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Semiotics and NLP Integration in Heritage Communication: A Case Study of Urban Destinations

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Research Article

Keywords:

Posted Date: February 17th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-8882435/v1

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Additional Declarations: No competing interests reported.

Abstract

This study investigates how digital transformation reshapes the representation and perception of cultural heritage within contemporary tourism by analysing social media narratives of three key heritage sites in Ankara: Hamamönü, Ankara Castle, and the Museum of Anatolian Civilizations. Using a mixed-methods approach, the research integrates visual semiotic analysis—examining colour schemes, compositional patterns, and symbolic codes—with NLP-based sentiment classification of user-generated content from X, Instagram, and Facebook. Findings show Hamamönü is primarily represented through traditional architecture (41%) and gastronomy-focused experiences (34%), emphasizing its cultural and experiential identity. Ankara Castle highlights archaeological heritage (38%) and the urban landscape (29%), underscoring historical and spatial dimensions. The Museum of Anatolian Civilizations is associated with educational value (45%) and interactive exhibition practices (27%), reflecting its strong role in digitally mediated museum experiences. Sentiment analysis indicates polarization: museum-related posts are overwhelmingly positive (82%), whereas critiques focus on Castle infrastructure (28%) and visitor management issues (19%). Overall, the study provides a data-driven framework demonstrating how social media analytics can guide evidence-based strategies for digital transformation, effective promotion, and sustainable communication of cultural heritage sites.

INTRODUCTION

The digital transformation of cultural heritage has evolved beyond mere archival preservation into a dynamic process of "image reconstruction" through user-generated content (UGC). Traditional semiotic approaches often fail to capture the real-time emotional resonance of heritage sites, creating a gap between official institutional narratives and visitor perceptions. This study addresses this gap by proposing a dual-layered deconstruction model that integrates Visual Semiotics with Natural Language Processing (NLP).

Current literature extensively covers either qualitative visual analysis or quantitative sentiment mining. However, a holistic "Semiotic-NLP" framework—one that treats pixels and text as a unified emotional ecosystem—is noticeably absent. By operationalizing Barthes' semiotic codes alongside modern sentiment algorithms, this research provides a replicable framework for decoding how historical spaces are reinterpreted in the "algorithmic culture" (Striphas, 2015).

To validate this model, three distinct heritage typologies (an urban district, an archaeological fort, and a museum) are examined. These sites serve as a laboratory to demonstrate how visual semiotics (e.g., color palettes, compositional codes) and textual sentiments either align or diverge in digital storytelling. The findings offer evidence-based strategies for digital heritage management, moving beyond descriptive analysis toward a predictive understanding of visitor engagement.

Tourism destination image represents a complex, multi-layered construct comprising cognitive beliefs and emotional reactions that collectively shape visitor behavior and destination choice dynamics (Echtner & Ritchie, 2003). In the contemporary digital ecosystem, social media platforms have emerged

as transformative forces in destination marketing, facilitating the co-creation of destination image through user-generated visual and textual content that profoundly influences potential visitors' perceptions and travel decisions (Mariani et al., 2016). These platforms enable tourists to document and share their experiences through rich visual narratives that effectively communicate brand personality traits, thereby shifting destination marketing toward a more user-centered paradigm (Garrod, 2009; Tussyadiah & Fesenmaier, 2009).

Despite the extensive literature on destination image formation, a significant methodological gap persists in the integrated analysis of visual and textual social media content. Existing research tends to focus either on quantitative textual sentiment analysis (Schuckert, Liu, & Law, 2015) or basic visual content categorization (Stepchenkova & Zhan, 2013), while few studies have employed a comprehensive qualitative framework that examines the synergistic relationship between visual semiotics and emotional discourse in shaping destination perception. This gap is particularly evident in the context of cultural heritage destinations, where the interplay between visual representation and emotional response requires more nuanced investigation.

Ankara, as Turkey's capital city, presents a compelling case study with its rich historical tapestry spanning Hittite, Phrygian, Roman, and Ottoman civilizations. Despite its cultural significance and status as a prominent tourism destination, Ankara's digital representation on social media platforms remains substantially unexplored in academic literature. The city's diverse cultural assets—including the traditional Ottoman architecture of Hamamönü, the strategic historical layering of Ankara Castle and the extensive archaeological collections of the Museum of Anatolian Civilizations—offer a unique opportunity to examine how heritage sites are represented, perceived, and emotionally experienced in the digital realm.

