AI-Driven Technologies: Challenges and Countermeasures of Machine Translation in ELF Contexts

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Abstract

With the revolution and development in artificial intelligence (AI) and translation amongst ELF learners, the accuracy and quality of machine translation (MT) has facilitated the process of language translations. This article discusses the challenges and countermeasures related with AI-driven machine translation (MT) technologies and the uses in the context of English as a global lingua franca (ELF) where MT and AI have significant roles in terms of a tool to express certain language output. However, the integration of these technologies in the setting, particularly in academic contexts, reveals several challenges. Key issues including linguistic inaccuracies, cultural insensitivity, and domain-specific translation difficulties have been criticized. Moreover, this paper shows a range of countermeasures, such as, hybrid translation models that combine AI with human expertise, the development of domain-specific translation tools, and the implementation of human expertise guidelines. Also, the paper highlights the importance of interdisciplinary of using machine translation and continuous improvement in AI technologies to enhance translation quality.

Keywords: Artificial Intelligence**,** Machine Translation**,** English as A Global Lingua Franca

1. Introduction

Translation, from the past until now, has played a pivotal role in our increasingly interconnected and multicultural world, serving as a bridge that facilitates communication, understanding, and collaboration across different linguistic and cultural parts. It facilitates the global exchange of knowledge, ideas, and information, thereby enabling cross-cultural communication, and understanding, also in academic, diplomatic, and commercial contexts. In an era dealing with the rapid exchange of information, the importance of translation extends beyond linguistic conversion. With translation, ones can access, share, and benefit from research findings, new knowledge, policies, and innovations (Munday et al., 2022). Furthermore, it preserves and promotes cultural heritage by making literary and historical texts available to a wider audience. By enhancing mutual understanding and cooperation among nations, translation plays a vital role in fostering global harmony and progress, underscoring its indispensable value in our increasingly globalized society (Zainudin & Awal, 2012). 'Translation', traditionally relied on human expertise to convey meaning accurately across languages. Nowadays, machine translation (MT) has emerged as a powerful alternative, leveraging computational methods to automate the translation process. Therefore, this article endeavors to explore the challenges and countermeasures of machine translation in terms of the usage in university contexts, offering insights into strategies for enhancing translation quality, promoting cultural inclusivity, and maximizing the benefits of AI-driven technologies in higher education.

2. The use of artificial intelligence (AI) and translation across language boundaries in higher education contexts

In the age of artificial intelligence (AI), where global communication and collaboration are beyond linguistic boundaries, it should be noted that an importance of English translation cannot be overstated. The global prevalence of English, both as a first and second language, underscores its status as a dominant medium of international communication. As of recent estimates, approximately 375 million people speak English as their first language, with the majority residing in countries such as the United States, the United Kingdom, Canada, Australia, and New Zealand. Beyond these native speakers, an additional 1.5 billion individuals use English as a second language, often

acquiring it as part of their education or professional development in regions including Europe, Asia, and Africa. This widespread adoption of English as a second language highlights its role as a lingua franca or ELF (Yuan, 2022). As a result, English can be seen and served as a gateway to knowledge dissemination, economic opportunity, and cultural exchange on a global scale (Al-Salman, 2007). In consequence, English translation also plays a significant role in facilitating the interoperability, accessibility, and usability of the widespread of information, enabling seamless communication and collaboration across diverse linguistic and cultural contexts.

Apart from the importance of translation and English language stated above, the dynamic landscape of higher education, in the era of globalization and digitalization, the integration of AI-driven technologies has emerged as a transformative force reshaping teaching, learning, and scholarly communication. Among these technologies, machine translation (MT) occupies a central role in facilitating cross-cultural exchange and multilingual discourse within English served as a lingua franca university context, especially in teaching and learning (Liu, 2022). The study of Atarchi et al. (2024) identified the AI tools used by doctoral students for translating and post-editing academic articles from online survey comprising 17 items. The result shows that the role of AI-powered translation tools has a great impact on facilitating the composition of research articles. In addition, a majority of research participants have stated the advantage of using machine translation as the tool to increase their confidences in writing.

