Comparative Analysis of NMT and Human Translation
—Poverty Alleviation Perspective

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Abstract. With President Xi's stress of "telling Chinese stories well" in the new era and the increasing needs of economic and cultural exchanges among countries around the world, translation is playing a critical role in information transmission and communication. Accompany the emergence of Neural Machine Translation (NMT) based on deep-learning technology, artificial intelligence has made a great process in the translation. However, few scholars have made the comparison between NMT and human translation in the theme of China's poverty alleviation. To provide reference for the publicity of China's poverty alleviation stories, through comparison analysis, this paper explores the ways to improve the translation efficiency of artificial intelligence in this specific area.

Keywords: Neural Machine Translation · Human Translation · Deep-learning · Poverty Alleviation

1 Literature Review

With the development of information technology, we have gradually entered the era of linguistic intelligence. As early as 1954, the world's first written machine translation system appeared in the United States. After that, machine translation began to develop continuously with the progress of computer technology. In recent years, deep-learning technology began to rise, and neural network machine translation (NMT) based on deep-learning technology began to enter the public view. In 2016, Google released neural network machine translation system, and since then machine translation has entered a new stage of rapid development [1].

With the gradual improvement of machine translation accuracy, the comparative analysis of machine translation and human translation has gradually emerged. Most of the previous studies on the comparison between machine translation and human translation are macroscopic, and the differences between machine translation and human translation can be obtained by comparing the translations between the two, but the translation comparison in some specific fields are from enough. With the enhancement of China's international strength, more and more fields need to go overseas, so the comparative study of machine translation and human translation begins to focus on specific fields. This is reflected in many aspects, but generally there are the following aspects of comparative analysis.

First of all, there are many comparative studies on machine translation and human translation from the perspective of literary text. Due to its high cultural connotation and aesthetic elements, literary text is more difficult for machine translation [2], research shows that machine translation lacks flexibility when translating the literature text, difficult to express the meaning of literature, and it often needs human intervention. Li Yao conducted a quality study on machine translation of the literary book Chronicle of a Blood Merchant [3], and emphasized that translation should be based on social and cultural background by comparing the density of vocabulary, the subject words, average length of words and average length of sentences. He emphasized in his research that translation should be based on socio-cultural background. Due to the different research methods and the different selection of texts, the research results varies greatly.

Secondly, the comparison between machine translation and human translation in national languages is not rare. Hari Danmu Abdukrim studied the translation quality of NMT in Uyghur and Chinese [4], and emphasized the importance of language resource base. Liu Yang studies the construction of parallel corpora for machine translation of small languages [5], and points out that the participation of human translation can build high-quality parallel corpora and greatly improve the quality of machine translation.

In addition, researchers also conduct comparative analysis of machine translation and human translation in the medical field. Jing Ning takes the terms of Huangdi Neijing as the research object and compared the results of machine translation and human translation [6], pointing out that, machine translation is difficult to accurately translate traditional medical terms compared with human translation. However, this study did not propose specific and feasible methods. Therefore, more empirical research is urgently needed to improve the translation efficiency of machine translation in terms of terms, which is not only required for medical terms, but also for the terms of poverty alleviation.

As the importance of spreading the Chinese voice in the new era increases, more and more political documents have been translated into English. Political literature is highly political, so it requires high accuracy [7]. Jiang Rong pointed out in his comparison between Google translation and human translation of political literature that translators can use Computer aided translation (CAT) to improve translation efficiency [7]. Currently comparative research for machine translation and human translation in the political literature is still insufficient, Chinese poverty alleviation story also belongs to the Chinese political literature, so it is in urgent need of political translation comparison of the use of NMT technology to improve the efficiency of political translation, so that we can know how to make Chinese stories spread out in a better way through researches about comparative analysis.

