



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 23 ISSUE 3 (2025), Page 226 – 240

UNRAVELING TOURISTS' PERCEPTIONS TOWARDS CONSERVATION OF THE UNESCO-LISTED MOGAO CAVES IN DUNHUANG, CHINA: A NETWORK TEXT ANALYSIS

Niu Liu¹, Diana Binti Mohamad²

*¹School of Housing, Building and Planning,
UNIVERSITI SAINS MALAYSIA*

*¹School of Management,
GUANGZHOU COLLEGE OF COMMERCE*

*²School of Housing, Building and Planning,
UNIVERSITI SAINS MALAYSIA*

Abstract

The Digital Dunhuang project aims to utilize digital technology to replicate and preserve the invaluable Dunhuang culture and art. Conservation of heritage becomes a consensus for conscious participation. Tourists' perceptions of heritage conservation at heritage sites strongly influence their travel experience. Understanding tourists' perceptions of the conservation of this digital platform is essential for its effective implementation. In the era of extensive growth in online tourism platforms, online posts and reviews have become crucial determinants of tourists' consumption choices. This study focuses on the analysis of online posts on Weibo related to Digital Dunhuang to explore tourists' perceptions of sustainable digitalization in cultural heritage tourism. This study employs network text analysis, word frequency analysis, semantic network analysis, and sentiment analysis of online travel posts and reviews using ROST CM6.0 to illustrate that Digital Dunhuang has markedly increased the visibility and appeal of Dunhuang, while also stimulating substantial interest in its cultural and digital initiatives. Furthermore, the limited mention of Digital Dunhuang in discussions related to conservation indicates a significant lack of awareness concerning the conservation efforts associated with Digital Dunhuang. The findings offer valuable insights into tourists' perceptions of Digital Dunhuang's alignment with successful conservation, contributing to methodological approaches to network analysis and sustainable cultural heritage tourism destination strategies.

Keywords: Tourist Perception, Heritage Conservation, Network Text Analysis

¹ Corresponding author. Email: diana_mohamad@usm.my

INTRODUCTION

The deterioration and destruction of cultural heritage tourism attractions are regarded as among the most urgent concerns in the field of tourism (Bec et al., 2021). Ensuring harmonious coexistence between conservation efforts and tourism is of utmost importance, particularly for World Heritage Sites that aim to preserve their exceptional global significance (Zhang et al., 2023). Digital technologies, such as augmented reality and virtual reality, have emerged as captivating tools to prevent physical harm to heritage sites while enhancing visitor experiences (Cranmer et al., 2023; Ghosh et al., 2024). Given the benefits of digital conservation, numerous heritage tourism destinations are progressively exploring the use of digital tools. The Digital Dunhuang Project exemplifies this by employing digital technology to replicate and preserve Dunhuang caves and cultural artifacts, which is dedicated to ensuring the long-term protection and sustainable utilization of Dunhuang's cultural heritage (Digital Dunhuang, n.d.).

The preservation of people's knowledge and emotional connections to their traditions and localities is advantageous for initiatives aimed at conserving heritage (Pati & Husain, 2023). Tourists' perceptions of heritage conservation at heritage sites also strongly influence their travel experience. The value of a visually appealing and distinctive destination image is undeniable (Stepchenkova & Zhan, 2013). Although digital tools are increasingly being used in historic conservation, there is a lack of understanding regarding the influence of these initiatives on tourists' perceptions. Existing studies have primarily used traditional research methods, which have limitations in terms of scope and sample size. For instance, usability tests were conducted via information-seeking tasks and posttest interviews with 14 participants from the Mogao Cave Panorama Digital Library (Hu et al., 2017) and 16 individuals from e-Dunhuang (Hu, 2018). These methods may not fully capture tourists' diverse experiences and perceptions. This gap in knowledge highlights the need to explore tourists' responses to digital conservation initiatives more comprehensively.

Web 2.0 applications have provided travelers with unprecedented opportunities to generate their own content about their travel experiences through media-sharing websites and social networks (Stepchenkova & Zhan, 2013). Although social media platforms have transformed the way travelers record and distribute their experiences, the valuable data produced on these platforms have not been thoroughly investigated. There are limitations to using social media big data for analyzing tourists' perceptions of digital heritage protection activities. This study aims to address this deficiency by utilizing social media data from Weibo (a leading social media platform in China) related to Digital Dunhuang to gain a thorough understanding of travelers' perspectives on sustainable digitization in cultural heritage tourism. By utilizing these data, this study offers a broader and more nuanced understanding of how tourists perceive digital

conservation efforts. This study improves upon the methodological approaches used in network analysis to understand tourists' perceptions and contributes to the development of strategies that encourage sustainable practices in cultural heritage tourism destinations.

