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A Study on Japanese-English Machine Translation Based on Large Language Models and Post-Editing Strategies

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Abstract

This study investigates the role of post-editing in enhancing neural machine translation (NMT) quality, focusing on Japanese-to-English translations in the Information and Communication Technology (ICT) sector. By analyzing outputs from three NMT platforms (DeepSeek, Youdao, DeepL) against an official benchmark, the research identifies persistent challenges, including inconsistent terminology (e.g., "critical infrastructure" vs. "core facilities"), tense inaccuracies ("had been restored" vs. "have returned"), and omissions of technical annotations (e.g., "Hikari (fiber-optic)"). While DeepL and DeepSeek demonstrate superior semantic and structural fidelity, their outputs require adjustments to align with domain-specific standards. The proposed post-editing framework prioritizes terminological alignment with authoritative references, temporal precision to emphasize ongoing actions, and structural coherence to restore source-text logic. Full post-editing is advocated for formal contexts to achieve human parity, whereas light post-editing suffices for rapid delivery with minimal quality compromises. Industry data highlights the dominance of the "machine translation + post-editing" model, adopted in 30.4% of projects in 2023, underscoring its efficiency and cost-effectiveness. However, human expertise remains irreplaceable in addressing nuanced challenges such as cultural adaptation and contextual dependencies. The study concludes by advocating for AI-augmented post-editing tools to streamline workflows while preserving the "humanistic core" essential for high-stakes translations. This synergy between technological advancement and human judgment is critical for advancing translation quality in the AI era, particularly in high-demand sectors like ICT.

Keywords: Machine Translation; Post-editing; Japanese-English Translation

1. Introduction

Machine Translation (MT), a discipline that utilizes computers to perform cross-linguistic automated translation, constitutes a critical domain within artificial intelligence research (Feng, 2018). The evolution of MT has progressed from rule-based approaches to statistical methods. Since 2006, statistical machine translation has further advanced into neural machine translation (NMT). Despite the success of NMT, its capabilities are often overstated, while current MT systems lack the "humanistic core" essential for translation. Consequently, machine translation and human translation should coexist harmoniously and complement each other (Feng and Zhang, 2022). Although MT output has achieved remarkable improvements in quality, it remains limited compared to human translation. To enhance efficiency and produce high-quality translations, a novel human-computer collaborative model—"machine translation + post-editing"—has rapidly developed, offering advantages in efficiency, quality optimization, and cost reduction.

The stunning introduction of generative AI technology represented by ChatGPT has triggered far-reaching impacts in the field of translation. Muñoz-Basols et al. (2023) explored the potential of AI-intelligent translators in language learning and emphasized the need to integrate large language model translation technology with education. Sahari et al. (2023) used semi-structured interviews and projection methods to investigate the attitudes of translation teachers and students towards Google Translate and ChatGPT. Teachers' and students' attitudes towards Google Translate and ChatGPT, and assessed the impact of ChatGPT on translation in Arabic contexts. The results showed that almost all participants were satisfied with ChatGPT. Most students preferred ChatGPT, while most teachers preferred Google Translate.

The 2024 China Translation Industry Development Report indicates that 52.9% of translation projects conducted by surveyed language service providers utilized machine translation in 2023. Among these, 30.4% adopted the "machine translation + post-editing" model, while 22.5% employed "fully machine-translated delivery" (China Translation Association, 2024). The "machine translation + post-editing" model has thus emerged as a dominant workflow in the language services industry.

According to the national standard Translation Services—Requirements for Post-Editing of Machine Translation Output, post-editing is defined as "editing and correcting machine-translated results." In recent years, neural machine translation (NMT), grounded in deep learning and neural networks, has become mainstream, outperforming statistical methods across numerous languages. However, MT systems still face challenges in semantic comprehension, contextual dependencies, and cultural nuances (Gong and Yin, 2024). Despite significant advancements, MT output often fails to meet high-quality demands. To balance translation quality and efficiency while leveraging human-machine synergy, post-editing has become a widely adopted practice in the translation industry (Cui, 2014).

