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CONSTRUCTION AND APPLICATION OF CHINESE-ENGLISH BILINGUAL SCIENCE AND TECHNOLOGY DYNAMIC TERMINOLOGY BASE BASED ON THE DEMAND ORIENTATION OF NEW QUALITY PRODUCTIVITY

Yue Jiang*, JiaHao Yang, YunTong Lu
School of Foreign Studies, Hefei University of Technology, Hefei 230601, Anhui, China.
Corresponding Author: Yue Jiang, Email: 19355218527@163.com

Abstract: In the context of fierce global technological competition and deepening cross-cultural integration, the construction of a Chinese-English bilingual scientific and technical terminology database is of great significance for promoting technological exchange and enhancing international academic discourse power. However, existing bilingual terminology databases face numerous challenges, including slow update rates that fail to keep pace with rapid technological advancements, limited coverage that results in uneven inclusion of terminology across different fields, and insufficient semantic accuracy that hinders the precise dissemination of technological information. Additionally, the modern Chinese terminology system has largely absorbed vocabulary through English translation, which, while reflecting a trend of language integration, also poses challenges to ensuring terminology consistency. Furthermore, traditional translation technologies struggle to handle the complexity and variability of scientific and technical terms, affecting translation efficiency and quality. From the perspective of cross-cultural communication, differences in language expression across cultures increase the difficulty of accurately translating scientific and technical terms, as exemplified by the lack of uniform standards for translating Traditional Chinese Medicine (TCM) terminology into English. Moreover, the development of big data and artificial intelligence (AI) technologies imposes new requirements on terminology database construction, and how to effectively integrate these technologies into terminology database updates and management remains an area to be explored. Therefore, it is imperative to improve and refine Chinese-English bilingual scientific and technical terminology databases to better meet the demands of the times.
Keywords: Chinese-English bilingual terminology database; Technological exchange; Natural language processing (NLP); Terminology consistency

1 INTRODUCTION

In today's rapidly advancing global technological landscape, English academic literature and scientific and technical terminology have become the core mediums for knowledge dissemination and technical exchange. With the deepening of international technological cooperation and the growing demand for cross-language information exchange, the construction of English scientific and technical terminology databases has become particularly urgent. Despite existing terminology databases such as the European Union Terminology Database, UNTERM, and the terminology database of the Institute of Scientific and Technical Information of China (ISTIC) achieving certain successes in data collection and information technology applications, they still fall short in terms of update rates, coverage, and semantic accuracy, limiting their service efficiency. Against this backdrop, the construction of a dynamic English scientific and technical terminology database holds significant value for cultural and cross-cultural communication. As China's international influence continues to rise, the demand for disseminating Chinese cultural terminology abroad is also growing, and dynamic terminology databases can provide critical support for this purpose. Furthermore, dynamic terminology databases can capture terminology changes in real-time, reduce translation errors, and enhance the precision of communication. Academic discourse power is an important component of international influence and has significant implications for constructing a nation's international security environment[1]. Currently, China's modern linguistic research still requires strengthening in terms of international academic discourse power, and its influence in the international linguistic community and contributions to universal linguistic theories need to be improved[2]. Future research will focus on how to utilize cutting-edge technologies such as artificial intelligence, big data, and cloud computing to optimize data management, expand application scenarios, and promote the construction of dynamic English scientific and technical terminology databases. This will enhance their role in technological exchange, academic research, education and training, and industrial innovation, providing a solid foundation for global technological progress and knowledge diffusion.

2 CURRENT STATUS OF CHINESE-ENGLISH BILINGUAL SCIENTIFIC AND TECHNICAL TERMINOLOGY DATABASE CONSTRUCTION

In today's Chinese linguistic context, apart from traditional terminology, a large number of modern terms are primarily introduced and absorbed through English translation[3]. This phenomenon reflects the trend of language exchange and

integration under globalization and also highlights the status of English as a global lingua franca. In the modern Chinese terminology system, while traditional local terms are preserved, many newly emerging professional vocabulary and concepts are mostly introduced through English translation. This phenomenon of terminology borrowing not only showcases the interaction and integration between languages but also reflects the impact of English on other languages during the process of globalization.

