Chapter 21
The Role of Artificial Intelligence in Enhancing Translation and Cultural Diversity with Reference English and Arabic Translation

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Abstract With the spread of globalization, the need for translators and scholars has grown, as translation is the only process that helps bridge linguistic gaps. Following the emergence of artificial intelligence (AI), a strong competitor has arisen to the translators, sweeping through all scientific and professional fields, including translation sector, with a set of tools that aid in the translation process. The current study aims to investigate the capability of AI tools in translating texts rich in cultural variety from one language to another, specifically focusing on English-Arabic translations, through qualitative analysis to uncover cultural elements in the target language and determine the ability of AI tools to preserve, lose, or alter them. Two AI translation tools were used (Spider-AI and Matacate), which revealed the success of AI tools in the translation process of linguistic aspect, through producing accurate and fluent translations that capture the general meaning of the texts. However, they were unable to convey subtle nuances and cultural characteristics, resulting in some gaps in the cultural aspect of the target language. The study emphasized the importance of the cultural aspect during the process of transferring meaning in translation. Therefore, it focused on the significance of collaboration between human translators and AI translation tools, to get better results.at the end the study concluded with the importance of continuing scientific research for updating AI translation tools, to create systems that are both technologically advanced and culturally sensitive.

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21.1 Introduction

The urgent need for translation processes, translators, and specialists has emerged since the onset of globalization and social media programs, to achieve successful and accurate linguistic and cultural communication. Following this, artificial intelligence technologies have swept all areas of life, including the field of translation, achieving notable linguistic efficiency [1, 2]. Consequently, the current research aims to explore the extent of these technologies' ability to practically apply the translation process. Translation does not only apply to transferring words from one language to another but is also a process of cultural communication. The question is whether artificial intelligence tools are capable of translating texts rich in cultural diversity.

The latest emergence of artificial intelligence technologies has created a significant buzz and revolutionized all scientific and professional fields, one of which is translation [3]. With the entry of artificial intelligence technologies, translation has become more efficient, effective, and of higher quality. Additionally, its application has become easier for everyone and at various levels, making it a major competitor to translators and specialists [4]. What distinguishes these tools is their superiority over human competitors in processing large and enormous amounts of data and texts in record time, which has attracted the attention and interest of companies, institutions, and individuals who rely on translation services for effective communication across languages.

Despite all these advantages, the biggest obstacle facing these tools has not been eliminated, Despite their technological advancement and strength, the main question remains, can the accuracy, quality, and precision of the translations generated by artificial intelligence convey the cultural aspect, since translation is not just a linguistic process but also a cultural one, as it transfers ideas, beliefs, habits, and cultural contexts [5], Have artificial intelligence tools managed to bridge these cultural gaps, or are they still relying solely on the linguistic aspect? The current research focuses on discussing the role of artificial intelligence tools in the translation process and how they deal with texts rich in cultural aspects, based on the Arabic and English languages, as they are culturally distinct. It also includes a comparative study between the translations produced by these tools and human translations.

The literature on AI-assisted translation reveals several critical gaps: AI tools struggle with accurately conveying cultural nuances and idiomatic expressions, leading to potential misinterpretations in culturally rich texts [6], There is a lack of comprehensive comparative studies between human and AI translations, particularly in complex domains like legal and literary texts. Additionally, domain-specific and culturally adapted models are needed to enhance AI's precision across various fields [7]. Collaboration between AI and human translators is essential to ensure cultural appropriateness, highlighting the importance of human-in-the-loop processes. Continuous research is required to develop AI systems that incorporate cultural knowledge and context, addressing ethical and social implications such as discrimination and representation in cross-border communication.

One of the most important features and characteristics of artificial intelligence tools is their quality and speed in producing translated texts in record time. They are capable of processing and translating vast quantities of texts that cannot be executed or matched by translators and specialists. This feature is particularly valued by those involved in e-commerce, for example, where the speed of producing accurate texts is essential for business success and goal achievement [8]. Another advantage, which may reduce the burden on translators and specialists, is the automation of tasks and the preprocessing or quality assessment of texts. All these features help specialists by allowing them to focus on more complex and creative aspects of the translation process, such as tailoring the content of translated texts for a specific target audience or ensuring cultural appropriateness.

