Integrating Big Data and Thick Data Analysis for User Experience Evaluation in Cultural Curation: a Case Study of the 2023 Hakka Expo in Taiwan

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Abstract—**This study presents an integrated approach to evaluating user experience (UX) in cultural curation by combining big data and thick data analyses, with a focus on the 2023 Hakka Expo in Taiwan (2023 HEIT). Big data plays a pivotal role in identifying UX hotspots and directing future research, while thick data, derived from sources such as user interviews, curatorial proposals, news reports, and social media exchanges, captures the depth of the UX. The fusion of these two data types provides a holistic view of UX, with big data offering quantitative metrics and thick data delivering qualitative insights into emotions and subtleties.**

Enhanced by a Large Language Model (LLM), the findings reveal that users valued the pragmatic and hedonic design elements of the 2023 HEIT. The LLM's analysis of user feedback and comments provided a detailed understanding of UX, identifying areas of satisfaction and potential enhancements, which aligns with research highlighting LLMs' effectiveness in uncovering user preferences and emotional responses. However, a comparison of high-frequency keywords from thick data sources with those from interview scripts revealed a discrepancy, indicating that the Expo's main messages did not always resonate with visitors. Future research will aim to incorporate more data and a broader range of sources to better understand the combination of big and thick data in studying cultural event experiences.

Keywords—Big Data, Thick Data, Cultural Curation, User Experience, Large Language Models

I. Introduction

In the digital era, the emergence of interactive technologies, particularly Large Language Models (LLMs), has been a transformative force across various industries. Notably significant is their role in preserving cultural heritage, where they have garnered considerable interest due to their potential to revolutionize how we engage with and understand cultural narratives, such as those of the Hakka culture. Integrating LLMs in cultural curation presents an unprecedented opportunity to enhance user experiences through personalized content delivery and interactive learning experiences, as evidenced by recent advancements in the field (Smith, 2019).

The infusion of such technologies into the curation of Hakka culture holds immense promise for safeguarding and promoting this essential aspect of traditional Chinese heritage, which is vital to the socio-economic and cultural identity of the Hakka community. However, evaluating user experiences within cultural curation is challenging due to the subjective nature of individual preferences and emotional responses. While User Experience Questionnaires (UEQs) are commonly employed to collect data through big data analytics, offering insights into various dimensions of user engagement, they may fall short in capturing the subtleties of

audience sentiments. In this context, thick data—encompassing comments, interviews, and social media interactions—provides a richer, more nuanced source of user feedback. Therefore, integrating big and thick data becomes essential for a holistic understanding of complex user experience issues.

This study leverages the 2023 Hakka Expo in Taiwan (2023 HEIT) as a case study to investigate the impact of interactive technology on the curation of Hakka culture, employing a blend of big and thick data methodologies. By analyzing questionnaire results in tandem with content from official documents, Facebook feedback, news coverage, and participant interviews, we aim to critically assess the effectiveness of such technology in engaging audiences, enhancing learning outcomes, and fulfilling user expectations.

This study provides actionable insights aimed at amplifying the role of interactive technology in promoting and preserving Hakka culture. The findings are anticipated to inform exhibition planners, designers, and policymakers, offering a comprehensive understanding of how interactive technology can be optimized for Hakka cultural exhibitions, thereby facilitating their effective dissemination and preservation.

II. Literature Review

In recent years, the field of cultural curation has expanded to incorporate diverse disciplines such as design, literature, and local cultural content, making it a key trend in contemporary curatorial practices (Yuru Lin, 2020). Concurrently, User Experience (UX) has emerged as a critical area of research in service and product development. To meet the high expectations of users, designers are increasingly involving them in the design process of new offerings, aiming to understand user needs and provide efficient solutions comprehensively (Kaplan and Haenlein, 2010).

Interactive technologies, enhanced by Large Language Models (LLMs), offer visitors personalized interaction with exhibits. These models can analyze user interactions and feedback in real time, providing tailored experiences and deeper insights into user engagement. The potential of LLMs in cultural heritage has been explored, suggesting their utility in analyzing user-generated content and offering personalized recommendations (Mortati et al., 2023). Studies have shown that audience satisfaction and participation increase significantly in exhibitions utilizing interactive technology (Tran et al., 2019). Visitors report a better UX when visiting museums with interactive technology than traditional ones (Giuliana Dimonopoli, 2022).