The selection of these three specific destinations is theoretically grounded in their distinct characteristics and representational value. Hamamönü embodies Ankara's historical and cultural identity through its preserved Ottoman-era architecture, traditional houses, and local handicrafts, making it particularly significant for examining how cultural elements shape visitor perceptions and emotional responses. Ankara Castle, with its panoramic views and historic fortifications, offers insights into the intersection of historical significance and contemporary tourist experience, while also revealing how infrastructure deficiencies can negatively impact destination image. The Museum of Anatolian Civilizations, housing one of Turkey's most important archaeological collections, provides a context for understanding how educational content and professional curation influence visitor satisfaction and cultural perception.

This study addresses critical research gaps by employing an integrated methodological approach that combines visual semiotics with sentiment analysis to decode Ankara's digital destination image. The research is guided by three fundamental questions: First, how do thematic elements (historical, cultural, infrastructural) and aesthetic components (color palettes, compositional features) manifest in social media representations of these cultural heritage sites?

Second, what emotional tendencies emerge from user-generated content, and how do these reflect the perceived strengths and weaknesses of each destination? Third, how can these insights inform the development of effective destination management strategies that leverage social media's potential for enhancing cultural tourism experiences?

Methodologically, this research adopts a qualitative dominant mixed-methods approach. Visual content analysis involves systematic examination of aesthetic elements and thematic coding of images shared across social media platforms. Sentiment analysis utilizes the VADER (Valence Aware Dictionary for Sentiment Reasoning) lexicon model (Hutto & Gilbert, 2014), complemented by qualitative text mining to capture the nuanced emotional dimensions of user responses. This integrated approach facilitates a comprehensive understanding of how visual and textual elements collectively construct destination image in digital environments.

The theoretical significance of this study lies in its extension of Echtner and Ritchie's (2003) cognitive-affective model to the digital realm, particularly through its examination of how visual semiotics and emotional discourse interact in social media contexts. By incorporating theories of semiotic layering (Barthes, 1964) and network society (Castells, 2010), the research provides a novel framework for understanding destination image formation in the age of social media. The study also contributes to methodological innovation in tourism research by demonstrating how qualitative and computational methods can be integrated to analyze complex social media data.

Practically, this research offers valuable insights for destination marketing organizations and heritage site managers seeking to optimize their social media strategies. By identifying the specific visual elements and emotional triggers that positively influence destination perception, the findings can inform more effective content creation and engagement strategies. Additionally, the research provides guidance for addressing infrastructure and service issues that generate negative feedback, thereby supporting continuous improvement in visitor experiences.

The study employs a robust data collection framework, gathering visual and textual content from multiple social media platforms including X (Twitter), Instagram, and Facebook. The dataset comprises 6,015 user comments and 900 images collected between January 1 and December 31, 2024, ensuring comprehensive coverage of seasonal variations and tourism patterns. Analytical rigor is maintained through inter-coder reliability measures (Cohen's $\kappa = 0.82$ for visual analysis; $\kappa = 0.78$ for sentiment classification) and systematic validation procedures that ensure the trustworthiness of findings.

In conclusion, this research advances our understanding of digital destination image formation by providing a holistic analysis of how cultural heritage sites are represented and perceived on social media platforms. By integrating visual semiotics with sentiment analysis, the study offers novel insights into the complex interplay between visual representation and emotional response in shaping destination perception. The findings contribute to both theoretical development in destination image research and practical improvements in heritage tourism management, ultimately supporting the sustainable development of cultural tourism in Ankara and similar heritage destinations.

CONCEPTUAL FRAMEWORK

1. Digital Image

Destination image is a two-layered construct that includes cognitive (belief/knowledge) and emotional (reactions) dimensions (Echtner & Ritchie, 2003). Social media can not only help organizations build more effective and ethical relationships with the public but also accelerate this process with user-generated content and turn it into "digital rumor" (McAllister-Spooner, 2009; Javed et al., 2025). For example, Tussyadiah & Fesenmaier (2009) argue that user-shared images influence travel intentions by creating "mental simulations" in tourists. However, Govers et al. (2007) criticize that images on social media simplify cultural complexity and reduce destinations to stereotypes such as "historical" or "modern".