Post-editing refers to the process of refining and modifying raw MT output to address linguistic errors, improve accuracy, and enhance readability (Feng and Cui, 2016). It is categorized into full post-editing and light post-editing. The aforementioned national standard defines full post-editing as "the process to achieve translations comparable to human-translated output," while light post-editing aims to "produce comprehensible text without matching human translation quality." The level of post-editing depends on the intended use of the translation and client requirements. The definition by Feng and Cui aligns with full post-editing, emphasizing not only error correction but also accuracy and readability enhancement. This study explores post-editing strategies from the perspective of full post-editing (Deng and Li, 2025).

2. Selection of Translation Texts and Online Machine Translation Platforms

The 2023 China Translation and Language Services Industry Development Report and 2024 China Translation Industry Development Report reveal that the "Information and Communication Technology (ICT)" sector accounted for 36.5% and 37.5% of translation business volume, respectively, ranking first among all specialized fields. This underscores the inevitability of machine translation adoption in ICT. This study focuses on Japanese-to-English translation of ICT texts, using the White Paper on Information and Communications issued by the Ministry of Internal Affairs and Communications of Japan in 2024 as the primary corpus (Mao and Zhu, 2024). The document addresses current challenges, technological evolution, and coexistence in the ICT domain.

To evaluate post-editing strategies, three widely used neural machine translation (NMT) platforms in China—DeepSeek, Youdao Translate, and DeepL—were selected for comparative analysis. Excerpts from the white paper were translated using these platforms to assess output accuracy and readability.

Sample 1:

Source Text (Japanese):

サービス再開に向け、移動電源車や発電機を活用した通信ビルへの電力の供給、ケーブルの損傷修理、断線区間へのケーブル新設、被害を受けていない中継伝送路への迂回等による基幹設備の復旧が進められた。また、被災者の通信確保のため、衛星携帯電話やポータブル衛星電話が配備された。5 月末時点で、石川県輪島市の一部（アナログ電話：約 180 回線、ひかり電話：約 40 回線）を残し、復旧が進んでいる。

Official English Version:

To resume services, efforts were made to supply power to communication buildings using mobile power supply vehicles and generators, repair damaged cables, install new cables in severed sections, and restore core facilities by rerouting through unaffected relay transmission routes. Additionally, satellite phones and portable satellite phones were deployed to ensure communication for the affected people. As of the end of May, restoration has progressed, leaving only a part of Wajima City in Ishikawa Prefecture (approximately 180 analog telephone lines and 40 Hikari (fiber-optic) telephone lines) still in need of recovery.

Comparative Translations:

DeepSeek:

In preparation for resuming services, restoration of critical infrastructure progressed through measures such as supplying power to communication buildings using mobile power supply vehicles and generators, repairing damaged cables, installing new cables in severed sections, and rerouting through unaffected relay transmission routes. Additionally, satellite mobile phones and portable satellite phones were deployed to ensure communication capabilities for affected residents. As of late May, restoration work is progressing with only some areas of Wajima City, Ishikawa Prefecture remaining (approximately 180 analog telephone lines and 40 fiber-optic phone lines).

Youdao Translate:

Efforts have been made to restore core facilities by supplying power to communication buildings using mobile power vehicles and generators, repairing damaged cables, installing new cables in broken sections, and bypassing undamaged relay transmission lines. Satellite mobile phones and portable satellite phones were also deployed to secure communications for the victims. As of the end of may, some parts of wajima city in ishikawa prefecture (about 180 analog telephone lines and about 40 hikari telephone lines) are still being restored .

DeepL:

In preparation for resuming services, restoration of critical infrastructure progressed through measures such as supplying power to communication buildings using mobile power supply vehicles and generators, repairing damaged cables, installing new cables in severed sections, and rerouting through unaffected relay transmission routes. Additionally, satellite mobile phones and portable satellite phones were deployed to ensure communication capabilities for affected residents. As of late May, restoration work is progressing with only some areas of Wajima City, Ishikawa Prefecture remaining (approximately 180 analog telephone lines and 40 fiber-optic phone lines).