Big Data is a transformative digital phenomenon that enables the accumulation and utilization of extensive datasets from human actions and automated systems. These datasets are characterized by their large volume, variety, velocity, veracity, variability, and complexity (Richard and Virginia, 2017). Researchers can leverage big data from various sources to understand customer behavior and preferences (Kaplan and Haenlein, 2010). Thick data, on the other hand, consists of detailed information about individuals or events derived from field notes and interviews. It provides situational behavioral insights that allow designers to analyze users in-depth, understand their experiences, and make design improvements. Thick data can analyze user experience by combining user insights with contextualization, offering valuable user insights and enabling researchers to analyze user behavior and provide personalized services (Mortati et al., 2023).

There are several challenges in assessing user experience in cultural curation. A clear overview of current UX research methods for cultural exhibitions must be provided. While there have been studies developing frameworks to measure UX in cultural spaces, there still needs to be more understanding of how visitors interact with new technologies and exhibits simultaneously (Giuliana Dimonopoli, 2022). Linnea explores Curatorial Intentions and Visitor Experience in the case of three publicly funded art museums in Sweden (Wästfelt Linnea, 2024). Visitors may experience difficulties interacting with cultural heritage content, such as digital media illiteracy and challenges understanding new interfaces, which can affect the user experience (Sara Khan et al., 2018). In summary, cultural curation presents challenges in linking different cultures, art projects, and social groups. Evaluating user experience in the context of cultural curation is complex due to diverse design and development spaces, tourists' varying personal preferences, and the audience's different psychological characteristics (O'Neill Paul, 2016).

III. Research Methods

This study employs a mixed-methods approach, integrating quantitative big data and qualitative thick data analyses to evaluate the user experience at the 2023 Hakka Expo in Taiwan (2023 HEIT). Our methodology is designed to provide a multifaceted view of the user experience, leveraging the strengths of both data types to uncover a comprehensive understanding of visitor interactions and perceptions.

3.1 Latent Dirichlet Allocation (LDA) Model Integration

Introduction to LDA:

Latent Dirichlet Allocation (LDA) is a generative probabilistic model that is widely used for topic modeling in natural language processing. It allows us to discover the abstract "topics" that exist within a large body of text data [15]. In this study, we employ LDA to uncover hidden themes within the thick data collected from various sources, such as interviews, social media, and news reports, to complement our big data analysis. (see Figure 1)
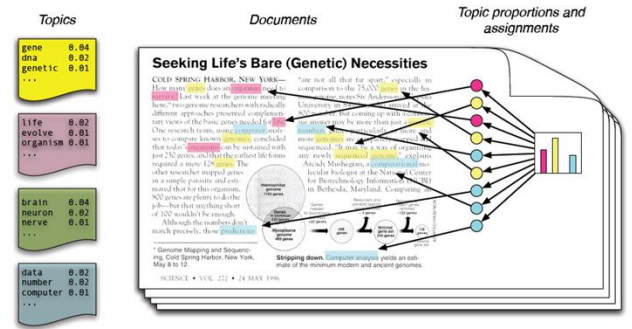

Fig. 1. LDA topic model

Rationale for LDA Integration:

The integration of LDA into our research methodology is motivated by the need to complement the quantitative insights from the User Experience Questionnaire (UEQ) with qualitative insights from user-generated content. LDA enables us to uncover the underlying themes and patterns in user feedback, providing a more holistic understanding of the user experience at the 2023 Hakka Expo in Taiwan (2023 HEIT).

Data Preparation for LDA: (see Figure 2)

To prepare the thick data for LDA analysis, we perform the following steps:

1) Textual data from interviews and social media are digitized and transcribed for uniformity.

2) A preprocessing pipeline is applied to the text data, which includes lowercasing, tokenization, removal of stop words, and stemming.