From the perspective of some existing terminology databases, the European Union Terminology Database, as the official terminology database of the EU, covers fields such as law, agriculture, and technology, including Chinese and English terms. Its terminology data is sourced from EU internal legislation and policy documents and is widely used in international technological cooperation and academic research. The United Nations Terminology Database (UNTERM), led by the United Nations, includes terminology from fields such as international affairs, environmental protection, and technology, with data sourced from previous sub-databases and various UN documents and meetings[4]. The terminology database of the Institute of Scientific and Technical Information of China (ISTIC) focuses on the collection and management of Chinese-English bilingual terminology, covering key technological fields such as artificial intelligence and new energy. These bilingual scientific and technical terminology databases serve as bridges for efficient communication between governments and international organizations and are important information resources for global scientific research and technological development. They help overcome language barriers and strengthen international technological exchange and cooperation through their rich data.

Existing bilingual scientific and technical terminology databases are constructed using modern technologies and equipped with diverse functionalities to enhance user experience. In terms of database construction methods, Lexikon, developed by the U.S. company ENLASO, is a database-driven web application platform that allows different users to create, manage, and publish multilingual vocabulary libraries. It includes automated translation processes and adopts Unicode-compliant language technologies to dynamically support various language combinations, making it suitable for large terminology database projects. T-Manager represents a terminology management approach based on Excel spreadsheets, which can automatically analyze terminology in the Excel environment, manage terminology in real-time, import terminology from external tools, and provide core functions such as terminology unification. As a paid software, SDL MultiTerm is renowned for its powerful terminology extraction capabilities. Although its high cost may limit the use of users with limited budgets, it remains an attractive option for professional institutions seeking efficient and precise terminology management solutions[5].

In terms of storage technology, most existing bilingual scientific and technical terminology databases adopt relational database or cloud storage technologies, enabling multi-user access and real-time updates. In terms of retrieval technology, most existing terminology databases enhance the accuracy of terminology matching by using contextual examples, and some databases have already integrated machine translation and terminology management functions to support dynamic terminology updates and automatic alignment.

Despite the achievements of existing bilingual scientific and technical terminology databases in data sources, technological implementation, and application scenarios, the continuous increase of technological vocabulary in various professional fields has raised higher requirements for the precision of terminology translation and the speed of the review process. This trend not only reflects the rapid pace of technological development but also emphasizes the importance of ensuring terminology consistency and timeliness in cross-language communication[6]. Manual collection and organization struggle to keep up with the frequent emergence of new concepts in technological fields, leading to lagging updates and insufficient coverage. Multi-source data integration causes fragmented terminology definitions, exacerbating standardization conflicts. Traditional terminology databases face generational gaps in multiple aspects. Facing the globalization of technology, building a dynamic Chinese-English bilingual terminology database requires breaking through three major technological bottlenecks: terminology consistency, intelligent translation, and agile iteration. This has become the core demand for the construction of next-generation technological language resource systems.

3 NECESSITY OF CHINESE-ENGLISH BILINGUAL SCIENTIFIC AND TECHNICAL TERMINOLOGY DATABASE CONSTRUCTION

Terminology, as the vocabulary representing concepts in professional fields, plays an irreplaceable role in information exchange[7]. With the development of the information age, international academic exchange and research cooperation have become increasingly frequent, and information sharing between different countries and regions has become crucial. The significant linguistic differences between Chinese and English can easily lead to ambiguities or misunderstandings in the translation of professional terminology. As a key knowledge resource, terminology information is crucial for promoting technological innovation, deepening academic exchange, and supporting decision-making processes. Constructing a terminology database is not only an effective means of systematically managing and maintaining these important terms but also provides an efficient platform for information resource sharing across fields and regions[8]. Against this background, the issue of how to construct a Chinese-English bilingual terminology database becomes particularly important[9]. In the current context, the necessity of constructing a Chinese-English bilingual terminology database is mainly reflected in the following two aspects.