LITERATURE REVIEW

Digitalization for Cultural Heritage Conservation

Due to the unique qualities of cultural heritage tourism, achieving a balance between conservation and tourism is crucial. Conservation is a frequently discussed concept in the context of historic tourist activities and management (Shafiee Roodposhti & Esmaeelbeigi, 2024). The utilization of digital technology in heritage tourism has sparked intense discussions around digitization and the preservation of cultural assets. Several researchers have suggested that the process of digitalization could benefit sites from physical damage caused by tourists. For instance, Cranmer et al. (2023) revealed how augmented reality might serve as a cutting-edge and captivating tool to enhance the sustainability of heritage tourism sites. Vileikis et al. (2023) presented the World Heritage Digital Documentation Platform for the Arab Region. The platform serves as an educational tool for the public as well as a resource for experts, scholars and governments in their research and conservation efforts. Ghosh et al. (2024) claimed that the application of digital technologies, particularly virtual reality, is crucial for safeguarding and spreading cultural heritage at cave art sites. Digitalization provides innovative methods that improve the documenting, conservation, and interpretation of cultural heritage.

Several studies have examined the correlation between digitalization and cultural heritage tourists. Tourists' satisfaction derived from their cultural heritage experience is impacted by the quality and efficacy of digital applications. Chung et al. (2015) conducted a study to examine the influence of interactive techniques on tourists' level of pleasure and their inclination to continue utilizing digital museum tours. Digital applications function as educational tools that enhance tourists' knowledge of the importance of conserving cultural heritage. For instance, Manglis et al., (2021) stated that augmented reality and other techniques have the potential to enhance tourists' engagement in underwater cultural tourism and increase tourists' understanding of and support for the conservation of natural heritage. The advent of digital tourism has led to a significant increase in the number of tourists, serving as a catalyst for the spread of local culture and fostering tourists' desire to conserve cultural heritage (Li et al., 2024). Digital technology has the potential to promote tourists' active engagement with cultural heritage and foster a sense of belonging and social responsibility among individuals (Koukopoulos & Koukopoulos, 2018).

Although there is an increasing focus on the significance of heritage preservation and its incorporation into tourism destination strategies, there is a lack of understanding regarding how these conservation initiatives impact tourists' impressions. Previous studies have employed traditional approaches such as interviews and case studies to comprehend the attitudes of tourists. For instance, Hu et al., (2017) performed a user evaluation test with a series of information-seeking tasks to assess the usability of the Mogao Cave Panorama Digital Library for 14 participants, followed by posttest interviews. Hu (2018) modified the tasks designed by Hu et al., (2017) into nine tasks and performed usability testing with 16 individuals. The findings indicated that e-Dunhuang, developed by the Digital Dunhuang project, exhibited significant enhancements in terms of visual aesthetics, content quality, and interactive capabilities. Nevertheless, both studies rely on rather small sample sizes, which means that the range of users they represent is limited. These approaches may not comprehensively encompass the wide range and profound nature of tourists' perspectives, particularly within the framework of digital preservation efforts.

Network Text Analysis in Tourism

The growth of new media and communication technologies in recent years has led to an increasing recognition of user-generated content (UGC) on the internet as an effective method of word-of-mouth. In the digital age, user-generated content refers to information or content produced by the populace and distributed online (Daugherty et al., 2008). Social networks and online UGC platforms have introduced a new aspect to destination management and promotion, which is the utilization of UGC information. The quantity and positivity of UGC have an impact on travelers' opinions of a place and can effectively counter information spread by destination agents who are trying to promote the destination (Stepchenkova & Zhan, 2013).

Several recent studies have utilized network text analysis by employing different text mining approaches. Stepchenkova & Zhan (2013) compared images of Peru obtained from the official Peru tourism website and from Flickr, a photo-sharing website, to identify significant differences in the projected and perceived images of Peru. This was achieved by creating maps that represented the combined projected and perceived images of Peru, as well as maps showing the geographical distribution of these images. Hardt & Glückstad (2024) employed natural language processing methodologies for reviewing more than one million Reddit postings on subreddits related to travel. They utilize social media data to examine disparities in the preferences and attitudes of tourism consumers both before and during the pandemic. Their study illustrates the capacity of theory-based natural language processing analysis of social media data to categorize travel consumers based on their values (Hardt & Glückstad, 2024). Kirilenko et

al. (2019) applied network analysis, spatial analysis, and geo-visualizations to examine TripAdvisor reviews of Florida attractions. The goal is to understand how travelers perceive a destination by discovering clusters of attractions that cater to specific tourist interests. Some studies focus on tourists' perceptions and impacts. Orea-Giner et al. (2022) investigated the correlation between customers' feelings and sentiments generated by their interactions with robots in hotels and the potential impact on hotel ratings. To achieve this objective, text mining techniques were applied to TripAdvisor reviews via Python 3.9.4(Orea-Giner et al., 2022).