Finally, we found that machine translation is often applied to the text in the field of law, science and technology through the literature sorting. Because the structure of legal text and technology text is usually rigorous, the description is more objective, so the translation readability of machine translation will be worse in dealing with professional, complex and long sentences [8]. This reminds us that we should not rely too much on machine translation when translating professional words for poverty alleviation, but should improve the accuracy and readability of translation through manual post-translation editing.

In general, comparative research of machine translation and human translation is little in the field of poverty alleviation, and more new research is urgently needed to promote the dissemination of poverty alleviation stories and improve the ability of overseas translation of poverty alleviation texts. Moreover, while previous studies emphasized the importance of vocabulary corpus, this paper will also focus on the corpus to help our research. At the same time, comparing machine translation with human translation can help us fully understand the shortcomings of both sides in translating poverty alleviation texts, so as to constantly optimize the machine translation technology and better serve the overseas dissemination of Chinese stories.

2   Principles of NMT and Human Translation

2.1   Principle of NMT

From the above analysis of the literature, we can see that Neural Network Machine Translation (NMT) has led translation to a new stage of development, and the reason of NMT's wide use is that it adopts a more advanced translation model. We will briefly describes the principles of NMT in the following.

Neural Machine Translation (NMT) as a recent machine translation method, compared with the traditional Statistical Machine Translation (SMT), NMT uses deep neural network to realize the end-to-end overall translation mode, making the translation language more natural, and it greatly improves the accuracy and fluency. Because artificial neural networks need to be constantly fed from layer to layer to complete calculations, passing through several layers, this is a deep artificial neural network, and this kind of machine learning is called deep-learning. NMT uses machine deep-learning technology. Deep-learning, "machine learning based on artificial neural networks", refers to the learning of the internal laws of the sample data to enable the machine to have the same analytical ability as people. NMT is able to train a neural network that can map from sequence to sequence, and can output a longer sequence, which performs very well in terms of translation, dialogue and literal generalization. NMT is actually a encoder-decoder system. Encoder encodes the source language sequence and extracts the information from it, and then converts this information to another language, the target language, through decoder, so as to complete the translation of the language. In order for machines to have human-like thinking, it is necessary to understand the characteristics and advantages of human translation.

DeepL translator relies on artificial neural network technology for text translation. In this paper, the now popular translation software DeepL is used as the NMT paradigm to compare with human translation. Human translation mainly refers to the behavior of converting one language into another through human means. Unlike machine translation, human translation is a way to artificially control the quality of translation. Next, take the relevant content of "poverty alleviation" as a comparison of Neural Machine Translation and human translation to explain the difference between Neural Machine Translation and human translation. In this way we can provide reference for the publicity of Chinese poverty alleviation stories and explore the ways for artificial intelligence technology to improve translation efficiency in the context of language intelligence.

2.2   Advantages/Characteristics of Human Translation

Although the machine translation is popular in this time, human translation is still irreplaceable. Human translation mainly makes use of human subjective initiative to convert between languages, so one obvious feature that distinguishes it from the machine translation is that people have ideological consciousness and their thinking is more flexible than that of machines. They can flexibly think about and make improvements to the grammar application, sentence fluency and structure in the process of translation. The translation from human translation usually has strong readability, which can express the meaning of the original text to a greater extent and facilitate the readers' understanding. Therefore, the sentences translated by human translators are stronger than the results of machine translation in terms of grammar and logic.

Not only that, due to the large differences in social and cultural backgrounds of different countries, there are usually large differences in cultural environments and ways of thinking and expression between the two linguistic societies. But the machine translation, due to its stereotypical computing algorithm, finds it difficult to understand the differences between the two cultures and choose the appropriate language to express them, and they can only systematically produce translation based on the original text. However, human translators, due to their flexibility and subjective initiative, can combine the language usage habits and ways of thinking of the two societies and translate the translated text with flesh and blood, which makes it easier for readers to understand..