Sources of information about the destination play a crucial role in cognitive image formation. For example, reviews on Tripadvisor as of 2024 reveal that hotels in Ankara generally receive high ratings. Guests considered factors such as location, staff service quality, room comfort, cleanliness and price/benefit balance when evaluating hotels. Moreover, more than 55% of the reviews for Ankara hotels emphasize tangible features of the city such as “ease of transportation” and “variety of museums” (Tripadvisor, 2024).

In contrast, emotional images are shaped by color palettes and metaphors. Fatanti & Suyadnya (2023) found that red and gold tones of Instagram posts triggered feelings of "national pride" (34%) and blue tones triggered feelings of "peace" (28%). In this context, the role of social media in destination image formation has gone beyond being a mere communication tool and turned into a collective perception engineering. However, the biggest contradiction in this process is the image mismatch between official and unofficial channels. In the Ankara 2019 and 2025 promotional videos produced by the Ankara Provincial Directorate of Culture and Tourism, it was found that while the city's "contemporary art" and "technopark" areas were highlighted, more than 50% of the content was focused on the theme of "history" (Ankara İl Kültür ve Turizm Müdürlüğü, 2019; 2025). This reflects the paradox created by the tendency toward uncontrolled user-generated content in destination branding (Papathanassis & Knolle, 2021).

The destination of Ankara, which is taken as a case study in the study, constitutes a striking example to analyze how digital representations operate within the socio-digital dialectic. Through the representations reproduced on digital platforms, Ankara’s destination identity is involved in a multi-layered transformation process that not only expands in spatial and cultural contexts but is also reconstructed at the symbolic level. This reveals that destination identity is not static, but continuously reshaped through digital interactions, providing a strong empirical basis for the study. The findings of the study show that while platform-based narratives increase the multi-readability of urban memory, they also reduce local identity to a universe of meta-touristic clichés through perceptual hyper-ritualization. This paradoxical situation is analyzed from the perspective of critical media theory on how digital media reproduce the authenticity-accessibility dilemma.

The research systematizes how social media transforms spatial signification practices into digital architecture by evaluating the multi-layered structure of the destination image in the digital age through the theories of semiotic layering (Barthes, 1964a; 1964b) and network society (Castells, 2010). The findings reveal that the tension between Ankara's "monumental state image" and "participatory urban story" is repackaged by platform algorithms in accordance with emotional capitalism. In this context, the study argues that social media strategies in tourism policies should be rethought in the context of the political ecology of digital narrative ecosystems, the epistemic authority of user-generated content, and algorithmic resistance strategies of local-specific identity, rather than purely interaction metric-driven approaches. The proposed "digital identity architecture" model integrates data-driven decision-making, participatory story mapping, and algorithmic cultural critique (Striphas, 2015) to propose a balanced representational regime for sustainable destination management.

Furthermore, supported by audience ethnography and social network analysis methods, this study questions the role of digital representations in creating emotional geographies (Bondi, 2005) and introduces a post-digital conceptualization of place attachment to the tourism studies literature.

2. Destination Marketing Strategies

The image of tourism destinations on social media is shaped by the cognitive and emotional interaction of visual narratives (Govers et al., 2007). Visual content reflects the identity of destinations and positively increases travel intentions by creating a "mental simulation" in the minds of users (Tussyadiah & Fesenmaier, 2009). In this process, elements such as visual optimization (file name, title, alt text) and color psychology play a critical role. In this sense, visuals become powerful tools in conveying destination stories. Pan et al. (2007) found that images emphasizing "authenticity" (e.g., local handicrafts) increased destination attractiveness more than generic landscapes.

Similarly, Stepchenkova & Zhan (2013) compared destination marketing organization and user-generated content images and found that users emphasize "ordinary" but intimate experiences (street food), while destination marketing organizations focus on "iconic" places. Lo et al. (2011) suggest that warm colors shape destination personality by evoking a sense of "comfort," while Echtner & Ritchie’s (2003) model is based on recent studies that suggest integrating neuro-tourism approaches. Using eye-tracking technology, Scott et al. (2022) showed that tourists focus more on people in images (smiling locals) than on static objects. Mariani et al. (2021) argue that AI-assisted sentiment analysis can overcome the basic positive/negative distinction by detecting "micro-emotions" (such as nostalgia).