By comparing and analyzing the above translations, DeepSeek and DeepL demonstrate superior translation quality, with accurate semantics and logical coherence closely mirroring the official version. However, minor inconsistencies persist, such as translating 「基幹設備」 as "critical infrastructure" (vs. the official "core facilities") and improper footnote placement (e.g., after punctuation). Youdao Translate exhibits critical semantic deviations (e.g., "bypassing" for 「迂回」 instead of "rerouting") and formatting errors (e.g., lowercase "may," redundant spaces in footnotes), compromising professionalism. All versions omit the brand annotation for 「ひかり電話」 ("Hikari (fiber-optic)" in the official text), potentially reducing technical precision. For formal contexts, DeepSeek or DeepL outputs are recommended as baselines, with adjustments to align terminology with the official version.

The translation quality of DeepSeek, Youdao Translate and DeepL was evaluated by BLEU (Bilingual Evaluation Understudy) scores using the Official English Version as the Reference, and the results were obtained as Table 1.

Table 1: BLEU Score Comparison of Translation Systems

Translation System	BLEU Score	Rank	Key Analysis
DeepSeek	0.7106	1	Nearly identical to the reference in word choice and sentence structure.
DeepL	0.7106	1	Matches DeepSeek, with only minor phrasing differences (e.g., prepositional phrases).
Youdao Translate	0.6213	2	Lower due to lexical variations (e.g., "bypassing undamaged") and simplified syntax.

Sample 2:

Source Text (Japanese):

応急復旧と並行し、基地局が本来の機能を回復する本格復旧を着実に進め、５月末時点では能登半島北部 6 市町の基地局のうち 97%が本来のかたちに戻っている。被災地全般にわたる本格復旧に向けて取組が継続されている。

Official English Version:

Efforts are being steadily made to achieve full recovery of the base stations, alongside emergency restoration. As of the end of May, 97% of the base stations in the six cities and towns in the northern part of the Noto Peninsula have returned to their original functionality. Efforts for comprehensive recovery across the disasteraffected areas are ongoing.

Comparative Translations:

DeepSeek:

While emergency restoration efforts were underway, full-scale restoration to recover the original functionality of base stations progressed steadily. As of the end of May, 97% of base stations in the six municipalities of the northern Noto Peninsula had been restored to their original operational state. Work continues to advance comprehensive restoration throughout the disaster-affected areas.

Youdao Translate:

As of the end of may, 97% of the base stations in six cities and towns in the northern noto peninsula had returned to their original state. Efforts are continuing for full-scale restoration throughout the affected areas.

DeepL:

In parallel with emergency restoration, full-scale restoration is steadily underway to restore base stations to their original functions, and as of the end of May, 97% of base stations in six cities and

towns in the northern Noto Peninsula had been restored to their original state. Efforts are continuing toward full-scale restoration throughout the affected areas.

By comparing and analyzing the above translations, DeepL's translation demonstrates the highest quality, closely aligning with the official English version in terminology accuracy (e.g., rendering「本格復旧」as "full-scale restoration") and structural fidelity (preserving the original parallel logic with phrases like "In parallel with emergency restoration..."). It maintains precise data representation (e.g., "97% of base stations") and adheres to formatting standards (correct capitalization of geographic terms like "Noto Peninsula" and punctuation). The only minor discrepancy lies in tense usage ("had been restored" vs. the official "have returned"), which slightly deemphasizes the ongoing nature of recovery efforts. DeepSeek's translation follows closely, accurately reflecting key terms such as "emergency restoration" but deviates slightly by translating「本来のかたち」as "original operational state" instead of the official "original functionality." Its use of the past perfect tense ("had been restored") further weakens the implication of continuity compared to the official present perfect tense. Youdao's translation suffers from critical flaws, including omissions (failing to translate the clause on concurrent emergency restoration), terminological vagueness (e.g., "original state" lacking functional specificity), and formatting errors (lowercase "may," "noto peninsula"). While it retains core data, its lack of professionalism and completeness renders it unsuitable for technical contexts. Overall, DeepL's output is recommended for formal technical documentation with minor tense adjustments (e.g., revising to "have been restored"), while DeepSeek serves as a viable alternative requiring terminology refinements. Youdao's translation is limited to informal, rapid comprehension scenarios. Notably, all versions overlook the official version's use of the present perfect tense ("have returned"), which subtly underscores the ongoing progress of restoration—a nuance critical for academic or industry reports to avoid misrepresenting timelines.

