Construction of a Multimodal Corpus Platform for Digital Empowerment of Cantonese Opera's International Communication

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Abstract. By leveraging digital technologies, the study reconfigures multimodal corpus data in multiple forms and dimensions, establishing a platform that supports multilingual data storage, retrieval, Virtual Reality (VR) interactive experiences, and educational purposes. The platform encapsulates Cantonese Opera's essence, showcasing its vibrant processes, techniques, and performances, and incorporates multi-sensory experiences and VR technology to reconstruct authentic performance scenarios for interactive exploration and understanding. The research emphasizes liveliness, interactivity, intelligence, and compatibility, outlining the technical architecture, operating environment, and data collection methods tailored to Cantonese Opera's diverse modalities. Ultimately, this study presents a comprehensive framework that integrates digital technologies, semiotics, corpus translation studies, and communication theories, thereby promoting the efficient and effective dissemination of Cantonese Opera globally and enhancing its international recognition and influence.

Keywords: Digital Enpowerment, Cantonese Opera, International Communication, Multimodal Corpus Platform Construction, VR Interactive Experience

1   Introduction

In the globalized world of today, the exchange of cultural products and ideas across borders has become increasingly common. Cantonese Opera, a unique and vibrant art form originating from southern China, has gained international attention due to its distinctive singing, acting, and musical styles [1]. However, as this traditional art form makes its way onto the global stage, the challenge of accurately translating its specific terminologies into other languages, especially English, becomes paramount. The dissemination of Cantonese Opera across borders has emerged as a crucial dimension in enhancing cultural soft power and fostering global cultural influence [2].

In recent years, the field of multimodal corpus research has garnered significant attention within the linguistic and translational communities, with applications spanning literature, discourse analysis, translation, and media studies [3]. This intersection of multimodal corpus studies and Cantonese Opera international communication presents a unique opportunity to explore innovative ways of documenting, preserving, and disseminating the rich cultural heritage of nations.

2   Digitalization of International Communication of Cantonese Opera

The advent of digital technologies has revolutionized the landscape of traditional Opera transmission, facilitating the collection, digitization, and multimodal representation of diverse cultural artifacts. Since the inception of national policies promoting the digital transformation of intangible cultural heritage (ICH) in 2005, significant strides have been made in digitizing ICH materials, including texts, images, audios, videos, and physical objects. The integration of 5G, VR/AR, multimedia, and artificial intelligence technologies has enabled the dynamic presentation and sharing of ICH content, enhancing its accessibility and appeal to a global audience [4]. However, while traditionla opera digitization efforts have flourished, the study of Cantonese Opera digital international communication remains relatively underdeveloped, particularly from a multimodal corpus perspective.

Research in China in this area tends to be traditional in scope, focusing primarily on textual translation issues and strategies. In contrast, international scholars have recognized the potential of digital technologies in revitalizing Cantonese Opera international communication [5], experimenting with innovative platforms and modalities to achieve liveliness and sustainability in cultural dissemination. For instance, Dimitropoulos et al. (2018) developed the I-treasures multimodal application, utilizing sensors and ICT to dynamically store and transmit ICH through a 3D game-like experience [6]. Similarly, The Qin Opera Chinese-English multimodal corpus constructed by Li (2023) provides valuable ideas and methods for the construction of multimodal corpus of traditional Chinese opera [7]. It is worthnoting that Liu (2023) explores the construction of a multimodal corpus platform for the external dissemination of ICH through digital empowerment, providing specific research ideas and methods for this study [8].

Given the existing research gap and the increasing importance of multimodal communication in the digital age, this paper aims to explore the construction of a multimodal corpus platform tailored for Cantonese Opera international communication. Drawing upon digital technologies and multimodal corpus methodologies [8], we endeavor to create a platform that showcases Cantonese Opera in its multifaceted glory, providing users with an immersive and interactive experience that transcends traditional text-based narratives [7]. By reimagining Cantonese Opera communication through this innovative platform, we seek to contribute to the global effort of preserving and promoting cultural heritage in the digital realm.