3) The preprocessed text is then represented as a term-document matrix, where the frequency of each term is counted within each document.
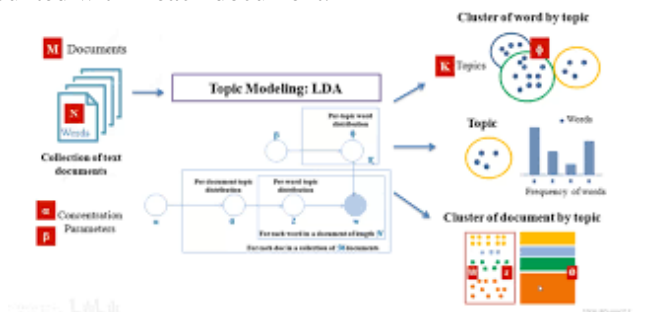

Fig. 2. Flowchart of LDA topic model

Application of LDA Model:

The LDA model is applied to the term-document matrix to identify the underlying topics. The number of topics to be extracted is determined through a combination of computational efficiency and interpretability of the results. The model is trained and optimized using a variational Bayes inference method, which approximates the posterior distribution of the model parameters.

Interpretation of LDA Results:

The LDA results are interpreted by examining the top terms associated with each topic. We then assign a label to each topic that best represents the theme encapsulated by the terms. These topics provide a qualitative overview of the major themes present in the user feedback, which can be linked to the user experience dimensions identified through the UEQ analysis.

IV. Case Study Results

This section focuses on the detailed analysis of the collected data, ensuring the research's rigor and the validity of the conclusions drawn from the user experience study at the 2023 Hakka Expo in Taiwan (2023 HEIT).

4.1. Big Data Analysis

For the research results of the User Experience Questionnaire (UEQ), this study drew that user experience assessment using UEQ tools can comprehensively evaluate a product, service, or system. Based on the results of UEQ, we can assess users' overall feelings about a specific product or service and identify focus areas for improvement. Use UEQ to get a more comprehensive user experience assessment. UEQ provides quantitative indicators of user experience. To sum up, through the research results of UEQ, we can obtain a thorough evaluation and in-depth understanding of user experience. This will help identify the strengths and weaknesses of a product or service and provide valuable guidance for improvement and innovation. At the same time, this comprehensive approach can help developers and designers better meet user needs and improve user satisfaction and market competitiveness of products or services. The UEQ's multidimensional framework allowed us to assess various aspects of the user experience, including pragmatic and hedonic qualities. Our analysis revealed that the 2023 HEIT exhibition received high ratings for both dimensions, indicating a well-received balance between functionality and emotional engagement (see Figure 3).

Fig. 3. UEQ questionnaire analysis results

The mean scores for Pragmatic Quality and Hedonic Quality were 1.788 and 1.607, respectively, with an overall mean of 1.70, suggesting an excellent user experience. These findings underscore the effectiveness of the exhibition's design in meeting users' needs and providing an enjoyable interaction. The confidence intervals ranged from 1.523 to 1.871, indicating a robust and consistent user response.

4.2. LDA Analysis Results

LDA Topic Modeling Outcomes (by Fig. 4 and Fig. 5):

Fig. 4. LDA of interview results

Topic Distribution:

The bubble chart in the image shows the distribution of four topics. The size of each bubble represents the proportion of that topic within the entire corpus.

Topic 1 appears to dominate with the largest proportion, followed by Topic 3 and Topic 2, while Topic 4 has the smallest share.

Topic-Term Distribution:

The bar charts on the right side of each image display the frequency and importance of keywords within different topics.

The blue bars indicate the overall term frequency across the corpus, while the red bars show the estimated term frequency within the selected topic.

Specific Data Analysis:

Topic 1: In the first image, Topic 1 is characterized by keywords such as "theme" (approximately 25 occurrences), "curator" (around 15 occurrences), "ecology" (about 10 occurrences), and "integration" (roughly 8 occurrences), suggesting a focus on exhibition planning and ecological content.

Topic 2: The second image shows Topic 2 with keywords like "world" (around 20 occurrences), "Taoyuan" (approximately 18 occurrences), "theme" (about 15 occurrences), and "narrative" (roughly 10 occurrences), indicating a theme related to global topics or cultural descriptions of specific regions.

Topic 3: In the third image, Topic 3 includes keywords such as "Tainan" (around 18 occurrences), "tea forest" (approximately 12 occurrences), "Shaoan" (about 11 occurrences), and "belong to" (roughly 10 occurrences), pointing towards content related to southern Taiwan.