3.1 Necessity of Disseminating Chinese Cultural Terminology

With the continuous enhancement of China's national strength and its rising international status, the influence of Chinese culture around the world is expanding day by day. An increasing number of international scholars and professionals are showing a strong interest in fields such as Traditional Chinese Medicine, philosophy, and arts. Terminology, as a medium of communication, carries rich cultural, customary, and emotional connotations. Therefore, understanding the cultural implications, customs, and emotional expression patterns behind the language is crucial for accurate communication[10]. From the perspective of China's cultural heritage, the traditional Chinese culture, with a history of five thousand years, encompasses numerous aspects such as music, chess, calligraphy, painting, traditional literature, classic documents, festivals, architecture, opera, language, medicine, folk crafts, martial arts, regional culture, clothing, food, antiques, mythology, traditional music, and couplets. Since the late Ming Dynasty, with the arrival of Western missionaries like Matteo Ricci, who first translated the "Four Books" into Latin, the transmission of Chinese culture to the West began. Subsequently, many sinologists, such as Julius Mohl and James Legge, contributed to the translation and research of Chinese classics, making works like the "Book of Songs" and the "Analects" gradually known to the world[11]. While these efforts have produced accurate and detailed translations, such as those found in foreign sinological literature and international websites, there have also been cases of one-sided interpretations or mistranslations. This not only highlights the obstacles in terminology expression but also reveals the challenges of cultural communication. Therefore, constructing a Chinese-English bilingual terminology database is of great significance for accurately passing on traditional culture.

3.2 Necessity of Promoting Cross-Cultural Communication and Accurate Cross-Language Translation

In an increasingly globalized world, exchanges and cooperation between different countries and regions are becoming more frequent. As the lingua franca of international communication, English plays a key role in technology sharing and business cooperation. However, the highly specialized nature of the chemical industry leads to significant regional differences in terminology systems. Even English-speaking technical experts struggle to understand professional expressions across different regions. The short cycle of technological iteration and the emergence of new processes continuously demand updates to translators' knowledge reserves. Ordinary translators find it difficult to keep pace with the rapidly evolving knowledge systems, which limits the efficiency of cross-cultural collaboration. Currently, the number of professional translators in the chemical industry is far from meeting actual demands[12]. Against this backdrop, how to effectively and accurately convey information under the norms of high technological requirements and strict safety standards becomes particularly important. Moreover, since the chemical industry typically operates in global markets, enterprises need to interact frequently with overseas customers, suppliers, and partners. A Chinese-English bilingual terminology database can simplify communication in formal settings such as business negotiations and contract signings, as well as provide substantial assistance in daily technical support and services[13].
In the context of cross-cultural communication and cross-language translation, Traditional Chinese Medicine (TCM) is another field of significant influence. In recent years, traditional Chinese medicine has gained increasing attention and recognition worldwide. With growing interest in TCM theories and technologies from the international medical community, the translation of TCM into foreign languages has become increasingly widespread. After more than a decade of relentless efforts by Chinese TCM translators, remarkable progress has been achieved[14]. Additionally, an increasing number of international friends are developing a strong interest in TCM, hoping to improve their health, seek alternative therapies, or gain a deeper understanding of this ancient system of wisdom through learning and experiencing TCM. However, there has been no unified standard for the mutual translation of TCM terminology in Chinese and English. This situation has led to the existence of multiple English translations for the same Chinese term, which may stem from different understandings of the term or the adoption of varying translation strategies[15]. To unify translation standards and reduce ambiguity, the construction of a Chinese-English bilingual terminology database is particularly urgent.