3   Digitalization of Catonese Opera for Multimodal Corpus Platform

In this section, this study explored the specifics of constructing a multimodal corpus platform tailored for the international communication of Cantonese Opera. The platform's design integrates digital technologies and multimodal data to enhance the global reach and appeal of Cantonese Opera, transcending traditional communication barriers and presenting a dynamic, immersive experience to international audiences.

3.1   Principles and Methods for Platform Construction

Central to the design of the multimodal corpus platform for Cantonese Opera is the principle of dynamism and interactivity. As stated in the UNESCO Convention for the Safeguarding of the ICH (2003), ICH encompasses "social practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artifacts and cultural spaces associated with them" that require a living, interactive context for their sustainability [9][10]. Thus, our platform goes beyond static textual or visual presentations, incorporating audio, video, and virtual reality (VR) modalities to recreate the vibrant, experiential aspects of Cantonese Opera performances and traditions. Interactivity is key to fostering engagement and emotional resonance with the audience. By enabling users to explore Cantonese Opera scenes, costumes, makeup, and performances through interactive VR simulations, the platform fosters a sense of immersion and participation, enhancing cultural understanding and appreciation.

Intelligence underpins the operational efficiency and versatility of the platform. Leveraging image recognition, speech recognition, and automated translation technologies, the platform processes and presents multimodal data in a seamless, intuitive manner. Intelligent features such as real-time bilingual subtitling and interactive hotspots provide a rich, informative experience for users across linguistic and cultural backgrounds. Compatibility is essential for data sharing and interoperability across different platforms and systems. The multimodal corpus platform adheres to standardized data formats and protocols, ensuring that Cantonese Opera content can be easily accessed, integrated, and updated by various stakeholders, including researchers, educators, and cultural institutions.

3.2   Technical Framework

The digitalization of Cantonese Opera for international communication through a multimodal corpus platform involves several key components (refer to Figure 1):

Multimodal Data Collection: Comprehensive data collection encompasses texts, images, audios, videos, and 3D scans of Cantonese Opera performances, costumes, sets, and artifacts. High-resolution capture techniques ensure accurate and detailed representation of the cultural heritage. To enhance transparency and reproducibility, the data collection methods are specifically tailored to Cantonese Opera's unique modalities. These methods involve detailed procedures for capturing and preserving the

intricate elements of Cantonese Opera, such as its musical notations, vocal techniques, stage movements, and costume designs. Comprehensive documentation of these tailored methods is provided to ensure clarity, facilitate future research, and allow for the replication and extension of the dataset.

Data Processing and Annotation: Collected data undergo rigorous processing, including cleaning, normalization, and annotation. Annotations cover linguistic, cultural, and performance-related metadata, facilitating efficient retrieval and analysis.

Multimodal Corpus Construction: The processed data are organized into a multimodal corpus, enabling users to search, browse, and interact with Cantonese Opera content in multiple modalities. Parallel corpora in multiple languages facilitate cross-cultural understanding and dissemination.

VR Interaction Platform: A dedicated VR interaction platform leverages 3D modeling and VR technologies to create immersive simulations of Cantonese Opera performances and related cultural contexts. Users can navigate virtual environments, interact with virtual objects, and experience Cantonese Opera from a first-person perspective.