Topic 4: The fourth image reveals Topic 4 with keywords like "Taiwan Pavilion" (approximately 15 occurrences), "development" (around 12 occurrences), "exposition" (about 10 occurrences), and "county/city" (roughly 9 occurrences), which may pertain to exhibitions and development in Taiwan.

Topic Coherence:

The coherence score (Cv) is 0.274, which is relatively low, indicating that the vocabulary within topics may not be highly related.

The UMass coherence score is -0.536, a negative value that further suggests potential issues with the coherence of vocabulary within topics.

The PMI coherence score is -4.978, also indicating a lack of positive correlation among the vocabulary within topics.

Confusion:

The confusion score is 26.20, which is relatively high and may imply that the topic model has some difficulty in distinguishing between different topics.

In conclusion, the LDA results reveal four main themes within the text, each defined by a set of high-frequency and highly relevant keywords. Topics 1 and 3 are more prominent in the corpus, likely representing the core subjects of the text. Topics 2 and 4, although smaller in proportion, still contain significant keywords such as "world," "Taoyuan," and "Taiwan Pavilion." The low coherence scores and high confusion suggest that further optimization of model parameters or preprocessing steps may be necessary to improve the quality of the topic model.
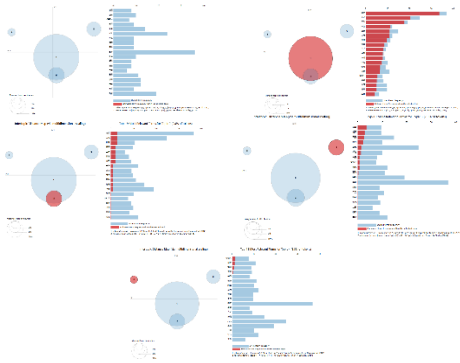
Fig. 5.LDA analysis of press releases

Topic Distribution (Marginal Topic Distribution):

Topic 1 is the most prominent, occupying approximately 30% of the topic distribution.

Topic 3 is the second most significant, making up about 25%.

Topic 2 and Topic 4 are less dominant, with Topic 2 at around 20% and Topic 4 at approximately 25%.

Term Frequency and Relevance:

Each bar chart displays the overall term frequency (blue bars) and the estimated term frequency within the selected topic (red bars).

Topic 2, terms like "Hakka", "culture", and "impression" are prominent, with "Hakka" having a high estimated frequency within the topic.

Topic 3 is characterized by terms such as "east", "surface", and "feeling", with "east" showing a particularly high frequency.

Topic 4 includes terms like "Hakka people" "know", and "things", with "Hakka people" being a key term.

Intertopic Distance Map:

The maps show the relative positions of topics in a two-dimensional space, indicating the similarity or distance between topics.

Topic 1 is distant from Topic 2, suggesting they cover distinct content.

Topic 3 is relatively close to Topic 1, indicating some overlap or similarity in content.

Coherence Scores:

The coherence score (Cv) for the model is 0.353, which is moderate, indicating a reasonable level of topic coherence.

The UMass score is -0.779, and the PMI score is -11.448, both of which are negative and suggest that there may be room for improvement in the model's coherence.

Confusion and Word Count:

The confusion score is 119.00, which is relatively high, indicating a complex model with potentially overlapping topics.

4.3 Integration with UEQ Results:

The integration of Latent Dirichlet Allocation (LDA) and User Experience Questionnaire (UEQ) in this study has provided a comprehensive approach to understanding the user experience at the 2023 Hakka Expo in Taiwan (2023 HEIT). Below are the key correlations and cross-comparison results between the two methodologies:

a.Complementing Quantitative and Qualitative Data:

The UEQ offered quantitative indicators of user experience, while LDA revealed qualitative themes and patterns within user feedback. This combination allowed researchers to gain insights from different perspectives, enhancing the overall understanding of visitor interactions and perceptions.

b. Uncovering Emotional Connections and Nuances:

LDA model results highlighted emotional connections to the Hakka culture, which were not explicitly captured by the UEQ. This suggests that while UEQ robustly measures user satisfaction, LDA complements it by bringing to light subtle themes and patterns in user feedback.

c. Alignment of Topics with User Satisfaction:

The qualitative themes derived from LDA were cross-referenced with the quantitative findings from UEQ. This integration helped understand how qualitative themes align with the quantitative measures of user satisfaction, providing a more nuanced interpretation of the user experience at the 2023 HEIT.