Another attribute of these tools is the accuracy and quality of the translated texts, which result from various factors, most importantly the languages used, and the data fed into these systems [9]. However, it is not possible to assert complete accuracy of the texts, as these tools still face limitations, such as determining context or dealing with idiomatic expressions and subtle cultural differences. For instance, studies have explored the quality and accuracy of widely used translation applications like Google Translate, Microsoft Translator, and Reverso. A study in 2019 compared the performance of these applications and found that they produce good and acceptable texts, but not without errors, inconsistencies, and sometimes poor choices of linguistic terms or failure to adhere to the required context [10]. To overcome these hurdles and impediments, the researcher suggested working on developing and improving the quality of these programs through continuous updates to the linguistic rules, in addition to ongoing human monitoring and oversight, to achieve error-free texts. Certainly, all these attempts will not eliminate the need for human involvement, given the complexity of linguistic styles, the diversity of fields, and the variety of cultures.

21.2 Human versus AI Translations Techniques

With the widespread use of artificial intelligence tools, especially in translation processes, and their success in producing accurate and high-quality texts, it became very important to compare them with human translations to examine the extent to which users can rely on these tools. To illustrate the results of these comparisons, graphs were utilized, which demonstrate the differences between human translators and artificial intelligence tools, derived from several previous studies. These figures help in visually comparing the performance in terms of accuracy, speed, and quality of translation, highlighting areas where AI tools excel and where human translators still hold an advantage, such as understanding cultural nuances and context-specific interpretations.

(1) **Translation Quality Score Comparison**

Figure 21.1 represents The study result that investigated the differences between three sources of translations (Human, NMT, SMT) regarding the translation quality [11].

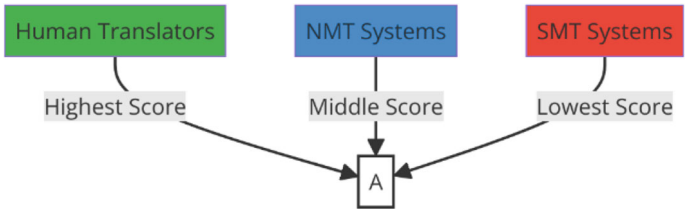

Fig. 21.1 The result that investigated the differences between three sources of translations (Human, NMT, SMT)

The study conducted a synchronic assessment of Google Translate, Microsoft Translator, and Reverso for English-Arabic translation, focusing on their performance in translating documents from the WHO, UN, Petra News Agency, and the Arab League. Using the intelligibility and fidelity scales for evaluation, the study found Google Translate to generally outperform the other systems in producing intelligible and fluent output without flaws across different documents, achieving the highest rates of error-free translation.

The main finding was that Google Translate provided the most accurate and fluent translations, followed by Microsoft Translator and then Reverso, across various metrics of intelligibility and fidelity. Despite their capabilities, none of the systems could completely substitute for human translators, underscoring the persistent limitations of MT in handling complex aspects of language such as context, idiomatic expressions, and subtle cultural nuances. As well the study highlighted a gradual improvement in the performance of these systems [11].

(2) **Translation Speed Comparison**

Figure 21.2 represents their data based on [12] study, that delves into advancements, challenges, and ethical considerations surrounding AI-driven language translation, emphasizing the shift from traditional translation methods towards AI and Machine Translation (MT) technologies. It reviews the evolution from rule-based and statistical machine translation approaches to the latest neural machine translation (NMT) techniques, detailing their advantages, limitations, and the ongoing debates in the field [12]. The numbers which are written in Fig. 21.2, are mentioning to words number translated per hour. This proves the immense power of these tools, which is beyond human capacity.

(3) **Domain-specific Translation Accuracy**

Figure 21.3 presents the data resulting from research that was done by [13], that indicated the enhanced accuracy of machine translation generated by deep learning techniques. In addition to the comparison of human and AI translations' accuracy and diversity in various domains. To conclude, to result that confirm the accuracy & diversity of AI translation, in multiple domains, like legal or medical translation, where high precision and accuracy are required, human translators would be more favored than machine translation systems. On the contrary, in big translation projects

