of the source text. Key figures include Cicero, Jerome, Schleiermacher, and Tytler.

Linguistic framework: anchored in linguistic theories (e.g., Chomsky’s generative grammar, Saussure’s structuralism, Halliday’s functional grammar), it scrutinizes how translation is achieved at lexical, syntactic, discourse, and pragmatic levels. Represented by scholars like Nida and Catford (HU, 2012).

Socio-Cultural framework: probes the production and reception of translations within explicit social, historical, and cultural contexts, on how socio-cultural factors influence translation and vice versa. Key scholars include Bassnett, Lefevere, Snell-Hornby, Even-Zohar, and Toury.

Psychological-Cognitive framework: assesses the cognitive processes of bilingual processing, emphases on mental representations, cognitive parts, and information processing paradigms. Its inquiries the psychological mechanisms and cognitive patterns of translators, with contributions from Sandra Halverson and Maxim Stamenov.

While the philological, linguistic, and socio-cultural perspectives concentration on translation products and effects, the psychological-cognitive framework focus on the translation process. The former applies to qualitative methods to study translation strategies, linguistic features, and cultural influences, while the latter uses experimental and observational methods to detect translators' cognitive and emotional factors. moreover, these frameworks often overlook situational factors, leading to partial conclusions.

The AI Perspective in Translation Research

The AI framework in translation research examines both translation products and processes with the situational factors. It focuses on the importance of technology in translation practices, particularly in human-computer interaction. This perspective discusses that translation is not only shaped by the translator's individual traits but also influenced by AI technologies, which in turn affect the interaction between translators and AI systems.

Key advantages of the AI perspective contain:

Objectivity and Scientific Rigor: By exploring the major amounts of translation data and human-computer interactions, it conquers the subjectivity and one-sidedness of traditional approaches, conceding more objective and scientific conclusions.

Integration of Commonality and Individuality: It specifics universal translation norms while considering the individual differences, such as creativity, working memory, emotional states, and interaction with outside resources. This addresses the neglect of individuality in traditional research.

Dynamic and Holistic Analysis: It explores both static and dynamic factors influencing translation, including linguistic, socio-cultural, and cognitive elements within AI scenarios. By reframing translation products and processes in AI environments, it reveals common features and general principles, advancing beyond the limitations of static, traditional perspectives.

2.2 Characteristics of Translation Research from the Perspective of Artificial Intelligence

Translation research from the perspective of artificial intelligence (AI) is rooted in AI technology scenarios, merging these scenarios with translation studies. It is distinguished by three key features: intelligence, situationality, and intergradability.

2.2.1 Intelligence

The intelligence built-in in AI-driven translation research is rooted in its emphasis on automated translation products and processes. On the contrast to traditional translation studies, which predominantly emphases on human-generated translations, this research paradigm examines machine translation and other AI-generated outputs, like audio-based translation. Such products extend beyond the scope of conventional translation studies.

what's more, the intelligence of this research is also manifested in its methodologies. By collecting translation data produced by AI systems, especially neural network-based machine

translation, researchers can identify patterns and characteristics of translation phenomena. This approach makes use of advanced technologies, such as pattern recognition and neural networks, to derive insights into the nature of translation, thereby rendering the research process itself more intelligent.

2.2.2 Situationality

The incorporation of AI technologies into translation research has profoundly widened and deepened its theoretical underpinnings, methodological approaches, and research scope, driving structural innovations and paving the way for the emergence of a new ecosystem tailored to fit AI translation research. By integrating computational tools, data-driven methodologies, and advanced analytical frameworks, AI has not only enhanced the precision and depth of translation studies but also enabled the exploration of previously uncharted territories, such as the cognitive and interactive dynamics of human-machine collaboration. This evolution has fostered a more holistic and adaptive research paradigm, one that accounts for the complex interplay of linguistic, cognitive, socio-cultural, and technological factors. it has laid the groundwork for a transformative and interdisciplinary ecosystem that redefines the boundaries and possibilities of translation research in the age of artificial intelligence.