d. Enhanced Understanding of UX:

The LDA model results provided a deeper understanding of the qualitative aspects of user feedback. For example, the "Cultural Appreciation" topic brought to the forefront users' emotional connections to the Hakka culture, which the UEQ did not explicitly capture. This indicates that LDA can complement UEQ by revealing nuanced themes and patterns in user feedback.

e. Potential of LDA in UX Research:

The application of LDA demonstrated its potential in uncovering subtleties in user sentiment that traditional analysis might overlook. It also provides a foundation for future research to explore the predictive power of such qualitative insights on user behavior and satisfaction.

f. Cross-Referencing LDA and UEQ Results:

The topics derived from LDA analysis were cross-referenced with the quantitative findings from UEQ. This integration allowed researchers to understand how qualitative themes align with the quantitative measures of user satisfaction, providing a more nuanced interpretation of the user experience at the 2023 HEIT.

V. Research Findings and Discussion

The integration of big data and thick data analyses has yielded a trove of insights into the user experience at the 2023 Hakka Expo in Taiwan (2023 HEIT). This section synthesizes the key findings, drawing connections between quantitative and qualitative data to comprehensively understand the user experience.

5.1 Big Data Analysis Insights

The User Experience Questionnaire (UEQ) results indicated that the exhibition was highly rated on both pragmatic and hedonic qualities, suggesting a well-received balance between functionality and emotional engagement. The mean scores for Pragmatic Quality and Hedonic Quality were 1.788 and 1.607, respectively, with an overall mean of 1.70, indicating an excellent user experience. These scores underscore the effectiveness of the exhibition's design in meeting users' needs and providing an enjoyable interaction.

5.2 LDA Analysis Insights

The LDA model results provided a deeper qualitative understanding of user feedback. For instance, the "Cultural Appreciation" topic revealed users' emotional connections to the Hakka culture, a nuance not explicitly captured by the UEQ. This suggests that while the UEQ robustly measures user satisfaction, the LDA model complements it by uncovering subtle themes and patterns in user feedback.

The potential of LDA in UX research was evident, as it unveiled subtleties in user sentiment that traditional analysis might overlook, laying a foundation for future research to

explore the predictive power of such qualitative insights on user behavior and satisfaction.

VI. Conclusions

While offering valuable insights into the user experience at the 2023 HEIT, the current study also reveals areas where further research is necessary to enhance our understanding of cultural curation and user engagement. Future studies should consider expanding the sample size to include a more diverse and representative audience, providing a broader perspective on user experiences and allowing for more generalizable findings.

In conclusion, the research evaluated the user experience at the 2023 HEIT through an integrated big data and thick data analysis approach. The findings indicate that while the exhibition was well-received, there is room for improvement in providing a more coherent and guided visitor experience. The study's limitations suggest that future research needs to expand the sample size and incorporate advanced analytical tools, such as LLMs, to capture a wider range of perspectives and experiences.

Integrating LLMs in future studies could further enhance our understanding of user engagement and satisfaction in the context of cultural exhibitions. Increasing the number of interviews and refining methodological approaches will deepen the knowledge of UX complexities in this context, paving the way for more impactful investigations.

This refined section now provides a structured and detailed account of the research findings and discussion, with clear references to the figures that support the analysis and conclusions drawn from the data.

Additionally, integrating advanced analytical tools, particularly Large Language Models (LLMs), presents an opportunity to delve deeper into the qualitative data. LLMs can offer nuanced text analysis, which can be particularly beneficial in understanding the emotional and contextual aspects of user feedback from social media and interview transcripts. Future research should explore the potential of LLMs in uncovering subtleties in user sentiment that traditional analysis might overlook.

Another area for future exploration is the longitudinal study of user experiences over time. This approach could provide insights into how user perceptions and interactions with cultural exhibitions evolve and how curators can adapt to meet changing expectations and interests.

Lastly, future research should also focus on developing and testing models that can predict user behavior and satisfaction based on the integrated analysis of big and thick data. Such models could serve as valuable tools for curators and designers in the planning and execution of more effective and engaging cultural exhibitions.

By addressing these future research directions, we can continue to advance the field of cultural curation, ensuring that it remains relevant and responsive to the evolving needs and preferences of users in the digital age.

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