According to Kenny & Winters (2020), machine translation has become increasingly prevalent in various contexts. For example, in regular university where English is served as a foreign language or lingua franca, translation is a tool revolutionizing the way academic materials are accessed, disseminated, and understood. To be more specific, machine translation (MT) help access to global data, generate collaboration across borders, and further academic translating materials. As universities strive to embrace globalization and accommodate diverse student populations, machine translation offers a promising solution for breaking down linguistic barriers and facilitating multilingual communication (Wang, 2021). By using MT technologies, it can enhance the accessibility of educational materials for non-native English speakers, international students, and individuals with diverse linguistic

backgrounds. Moreover, machine translation has the potential to facilitate cross-cultural exchange and collaboration, fostering a more inclusive and globally engaged academic community.

Nevertheless, using MT technologies can also create flaws. In terms of translation accuracy, the research reveals the results in translations that often lack grammatical accuracy and readability, particularly in Thai language, such as tone, formality, and context-specific meanings. This leads to translations that may be grammatically correct but fail to convey the intended academic tone or cultural nuances (Chimsuk et al., 2009).

3. What is Machine Translation?

In terms of globalization and digital connectivity, the field of machine translation (MT) also stands at the forefront of technological innovation, positioned to completely transform communication between different cultures and overcome language obstacles. Machine translation (MT) itself refers to the automated process of converting text or speech from one language to another using computer algorithms and software (Asscher, 2023). It contains various related methodologies, including Rule-Based Machine Translation (RBMT), Statistical Machine Translation (SMT), and Neural Machine Translation (NMT). The goal of MT is to facilitate communication across different languages by providing translations that are both accurate and contextually appropriate. Despite significant advancements, challenges such as handling idiomatic expressions, cultural nuances, and low-resource languages remain areas of active research and development. Additionally, MT has witnessed some benefits, offering the promise of rapid, scalable, and cost-effective translation solutions. However, despite the remarkable progress made in recent years, machine translation continues to encounter challenges and disproof that impede its efficacy and reliability.

4. MT with linguistic challenges, cultural nuances, and domain specificity

By leveraging advanced artificial intelligence and natural language processing technologies, machine translation enables researchers to access and interpret vast amounts of literature and data in multiple languages, thereby broadening the scope of their investigations (Liebling et al., 2020). This technological advancement facilitates the inclusion of diverse perspectives

and findings that might otherwise remain inaccessible due to language barriers. Consequently, machine translation not only enhances the comprehensiveness and depth of certain studies but also promotes greater inclusivity and diversity in academic research, fostering a more complete understanding of complex global issues.

The influence of machine translation on field studies is not without challenges. The accuracy and reliability of machine-generated translations can vary significantly, particularly when dealing with idiomatic expressions, specialized terminologies, and culturally nuanced texts. Such limitations necessitate careful validation and, human post-editing to ensure the fidelity of translated materials (Khasawneh et al., 2023). Furthermore, the ethical implications of relying on machine translation in research must be considered, especially regarding the potential for misinterpretation and the perpetuation of biases embedded within training data. As machine translation continues to evolve, it is imperative for researchers to adopt a critical approach, balancing the benefits of technological efficiency with rigorous standards for accuracy and cultural sensitivity.

Despite significant steps in AI-driven translation, machine translation systems often struggle to accurately capture the subtleties, nuances, and specific characteristics inherent in human language. The complexity of language, characterized by its semantic ambiguity, syntactic variability, and cultural connotations, also poses difficult challenges for automated translation systems, which may result in inaccuracies, mistranslations, and distortions in the translated output (Wei, 2020). However, the adoption of machine translation in academic settings is still facing its challenges, as it deals with issues of linguistic accuracy, cultural sensitivity, and domain specificity in terms of translation.

Firstly, to be more specific, in terms of linguistic accuracy, machine translation often struggles with idiomatic phrases. For instance, translating the English phrase "kick the bucket" into another language could result in confusion since the phrase means "to die," not the literal action of kicking a bucket. According to the study of Tongpoon-Patanasorn et al. (2020), they investigated the effectiveness of Google Translate in translating academic abstracts from Thai to English. The study focuses on assessing the quality of translations produced by the machine translation tool, particularly in academic

contexts, where precision, clarity, and formality are essential. Key findings from the study also reveal that the translation accuracy has been occurred but still struggling with technical terms and complex sentence structures common in academic writing. For example, when using machine translation with Thai sentence "เมื่อธุรกิจรีสอร์ท ได้รับ ประโยชน์จากทรัพยากรธรรมชาติของท้องถิ่น จึงควรร่วมรับผิดชอบ", the result is "When resort business Benefit from local natural resources. Should be responsible. This can be seen as an incomplete sentence because machine translation tool cannot clarify the beginning and the ending of the sentence, especially in other languages.