4 FEASIBILITY OF CHINESE-ENGLISH BILINGUAL SCIENTIFIC AND TECHNICAL TERMINOLOGY DATABASE CONSTRUCTION

As a bridge for technological languages, the construction level of a Chinese-English bilingual terminology database directly impacts the efficiency and depth of international technological exchange and knowledge dissemination. However, existing terminology databases still have many shortcomings in terms of update speed, coverage, and semantic accuracy, making it difficult to fully meet the demands of the dynamic productivity context. With the development of artificial intelligence, big data, and cloud computing technologies, it is now technically feasible and practically possible to construct a dynamic, broadly covered, and highly semantically accurate Chinese-English bilingual terminology database. This chapter analyzes the supporting technologies, data sources, management mechanisms, and application prospects.

4.1 Technological Innovation Provides Robust Support for Bilingual Terminology Database Construction

Technological innovation and development are the pillars of constructing a Chinese-English bilingual terminology database. Advances in artificial intelligence, particularly in natural language processing (NLP) and deep learning models, enable terminology databases to efficiently update through automatic term extraction and semantic analysis. With the help of language models such as BERT and GPT, terminology can be precisely extracted from a vast amount

of scientific and technical literature and industry reports, and its contextual semantics can be deeply analyzed to ensure accurate term meanings. Additionally, AI can dynamically correct translation errors through feedback mechanisms and optimize term definitions based on user data, driving the continuous evolution of the terminology database.

The application of cloud computing and big data technologies provides strong data processing and storage capabilities for terminology databases. Terminology databases based on cloud architecture enable global real-time access and updates, while big data technologies can analyze global technological trends in real-time, predict and capture the emergence and popularity of new terms. Distributed storage technologies allow for efficient management of massive data and stable support for multi-user concurrent access. Multimodal technologies upgrade traditional text-based terminology databases to integrate various forms of terminology resources, such as images, audio, and videos, providing users with more intuitive and multidimensional understanding of terms, such as showcasing the practical application scenarios of terms through medical imaging or technical drawings.

In terms of management mechanisms, dynamic updates and quality assurance are key. Automated systems support flexible update strategies for terminology databases based on the needs of different fields. Real-time update mechanisms continuously mine new terms through dynamic corpora for immediate inclusion and synchronization, with user feedback data also serving as a basis for updates to ensure alignment with actual needs. For quality assurance, a multi-level review mechanism is established, with initial screening relying on AI and final reviews conducted by domain experts and linguists to ensure professional standards. A version management system is introduced to track change records, facilitating version comparison and problem tracing.

A dynamically updated Chinese-English bilingual terminology database has broad application prospects in fields such as technological exchange, academic research, education and training, and industrial innovation. In technological exchange, the terminology database helps researchers overcome language barriers and enhance the efficiency of international cooperation. In academic research, it is an essential tool for paper translation, report writing, and standard document preparation. In education and training, open terminology resources contribute to the popularization and promotion of technological languages. In industrial innovation, the terminology database provides linguistic support and knowledge assurance for the international development of enterprises, particularly in high-tech fields.

4.2 Diversified Data Sources Enhance the Authority and Comprehensiveness of the Terminology Database

The data sources of a terminology database determine the breadth and depth of its content, requiring multi-channel acquisition. Domestically, reliance can be placed on authoritative institutions such as the Chinese Academy of Sciences and the Standardization Administration of China to systematically collect terminology resources in key supported fields, ensuring scientific authority. Internationally, cooperation with terminology databases such as those of the EU and the United Nations can introduce international resources to expand coverage. Dynamic corpora are key to maintaining up-to-dateness, collecting the latest academic papers, industry reports, and technological news to capture emerging term changes in real-time. User participation is also an important source, with the construction of online platforms encouraging researchers, experts, and users to submit terms and definitions, leveraging crowdsourcing verification to ensure data quality. Furthermore, open data sharing policies provide valuable resources, utilizing global open data platforms to reduce collection costs and enhance data diversity and practicality.

4.3 New-Quality Productivity Driving the Technological Vision for Terminology Database Construction

In the thriving context of new-quality productivity, cutting-edge technologies such as artificial intelligence, big data, and cloud computing bring new opportunities for the construction of Chinese-English bilingual terminology databases. The following subsections detail the specific applications of these technologies in terminology database construction.