This study posits that visual narratives in tourism function not merely as marketing tools but as symbolic representations reflecting the socio-cultural and spatial codes of destination identity. Using Ankara as a case study, it examines the dialectical impact of digital representation on tourism geographies by critically analyzing how social media both constructs and constrains this identity. Adopting an interdisciplinary lens (media studies, cultural geography, behavioral marketing), the research systematically investigates visual hegemony and intersubjective narratives in destination branding,

evaluating the interplay between algorithmic content optimization, audience engagement metrics, and meaning production.

Qualitative analysis reveals representational gaps between user-generated content and corporate strategies, demonstrating that contradictory portrayals of Ankara's historical heritage and modernity foster perceptions of identity fragmentation among digital audiences—a paradox mediated by local storytelling. The findings advocate integrating digital ethnography into tourism policy and propose visual data mining and AI-driven content optimization as operational frameworks for sustainable brand strategies. Furthermore, by synthesizing affective geography and digital placemaking concepts, this study addresses a methodological gap in the literature and offers policymakers practical guidance for cultural algorithm design.

3. The Effect of Social Media on Destination Image

Sentiment analysis has become a critical tool in tourism research to understand the dynamics of destination perception by quantifying the emotional tone of textual and visual content on digital platforms (Hutto & Gilbert, 2014). In particular, the collective knowledge pool created by social media through user-generated content is being integrated with AI-based NLP models (e.g., BERT, LSTM) to analyze the emotional codes of tourist experiences (Li et al., 2022).

This approach overcomes the limitations of traditional survey methods and offers real-time and scalable analysis (Gretzel et al., 2015). Sentiment analysis also bridges big data and consumer psychology. Liu (2012) emphasized and confirmed that this method is effective in detecting "experience gaps" (e.g., statements, complaints, dissatisfaction, and service failures). For example, Xiang et al. (2015) analyzed TripAdvisor reviews and linked negative sentiment to specific hotel attributes such as cleanliness.

However, Schuckert et al. (2015) emphasized that the cultural subtleties of algorithms, especially the indirect criticisms that are common in Asian cultures, can be misunderstood by algorithms and this can be misleading for service providers. In this context, a study conducted by Çetin & Bayram (2022) found that individuals who participate in electronic recreation activities for social interaction purposes generally do not have high levels of fear of missing out (FoMO). This finding emphasizes the importance of emotion analysis in understanding the impact of digital interactions on individuals' emotional states.

One of the pioneering applications of sentiment analysis in tourism is the transformation of comments on platforms such as Instagram, Tripadvisor, etc., into maps of emotional tendencies, revealing the "hidden" weaknesses of destinations (Park et al., 2021). For example, the identification of expressions of anger about Barcelona's overtourism problem through natural language processing has provided the city government with the opportunity to develop data-driven strategies for crowd management policies (Garcia-Retamero et al., 2023). Similarly, visual sentiment analysis techniques decipher the visual mythology of destination image through the color palette, composition, and object distribution of geotagged photos on Instagram (Kim et al., 2020).

However, the limitations of these methods should not be ignored. The role of linguistic irony and cultural context in emotion classification can lead to a 15–20% error margin of machine learning models (Cambria & Hussain, 2022). Therefore, sentiment analysis in tourism research increases its validity when supported by qualitative data triangulation and cultural semiotics (Mariani et al., 2021).

The multi-layered nature of sentiment analysis in tourism studies provides an epistemological ground for mapping the emotional geographies of social media images in light of Bourdieu's (1986) conceptualization of symbolic capital and Ahmed's (2004) theories on the political ontology of emotions. This approach not only analyzes the sociomaterial interactions of digital representations from the perspective of Latour's (2005) actor-network theory but also reveals hegemonic-counternarrative tensions in cultural representation through Foucauldian (1972) discourse stratifications (Keyder, 2005; Bartu Candan & Özbay, 2014).

This methodological innovation not only maps the affective ontology of tourism geographies from a cartographic perspective but also deciphers the sociopolitical codes of representational practices on digital platforms, specifically in the dialectical context between neoliberal urbanization discourses and the commodification of public space, through critical hermeneutical methods. This analytical matrix, in which qualitative findings are examined in dialog with social theory, brings an integrated paradigm of methodological pluralism and critical realism to the post-digital urban studies literature.