In addition, literary texts are often used as translation materials to promote the liberal exchange between different countries. The language used in literary texts is elaborate, the wording fits the overall context, and the atmosphere of the text is coherent, which can easily become dull and lose the context of the original text when translated by machines. Because it is difficult for the machine to recognize the context of the original text. The human translator can accurately grasp the meaning and context of the original text through his or her subjective initiative, and the translation is more appropriate.

However, the shortcomings of human translation are also obvious. Human translation completely relies on people to translate, and human energy is limited, so the speed of translation cannot be faster than the machine translation. Therefore, human translation takes a lot of time. Not only that, when translating some texts with strong professionalism and objectivity, the pursuit should be the faith to the original text, but due to the existence of subjective initiative, the translator is likely to translate by her own understanding, which may deviate from the meaning of the original text to a certain extent.

3   Comparative Analysis of NMT and Human Translation

We selected the representative poverty alleviation words as the object of our research and then input them into DeepL translator as an example of translation result of NMT. The term is also then translated by humans. Finally, the two translations are compared and studied to conclude the differences between them. By contrast, we found the following differences.

3.1 Verbatim Translation

During our analysis, we found that Neural Machine Translation and human translation are prone to verbatim translation differences when translating poverty alleviation words. The verbatim translation mentioned here refers to the direct literal translation of the words without correctly understanding the meaning of the original text, which leads to the lacking expression of the original text and even misinterpreting the meaning of the original text.

For example, "两不愁三保障", it has a special meaning in China as a characteristic word of poverty alleviation. "两不愁" refers to "ensure that the rural poor have no worries about food and clothing". "三 保 障" refers to "ensure the compulsory education, basic medical care and housing safety". However, in DeepL, the translation result of "两不愁三保障" is "two worries and three guarantees". Obviously, Neural Machine Translation directly uses verbatim translation in this word. It translates "愁" directly into "worries" and "保障" directly into "guarantees". However, it ignores the consistency with the original text, and also produces a missed translation. "Two worries" not reflecting "不愁", it directly omitted the meaning of "不", and misinterpreted the original meaning.

While human translation combines the meaning of the word itself, with no verbatim translation performing. It translates it into "Guarantee the basic needs of food and clothing for those living in poverty and ensure that they have proper access to compulsory education, medical care, and safe housing." Human translation is based on the meaning behind the poverty alleviation words, and the meaning of the words is relatively well expressed, which can describe the specific meaning of the poverty alleviation words and promote the publicity of poverty alleviation undertakings. However, human translation also has the problem of not concise enough, and its content is relatively long.

For some sentences about poverty alleviation in official government reports, there are also differences in verbatim translation between Neural Machine Translation and human translation. For example, "建设持久和平、普遍安全、共同繁荣、开放包容、清洁美丽的世界". This sentence expresses China's ardent hope for the success of international poverty alleviation and its call to build a community with a shared future for mankind without poverty and common development. This sentence is the content of the report of the 19th National Congress of the Communist Party of China, so the statement of this part should be precise.

In the Neural Machine Translation with DeepL as a carrier, it is translated as: Building a world of lasting peace, universal security, common prosperity, openness and inclusiveness, cleanliness and beauty". It translates "持久和平"、 "普遍安全"、"共同繁荣"、"开放包容"、"清洁美丽" and a series of words into nouns. And it used verbatim translation according to space order. The hierarchy between words is not so high and it appears boring, obviously not suitable as a translation in the official report. Not only that, "建设" acts as a verb in this sentence, which should use the pattern of "to+verb" to express action, so the use of "building" in this sentence maybe questionable.

However, human translation translated the sentence as: "to build an open, inclusive, clean, and beautiful world that enjoys lasting peace, universal security, and common prosperity." Human translation uses "开放包容" and "清洁美丽" as adjective to modify the "world". It also interprets "持久和平", "普遍安全", and "共同繁荣" as nouns, but they further modify world in the form of attributive clauses. In the meantime, it uses

"enjoy" to describe the good expectations for the future world. Overall, human translation is more suitable for use in official bilingual reports.