For the content of Example 2, the three methods were also compared and analyzed by the BLEU method, and the results are as Table 2.

Table 2: BLEU Score Comparison of Translation Systems

Translation System	BLEU Score	Rank	Key Analysis
DeepL	0.8521	1	Best alignment with reference in structure & terminology (e.g., "full-scale restoration"). Minor tense deviation ("had been restored" vs. "have returned").
DeepSeek	0.7983	2	Accurate key terms but uses "original operational state" (vs. official "functionality"). Past perfect tense weakens continuity nuance.
Youdao Translate	0.6327	3	Critical omissions (emergency restoration clause), vague phrasing ("original state"), and formatting errors (lowercase proper nouns).

3. Post-translation Editorial Strategy

To enhance the quality of machine-translated texts, post-editing should systematically address discrepancies in terminology, structure, and contextual nuance. Prioritize aligning key terms with authoritative references—such as official documents or industry glossaries—to ensure consistency, particularly for technical phrases like "full recovery" over literal equivalents like "full-scale restoration." Revise verb tenses to reflect the source text's temporal intent, such as replacing past perfect constructions ("had been restored") with present perfect ("have returned") to emphasize ongoing progress. Restructure fragmented or reordered clauses to restore the original logical flow, such as reintroducing parallel actions (e.g., "alongside emergency restoration") omitted in raw machine output. Correct formatting inconsistencies, including geographic term capitalization ("Noto Peninsula") and footnote placement, to meet professional standards. Replace vague expressions like "original state" with functionally precise terms like "original functionality" to enhance technical clarity, while localizing ambiguous references (e.g., "municipalities" vs. "cities and towns") for

audience relevance. For formal contexts, adopt a comprehensive approach (full post-editing) to achieve human parity by refining fluency, accuracy, and adherence to official terminology. In time-sensitive scenarios, light post-editing may suffice, targeting critical errors such as data inaccuracies or omissions while tolerating minor stylistic deviations. This balanced strategy ensures efficiency without compromising essential quality, aligning with the pragmatic demands of modern translation workflows (Suzuki, 2024; Zhong and Gu, 2024; Wen and Tian, 2024; Yamada, 2021; Ming et al., 2017).

4. Conclusion

This study underscores the pivotal role of post-editing in bridging the gap between neural machine translation (NMT) output and professional translation standards, particularly within the high-demand sector of Information and Communication Technology (ICT). By analyzing Japanese-to-English translations of ICT texts through platforms like DeepSeek, Youdao, and DeepL, the research reveals that while NMT systems achieve notable accuracy in semantics and structure (e.g., DeepL's adherence to parallel logic in "In parallel with emergency restoration..."), persistent challenges remain. These include inconsistent terminology (e.g., "critical infrastructure" vs. official "core facilities"), tense inaccuracies ("had been restored" vs. "have returned"), and omissions of brand-specific annotations (e.g., "Hikari (fiber-optic)").

The proposed post-editing strategy prioritizes terminological alignment with authoritative references, temporal precision to reflect ongoing actions, and structural coherence to restore source-text logic. Full post-editing, emphasizing human parity through fluency and accuracy refinement, is recommended for formal contexts, whereas light post-editing suffices for rapid delivery with tolerable stylistic deviations. Critical adjustments—such as replacing vague terms ("original state") with functionally explicit phrasing ("original functionality") and standardizing formatting—prove essential for technical clarity.

Industry data corroborates the dominance of the "machine translation + post-editing" model, with 30.4% adoption in 2023, reflecting its efficiency and cost-effectiveness. However, the study highlights the irreplaceable human role in addressing nuanced challenges like cultural adaptation and contextual dependencies. Future research should explore AI-augmented post-editing tools to further streamline workflows while maintaining the "humanistic core" indispensable for high-stakes translations. This synergy between technological advancement and human expertise remains critical to advancing translation quality in the AI era.

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