

Original Research Article

Challenges and solutions for deepseek in translating aviation technical texts

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Abstract: Aviation technical English translation plays a crucial role in advancing China's aerospace technology and facilitating international exchanges in this field. This study utilizes Deepseek's machine translation system and selects representative aviation technical texts as the research corpus. Through a comparative analysis of Deepseek's translations and human translations, this study identifies several challenges in the Chinese-to-English translation process and proposes corresponding pre- and post-editing strategies.

Keywords: deepseek; aviation technical English; machine translation; challenges and optimization strategies

1. Introduction

Amid globalization and the rapid evolution of the aviation industry, the translation of aviation technical texts facilitates the transfer of technology and promotes the exchange of academic resources, thereby advancing the development of China's aviation sector.

Using "aviation English translation" and "aviation machine translation" as keywords, the author conducted a literature search on the CNKI academic platform, yielding 91 results. These primarily cover studies in areas such as aviation English, maintenance manuals, and air transport contract translation. However, research on pre- and post-editing of machine translation in aviation English translation remains scarce. Significant gaps persist in machine translation studies within the aviation domain, particularly in the areas of "translation errors" and "optimization strategy research," which require further in-depth investigation.

"Human-machine collaboration is a process of mutual communication and understanding between humans and machines, where artificial intelligence empowers human intelligence to effectively solve complex problems"^[1]. Studies have confirmed that the human-machine collaborative model, which incorporates pre-translation preprocessing and post-translation verification, can significantly enhance translation quality. This study systematically analyzes the shortcomings of the machine translation system and proposes optimization strategies to improve the quality of its outputs.

2. Linguistic features of aviation English

Aviation Technical English is characterized by its technical nature and objective representation.

The technicality of aviation texts is reflected in two dimensions: high terminology density and pragmatic conventions. According to the Global Performance Navigation Manual (Doc 9883), terminology accounts for approximately 40% of such texts. The language adheres to International Civil Aviation Organization (ICAO) standards, with sentence structures predominantly featuring "noun phrase dominance."

Objective representation is primarily demonstrated through frequent use of nominalization and passive voice. In Aviation English, "nouns and noun phrases occur more frequently than in general English, exhibiting stronger nominal characteristics"^[2], and furthermore, "passive voice constructions appear more frequently than in general English"^[2]. Both syntactic choices aim to convey information precisely and objectively.

The linguistic features of Aviation English determine the challenges faced by the Deepseek translation system in this field: High terminology mistranslation rates, low utilization of nominalized structures, and inadequate reconstruction of passive voice constructions. To address these challenges, the author adopts a pre- and post-editing model.

3. Analysis of typical challenges in deepseek's aviation English translation and solutions

As an inevitable product of technological advancement, machine translation still exhibits significant limitations when applied in high-end technical fields and high-precision scenarios.

3.1. Terminology recognition challenges and solutions

"With the specialization, intersection, and continuous deepening of disciplinary development, some terms possess considerable vitality and are widely used, often leading to their diversity and making them difficult to standardize in practice"^[4]. This challenge can be addressed through the pre- and post-editing model. Pre-translation requires the translator to provide Deepseek with appropriate prompts, while post-translation necessitates the translator possessing strong aviation domain knowledge to accurately identify terminology and employ standardized expressions.

Example 1

通常,较大迎角时压力中心前移,而小迎角时压力中心后移。在机翼结构的设计中,压力中心的移动是非常重要的。

Deepseek Translation Output: Typically, the center of pressure moves forward at higher angles of attack and aft at lower angles of attack. In wing structural design, the movement of the center of pressure is of considerable importance.

Revised Translation: At high angles of attack, the CP moves forward, while at low angles of attack the CP moves aft. In the design of wing structure, this CP travel is very important.

The term "angle of attack" denotes the angle between the projection of the aircraft's velocity vector in its plane of symmetry and the wing chord line. A "high angle of attack" indicates a relatively large angle (typically >15°) between the wing chord and the incoming airflow direction, whereas a "low angle of attack" refers to a relatively small angle (typically <5°).

"Machine engines tend to translate literally, yet mismatches between Chinese and English terms—Especially with compound terminologies—Are common"^[5]. The terms "high angle of attack" and "low angle of attack" do not inherently carry comparative meaning. The translation provided by Deepseek evidently contains clear inaccuracies.

Prompt design considers the following five dimensions: defining the text domain, clarifying the translation task, specifying the application scenario, prescribing linguistic features, and establishing quality requirements.

For frequently used terminology, supplying Deepseek with appropriate prompts can enable accurate recognition.