RESEARCH METHODOLOGY

Introduction of Mogao Caves and the Digital Dunhuang Project

In 1987, China submitted its initial selection of six sites for inclusion in the UNESCO World Heritage List. One of these notable sites was the Mogao Caves, also referred to as the Dunhuang Caves, located in Dunhuang in the Gansu Province of far northwestern China (Nevilleeagnew & Jinshi, n.d.). The location of Mogao Caves is shown in Figure 1.

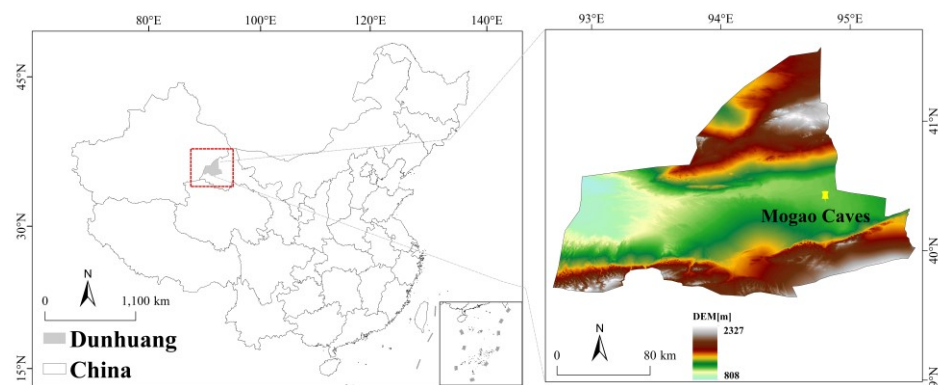


Figure 1: Research Location Map

Source: Obtained from Map World and Geospatial Data Cloud, organized by the author using ArcGIS 10.8

The fact that this place was chosen highlights its national significance. It is the most abundantly endowed and oldest repository of Buddhist art in the world. The construction of this monument dates back to 366 AD and serves as a remarkable testament to the artistic prowess of Buddhism. Prior to the conclusion of 2004, the selection of World Heritage sites was based on six cultural criteria and four natural criteria. To be listed on the World Heritage List, places must possess exceptional global importance and satisfy at least one of the ten selection criteria (Mogao Caves, n.d.). The Mogao Caves, designated as a World Heritage Site, satisfy all six cultural criteria. The Digital Dunhuang project, launched by

the Dunhuang Research Academy, aims to utilize digital technology to replicate and preserve invaluable Dunhuang caves and artifacts. The goal is to achieve long-term conservation and sustainable utilization of the UNESCO-listed Mogao Caves (Digital Dunhuang, n.d.).

METHODOLOGY

Data Source

To address the identified gaps, this study utilizes social media big data, specifically from Weibo, to obtain greater diversity of tourists' perceptions. Weibo is a prominent social media platform in China that enables anyone to generate, distribute, and explore online information. It integrates real-time public self-expression with a robust platform for social interaction, content aggregation, and content dissemination (Weibo, n.d.). Weibo, established in 2009, is the dominant player in the market and has a large number of users (Wang et al., 2022). In December 2023, the Weibo Corporation announced that it had 598 million monthly active users, which was an increase of 11 million compared to the same quarter in the previous year (Thomala, 2024). Considering its user size, active user activity and social significance, this research utilizes online posts from Weibo as the primary data source for network text analysis.

Data Collection and Processing

The tremendous progress in computer and data science has facilitated the utilization of sophisticated big data analytics to gather, retain, examine, and present social media data (Chen et al., 2021). This research applies the web scraping software Octoparse to extract online posts made by Weibo users regarding the key words Digital Dunhuang. The data collection period spanned from January 2022 to March 2024, which produced a total of 1503 posts. There are 627 in 2022, 764 in 2023, and 112 from January 2024 to March 2024.