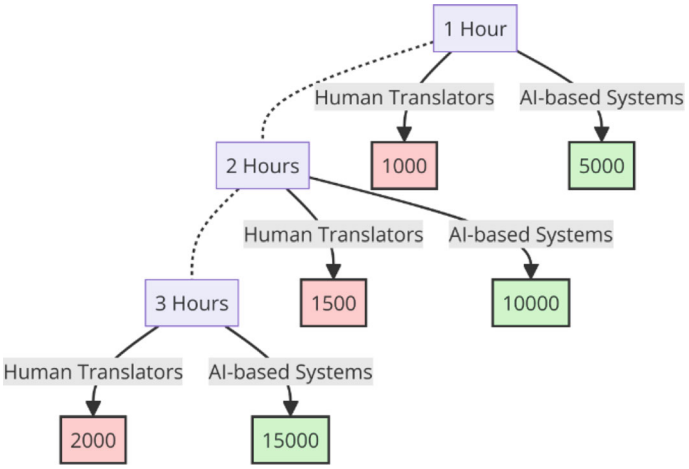

Fig. 21.2 Translation speed of words number translated per hour

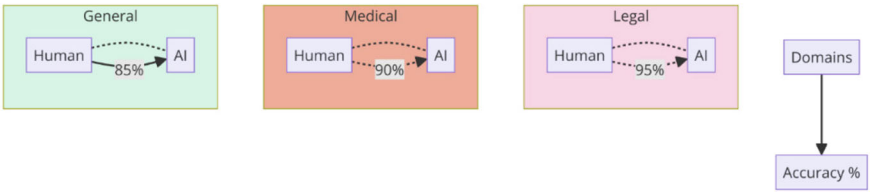

Fig. 21.3 Enhanced accuracy of machine translation generated by deep learning techniques

with short deadlines and cost reduction, the preferable method would be AI-assisted translation [13].

This comparison of human and AI translation indicates the need for interaction and collaboration between the two. While AI can automate and speed up some aspects of the translation process, human knowledge and judgment are necessary for globalization, awareness about cultural context [13]. The next section will illustrate how this collaboration can be used to eliminate cultural boundaries and diverse populations through translation.

The problem of the study is the ability to manage texts rich in culture diversity using AI translation tools and whether such tools have the capability to bridge the cultural gaps or these tools rely mostly on language only, which might result in some loss or alternation of culture. Indeed, as the main introduction indicates, the problem is well stated. It explains the paper's main purpose, which is to investigate solutions to the problem.

The goal of this research study is to identify the ability of artificial intelligence tools in translating texts that are rich with cultures diversity. In case of English to

Arabic translations. The study seeks to identify if artificial intelligence translation tools translate texts rich in cultural variety [4].

The paper begins with the statement that effective translation is required in the modern world due to the globalization of many industries and the phenomenon of migration. It also states the aim of the study which is to analyze the performance of AI technologies in preserving cultural elements. The review of the literature section describes several research studies which have focused on AI tools and their ability or inability to ensure a culturally sensitive translation. The methodology section outlines that the method underpinning the study is qualitative analysis and describes how the texts were selected. Data analysis and discussion provide a comparison between the quality of human and AI translation with respect to the cultural elements. The last section reflects upon the findings of the study and concludes the paper by providing some implications for the issue discussed and some future research directions in the field of AI technologies employed for the purposes of translation.

21.3 Methodology

Based on previous studies that emphasized the role of English in multicultural communication [14], translation between English and Arabic was chosen as the focus of this study to understand how AI tools deal with cultural challenges in translation. The following outlines of what type of approach and methodology will be using to examine the cultural elements in the English language & in Arabic AI-assisted. These include the analysis features and data acquisition, corpus types involved in the investigation.

Considering the intricacy and subjectivity of cultural features assessment in translation, the qualitative method is considered more appropriate [15]. Qualitative analysis allows exploring the context of the translated texts in more detail and depth in meaning and include cultural connotation analysis in texts. Consequently, this approach enables us to interpret the preserved, lost, and altered cultural elements in the AI-assisted translations and to develop rich descriptive results on the AI impact on cultural diversity in translation. Nevertheless, to complement qualitative analysis, certain quantifiable measures can be used as well. For instance, the number & rate of culturally specific terms, idioms, expressions in the source and target texts can be calculated and measured against each other to evaluate the extent to which cultural aspects in translations are preserved or lost. Such quantitative data would help reinforce the results of a qualitative study and further test the cultural implications of Ai Tools.

The analysis utilizes a sample of English-Arabic parallel programs with the aim of enhancing research credibility and dependability. The sample has varied texts, The variability of them is important in helping capture aspects of culture and translation problems. The corpora will meet the following criteria:

First, the existence of good-quality, & human translation for reference allowing precise comparison between AI-assisted and human translations.

Second, corpora will reflect various text genres, and register variation, to ensure as much variation in cultural elements as possible to reflect any potential domain-dependent cultural differences [16].

Finally, corpora will include a mixture of time periods and geographies; thus eventually, a dataset of cultural elements' variation may be created.

Ten examples of such corpora have been chosen to represent the data required for English-Arabic language translation, and AI-assisted translation analysis. Five texts of them are in Arabic language, and five are in English; they represent cultures evenly, geographically, and locally.