Secondly, for cultural sensitivity, it deals with culture references, formal and informal languages, and culturally specific terminology. For instance, translating the concept of "Thanksgiving" into another languages where this holiday is not celebrated might require additional explanation or adaptation.

Lastly, domain specificity in terms of translation, Chimsuk & Auwatanamongkol (2009) mentioned the use of machine translation and the output of Thai words such as "โรคเบาหวาน" which the general machine translation output is "sweet urine disease" (Incorrect) or in business domain specificity the word "ทุนจดทะเบียน" is translated as "capital registration" (Incorrect).

In addition to this, the inherent variability and dynamism of language evolution further compound these challenges, necessitating continuous adaptation and refinement of machine translation algorithms to keep pace with linguistic trends and developments. According to the study of Liu (2022), the recent AI technologies in translation still somehow lacks the ability to replace an entirely human translator. In addition, it can be seen as a flaw of nuances comprehension in terms of colloquial language and cultural aspect.

Machine translation still grapples with the cultural diversity and sensitivity. Translation is not merely a mechanical process of substituting words from one language to another but a nuanced act of intercultural communication, wherein cultural nuances, conventions, and context play a vital role in conveying meaning and intent. According to Asscher (2023), machine translation is insufficient to deal with cultural concepts. For example, it faces some difficulties with contextual complexities of a source-text which

finally leads to misunderstanding in the translation process. Machine translation systems, however, often struggle to navigate the intricacies of cultural dimensions, leading to mistranslations, misinterpretations, and cultural insensitivity in the translated content or output. The inadequacy of machine translation algorithms to grasp cultural nuances poses significant challenges in domains such as marketing, literature, diplomacy, and legal translation, where cultural appropriateness and resonance are paramount for effective communication and comprehension, particularly in terms of teaching and learning in the higher education contexts.

Translation tasks in specialized domains demand a thorough understanding of domain-specific terminology, concepts, and conventions, which might not be adequately handled by using only generic machine translation systems (Kolhar & Alameen, 2021). The lack of domain expertise and contextual knowledge inherent in machine translation algorithms may result in inaccuracies, ambiguities, and misinterpretations in translated content, thereby undermining the reliability and credibility of machine-translated texts (Araújo et al., 2020). Moreover, the rapid increase of domain-specific jargon, terminologies, and neologisms further exacerbates these challenges, necessitating adaptive and context-aware translation solutions to ensure terminological accuracy and domain relevance.

5. Countermeasures of Machine Translation

In response to these challenges, various countermeasures and strategies have been proposed to enhance the efficacy and reliability of machine translation systems. One approach involves using the power of neural machine translation (NMT), a latest paradigm in machine translation that employs deep learning techniques to model complex linguistic patterns and dependencies (Das, 2018). Neural machine translation systems have demonstrated superior performance in capturing semantic nuances, syntactic structures, and contextual dependencies, thereby enhancing translation quality and fluency compared to traditional statistical machine translation (SMT) approaches (Stahlberg, 2020). Additionally, advancements in pre-trained language models, such as transformer-based architectures like BERT (Bidirectional Encoder Representations from Transformers) and GPT (Generative Pre-trained Transformer), have facilitated significant improvements in machine

translation by enabling contextual understanding and generating more coherent and contextually relevant translations (Gruetzemacher & Paradice, 2022).

Similarly, in EFL (English as a Foreign Language) contexts and ELF (English as a Lingua Franca) contexts, the processes against the limitations of machine translation (MT) often focus on enhancing linguistic accuracy and cultural appropriateness among those learners. In regular classes, they are encouraged to use MT as an additional tool rather than a primary source for language learning. One effective strategy is the incorporation of post-editing practices, where learners critically assess and revise MT outputs to improve grammatical and contextual correctness. Furthermore, it can enable learners to spot, identify, and correct common errors made by MT systems. Cultural sensitivity is also a key focus, learners can be trained to recognize when MT may misinterpret or fail to convey culturally nuanced expressions (Asscher, 2023). Integrating these countermeasures into the curriculum helps mitigate the over-reliance on MT, fostering a more balanced and reflective approach to language acquisition.