METHOD

This research adopts a methodological design based on the qualitative research paradigm in order to analyze the images of tourism destinations on social media from a multidimensional perspective. By examining the visual and textual components of the data obtained from social media platforms in an integrated analytical framework, the study aims to holistically interpret digital representations of destination image with an interdisciplinary approach. The research process consists of four main stages: data collection, semiotic analysis of visual content, sentiment analysis on textual data and systematic evaluation of ethical principles. The methodology is designed in methodological harmony with the multi-data integration model developed by Stepchenkova & Zhan (2013), a prominent scholar in the field of tourism marketing and digital communication, and the digital content analysis protocol proposed by Liu (2012).

The study aims to make a theoretical contribution to the literature by addressing the conceptual, emotional and behavioral dimensions of the reflections of destination image on social media with a method approach based on the synergistic combination of qualitative data. In addition, the validity and reliability of the findings were increased by using the triangulation method in data analysis, and the principles of the European Data Protection Regulation were taken as basis in the ethical evaluation phase. Ankara has a multilayered identity extending from antiquity to the Republic. Hamamönü (Ottoman heritage), Ankara Castle (Roman-Byzantine traces), and the Museum of Anatolian Civilizations (Neolithic-

Urartu collections) are landmarks that represent this stratification. These three destinations are critical in visualizing the city's image of "historical continuity" on social media.

Furthermore, these destinations are the most frequently tagged and geographically prominent places on the social media platforms X, Instagram, and Twitter, which constitute the main theme of this study (Republic of Turkey Ministry of Culture and Tourism, 2020; Turkey Culture Portal, 2025). Hamamönü's "Instagrammable" architecture, in particular, aligns with young visitors' aesthetic sharing tendencies. In their study emphasizing the impact of social media on travel planning and users' trust in social media content, Fotis et al. (2012) concluded that the images and user experiences shared on social media influence destination choices.

On the other hand, cultural tourism is a priority in Ankara’s tourism strategy. While the Museum of Anatolian Civilizations is an "anchor museum" that attracts international visitors, Ankara Castle is a common focus of interest for local and foreign tourists. This diversity allowed for a multidimensional analysis of the destination image (Republic of Turkey Ministry of Culture and Tourism, 2020). When all these priorities are in place, all three places have a strong "indicator system". For example, the Hittite lion sculptures in the museum directly represent Anatolia’s ancient past, in line with Peirce’s (1932) concept of the "iconic sign". This supports the methodological framework of visual semiotics (MacCannell, 1976). The findings of the study reveal the role of the selected destinations in shaping the cultural image of Ankara on social media and the implications for tourism policies on an academic basis.

Guided by this methodological framework, the study is driven by several research questions that structure the analysis and ensure alignment with the objectives of understanding the digital representation of destination image. First, the study investigates which thematic elements—such as historical, cultural, or infrastructural features—are emphasized in visual content shared on social media for Hamamönü, Ankara Castle, and the Museum of Anatolian Civilizations. Second, it examines how aesthetic components, including color palettes, composition, and visual symbolism, shape the cognitive and emotional perceptions of users. Third, it explores how sentiment expressed in user-generated textual content—including nostalgia, admiration, or criticism—contributes to the formation of destination image and highlights perceived strengths and weaknesses of each site. Fourth, the study seeks to identify differences between local and international visitor perceptions, analyzing how cultural and contextual factors influence emotional responses and interpretations. Finally, the research addresses the practical implications of these findings for destination management, asking how insights from visual and textual analyses can inform social media strategies, interactive marketing, brand positioning, and infrastructure development to optimize the cultural and touristic image of Ankara.

Data Collection

The data collection phase of the study was designed considering the critical role of social media platforms in tourism destination image formation. This study was conducted on the posts between January 1 and December 31, 2024 to examine the effects of social media platforms on tourism destination image formation. In the data collection phase, BrandMentions Web Monitoring tool was used

to collect visual and textual posts tagged #Hamamönü, #AnkaraKalesi and #AnadoluMedeniyetleriMüzesi over a one-year period. The 6 878 user comments (X: 4,009; Instagram: 1,525; Facebook: 481; YouTube: 473; TikTok: 297; LinkedIn: 93), 6,015 comments from X, Instagram and Facebook platforms with the highest volume were selected as the sample for analysis. The visual sample was limited to a total of 900 images, 300 images for each destination; only content with 50 or more interactions (likes/shares) was prioritized in the analysis so that posts with strong image representation power could be evaluated.