Arabic Texts:

1. Al Jazeera news article on the continued Syria war, 2021
2. A cultural tradition posts from Egyptian Influencer in social media 2022
3. An excerpt from Naguib Mahfouz's novel "Palace Walk" by 1956
4. An excerpt from Ahmed Saadawi's novel "Frankenstein in Baghdad" by, 2013
5. An excerpt from Saudi novel: "Girls of Riyadh" by Rajaa Alsanea 2005

English Texts:

1. A news article from The New York Times about the U.S. presidential elections (2020)
2. An excerpt from Jane Austen' novel "Pride and Prejudice" (1813)
3. An American Influencer post on social media wrote about his experiences in Morocco and their traditional customs (2019)
4. An excerpt from French novel "Madame Bovary" by Gustave Flaubert 1856.
5. An excerpt from German novel "The Sorrows of Young Werther" by Johann Wolfgang von Goethe 1774

These texts include a variety of genres, often catering to specific cultural perspectives and challenges. Moreover, the Arabic and English texts are feature in time and geographical orientation is broad.

Following the completion of data collection, the researcher will utilize the content analysis method. This method implies a research technique for making replicable and valid inferences from texts to their context in which the patterns and themes of cultural elements and corresponding meanings will be identified [15]. It will have multiple stages.

First, the researcher will define the units of analysis such as words, phrases, sentences, or paragraphs where the cultural elements should be identified.

Second, a coding scheme will be prepared. The schema is a guide that determines the groups and types of the cultural elements analyzed–it helps to systematize and interpret the data. Hence, the coding scheme will be defined in relation to the cultural elements.

Third, Coding the data, in this stage, the researcher will read all the translated texts and code relevant units of analysis using the respective categories in the coding scheme. The entire exercise will be undertaken in an iterative manner. In this case,

the coding will be guided by the categories of potential meanings associated with cultural elements for the meaning analysis.

Finaly, After the data has been coded, it will be analyzed to identify patterns or similarities and differences in how the AI-assisted translations handle different cultural elements. These patterns will then be interpreted with reference to the research objectives and the existing body of literature and used to draw conclusions about the impact of AI on translation diversity.

Two AI-assisted tools are Spider-AI and Matacate which are applied to the translation during the analytic session. Both have made these two AI translation systems distinct and a significant force to reckon with when there is a reference to the best AI translation systems. Spider-AI presents an NMT multilingual platform having more than 100 languages, e.g., English and Arabic. More precisely, the system uses advanced techniques such as transfer learning and domain adaptation to enhance translation quality across varied text types and domains [8].

Matacate is a hybrid translation system that merges rule-based and neural machine translation tricks. Moreover, it uses the rule-based language model for fluency, & the neural generation model for accuracy. The latter has demonstrated good results, especially for intricate linguistic phenomena and cultural considerations [8]. Thus, utilizing Spider-AI and Matacate for translating the beforehand-chosen texts allows regarding and contrasting how the AI functions under various architectures and utilizing different tactics toward cultural elements involved in the translation process. Consequently, this could form a general representation of how AI-assisted English-Arabic translation works in the context of preserving cultural diversity.

The 10 chosen texts are translated from their source language to their target language. The English texts translation would be from English to Arabic, while Arabic texts are from Arabic to English, and the translation rely on Spider-AI and Matacate. Finally, the qualitative content analysis method explained in the preceding section is applied to the translated texts to recognize how the cultural elements remain, loss, or change in an AI-assisted translation process. The outcomes of this analysis will lend itself to making a conclusion regarding the influence of AI on English-Arabic translation with regards to the element of cultural diversity. They may also form the basis of recommendations for further research or auto-tool improvement [16].

Cultural analysis of the elements in AI-assisted translations will rely on the following factors:

1. The coding scheme: The coding scheme is the foundation of the content analysis approach. It will be developed based on the research objectives and the types of cultural elements to be analyzed. The coding scheme will guide the identification and categorization of cultural elements in the translated texts, such as culture-specific terms, idioms, values, norms, and beliefs. The effectiveness of the analysis will depend on the comprehensiveness and robustness of the coding scheme [8].
2. The extent to which the researcher(s) are qualified and competent about cultural translation, The analysis of cultural elements requires an in-depth understanding

of both English and Arabic languages, and the cultural differences reflected through them. Therefore, the qualification of the researcher or researchers to be aware of the cultural norms, values, and beliefs of the societies that produced the source texts would allow them to successfully identify and analyze the cultural elements present in the translations.