Example 2

尾翼组件涵盖整个尾部结构,由垂直安定面和水平安定面等固定翼面构成。

Deepseek Translation Output with Prompts: The empennage comprises the entire tail assembly, consisting of fixed airfoils including the vertical stabilizer and horizontal stabilizer.

Revised Translation: The empennage includes the entire tail section, consisting of fixed surfaces such as the vertical stabilizer and horizontal stabilizer.

When provided with appropriate prompts, Deepseek successfully recognized the three key terms in Example 2: "empennage," "vertical stabilizer," and "horizontal stabilizer." The term "empennage" is a specialized aviation terminology referring to the tail section of an aircraft. Furthermore, given that the structure described is part of the "tail section," the term "固定翼面" should be accurately translated as "fixed surfaces."

By supplying Deepseek with well-designed prompts, translators can achieve efficient human-machine interaction, steering the system toward generating the desired translation output.

Through iterative prompt optimization, translators can systematically enhance the efficiency and quality of technical text translation. Digital empowerment indeed offers considerable convenience. However, "while large language models may occasionally produce unexpectedly good results, they can also generate seemingly plausible but factually incorrect or fabricated content"^[6]. For instance, in Example 2, Deepseek translated "固定翼面" as "fixed airfoils," which is technically inaccurate. The core of human-machine collaboration remains centered on the "human," with the "machine" serving merely as an auxiliary tool to improve work efficiency.

3.2. Problems in logical relation recognition within sentences and translation strategies

The Deepseek translation system exhibits three major deficiencies in processing the logic of aviation technical texts: insufficient syntactic parsing capability, ineffective use of nominalized structures, and inaccurate identification of focal information.

Example 3

建议采用冗余设计以降低失效概率。

Deepseek Translation Output: It is recommended to implement redundant design to reduce the probability of failure.

Revised Translation: Redundant design is recommended to reduce the probability of failure.

In Example 3, the original Chinese sentence "建议采用冗余设计" contains two verbs. The translation provided by Deepseek uses an impersonal "It is..." structure, which fails to highlight the focal information and shifts emphasis onto the action of "implementation," resulting in a slightly verbose output. In contrast, the revised translation nominalizes "redundant design" and places it in the subject position, omitting the verb "implement" because the passive construction "is recommended" inherently implies execution. This results in a more compact sentence structure and sharper informational focus. While Deepseek can recognize some relatively obvious nominalized structures, such as translating "失效概率" as "probability of failure" in Example 3, it still shows shortcomings in judging focal information and selecting appropriate subjects. This indicates that Deepseek cannot exercise "self-awareness" or "aesthetic judgment," and is thus unable to evaluate underlying logical relationships or the perceived "quality" of a translation.

To address Deepseek's inability to accurately identify logical relationships within sentences, the author proposes the following strategies: reconstruct the syntactic framework by segmenting syntactic units and explicating syntactic logic. This involves classifying primary and secondary information based on sentence meaning and connectives, adding subjects to subjectless sentences, incorporating cohesive devices to improve the readability of machine-generated translations, and appropriately supplementing information that highlights syntactic logic to clarify the agent.

Example 4

缩微小飞机和地平线的关系和真实飞机相对于实际地平线的关系是一样的。

Pre-edited Deepseek Translation Output: The relationship between the miniature aircraft and the horizon is the same as that of a real aircraft relative to the actual horizon.

Revised Translation: The relationship of the miniature aircraft to the horizon bar is the same as that of the real aircraft to the actual horizon.

In Example 4, pre-editing was applied to highlight the internal logical relationships in the source text. While Deepseek correctly consolidated "the relationship between the miniature aircraft and the horizon" as the sentence subject, its output still contained logical inaccuracies. In Aviation English, the preposition "to" precisely conveys spatial directionality, whereas Deepseek's use of "between" to describe this relationship lacks accuracy.

4. Conclusion

This study has investigated the translation challenges posed by the Deepseek system in handling aviation technical texts. The findings indicate that, given the unique practical demands of Aviation English, Deepseek exhibits notable limitations in accurately recognizing and translating terminology, and selecting appropriate nominalized structures. In response, translators can optimize prompts and enhance the logical explicitness of source texts to improve Deepseek's initial outputs and increase post-editing efficiency.

High-quality human-machine collaboration can maximize the effectiveness of aviation technical text translation. In the ongoing digital transformation of aviation translation, deeply understanding the limitations of machine translation and overcoming these barriers will contribute to improved translation quality for such specialized texts, thereby fostering advancement within the industry.

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