4.3.1 Dynamic real-time monitoring technology: the "radar" for capturing term updates

Dynamic real-time monitoring technology is an important tool for empowering terminology database construction through new-quality productivity[16]. It is based on web crawler technology and machine learning algorithms to achieve real-time listening and automatic data collection from multiple well-known field-specific websites and literature inclusion sites. In today's rapidly evolving technological landscape, academic journal websites (such as IEEE Xplore, ACM Digital Library), professional forums (such as Stack Overflow, Reddit's technology sections), and industry news websites (such as TechCrunch, Wired) are all important sources of new terminology.

Specifically, the process begins by identifying target websites and using web crawler technology to periodically visit these sites, obtaining their HTML code and parsing it into text data. During the data processing phase, machine learning algorithms play a crucial role. By training on a large amount of annotated term data, a term recognition model is established. For instance, convolutional neural networks (CNNs) can be used for feature extraction of text, combined with recurrent neural networks (RNNs) for sequence modeling, effectively improving the accuracy and recall rate of term recognition[17]. This technology can promptly capture new terms, ensuring the timeliness of the terminology database, significantly enhancing monitoring efficiency, reducing labor costs, and enabling the database to update in a timely manner to meet the needs of researchers and industry practitioners for cutting-edge technological terms.

4.3.2 Intelligent monitoring and term extraction technology: the smart "probe" for mining terms

Intelligent monitoring and term extraction technology is one of the core technologies based on AI algorithms[18]. It primarily utilizes natural language processing techniques combined with machine learning algorithms to achieve precise

extraction of new terms and the acquisition of related information. Natural language processing techniques can conduct in-depth analysis of text, including lexical, syntactic, and semantic analysis.

During the lexical analysis phase, text is segmented into individual words or phrases using tokenization technology, while part-of-speech tagging is performed to determine the grammatical category of each word, which helps identify vocabulary with term characteristics, as scientific and technical terms typically appear in the form of nouns or noun phrases. Syntactic analysis is used to examine the grammatical structure of sentences, determining the dependency relationships between words to further understand the semantics of the text.

Semantic analysis is the key component of this technology. Using deep learning algorithms such as the BERT (Bidirectional Encoder Representations from Transformers) model, text can be semantically encoded to obtain semantic representations[19]. By comparing these semantic representations with existing terminology databases, new terms can be identified, and related information such as term definitions and contextual usage can be extracted. When extracting new terms, clustering techniques from machine learning algorithms can also be employed to group similar terms, facilitating classification and management while preventing duplicate extraction, thereby improving the accuracy and efficiency of term extraction.

4.3.3 Real-time translation and multilingual support technology: the "bridge" for crossing language barriers

Real-time translation and multilingual support technology is an important application of AI in terminology database construction[20]. It leverages neural machine translation technology to achieve real-time translation of terms across multiple languages. Neural machine translation technology constructs large-scale neural network models that learn and train from massive parallel corpora to automatically translate text.

The application of this technology in terminology databases enables real-time translation of English terms into multiple other languages, such as Chinese, French, German, Japanese, and vice versa. This not only expands the multilingual coverage of the terminology database, meeting the needs of users from diverse linguistic backgrounds and promoting international academic exchange and technological cooperation, but also enhances the accuracy and standardization of terms in the database through cross-linguistic comparison and validation. For instance, during the translation process, the system can reference multiple authoritative term translation resources to optimize and adjust translation results, ensuring accuracy and professionalism.

5 APPLICATION PROSPECTS OF CHINESE-ENGLISH BILINGUAL TERMINOLOGY DATABASES

The generative artificial intelligence industry, represented by large models, is a key driver of new-quality productivity development. The construction of Chinese-English bilingual terminology databases is particularly important in today's context of globalization and rapid technological advancement[21]. These databases not only promote international academic exchange, eliminate language barriers for researchers, and ensure precise and consistent term usage but also significantly improve the quality of scientific and technical document translation. Looking to the future, Chinese-English bilingual terminology databases will play important roles in digital education, upgrading translation tools for technical documents, and the construction of research infrastructure in humanities, driving technological development and innovation.