In contemporary translation studies, there is a paradigm turn from micro-level neurocognitive techniques to macro-level situational cognition (Muñoz, 2017). This transition combines research on neural networks in the brain with socio-cultural factors, thereby increasing the ecological validity, precision, and scientific rigor of translation studies. Even though neurocognitive research in translation and interpreting stays a relatively underexplored domain (García, 2019), some scholars have started employing experimental methodologies to examine how interactions between translators and their environments influence the translation process (Cui & Zheng, 2021).

To achieve a comprehensive understanding of translation within AI-driven contexts, it is fundamental to employ a vast array of research methodologies that explore the influence of AI technologies and environments on translators' emotional and cognitive proclaims. While AI research advances and its applications become widespread, translation studies will continue to incorporate multifaceted perspectives, enabling the creation of situational models that fits to AI translation. These integrative techniques will not only root in our insights into the interplay between human and machine but also drive the evolution of translation research, ensuring its relevance and adaptability in an era defined by rapid technological transformation.

2.2.3 Integrability

The integrability of AI-driven translation research denotes the interactive and integrative nature of AI technologies within translation studies, covering both theoretical and applied research dimensions. This perspective highlights the seamless incorporation of AI tools and methodologies into the fabric of translation research, enabling a dynamic interplay between computational innovations and traditional scholarly inquiry.

On a theoretical level, it enriches the conceptual frameworks by introducing data-driven models and hybrid approaches that bridge connectionism and symbolism. On an applied level, it enhances practical translation processes through advanced technologies such as neural machine translation, natural language processing, and intelligent data analytics. This dual focus fosters a cohesive and interdisciplinary research ecosystem, where AI not only complements but also transforms the ways in which translation is studied and practiced.

Theoretical Research

Computational psycholinguistics provides a primary basis for constructing models of language representation and cognitive processing within the human brain (Crocker, 2010). These models yield valuable insights into the cognitive mechanisms underlying translation. By interdisciplinary collaboration, translation researchers enhance neurocognitive computational models to describe, interpret, and predict translation behaviors. What's more is, these models incorporate both macro-level factors (e.g., cultural and historical influences) and micro-level factors (e.g., individual experiences, emotions, and personality traits), thereby enhancing the explanatory and predictive power of translation research frameworks (Lang & Hou, 2022).

Applied Research

In practical terms, the intergradability of AI and translation research is clear in machine translation. Originating from Alan Turing's vision which is using computers to reflect human intelligence, machine translation aims to mimic human translation capabilities, making it a cornerstone of AI (FENG, 2018).

With improvements in big data and deep learning, machine translation has entered the "machine learning" phase. Exploring human-machine interaction mechanisms, particularly the synergy between human translators and computer- facilitated instruments or post-editing processes. This integration helps to improve translation quality while reducing the cognitive load on translators (Carl & Schaeffer, 2017).

While current machine translation systems cannot fully replicate human cognitive operations, they enable the study of interactions between translators and AI tools. This includes examining how translators interact with translation aids, machine translation outputs, cloud resources, and even crowdsourcing platforms. Thes research sheds light on the cognitive processes of translators working in AI-enhanced environments (O'Brien, 2017).

Main Fields of Translation Research from the Perspective of Artificial Intelligence

Translation research from the perspective of artificial intelligence (AI) embraces several key areas: translation computational modeling, research on human-machine translation products and effects, translation process research, and AI-driven or intelligent translation teaching research.

3.1 Translation Computational Modeling

Translation computational modeling under the AI perspective contains constructing cognitive models that anticipate the translation process by integrating digital representations of linguistics, computational psycholinguistics, socio-cultural factors, behavioral cognition, and translation products. As computational psycholinguistics traditionally concentrate on macro-level language processing and lacks neural-level algorithmic specificity (Crocker, 2010), Marr (1982) emphasizes the importance of describing cognitive processes across three layers: the computational layer, representation layer, and physical layer.