3.2 Proprietary Terms

When translating specialized words about poverty alleviation, it is more difficult for translators to weigh the degree of translation with reality. Insufficient translation will lead to the lack of information expressed in the original text, let alone a good interpretation of the major policies of the state. In particular, there are a large number of phrases and idioms in the sector of poverty alleviation. In the face of these languages, we should not only translate them accurately, but also actually get close to people's lives, and translate and describe them with down-to-earth words.

"扶贫同扶志扶智结合" is the fundamental way to win the battle against poverty. Here, "扶志" refers to "help people build confidence and thought", and "扶智" refers to "help people acquire knowledge and technology". In the DeepL, NMT translated "扶贫同扶志扶智结合" into "Combining poverty alleviation with helping the will and wisdom", which understands "志" as "will", the meaning of "purpose and ambition", and it clearly does not correctly express the information that the original text wants to express.

The result of human translation is "Poverty Alleviation Through Increasing People's Confidence and Helping Them Acquire Knowledge and Skills", which means "understanding" 扶志 "as" increase people's confidence". Moreover, it understands "扶智" as "help people acquire knowledge and skills". The results of human translation are based on the thinking and understanding of proprietary words for poverty alleviation, which can better convey the meaning of proprietary words than the results of NMT translation, and it can also correctly express purpose of poverty alleviation policy.

3.3 Omission of Translation

During our analysis, we also found that semantic mistakes often occur when translating words about poverty alleviation, mainly reflected in the lack of modifiers and lack of fine combination of similar words and then lead to omission of translation. The omission of translation is mainly due to the negligence of the machine system and the improper understanding of Chinese, which leads to the lack of modification, incomplete and inaccurate semantics. The vocabulary of poverty alleviation is not in common use in daily life, in addition, many words are constantly updated. If such words are not imported into the computer system, it will lead machines to understand translation with existing programs. When the machine encounters words that do not understand, it will calculate the comparison of sentence similarity through the machine memory to match the closest-meaning translation. If not, it can only skip the meaning of a word, which leads to the omission of translation.

Take "送教上门" as an example, the result of DeepL translation is "home delivery", the result of human translation is "send education to home". We can only feel the meaning of sending things home through machine translation, but the meaning of "teaching" is not reflected. This belongs to the omission of translation. Compared with NMT, human

translation reflected the meaning of "teaching" accurately, fully expressed its original meaning.

Secondly, such as the term "建档立卡", which means the accurate identification and collection of information of subjects to be alleviated and then establish corresponding electronic files and databases to realize targeted poverty alleviation and the dynamic management of poverty alleviation. It is an important means in poverty alleviation work. It is a verb phrase due to "建" and "立", so attention should be paid enough to reflect the dynamics of poverty alleviation in translation, in order to accurately express the meaning of the original word.

The result of DeepL for the "建档立卡" is "File and card". Obviously, it only translated the two word literally, and missed the translation of two important verbs——"建" and "立", failed to reflect the dynamic management process of poverty alleviation. Human translation for "建档立卡" is "poverty registration", in which "poverty" reflects that the object is the poor areas or the poor population; "registration" means registering the population of poor areas, expressing the way and purpose of "建档立卡", and it reflected the dynamic management of poverty alleviation work.

3.4 Part of Speech

In the process of comparing neural NMT with manual translation, we noticed that the form of language will change accordingly. In order to keep the correctness and accuracy of the translation, there are often conversions of parts of speech. Conversion of parts of speech refers to changing the part of speech of some words in the original text while keeping the original meaning unchanged, so that the translated text is fluent and natural, which conforms to the expression habits of the target language. However, sometimes, due to the incompleteness of corpus and other reasons, neural machine translation will lead to the wrong expression of the original text owing to the error of conversions of parts of speech.