The initial phase involved exporting the data gathered by Octoparse to Excel for the purpose of assessing and processing it. Subsequently, the data in the specified scenarios, including illegible posts with ambiguous language, posts unrelated to Digital Dunhuang, duplicated reposts, uncivilized language descriptions, extraneous and insignificant high-frequency terms, and malevolent remarks that deviated from the actual circumstances, were eliminated. For instance, several hash tags including "Digital Dunhuang" are actually promotional content for cultural books and will be removed. After processing, a total of 1,489 posts, amounting to 590,000 words, were acquired. Ultimately, all textual data were stored in a .txt document to facilitate subsequent analysis of the content.

Data Cleaning

This study utilizes ROST CM6.0 software to process the initial textual data and performs word frequency analysis, social network analysis, and semantic network analysis. Since the software has a limited segmentation database, it is incapable of recognizing common terms such as place names and scenic location names. Hence, throughout the text organization process, frequently used nouns, verbs, and adjectives are first identified and incorporated into the custom segmentation database to prevent them from being unrecognized or filtered. Examples of such terms include "Dunhuang Research Academy", "Mogao Caves", "Digital Dunhuang", "Dunhuang Caves", and "Gansu Dunhuang". Subsequently, inconsequential and unrelated terms identified in the initial segmentation outcome are incorporated into the system's filtering thesaurus for the second segmentation process. For instance, words such as "always" and "some" are included in the filtering vocabulary.

To emphasize the main terms, similar phrases in the text were merged, such as "Digital Dunhuang" and "The Digital Dunhuang Project", which were merged into "Digital Dunhuang", or the keywords were incorrectly divided and then recombined, such as "Dunhuang Mogao Grottoes" and "Dunhuang Mogao Caves", which were merged into "Mogao Caves". Finally, the modified .txt file is loaded into the ROST CM6.0 software, where it undergoes semantic network analysis, high-frequency feature word analysis, and emotional analysis in a sequence of steps. Network text analysis surpasses the constraints of traditional approaches by utilizing the abundance and variety of user-generated content on social media, offering an expanded awareness of how tourists perceive and react to digital conservation initiatives such as Digital Dunhuang.

ANALYSIS AND DISCUSSION

High-Frequency Feature Word Analysis

Word frequency analysis is employed to identify the fundamental terms in the text using both the system's default vocabulary and vocabulary provided by the user and to calculate the frequencies of words. Word frequency analysis is employed to gather word frequency statistics, and the resulting documents are arranged in descending order based on word frequency. By analyzing the content shared by tourists on Weibo regarding Digital Dunhuang, it is possible to gain an initial understanding of their opinions. Table 1 displays the initial 40 words with the highest frequency, while Figure 2 shows their corresponding word clouds.

No.	Characteristic Words	Frequency	No.	Characteristic Words	Frequency
1	Dunhuang	5356	21	Platform	525
2	Culture	3347	22	Civilization	486
3	Digitalization	2056	23	Digital Library Cave	442
4	Digital Dunhuang	2033	24	Resource	425
5	China	1861	25	Experience	416
6	Cultural Relic	1731	26	Tradition	405
7	Conservation	1688	27	Internet	381
8	Mogao Caves	1537	28	Global	376
9	Technology	1451	29	Centre	374
10	Dunhuang Research Academy	1163	30	Millennium	358
11	Mural painting	959	31	Inherit	357
12	Research	949	32	Disseminate	339
13	Development	948	33	Immerse	319
14	Build	896	34	Realize	312
15	Country	805	35	Spirit	307
16	Innovation	970	36	Archaeology	305
17	Cave	716	37	Virtual	294
18	Fan Jinshi	686	38	Society	279
19	Museum	558	39	Unite	273
20	Cultural Heritage	549	40	The Silk Road	270

Table 1: Frequent Word Statistics of Digital Dunhuang
Source: Obtained from ROST CM6.0 and organized by the author



Figure 2: Frequent Word Statistics of Digital Dunhuang Word Clouds
Source: Obtained from ROST CM6.0 and organized by the author

Based on an investigation of the top 10 feature terms, "Dunhuang" emerged as the most referenced term, followed by "culture", "digitalization", and subsequently "Digital Dunhuang". The Mogao Grottoes are located in Dunhuang city. The implementation of Digital Dunhuang has dramatically increased the city's popularity and attracted greater attention. The inclusion of Digital Dunhuang in discussions about culture indicates a genuine concern about the cultural implications and values associated with the Mogao Caves, as demonstrated by Digital Dunhuang. The combination of the third and ninth most frequently used terms indicates that tourists were also impressed by the cutting-edge technology and creative approaches implemented at Digital Dunhuang.