Current research, such as the Noise Channel Model of the Translation Process (Carl & Schaeffer, 2017) and studies by Lu Sheng et al. (2020), created methods like Hidden Markov Models and machine learning to predict translation cognitive processes. These models combine linguistic, cognitive-behavioral, and socio-cultural frameworks, linking translators' behaviors and processes with final translation products. they mainly focus on the computational and representation layers, leaving the physical layer unexplored.

With the rise of computational neuroscience, researchers are now investigating how neural interactions enable brain computations, opening new avenues for exploring the physical layer of translation cognitive processing.

3.2 Research on Human-Machine Translation Products and Effects

This field examines the quality and effectiveness of machine translation (MT) compared to human translation (HT) by analyzing large datasets of both. It explores linguistic and textual features at phonological, lexical, syntactic, semantic, and collocational levels, as well as stylistic and cultural acceptability.

Key areas of focus include:

Linguistic Features: Analysis of morphemes, lexical density, sentence length, high-frequency words, and syntactic structures in translated texts.

Socio-Cultural Features: Investigation of how translation products reflect cultural and social contexts.

For example, Li Fengqi (2022) compared the fidelity, fluency, terminology, style, and cultural acceptability of English-Chinese translations by professional learners and neural MT systems. Wang Zhijun (2022) highlighted MT's limitations in word collocation, emphasizing the need for human intervention and meaning reconstruction. Lu (2023) compared human and machine simultaneous interpreting, revealing significant differences in processing objects, strategies, and quality, and proposed collaborative human-machine interpreting models.

3.3 Research on the Translation Process

AI-driven translation process research investigates human-computer interaction, micro-level neurocognitive processes, and macro-level situational cognition, integrating neural network studies with socio-cultural research.

Interactive Machine Translation (IMT)

Interactive learning in AI allows user feedback to enhance translation models during use. IMT integrates human input into the training process, improving translation outcomes. For instance:

Zuo (2021) demonstrated how AI technologies create intelligent, interactive environments for translators.

Wang et al. (2023) advocated for a harmonious human-machine ecosystem, emphasizing data security, ethical considerations, and the enhancement of translators' technical and humanistic skills.

Geng and Hu (2023) explored AI-assisted post-translation editing as a new direction, offering tools for proofreading, evaluation, and feedback in translation teaching.

Neurocognitive and Situational Research

Since the 21st century, translation and interpreting studies have increasingly aligned with neurocognitive research. García (2019) described this as a "known area to be explored." Key developments include:

Zhao (2018) highlighted the role of cognitive technologies in aiding translation practice.

Qian et al. (2022) studied how MT error types affect translators' attention allocation.

Ethnographic methods, such as observation and interviews (Risku, 2017), and experimental approaches (Cui & Zheng, 2021) have been used to explore translator-environment interactions.

Social neuroscience has further integrated social factors into experimental designs, recognizing that cognition is situational, context-dependent, and influenced by emotional, behavioral, and cultural factors (Ibáñez, Sedeño & García, 2017). This has led to the emergence of "translation context neurocognitive research," combining experimental and situational paradigms (Lu & Zheng, 2022).

O'Brien (2017) noted that while current MT cannot replicate human cognitive operations, it enables the study of human-machine interaction, allowing translators to adapt their processes to AI tools and automate parts of their work (Carl, 2020).

3.4 Teaching Intelligent Translation

Research on intelligent translation teaching in the era of artificial intelligence (AI) encompasses three main areas: theories of intelligent translation teaching, translation competence, and translation education technology.

Intelligent Translation Education

Intelligent translation education represents a new paradigm that integrates translation teaching with AI technologies and modern educational concepts. By creating an intelligent teaching environment that leverages human-computer interaction, cooperation, and symbiosis, and applying data-driven evaluation methods, it enhances the efficiency and quality of translation teaching (WANG & Liu, 2023).

