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Research on Business English Translation Model Based on Weighted Multi-Objective Deep Belief Network

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ABSTRACT

Business English translation plays a crucial role in promoting international trade and technological exchange, but traditional translation methods suffer from issues such as low efficiency and insufficient accuracy. To address these challenges, this paper proposes a business English translation model based on Weighted Multi objective Deep Belief Network (WM-DBN), combined with artificial intelligence (AI) and fifth generation mobile communication (5G) technology, aiming to improve translation quality and shorten modeling time. This model constructs a deep network structure by stacking multiple Restricted Boltzmann Machines (RBMs) and optimizes it using a strategy that combines unsupervised layer by layer pretraining with supervised fine-tuning to better capture the complex dependencies between texts. This study not only effectively improves the quality and efficiency of business English translation, providing strong support for information flow and communication between multinational enterprises, but also provides new technical ideas for translation work in other fields.

KEYWORDS

Business English Translation, Deep Learning, Deep Belief Network (DBN), Artificial Intelligence (AI), 5G Technology

INTRODUCTION

With the acceleration of globalization and increasing cross-cultural communication, the role of language as a bridge has become increasingly prominent (Atasheva, 2024; Chen, 2024). In international business activities, high-quality business English translation is very important for promoting international trade, technical cooperation, and management of multinational enterprises (Roshid & Kankaanranta, 2025; Zhang et al., 2021). However, the traditional translation mode relies on manual operation, which is generally inefficient, expensive, and inconsistent, making it difficult to meet the dual needs of timeliness and accuracy in the modern business environment (Fan & Zhang, 2025; Mirzakhodjaev & Yuldasheva, 2025). Although artificial intelligence (AI) technologies such as neural machine translation (NMT) have made remarkable progress in the general field, the existing models still face challenges such as semantic distortion, mistranslation of terms, and insufficient context-dependent modeling in business English scenes with strong professionalism and complex semantics (Naikoo & Ganai, 2025). At the same time, the popularity of 5G communication technology provides infrastructure support for high-bandwidth and low-latency data transmission,

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creating unprecedented conditions for the deployment of real-time intelligent translation systems (Kelechi et al., 2019).

In view of the above problems, this study aims to build an efficient, accurate, and adaptable business English translation model so as to improve the translation quality, shorten the modeling cycle, and explore its application efficiency in different network environments and terminal devices. The research focuses on solving the problems of weak generalization ability and long training time of traditional deep learning models in dealing with professional texts while at the same time realizing the deep integration of the AI algorithm and 5G communication architecture and promoting the development of intelligent, real-time translation. Therefore, this paper proposes a business English translation model based on a weighted multi-objective deep belief network (WM-DBN).

In this model, multiple restricted Boltzmann machines (RBMs) are stacked to form a deep network structure and the mixed training strategy of unsupervised layer-by-layer pretraining and supervised fine-tuning is adopted to effectively extract the high-order semantic features in the text. In order to further improve the robustness and generalization performance of the model, a weighted integration mechanism based on the dual-objective optimization of classification error and model diversity is introduced to dynamically allocate the decision weights of each sub-model. The experiment was carried out on a multisource business corpus covering the fields of law, finance, and marketing. Mainstream models such as convolutional neural network (CNN), recurrent neural network (RNN), and graph neural network (GNN) were compared, and their cross-platform adaptability was tested on high-performance computers and mobile devices in the 4G/5G network environment.

The experimental results show that the proposed WM-DBN model has excellent translation accuracy on multiple datasets, with the highest translation accuracy reaching 84%, which is significantly better than that of the contrast models. On the F_1 score index, WM-DBN achieved excellent (98%) performance, showing a good balance between accuracy and recall. In addition, the model shows lower response delay and higher stability in the 5G network environment and can still maintain good performance even on mobile devices with limited resources, which verifies its feasibility and efficiency in real business scenarios. This study not only significantly improves the automation level and service quality of business English translation but also greatly shortens the model training and deployment time, which is helpful to accelerate the information circulation and cooperation efficiency among multinational enterprises. The research results can be widely used in intelligent conference systems, cross-border electronic commerce, remote business negotiation, and other practical scenarios, providing technical support for building an efficient and reliable multilingual communication platform.

The innovations of this study are as follows: applying the WM-DBN model to business English translation for the first time, which breaks through the limitations of traditional NMT in structural design and training efficiency; creatively integrating the AI deep learning model with the 5G network topology; building a cloud–edge–end collaborative intelligent translation system; and giving full play to the advantages of 5G's ultralow latency and high bandwidth. The proposed multi-objective weighted integration strategy effectively improves the stability and generalization ability of the model and provides a new technical path and theoretical reference for machine translation in professional fields.

LITERATURE REVIEW

With the rapid development of information technology, machine translation, as a bridge connecting different languages and cultures, plays an increasingly important role in promoting global communication (AlAfnan, 2025; Ekuerhare & Udoka, 2024; Sun, 2023). Especially in the field of business English, accurate and efficient translation services are crucial for promoting international trade and technological exchanges (Al-Mallahma, 2025; Al-Tarawneh & Al-Badawi, 2025).

In recent years, the development of deep learning technology has provided new opportunities to improve the quality of machine translation (Chen, 2023; Popel et al., 2020; Zhang et al., 2023). Xu