By considering the 5th and 10th most highly mentioned words, it is noticeable that people recognize the significance that the government places on Digital Dunhuang and the endeavors of the authority Dunhuang Research Academy who initiated the Digital Dunhuang project. "Cultural Relic", "Conservation", and "Mogao Caves" ranked sixth, seventh, and ninth, respectively. An analysis of these phrases revealed that people associate Digital Dunhuang with the preservation of Mogao Caves and recognize the significance of Digital Dunhuang in the conservation efforts of fragile cultural heritage relics.

Notably, in terms of ranking, tourists' perception of the role of digital Dunhuang's cultural value exceeds that of its heritage protection. This shows that the role of Digital Dunhuang in the conservation of Dunhuang heritage needs to be further publicized and disseminated to enhance understanding and recognition in the public mind.

Semantic Network Analysis

Semantic network analysis involves extracting frequently occurring key terms from a text and using a co-occurrence matrix to create a network structure diagram. This function provides a direct measure of the correlation between different feature words. This study examines the semantic network of Weibo posts related to Digital Dunhuang. The semantic network diagram of Digital Dunhuang, which contains 26 feature words, is shown in Figure 3.

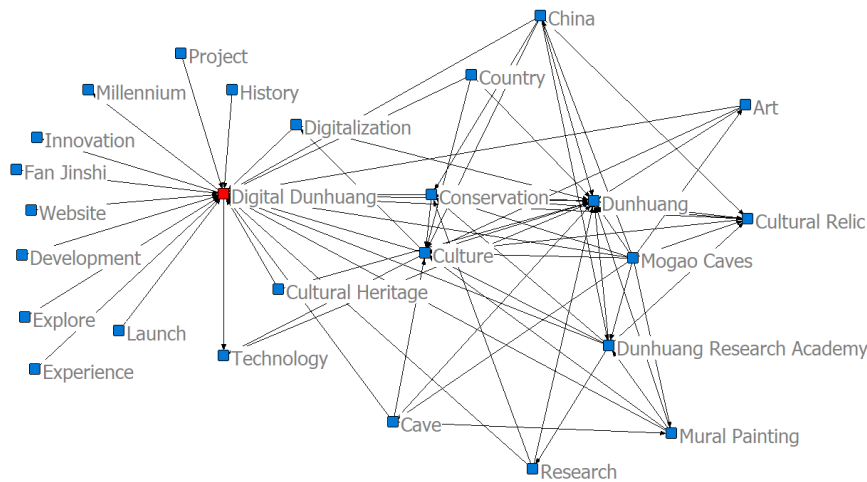


Figure 3: Semantic Network Diagram of Digital Dunhuang
Source: Obtained from ROST CM6.0 by the author

The feature words are summarized and divided into four categories: (1) Digital Dunhuang Project, which includes Digital Dunhuang, Project, Technology, Launch, Experience, Website, Development, Explore, Digitalization, and Innovation; (2) The feature and value of Dunhuang Mogao Caves, which include Cultural Relic, Art, Mogao Caves, Cave, Mural Painting, Cultural Heritage, Millennium, and History; (3) National Institutions, Organizations and Individuals Related to Digital Dunhuang to Digital Dunhuang, which includes Country, China, Dunhuang, Dunhuang Research Academy, and Fan Jinshi; and (4) The impact of Digital Dunhuang, which includes Conservation, Research, Culture.

Typically, most diagrams representing the structure of semantic networks consist of active elements. The primary feature terms strongly associated with Digital Dunhuang are Experience, Explore, Innovation, Culture, Technology, and Conservation. Visitors are inclined to engage in discussions regarding the project's technological aspects, its cultural and innovative experiences, and its cultural education and preservation value in relation to cultural assets.

The social network semantic analysis functions of ROST CM6.0 rely on shared characteristics. This paper employs the analysis function to filter out data that are not related to the substance of the analysis. It then selects the top 20 groups of high-frequency co-occurring words, which are presented in Table 2. The objective is to enhance the methodological approaches used in network text analysis to better comprehend tourists' perceptions of sustainable digitization in cultural heritage tourism through the utilization of social media big data.