Application Programming Interface (API) and Data Sharing: APIs enable real-time data sharing and integration with third-party platforms, fostering collaboration and data reuse across the global cultural heritage community.
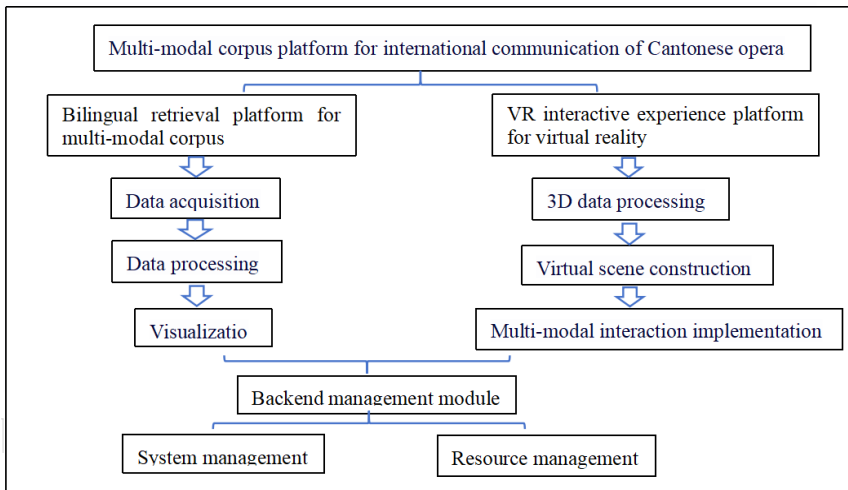

Fig. 1. Framework of the multimodal corpus platform for international communication

3.3   Implementation and User Experience

The multimodal corpus platform for Cantonese Opera international communication offers a range of features tailored to diverse user groups, including researchers, educators, cultural enthusiasts, and the general public. Researchers can access a vast repository of annotated multimodal data, facilitating in-depth analysis and cross-cultural comparisons of Cantonese Opera traditions. Educators can incorporate VR simula-

tions into their curricula, providing students with hands-on, interactive learning experiences that deepen their understanding and appreciation of Cantonese Opera. Cultural Enthusiasts can explore Cantonese Opera performances, costumes, and traditions in an immersive, interactive manner, fostering a sense of connection and belonging to the cultural heritage. General Public can discover and engage with Cantonese Opera through entertaining and educational VR experiences, broadening their cultural horizons and fostering global cultural exchange.

3.4   Multi-Modal Data Collection Methods for the International Communication of Cantonese Opera

Given the broad scope, diverse nature, and rich cultural expressions of Cantonese opera, data collection for its international communication necessitates a comprehensive and multifaceted approach. This section outlines the various methods employed in gathering multi-modal data, with a focus on audio-visual recordings, two-dimensional (2D) data capture, and three-dimensional (3D) data processing [2].

3.4.1 Audio-visual Recordings.

Audio-visual recordings form the cornerstone of capturing the live performances and behind-the-scenes activities of Cantonese opera. This process involves several key steps: 1) Standardization of Formats: Ensuring that audio and video resources are captured in universally compatible formats facilitates subsequent processing and sharing. High-definition recordings are preferred to retain the nuances of performance. 1) Sampling, Quantization, and Detection: Newly acquired audio-visual data undergo sampling, quantization, and thorough detection to ensure optimal signal quality. This step ensures that audio is clear and balanced, while video is stabilized and visually appealing. 3) Post-processing: After initial capture, audio-visual data undergo post-processing techniques such as audio equalization, noise reduction, color optimization, and frame stabilization. These enhancements not only improve the viewing experience but also ensure the data is suitable for digital storage and distribution.

3.4.2 Two-Dimensional (2D) Data Capture.

For textual and graphic materials related to Cantonese opera, 2D data capture involves capturing information from printed materials, digital images, and other two-dimensional sources. The following steps are crucial: 1) Tagging and Labeling: Each data object is thoroughly tagged and labeled for efficient retrieval and classification. This includes metadata such as the title, date, source, and subject matter. 2)Color Optimization and Content Recognition: Images and graphics undergo color correction and enhancement to ensure they accurately represent the original material. Advanced content recognition techniques are employed to identify key elements and characters. 3) Digital Preservation: Once processed, 2D data is converted into digital formats for long-term preservation and easy accessibility.