3. Quality of AI-assisted translation: this is about how accurate and fluent the AI-based translations are. Poor-quality translations characterized by numerous errors and mistranslations may lead to difficulties in identifying and understanding the cultural elements. However, the problem of quality can be resolved by using sophisticated AI-based translation systems such as the Spider-AI and the Matacate, which have demonstrated excellent performance in English-Arabic translations.
4. The diversity and representativeness of the selected texts: The analysis will also rely on the selected ten texts for its findings, The more diverse and representative they are, the more the findings can be generalized to the broader context of English-Arabic translation. It leads to the text selection which combines different disciplines: history, art, literature and even culture contexts for inclusive pursuits.
5. The proper translation of these aspects with an adequate research design implies that this study will provide numerous valuable insights on the effect of advanced technology on cultural diversity in English-Arabic translation.

21.4 Analysis and Discussion

Arabic Text

Al Jazeera news article on the continued Syria war, 2021

See Tables 21.1, 21.2 and 21.3.

English Text

An excerpt from German novel

"The Sorrows of Young Werther"

By Johann Wolfgang von Goethe 1774

Table 21.1 Cultural elements in the Al Jazeera source text (Syria war news article)

Element type	Description
Political and ideological	Use of jargon such as "regime," "opposition," and "jihad." Terms and phrases don't directly relate to the conflict but specify ideological positions
War affiliation and ethnicity	During the war, Arab militias' affiliations split the Syrian population on Arab, regional, or ethnic bases (e.g., "Alawites," "Kurds," or "Sunnis")
Religious references	Phrases such as "Ma malakat amin" (derived from the Quran), "Islamic State," "caliphate," and "Sharia law" are used to reference religious ideologies

Table 21.2 AI-assisted translation of cultural elements in the Al Jazeera article on the Syria war

AI translator	Cultural element treatment
Spider-AI	Maintains most cultural elements but lacks accuracy in translating some political terms; "jihad" is translated as "quarrel" instead of "striving." Some religious terms are wrongly translated
Matacate	Adapts cultural references (e.g., "Alawites" is understood as a minority sect of Islam) for inclusivity, portraying cultural diversity

Table 21.3 Interpretation of AI translation challenges in the Al Jazeera Syria war article

Aspect	Detail
Language translation issues	Demonstrates the challenge of accurately transferring the complexities of Syrian political and religious dynamics into English
Cultural-specific methodology	Emphasizes a culturally specific methodology aimed at preserving the language's and the source country's cultural nuances

See Tables 21.4, 21.5 and 21.6.

Comparison of Spider-AI and Matacate translations

See Table 21.7.

In general, the machine-based translation systems scoring indicate that both have strong points and weak points when it comes to dealing with the cultural issues while translating from the English to the Arabic language. Spider-AI is superior in terms

Table 21.4 Cultural elements in the Goethe's "The Sorrows of Young Werther"

Element type	Description
Social state and hierarchy	Emphasizing social ranks through terms like "gentleman" and "lady."
Gender roles and norms	Direct reflection of gender roles (e.g., "man in control," "empty-headed society lady," "woman suitable for marriage")
19th-century etiquette	English politeness and etiquette portrayed through characters' behavior and societal expectations (e.g., self-esteem, group behavior)

Table 21.5 AI-assisted translation of cultural elements in Goethe's "The Sorrows of Young Werther"

AI translator	Cultural element treatment
Spider-AI & matacate	Attempts to maintain cultural elements but sometimes loses nuances and historical contexts. For example, translating "gentleman" to " رجل نبيل" captures "kind" but misses specific English notions tied to the term

Table 21.6 Interpretation of AI translation challenges in Goethe's "The Sorrows of Young Werther"

Aspect	Detail
Translation challenges	AI-assisted translations struggle with conveying the historical and literary depth across cultural and temporal divides
Importance of cultural knowledge	Emphasizes the necessity of cultural and historical understanding for accurate translations of classic literary works

Table 21.7 Comparison of spider-AI and matacate translations

Aspect	Spider-AI	Matacate
Accuracy	Generates more accurate translations but may lose cultural nuances	Rationalizes cultural themes to make translations understandable, risking loss of cultural identities
Cultural features	Limited by the cultures it has encountered, struggles with deep cultural senses and connotations	Better at idiomatic meanings and culturally appropriate translations but may simplify or misrepresent cultural aspects
Overall	Superior in conveying main ideas and structure	Excels in producing translations that are culturally versatile and understandable

of the main ideas as well as the overall structure as compared to Matacate which is better as regards idiomatic meaning and culturally appropriate translations.