For example, "讲好中国故事". In such an era of fierce competition for international discourse power, this sentence means telling Chinese stories in a good way, so that the world can know the real China. But in DeepL, the translation of this sentence is "Tell a good Chinese story". Obviously, the error of conversions of parts of speech have occurred in the translation process of Neural Machine Translation. The word "好" is directly defined as an adjective, and it is considered as an adjective to modify the word "故 事". However, in fact, the word "好" is used as an adverb to modify the word "讲". The result of NMT will lead to misunderstanding of our country by other countries. Human translation, on the other hand, combines the Chinese context, comprehensively considers the parts of speech of words, and translates the sentence into "Tell Chinese stories well". It focuses on the adverb "well", accurately and concisely express China's determination and confidence to spread Chinese stories, and explain China in an international way with a discourse system that westerners can understand and accept, so as to achieve the purpose of propaganda.

There is also the saying "幸福乡村惠民生", which means that a beautiful and happy village can make people's life better. The translation result of DeepL is "happy villages preferential people's livelihood". Here, NMT regards the word "惠" as the adjective "优惠的, 特惠的" and translates the word "惠" into "preferential", which means to give

an advantage to a particular person or group. This made a mistake in part-of-speech translation and distorted the meaning that the original text intended to convey.

In human translation, we translate "幸福乡村惠民生" into "Happy country benefit the people's livelihood" by combining the sentence meaning and relevant context. The word "惠" is processed into the verb "benefit", which means to be useful or profitable to someone. This processing is also more in line with the requirements of part-of-speech conversion. Therefore, human translation can be more flexible in terms of the accuracy of matching with the original text.

3.5   Translation Efficiency

When translating texts, we should not only pay attention to the accuracy of translation results, but also consider the time cost of translation. NMT translation can translate a 5,000-word Chinese text into English in one minute because of its fast computer operation, which can save a lot of time cost for translators. However, when it comes to human translation, the time for translators to translate a 5000-word article is uncertain. Translation time is largely influenced by text type, number of new words and other reasons. Therefore, the time cost is often much more than NMT translation.

Moreover, NMT translation is simple and easy to use. Users can get the translation results in a short time only by simple input. However, human translation has higher professional requirements for translators. Therefore, NMT is more suitable for the public in terms of difficulty.

All in all, NMT and human translation are highly complementary in terms of translation quality and efficiency. When translating high-standard translations, we can't just rely on one kind of translation, and the correct way is to combine them organically (Table 1).

Table 1. Comparison of NMT and HT.

Category	NMT	Human Translation
Verbatim translation	Direct literal translation; misunderstand the original meaning	It can effectively grasp the poverty alleviation situation, and the translation results are more accurate
Proprietary terms	Lack of adequate term files	
Omission of translation	Lack of key modifier translation	
Part of speech	Miscalculation of part of speech	
Translation efficiency	Language transformation efficiency is high; simple and easy to use	Low efficiency; long translation cycle; high requirements for translators

Through the above analysis of differences between NMT and human translation, we found that NMT's translation of poverty alleviation terms is often affected by lack of

adequate terminology, misunderstanding of the original text and misjudging the lexical nature. After finding out the reasons for the effect of NMT translation, we should address each of them in a targeted manner. The following are the suggestions we have made through our analysis to improve the efficiency of NMT translation, with a view to contributing to the external publicity of the poverty alleviation cause.

4 Suggestions on Improving the Accuracy of Poverty Alleviation Translation Results After the Comparison

4.1 Establish a Term Database for Poverty Alleviation

Through the above comparison, we know that because there are many professional terms in poverty alleviation in China, it is difficult for machine translation to accurately translate these terms, which will affect the external publicity of the national poverty alleviation policy to a certain extent. Poverty alleviation vocabulary is a unique vocabulary in China. Many of the terms have not been translated or the existing translations may be updated, which requires us to constantly improve the terminology bank related to poverty alleviation and improve the accuracy of NMT terms. At the same time, in the process of translation, each user is authorized to make additions to the terminology database and be recorded in the terminology database after submission and approval. Therefore, the content of the terminology database is constantly optimized to provide different perspectives for the interpretation of poverty alleviation vocabulary, and increase the elasticity of NMT.