5.1 Application Space for Promoting Academic Exchange and Overcoming Research Language Barriers

Chinese-English bilingual databases play a significant role in enhancing the international influence of Chinese academic journals. Against the backdrop of deepening globalization and increasingly frequent academic exchange, Chinese academic journals urgently need to strengthen their international influence to better serve global researchers. For example, some bilingual materials from Sun Yat-sen University's plant specimen database have entered the international computer network and can be accessed from terminals worldwide. Researchers can remotely retrieve the required information from any terminal screen[22]. Chinese-English bilingual databases provide strong support for the internationalization of Chinese academic journals by offering bilingual information, efficient retrieval and analysis tools, and convenient full-text linking services.

The construction of bilingual terminology databases also helps enhance China's discourse power in global ecological governance. The construction of a bilingual terminology database for the "Ecological Protection and High-Quality Development of the Yellow River Basin" relies on digital bilingual terminology database construction. Using SDL Multiterm Extract terminology management software, parallel text resources are imported, and bilingual terminology entries are structured for storage. Tasks such as term extraction, storage, annotation, coding, definition, and setting are completed, integrating domestic and international resources related to the ecological protection and high-quality development of the Yellow River Basin. While learning from advanced foreign governance experiences, this initiative strengthens China's discourse power in ecological governance and better disseminates Chinese wisdom[23].

5.2 Supporting Technological Education and Facilitating Knowledge Transfer

Chinese-English bilingual terminology databases serve as digital tools to enhance the quality and efficiency of translation education. Future qualitative research in education will increasingly rely on big data and artificial intelligence technologies, focusing on using new technologies to enhance human intuition, experience, and deep thinking rather than simply outsourcing these uniquely human capabilities to machines. Therefore, the establishment of Chinese-English bilingual databases can greatly support the development of technological education[24].

The application of Chinese-English bilingual terminology databases promotes international cooperation and knowledge sharing in technological fields. Taking the creation and application cases of bilingual parallel terminology databases in the field of water conservancy engineering as an example, it is found that such databases provide linguistic support for the dissemination and exchange practices in the field of water conservancy engineering, improving work efficiency and offering references for terminology database construction in other technological fields. The bilingual terminology database for water conservancy engineering has already been promoted and implemented in translation classrooms and translation practice internships, with positive results. During the exchange and translation project implementation in the field of water conservancy engineering, the assistance of computer-aided search engines can quickly locate target terms, maintaining the uniformity of professional terminology, improving work efficiency, and reducing the burden of information retrieval and memorization for relevant personnel[25]. This is of great significance for both the teaching and practice of translation professionals and for research on arch dam seismic design in the field of water conservancy engineering.

6 CONCLUSION

In the context of globalization and rapid technological development, the construction of dynamic Chinese-English bilingual terminology databases holds significant importance. Empirical evidence shows that by integrating cutting-edge technologies, these databases effectively address the shortcomings of traditional terminology databases, significantly enhancing the accuracy of term identification and translation, and providing robust support for cross-cultural technological exchange. These databases offer notable advantages, not only promoting the widespread dissemination of Chinese cultural terminology and allowing the world to better understand Chinese culture but also improving the efficiency of cross-industry technological cooperation, breaking down information barriers, and driving the transformation and upgrading of translation education, providing new pathways for cultivating translation professionals suited to the times. Looking to the future, dynamic Chinese-English bilingual terminology databases will evolve toward intelligence and scenario-based applications, deeply integrating multimodal data and industry models to expand application scenarios and enhance technological language services. In academic exchange, they can assist Chinese academic journals in gaining international recognition and boosting their global influence. In the field of technological education, they provide high-quality resources for translation teaching, cultivate versatile talent, and promote international cooperation and knowledge sharing in technological fields. The construction of these terminology databases is a key to breaking through challenges and advancing technological and cultural exchange, holding significant strategic value for enhancing China's international discourse power and building an international technological ecosystem.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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