21.5 Conclusion

Giving this analysis, we had look at the role of AI-assisted translation in keeping linguistic diversity mainly on English-Arabic translation. Of course, qualitative content analysis helps us to understand whether cultural components remain intact, undergo transformation, or disappear altogether in AI versions of translation. The discovery from our study is that AI can provide certain possibilities and yet not be able to fully capture the meaning behind the cultural diversity. The machines may be able to work out correctly the meaning of a given phrase but may not vice versa. Additionally, we observe that Spider-AI chooses a similar paraphrasing strategy compared to Matacate, however, Spider-AI bases its translations on literal translation, while Matacate focuses more on cultural appropriateness [17].

This study illustrates that AI-guided translation is one of the most useful tools for providing the desired level of cultural interaction. Using AI methods, original material from a special language or culture becomes more available to the audience, thereby removing obstacles and encouraging international collaboration. Nevertheless, cultural consciousness conscious methodologies to AI translation are much needed, which apply the culture, cultural identity, and perspective, make it possible

[18]. To maximize the capabilities of AI in translation and preserving intercultural diversity, there should be linguistically correct and culturally sensitive systems. In addition, AI developers need to work closely with human translators and subject matter experts in this sphere.

21.5.1 Implications for Cultural Diversity in AI-Assisted Translation

Machine-assisted translation has the capacity to support cross-cultural communication and understanding by enabling the distribution of text from various languages and cultures among people from different places. Yet, the examples illustrate the hazards that the cultural misrepresentation, simplification, and, especially in the complicated context of cultural traditions and historical issues, occurred in AI-assisted translations. Translation systems capable of the adaptation to the cultural specificity of every society and informed by the intelligence and skills of human translators and cultural experts is the key approach to promotion of cultural diversity and inclusion. This needs to be a horizontally oriented approach along with the involvement of researchers, developers, translators, and cultural stakeholders to design AI-assisted translation systems of proper language translation and preserve cultural diversity without affecting the cultural background of people.

At the end of the current paper, there are several recommendations, as follows:

Areas for improvement in AI-assisted translation

Cases studies and analysis of culture elements in AI-assisted translations, the identified areas for improvement by AI-assisted translation also illuminate several manners in which the translation can be perfected:

1. **Incorporating cultural knowledge and context**: The AI-based translation systems will have to extract cultural information along with contextual vocabulary other than just linguistic data. This is made possible by accumulation of data to cultural databases, ontologies and knowledge graphs that give information on cultural patterns, values and practices.
2. **Developing domain-specific and culturally adapted translation models**: AI-assisted translating systems must be prepared and tailored to be working in specific domains and cultural contexts, AI ought not to go for general, mechanical solutions. Such can be achieved when the models are taught on the domain-specific and culturally suitable datasets, as well as by utilizing transfer learning and domain adaptations.
3. **Enhancing collaboration between human translators and AI systems**: Human translation-aided translation should not be considered an alternative to human expertise, but as a process that is meaningfully undertaken collaboratively by a human translator and an AI system. This may be done by having a software using

AI technology to manufacture the translations just after which human translators get the chance to sample, review, and respond to the production.

Potential collaborations between human translators and AI

For the effective utilization of the AI-assisted translation while stressing the cultural context and correctness, it is a must for collaborations between experts-human translators and AI systems. Some potential avenues for collaboration include:

1. **Human-in-the-loop translation**: Humans can interpret a translator and function with an AI system as an editor reviewing and correcting the AI translation to make sure that it was a culturally appropriate and idiomatic fluency. AI technology is very fast and time saving but it is not as creative as human translators, it's for this reason that this approach integrates speed and efficiency of AI with the cultural knowledge and creativity of human beings.
2. **Collaborative translation platforms**: Website portals could be implemented to enable the co-work of the human interpreters and AI systems, making possible the exchange of insights as well as the improvement of the translation via immediate feedback, sharing opinions, and session revision of the translation. Besides, these platforms could also be knowledge, or resources banks where historical information could be obtained that could be useful in informing and improving the AI-assisted translations.
3. **Translator training and education**: Human translators need to be in the loop as they would need to take these courses which will teach them the use of AI translation aids as well as critical thinking in which the AI-generated translation can be checked. It can even contribute to the creation of a deeper connection between humans and machines by adopting a more cooperative, culturally sensitive and linguistically friendly approach for translation.

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