In practice, technologies like intelligent learning analytics and ChatGPT-like tools can support independent translation training, act as learning companions, and provide 24/7 Q&A services to address common translation challenges. In interpreting education, voice

recognition and machine interpreting tools can revolutionize training and practice, enabling applications in fields such as community interpreting, court interpreting, international healthcare, and rescue operations (WANG & LI, 2019).

For translation assessment, ChatGPT can evaluate learners' translations using established quality metrics (e.g., DQF, MQM, BLEU), while teachers provide professional feedback and targeted guidance based on AI-generated insights.

Translation Competence

Translation competence encompasses the knowledge, skills, and strategic approaches necessary for executing translation tasks (Miao, 2007; Qian, 2011). In the era of artificial intelligence, understanding translation competence requires addressing new challenges and orientations in translator training.

Initially derived from the concept of "bilingual competence," translation competence has expanded to incorporate socio-cultural and intercultural communication skills (Xu, 2002; Toury, 2012; Colina, 2003). With the advent of AI, proficiency in utilizing translation-related tools and technologies has become increasingly indispensable (Pym, 2004). Liang and Liu (2023) identified three fundamental advantages of human translation competence: bilingual conversion, communicative ability, and linguistic proficiency. By implementing targeted pedagogical strategies, these competencies can be further developed, thereby enhancing both the quality of human translation and the effectiveness of human-machine collaborative translation.

Translation Education Technology

Translation education technology pertains to the systematic design, development, application, management, and evaluation of instructional processes and resources, with the objective of optimizing translation education through technological advancements (Zhang & Lyu, 2023).

Scholars advocate for the integration of starting the technologies, including artificial intelligence, big data, the Internet of Things, and brain-computer interfaces, to revolutionize translation education. For instance, Li et al. (2019) highlighted the significance of data fusion technologies in integrating multi-source and multi-modal educational data, encompassing behavioral, physiological, psychological, cognitive, and emotional dimensions. Furthermore, Wang (2021) proposed the development of intelligent translation teaching platforms that leverage big data analytics, learner profiling, and deep learning methodologies to deliver personalized learning interventions and enhance educational outcomes.

4. Significance of Translation Research from the Perspective of Artificial Intelligence

The integration of AI and translation research expands the scope, created the new methodologies, and enriches the translation studies.

4.1 Expanding the Perspective of Translation Studies

AI technologies like text mining, deep learning, and neural machine translation have changed translation research from a purely linguistic focus to an interdisciplinary approach. This contains integrating philological, linguistic, socio-cultural, and cognitive-psychological perspectives.

Traditionally, translation studies concentrated on linguistic features, but AI enables multi-level analysis of translation language features and supports the study of translation universals. AI also increased technological backing for process-oriented and product-oriented research, allowing for a more comprehensive understanding of translation phenomena.

4.2 Renewing the Methodology of Translation Studies

As translation research has historically depended on qualitative methods, AI introduces quantitative and computational approaches. For instance, computational neuroscience can model brain-based language processing and human language mechanisms, enabling the construction of neurocognitive models to describe, interpret, and predict translation behaviors.

AI also enhances empirical research by enabling the analysis of large bilingual corpora and providing vivid, intuitive visualizations of translation data. Technologies like neural machine translation and text mining reveal translation phenomena and facts that are difficult to observe in manual translation processes, enriching the empirical basis of translation studies.

Conclusion

This study presents a comprehensive examination of translation research through the lens of artificial intelligence (AI), analyzing its origins, fundamental principles, defining characteristics, primary research domains, and overall significance. The findings indicate that AI-driven translation research arises from the convergence of AI technologies and translation studies, distinguished by its intelligence, situational adaptability, and interdisciplinary nature. Nevertheless, this study does not extensively address cultural and emotional dimensions in translation, which remain crucial areas for future investigation. Moreover, while this research introduces a novel perspective for translation studies, further exploration is required to assess the extent to which emerging technologies can enhance and reshape translation research methodologies.

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