On the contrary, Jeanjaroonsri (2023) conduct research with the data that were collected through a questionnaire from 305 English learners who enrolled in various English for Specific Purpose courses in a public university in Thailand. The study aims to explore learners' independent use and perceptions of machine translation for their foreign language writing. The result shows that while machine translation can be served as a helpful supplementary tool for Thai EFL learners, it comes with significant challenges, particularly in terms of translation accuracy, reliance on literal outputs, and the lack of contextual understanding.

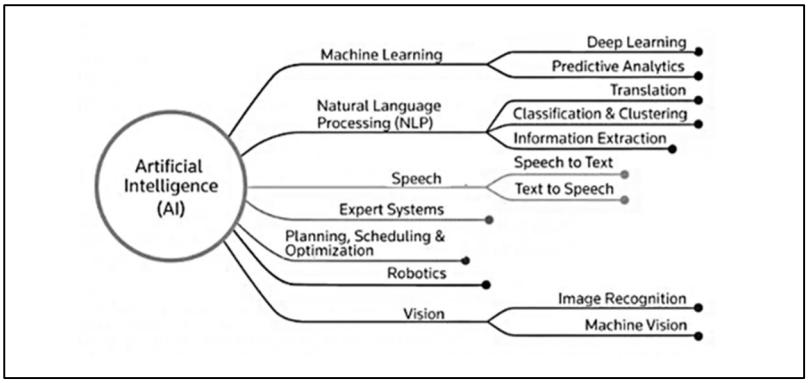

Fig 1: NMT, AI, and Deep Learning using Neural Networks (adapted from Antonio Grasso, as quoted in Das, 2018, p.5)

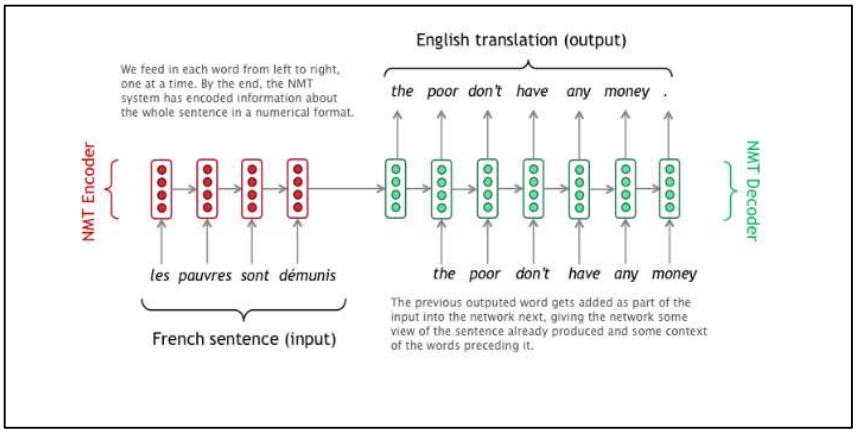

Fig 2: Illustration of Neural Machine Translation in Google translate (Abigail See's slides for Standford's CS224n class, as quoted in Das, 2018, p.5)

From the figures shown above, Neural Machine Translation (NMT) is considered as an up-to-date technology that leverages artificial intelligence (AI) and deep learning techniques to produce more accurate and fluent in language translation settings. Unlike traditional phrase-based systems, NMT uses neural networks to model entire sentences as continuous sequences, capturing complex linguistic patterns and contextual nuances. These neural networks, particularly deep learning architectures like Long Short-Term Memory (LSTM) and Transformer models, enable the system to learn from vast amounts of bilingual text data, improving its ability to handle idiomatic

expressions, syntactic structures, and word ambiguities. For example, as can be seen from Figure 2, the input language is French sentence ‘les pauvres sont démunis,’ which is encoded into numerical format and finally turned into English translation output as ‘the poor don’t have any money.’

From the example shown in the figure, AI and deep learning contribute to NMT’s ability to generalize better across languages and domains, leading to more natural and human-like translations. However, while NMT represents a significant advancement, it still faces challenges such as handling low-resource languages and maintaining consistency in specialized terminology, areas where ongoing research and development are focused.