4.2 Use Linguistics Knowledge to Improve the Deep-Learning Algorithm

In addition, since NMT uses deep-learning technology to perform calculations, although it is technologically advanced, there is still a problem of misunderstanding the context of the original text and misinterpreting its meaning. Therefore, we need to continuously improve the algorithm of NMT to make it understand the meaning of the original text as correctly as possible. Deep-learning distinguishes the data by analyzing the input layer data, and the effect is much more efficient than traditional machine learning algorithms, but it is still part of the field of computer science. When applied in the field of natural language processing, we have to pay attention to the understanding of semantics.

Deep-learning should also improve the existing knowledge model by promoting the multi-disciplinary intersection between linguistics and computer science, and discovering semantic laws through multiple learning of linguistics theory. By creating a deep-learning algorithm with "temperature", we can enhance language processing and spread Chinese stories "with temperature" and "depth".

4.3 Using Computer-Aided Translation (CAT)

The previous comparison shows that human translation is significantly better than neural network machine translation in terms of translation quality, but its translation efficiency is usually very low. Therefore, in order to increase the translation efficiency as much

as possible while maintaining the translation quality, it is a good choice to use NMT mainly and supplemented by machine translation. We can use computer-assisted translation (CAT) to improve the efficiency of poverty alleviation translation. In the process of translating poverty alleviation vocabulary, there are many phenomena of term duplication. CAT records the data entered by the translator in the backstage through the translation memory technology, and when the translator mentions the data a second time, CAT provides the previous translation results. For similar sentences, CAT also gives translators appropriate advice, which can greatly improve the efficiency of translation. At the same time, CAT can also identify the wrong words in the article, check whether the article has spelling errors punctuation errors, inconsistent terms and other low-level errors, and then provide feedback to the translator, which can improve the accuracy of translation and play the role of proofreading and review.

4.4   Enhance Translation Post-editing

From the above analysis, it can be seen that it is difficult to be accurate with machine translation, and it will make a series of low-level errors such as misjudgment of words and context understanding errors, which reflects the importance of translation post-editing. Since the current NMT technology is not enough to output completely, it is necessary to ensure the accuracy of translation when dealing with articles about China's international image such as poverty alleviation. Due to the great differences between Chinese and Western thinking and culture, it is difficult for NMT technology to identify the differences between input language and output language, which requires translators to conduct post-translation editing after NMT processing and organically combine NMT technology with human translation. The translator uses the human brain to think and to feel the cultural differences between the East and the West, further improves the output text, and pays more attention to the reasonable transformation between the two texts, so as to make the final translation more accurate.

5   Conclusion

However, the methods of improving the efficiency and accuracy of NMT translation still need to be continuously innovated and perfected. The above proposed method is only used as a reference for the results of this paper, and still has many shortcomings. First, the authors' own level has limitations due to lacking of enough professional knowledge. Secondly, the corpus of poverty alleviation studied in the paper is insufficient, and the results obtained may not be universal. Finally, the proposed method is not systematic and deep enough, so it needs to be constantly improved.

With the strengthening of China's national strength, the "going out" strategy is particularly important. It is the bounden duty of each of us to spread the Chinese stories well in the context of the new era. Making full use of NMT and human translation in the context of language intelligence will help us to spread China's poverty alleviation stories more efficiently. Poverty alleviation stories are an integral part of China's story. By properly translating these stories into English, China's experience in poverty alleviation can also be shared by the world. Moreover, the overseas spread of China's poverty

alleviation stories also provides a sample of China for countries around the world. At the same time, it is also conducive to establishing China's image as a big country and enhancing China's international discourse power.

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