Table 2: The Top 20 Groups of High-frequency Co-occurring Words

Sequence	Words	Characteristic Words	Co-occurrence Frequency
1	Digital Dunhuang	Dunhuang	900
2	Digital Dunhuang	Culture	593
3	Digital Dunhuang	Mogao Caves	551
4	Digital Dunhuang	Dunhuang Research Academy	508
5	Dunhuang	Mogao Caves	492
6	Dunhuang	Culture	470
7	Digital Dunhuang	China	782
8	Digital Dunhuang	Digitalization	444
9	Dunhuang	Dunhuang Research Academy	435
10	Digital Dunhuang	Cultural Relic	432
11	Digital Dunhuang	Mural Painting	430
12	Dunhuang	Mural Painting	384
13	Digital Dunhuang	Conservation	378
14	Dunhuang	Cultural Relic	355
15	Dunhuang	China	337
16	Dunhuang	Conservation	329
17	Digital Dunhuang	Research	326
18	Dunhuang Research Academy	Culture	304
19	Dunhuang	Digitalization	300
20	Digital Dunhuang	Cave	298

Source: Obtained from ROST CM6.0 and organized by the author

By conducting co-occurrence analysis, we determined that the term "Digital Dunhuang" is the main word in this text. Specifically, we identified 10 distinctive words that frequently appear alongside "Digital Dunhuang", making up 50% of the cooccurrences. According to the distribution of cooccurring words, the cooccurrences of Digital Dunhuang and culture, Mogao caves, digitization, cultural relics, and murals were 593, 551, 444, 432, and 430, respectively. There were 378 instances where the phrases "Digital Dunhuang" and "Conservation" appeared together. These instances indicated that there was some discussion regarding the significance of digital Dunhuang in preserving the cultural heritage of Dunhuang. However, there was no significant relationship between the two variables.

Sentiment Analysis

Tourists convey their emotional attitudes regarding a particular topic by using descriptive words and sentences in their Weibo online posts. This paper utilizes sentiment analysis in ROST CM6.0 to categorize and examine online posts on Weibo that are related to Digital Dunhuang. It then derives statistical data on the distribution of emotions and subsequently determines the sentiment of tourists towards Digital Dunhuang and its conservation. According to Table 3, tourists exhibit the highest percentage of good feelings, amounting to 83.03%. Negative

emotions made up 10.65% of their emotions, while neutral emotions accounted for 6.32%. The distribution of positive emotion intensity showed that 49.83% of the variance was attributed to general positive emotion, followed by normal positive emotion and medium positive emotion. Similarly, in the distribution of negative emotion intensity, the highest proportion, 4.72%, was accounted for by general negative emotions, followed by normal negative emotions and medium negative emotions.

Based on the analysis of emotional light distribution, it is evident that tourists' satisfaction with Digital Dunhuang primarily stems from positive emotions, with only a minimal occurrence of highly negative emotions. In general, tourists had a favorable view of the tourism experience provided by digital Dunhuang and its contribution to culture, research, and heritage preservation. Positive emotional perceptions outweighed negative ones, and the digital Dunhuang project successfully spread its image, confirming the results of the previous analysis of frequently used words. For example, "The digital Dunhuang project has obtained data from approximately 290 caves, and these images can accurately record the occurrence of diseases in different parts of the cave. It is also possible to simulate the effects of wind and humidity in caves to inform the development of conservation programs. In the dissemination of Dunhuang culture, people can visit the Digital Dunhuang website for a virtual tour", "This represents a new advancement in the fusion and advancement of science, technology, and culture. It also serves as a modern approach to showcasing and spreading the cultural significance of the Dunhuang Caves. This approach aims to foster new ways of thinking that contribute to the research, conservation, and promotion of Dunhuang culture and its legacy".

Nevertheless, the detrimental assessment of tourists also offers a specific point of reference for the advancement of the Digital Dunhuang project. It is imperative to acknowledge and efficiently handle the aspects that lead to tourists' unfavorable feelings, as these unpleasant emotions displayed by visitors can be traced to the influence of their experience. By considering the substance of the visitor evaluation text, it may be inferred that negative feelings primarily stem from real experiences. Some individuals believe that the digital immersion experience is inadequate and that it is essential to physically visit the area and personally encounter it. They argue that merely viewing Dunhuang digitally cannot elicit the same level of excitement and emotional response as physically being present at the site. Some individuals found the digital presentation slightly intimidating. The text describes "a panoramic virtual reality experience where a distorted fisheye lens highlights an empty grotto", "Across the street, there is a large statue of Buddha without a face. The walls of the grotto are adorned with intricate and diverse decorations. Even though the experience can only be seen on a computer screen, it evokes an indescribable feeling of oppression".