3.4.3 Three-Dimensional (3D) Data Processing.

To recreate the immersive experience of Cantonese opera performances, 3D data processing is essential. This complex process involves: 1) 3D Modeling: Using specialized software, 3D models of sets, costumes, props, and even performers are created. This step requires detailed measurements and meticulous attention to detail. 2) 3D Laser Scanning: High-precision laser scanning is employed to capture the geometry and texture of real-world objects, allowing for the creation of highly accurate digital replicas. 3) Multi-view 3D Image Reconstruction: By combining images captured from multiple angles, a comprehensive 3D model of a scene or object is reconstructed. This technique is particularly useful for complex environments and performances. 4) Texture Mapping and Rendering: Textures from the original materials are applied to the 3D models, and the models are rendered to ensure they look realistic under various lighting conditions.

3.4.4 Specialized Considerations.

Given the unique cultural and artistic features of Cantonese opera, special considerations must be made during data collection: 1) Preserving Cultural Authenticity: Ensuring that data collection methods respect and preserve the cultural authenticity of Cantonese opera is paramount. Collaboration with domain experts is crucial to avoid misinterpretation or distortion of traditional practices. 2) Documenting Traditional Techniques: Special attention is given to capturing traditional performance techniques, costume designs, and makeup styles. This includes documentation of intangible aspects such as voice modulation, body language, and facial expressions. 3) Privacy and Ethical Considerations: The collection of personal information from performers and creators must adhere to strict privacy and ethical guidelines, ensuring that all participants give informed consent.

4   Platform Applications

The platform we are developing for the international communication of Cantonese Opera is a comprehensive system that integrates cutting-edge digital technologies, semiotics, corpus linguistics, and cross-cultural communication theories. It aims to revolutionize the way Cantonese Opera is presented and disseminated globally, enhancing its accessibility, understanding, and appreciation among international audiences.

4.1   Cantonese Opera Multi-Modal Corpus for Bilingual Data Platform

The Cantonese Opera Multi-modal Corpus Bilingual Data Platform serves as a comprehensive digital repository for Cantonese Opera-related data. Utilizing advanced digital technologies, this platform collects, stores, processes, and showcases various modalities of Cantonese Opera data, transforming them into reproducible and shareable digital content. Standardized and granular classification methods are employed to manage textual and image-based electronic data, ensuring their efficient retrieval and

use. By leveraging intelligent corpus and terminology alignment tools, the platform facilitates bilingual parallel sentence alignment and standardized terminology extraction across multiple languages. This results in a unified database resource that not only preserves Cantonese Opera's rich cultural heritage but also enhances its international outreach through multilingual access. The open API ports further enable real-time data crawling, analysis, cleaning, and automatic translation, ensuring the platform's timeliness and sustainability. The platform's modular design, openness, and compatibility make it a valuable resource for researchers, scholars, and practitioners interested in Cantonese Opera. It provides a robust multilingual search engine, allowing users to access aligned bilingual terms and sentence pairs, accompanied by associated symbols, images, audio, and video materials. This multi-modal approach enriches the diversity and vividness of information, facilitating a more comprehensive understanding and appreciation of Cantonese Opera among international audiences.

To ensure robust performance and seamless multilingual functionality, the platform has undergone extensive testing across different languages and dialects. This testing ensures that the platform's multilingual support is reliable and effective, enhancing its accessibility and usability for a global audience. The open API ports further enable real-time data crawling, analysis, cleaning, and automatic translation, ensuring the platform's timeliness and sustainability.

The platform's modular design, openness, and compatibility make it a valuable resource for researchers, scholars, and practitioners interested in Cantonese Opera. It provides a robust multilingual search engine, allowing users to access aligned bilingual terms and sentence pairs, accompanied by associated symbols, images, audio, and video materials. This multi-modal approach enriches the diversity and vividness of information, facilitating a more comprehensive understanding and appreciation of Cantonese Opera among international audiences.