Another promising avenue for enhancing machine translation quality involves the integration of human expertise and oversight into the translation process through the hybridization of machine translation and human post-editing. Hybrid machine translation models combine the computational capabilities of machine translation systems with the linguistic proficiency and cultural insights of human translators, thereby synergizing the strengths of both approaches and mitigating their respective limitations (Wu et al., 2016). According to Zong’s study (2018), he proposed a framework of machine translation blending with human translation which can be used as a new model to do the basics translation and then followed by human post-editing. In this case, human post-editing allows for the refinement and correction of machine-translated output by human translators, ensuring linguistic accuracy, cultural sensitivity, and domain relevance while maximizing efficiency and scalability. Moreover, collaborative frameworks that facilitate iterative feedback loops between machine translation systems and human translators enable continuous improvement and adaptation to evolving linguistic and cultural dynamics, fostering a virtuous cycle of refinement and enhancement in translation quality.

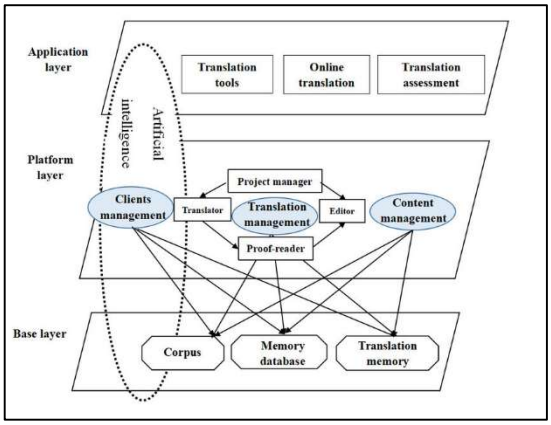

Fig 3: A framework of machine translation blending with human translation
Source: (Zong, 2018)

From Figure 3, a framework that blends machine translation (MT) with human translation (HT) aims to harness the strengths of both approaches, creating a well-matched translation process that maximizes efficiency and accuracy. This hybrid model typically involves an initial machine translation, followed by human post-editing to refine and correct the output. The framework operates on the principle that while MT can quickly generate a rough draft by handling large volumes of text and identifying basic patterns, human translators bring expertise in cultural nuances, contextual understanding, and creative expression, which are often beyond the reach of current AI technologies. Among EFL settings, this collaboration can take various forms, such as interactive translation environments where translators work alongside MT systems, actively guiding and refining the machine's output in real-time. By combining the speed and consistency of MT with the nuanced decision-making of human translators, this framework not only improves translation quality but also reduces time and costs, making it an increasingly popular approach in both commercial and academic settings.

Furthermore, efforts to address the challenges of cultural sensitivity and diversity in machine translation involve the integration of cultural knowledge bases, socio-linguistic resources, and cross-cultural communication strategies into translation algorithms. Cultural adaptation techniques, such as sentiment analysis, cultural profiling, and style transfer, enable machine translation systems to account for cultural nuances, preferences, and conventions in the translation process, thereby enhancing

cultural appropriateness and resonance in translated content (Tursunovich, 2022). Moreover, collaborative initiatives that involve diverse stakeholders, including linguists, translators, domain experts, and cultural consultants, facilitate the development of culturally aware machine translation systems that reflect the diversity and richness of global languages and cultures.

6. Conclusion

In summary, the integration of AI-driven machine translation technologies within English as a Lingua Franca (ELF) university contexts presents both significant opportunities and interesting challenges. While these technologies have the potential to enhance accessibility and efficiency in multilingual academic environments, their implementation must be approached with careful consideration of their limitations. Key challenges such as linguistic accuracy, cultural sensitivity, and domain specificity underscore the need for ongoing refinement and validation of machine translation systems. Moreover, the risk of biases emerged to the deployment of these technologies in educational settings.

To effectively address these challenges, a multifaceted strategy that incorporates human oversight or post-human editing, interdisciplinary collaboration, and continuous improvement is essential. Hybrid models that combine the computational power of AI with the nuanced understanding of human translators can moderate many of the results associated with machine translation. Additionally, fostering collaborations between linguists, technologists, and educators can drive innovations that clarify the contextual and cultural relevance of translations. By adopting these countermeasures, universities can leverage AI-driven machine translation technologies to support and enrich the multilingual academic discourse, thereby reinforcing the role of English as a global lingua franca while maintaining the integrity and quality of scholarly communication.

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