Table 3: Sentiment Analysis Statistics Results

Emotion Type	Proportion	Emotion Segmentation	Proportion
Positive	83.03%	Normal (0 - 10)	17.30%
		Medium (10 - 20)	15.90%
		High (above 20)	49.83%
Neutral	6.32%	null	null
Negative	10.65%	Normal (-10 - 0)	4.72%
		Medium (-20 - 10)	1.00%
		High (under -20)	0.27%
Total	100%	null	null

Source: Obtained from ROST CM6.0 and organized by the author

CONCLUSION

This study examines online posts on Weibo, a prominent social media site in China, about Digital Dunhuang. The goal is to investigate travelers' perspectives on sustainable digitalization in cultural heritage tourism. This study contributes to the literature by addressing the aforementioned gaps through a novel methodological approach. Through the application of network text analysis, social media data from Weibo relating to Digital Dunhuang were examined.

High-frequency feature word analysis revealed that the term "Dunhuang" is the most frequently discussed term, followed by "culture," "digitalization," and then "Digital Dunhuang." The installation of Digital Dunhuang has significantly increased the city's attractiveness and garnered wider attention. The use of Digital Dunhuang in conversations regarding culture demonstrates a sincere interest in the cultural ramifications and principles linked to the Mogao Caves. Nevertheless, tourists are more aware of the cultural value of Digital Dunhuang than are those who are aware of its heritage conservation. This demonstrates the necessity of promoting and spreading awareness about the significance of Digital Dunhuang in preserving the Dunhuang heritage. The author conducted Semantic Network Analysis and discovered that the frequency of co-occurrence between "Digital Dunhuang" and "Conservation" was lower than that of other key phrases such as culture and digitalization. These occurrences suggested that there were deliberations on the importance of digital Dunhuang in safeguarding the cultural legacy of Dunhuang. Nevertheless, there was no substantial correlation between the two variables. The results of the sentiment analysis indicate that travelers had a positive perception of the tourism experience offered by Digital Dunhuang, as well as its significant role in promoting culture, facilitating study, and preserving heritage. This criticism arises from the inherent limitation of the virtual experience since it fails to fully replace an in-person visit, and the digital presentation can be quite daunting.

The findings offer valuable insights into tourists' perspectives on the successful conservation of Digital Dunhuang alignment, thereby contributing to

the development of strategies that enhance sustainable practices in cultural heritage tourism destinations.

ACKNOWLEDGEMENT

The authors would like to thank the Institute of Postgraduates Studies, Universiti Sains Malaysia, for offering the IPS Conference Fund and funding the research activities related to this project.

REFERENCES

- Bec, A., Moyle, B., Schaffer, V., & Timms, K. (2021). Virtual reality and mixed reality for second chance tourism. *Tourism Management*, 83, 104256. <https://doi.org/10.1016/j.tourman.2020.104256>
- Chen, J., Becken, S., & Stantic, B. (2021). Using Weibo to track global mobility of Chinese visitors. *Annals of Tourism Research*, 89. <https://doi.org/10.1016/j.annals.2020.103078>
- Chung, N., Han, H., & Joun, Y. (2015). Tourists' intention to visit a destination: The role of augmented reality (AR) application for a heritage site. *Computers in Human Behavior*, 50, 588–599. <https://doi.org/10.1016/j.chb.2015.02.068>
- Cranmer, E. E., tom Dieck, M. C., & Jung, T. (2023). The role of augmented reality for sustainable development: Evidence from cultural heritage tourism. *Tourism Management Perspectives*, 49. <https://doi.org/10.1016/j.tmp.2023.101196>
- Daugherty, T., Eastin, M. S., & Bright, L. (2008). Exploring Consumer Motivations for Creating User-Generated Content. *Journal of Interactive Advertising*, 8(2), 16–25. <https://doi.org/10.1080/15252019.2008.10722139>
- Digital Dunhuang. (n.d.). Retrieved from <https://www.e-dunhuang.com/index.htm>
- Ghosh, B., Singh, R., & Sawant, M. (2024). Digital Technology: A Step to Protect Cave Art of Indian Subcontinent as National Heritage – A Review. *Preservation, Digital Technology & Culture*, 53(1), 15–28. <https://doi.org/10.1515/pdtc-2023-0047>
- Hardt, D., & Glückstad, F. K. (2024). A social media analysis of travel preferences and attitudes, before and during Covid-19. *Tourism Management*, 100. <https://doi.org/10.1016/j.tourman.2023.104821>
- Hu, X. (2018). Usability Evaluation of E-Dunhuang Cultural Heritage Digital Library. *Data and Information Management*, 2(2), 57–69. <https://doi.org/10.2478/dim-2018-0008>
- Hu, X., Ho, E. M. Y., & Qiao, C. (2017). Digitizing Dunhuang Cultural Heritage: A User Evaluation of Mogao Cave Panorama Digital Library. *Journal of Data and Information Science*, 2(3), 49–67. <https://doi.org/10.1515/jdis-2017-0014>
- Kirilenko, A. P., Stepchenkova, S. O., & Hernandez, J. M. (2019). Comparative clustering of destination attractions for different origin markets with network and spatial analyses of online reviews. *Tourism Management*, 72, 400–410. <https://doi.org/10.1016/j.tourman.2019.01.001>
- Koukopoulos, Z., & Koukopoulos, D. (2018). Evaluating the Usability and the Personal and Social Acceptance of a Participatory Digital Platform for Cultural Heritage. *Heritage*, 2(1), 1–26. <https://doi.org/10.3390/heritage2010001>
- Li, J., Peng, X., Liu, X., Tang, H., & Li, W. (2024). A study on shaping tourists' conservational