International communication of Cantonese Opera necessitates cross-linguistic and cross-cultural translation. In the digital age, translation has transcended traditional textual forms, embracing multi-modal contents such as images, sounds, and videos. Our platform offers a translation practice and training space tailored for Cantonese Opera, where researchers, translators, and learners can engage in multi-modal translation tasks. Users can leverage the platform's keyword search tool to retrieve bilingual aligned terms and sentence pairs, while also accessing associated multi-modal data for a more holistic understanding of the context. The platform's semantic analysis and metaphorical symbol studies further enhance translation accuracy and creativity. Moreover, users can create their own accounts, form translation teams, upload multi-modal texts, align corpora, and generate Translation Memory Exchange (TMX) memories, streamlining translation workflows and boosting efficiency. The interactive platform fosters collaboration among translation professionals, researchers, and students, promoting knowledge sharing and skill development. It provides a conducive environment for experimental translation practices, remote collaboration, and crowdsourced translation projects, contributing to the internationalization of Cantonese Opera.

4.2   Virtual Reality (VR) Multi-Modal Platform for Cantonese Opera

VR technology, as a pivotal medium for future communication, revolutionizes the way Cantonese Opera is presented to international audiences. VR platform integrates 3D, VR, and AR technologies to create immersive virtual scenarios, replicating the essence of Cantonese Opera's performances, settings, and traditions [11]. Users, equipped with VR headsets and controllers, can navigate through virtual environments, witnessing firsthand the operatic performances, costumes, sets, and even the backstage preparations. This first-person perspective heightens engagement, fostering a deeper emotional connection with Cantonese Opera. The platform's bilingual capability ensures seamless communication across languages, enhancing cross-cultural understanding and appreciation. The VR platform's advanced spatial awareness and bilingual voice recognition technologies further enhance the realism and interactivity of the experience. Users can interact with virtual characters, engage in dialogues, and perform tasks, simulating real-life encounters with Cantonese Opera. This immersive and interactive narrative approach transforms passive viewing into active participation, strengthening memory retention and cultural identification.

International communication of Cantonese Opera necessitates the cultivation of skilled professionals. Our VR platform serves as an innovative teaching tool, offering a virtual reality environment for cross-cultural language communication training. Learners can select roles and scenarios tailored to their needs, engaging in simulated conversations and interactions within the virtual Cantonese Opera world. The platform's multi-modal corpus, including dialogues, explanations, images, and videos, reconfigures according to the scenario and role, fostering a deep understanding of cultural nuances and linguistic complexities. The VR platform's multi-language speech recognition, intelligent translation, and voice synthesis capabilities facilitate simulated interpreting scenarios, bridging the gap between traditional classroom teaching and real-world contexts. This immersive learning environment encourages learners to experiment with different communication strategies, addressing cultural conflicts and misunderstandings, and enhancing their cross-cultural competencies [11]. Moreover, the platform's integrated learning monitoring and evaluation system, powered by advanced speech recognition technologies, provides timely and accurate feedback on learners' performance. This comprehensive evaluation mechanism ensures that learners can continuously refine their skills and achieve optimal learning outcomes [12].

5   Conclusion

This study on the Construction of a Multimodal Corpus Platform for Digital Empowerment of Cantonese Opera's International Communication has demonstrated the feasibility and potential of leveraging digital technologies to enhance the international outreach and impact of this intangible cultural heritage. Through a comprehensive analysis of the multimodal commonalities between multimodal corpus and Cantonese Opera international communication, this research has explored and constructed a

platform tailored to the specific needs of Cantonese Opera's international dissemination.

This research represents a significant contribution to the field of multimodal corpus platform construction for traditional opera international communication. It offers a novel approach that combines digital technologies, semiotics, corpus translation studies, and communication theories, providing a comprehensive framework for the efficient and effective dissemination of Cantonese Opera globally. As the digitalization of opera international communication continues to advance, the platform constructed in this study serves as a valuable reference and a stepping stone for future research and development in this domain.

While the platform has demonstrated its potential, there are still opportunities for further refinement and expansion. Future research could focus on enhancing the platform's compatibility with other systems, optimizing the data annotation and retrieval processes, and exploring more advanced VR and AI technologies to further enrich the user experience. Additionally, as Cantonese Opera's international audience becomes increasingly diverse, there is a need to adapt the platform's content and interface to better serve these audiences and foster deeper cross-cultural understanding and appreciation.

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