- intentions towards cultural heritage in the digital era: exploring the effects of authenticity, cultural experience, and place attachment. *Journal of Asian Architecture and Building Engineering*, 1–20. <https://doi.org/10.1080/13467581.2024.2321999>
- Manglis, A., Fourkiotou, A., & Papadopoulou, D. (2021). A Roadmap for the Sustainable Valorization of Accessible Underwater Cultural Heritage Sites. *Heritage*, 4(4), 4700–4715. <https://doi.org/10.3390/heritage4040259>
- Mogao Caves. (n.d.). *UNESCO World Heritage Centre*. Retrieved from <https://whc.unesco.org/en/list/440/>
- Nevilleeagnew, M., & Jinshi, F. (n.d.). *SPRINGER BRIEFS IN ARCHAEOLOGY ARCHAEOLOGICAL HERITAGE MANAGEMENT Strategies for Sustainable Tourism at the Mogao Grottoes of Dunhuang, China*. <http://www.springer.com/series/10186>
- Orea-Giner, A., Fuentes-Moraleda, L., Villacé-Molinero, T., Muñoz-Mazón, A., & Calero-Sanz, J. (2022). Does the Implementation of Robots in Hotels Influence the Overall TripAdvisor Rating? A Text Mining Analysis from the Industry 5.0 Approach. In *Tourism Management* (Vol. 93). Elsevier Ltd. <https://doi.org/10.1016/j.tourman.2022.104586>
- Pati, A., & Husain, M. (2023). People's perspectives on heritage conservation and tourism development: a case study of Varanasi. *Built Heritage*, 7(1), 17. <https://doi.org/10.1186/s43238-023-00098-w>
- Shafiee Roodposhti, M., & Esmacelbeigi, F. (2024). Viewpoints on AR and VR in heritage tourism. *Digital Applications in Archaeology and Cultural Heritage*, 33. <https://doi.org/10.1016/j.daach.2024.e00333>
- Stepchenkova, S., & Zhan, F. (2013). Visual destination images of Peru: Comparative content analysis of DMO and user-generated photography. *Tourism Management*, 36, 590–601. <https://doi.org/10.1016/j.tourman.2012.08.006>
- Thomala, L. L. (2024). *Weibo corporation: Maus 2023*. Retrieved from <https://www.statista.com/statistics/795303/china-mau-of-sina-weibo/>
- Vileikis, O., Rigauts, T., Rouhani, B., Ziane Bouziane, M., & Santana Quintero, M. (2023). DIVE INTO HERITAGE: A DIGITAL DOCUMENTATION PLATFORM OF WORLD HERITAGE PROPERTIES IN THE ARAB STATES REGION. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XLVIII-M-2–2023, 1613–1620. <https://doi.org/10.5194/isprs-archives-XLVIII-M-2-2023-1613-2023>
- Wang, Z., Huang, W. J., & Liu-Lastres, B. (2022). Impact of user-generated travel posts on travel decisions: A comparative study on Weibo and Xiaohongshu. *Annals of Tourism Research Empirical Insights*, 3(2). <https://doi.org/10.1016/j.annale.2022.100064>
- Weibo. (n.d.). *Weibo group business overview*. Retrieved from <http://ir.weibo.com/corporate-profile>
- Zhang, H., Xiong, K., Fei, G., Jin, A., & Zhang, S. (2023). Factors Influencing the Conservation Intentions of Visitors to a World Heritage Site: A Case Study of Libo Karst. *Sustainability (Switzerland)*, 15(6). <https://doi.org/10.3390/su15065370>

Received: 6th February 2025. Accepted: 19th May 2025