Data analysis was conducted in a two-stage model that combines qualitative and quantitative approaches. In the first stage, NVivo 12 (2025) software was used to analyze the visual and textual contents at the semiotic level within the scope of thematic analysis; the contents were conceptually categorized on the basis of the codes and sub-codes that emerged. In the second stage, automatic sentiment classification ("positive", "negative", "neutral") was applied with the VADER Sentiment Analysis algorithm; neutral comments were obtained by subtracting positive and negative data from the total number of comments. The results of the automatic emotional distribution were cross-checked through a manual validation process measured by Cohen's $\kappa = 0.78$, thus ensuring inter-coder consistency. In order to increase the validity and reliability of the study, all data collection and analysis processes were conducted within the framework of ethical principles. Posts containing personal data were excluded from the analysis; all remaining content was anonymized and documented through a systematic filtering and coding protocol. In this way, in-depth and reliable findings on the tourism destination image of social media posts were obtained through a highly representative data set with a high level of interaction.

Visual Content Analysis

The visual analysis was conducted with a qualitative approach, and the thematic coding framework developed by Garrod (2009) was adapted and the process focused on three main components (Table 1).

Insert Table 1 here.

1. Color and Esthetics

- Color Palette Extraction: Each image was uploaded to Adobe Color (2017) to extract three main color tones (primary, secondary, tertiary).

- Tone Separation: Warm tones (red, orange, yellow) and cool tones (blue, green, purple) were categorized.

- Perception Assessment: According to the theory of color psychology by Lo et al. (2011), the effects on destination image were interpreted based on the assumption that warm colors create energy and vitality, while cool colors create a sense of calmness and confidence.

2. Composition and Focal Objects

- Framing Criteria: Symmetry (equal distribution on the same two sides) and perspective (near-plan, far-plan) ratios in the images were manually measured and graded.

- Focal Object Recognition: Items such as historical buildings, local food, architectural details were marked according to their dominant position and level of clarity in the image.

- Evaluation: Which object was placed in the center or in the third line, and how it directed the focal power and viewer attention were recorded in a qualitative description.

3. Thematic Coding

- Creating a Code Scheme: Four main themes were defined: historical, cultural, gastronomic and infrastructural.

- NVivo 12 Process: Coders imported each image into NVivo and labeled them according to the above themes.

- Reliability Check: Cohen's κ = 0.82 was obtained in the comparison between two independent coders, confirming coding consistency. Code discrepancies were resolved by a third expert.

Emotion Analysis

Sentiment analysis of text data was conducted using the VADER (Valence Aware Dictionary for Sentiment Reasoning) lexicon model (Hutto & Gilbert, 2014). First, raw texts were subjected to tokenization, stop-word removal and stemming (Porter, 1980; Bird et al., 2009). Each comment was measured with a "compound" score between -1 (extremely negative) and +1 (extremely positive), quantifying the emotional intensity of the comments (Hutto and Gilbert, 2014). Finally, the classification accuracy of the model was cross-checked with two human coders on 500 randomly selected comments, using Cohen's κ = 0.78 (Cohen, 1960; Carletta, 1996). Text preprocessing consists of three basic steps (Porter, 1980; Bird et al., 2009) to increase the reliability of the analysis result (Table 2).

Insert Table 2 here.

VADER automatically classifies comments into three sentiment categories (positive, negative, neutral) and assigns a "compound" score to each, taking into account the linguistic complexity of social media texts—emojis, capitalization, slang usage (Hutto & Gilbert, 2014). Scores are scaled from -1.0 to +1.0, with high positive scores indicating positive affect and high negative scores indicating negative affect (Table 3).

Insert Table 3 here.

Manual Validation

Insert Table 4 here.

To test the reliability of automatic emotion classification, 1 500 randomly selected comments were labeled by two independent human coders (Carletta, 1996). Inter-coder consistency was measured by Cohen's κ coefficient and a value of κ = 0.78 was considered as an indicator of "good" agreement (Cohen, 1960).

Data Analysis and Reliability Qualitative Data Analysis:

Visual contents were analyzed on the basis of frequency distributions of descriptive themes and the code groups obtained were visualized by thematic mapping method. In this process, using software similar to NVivo, code reliability was tested by two independent researchers with mutual supervision, and coding consistency was verified with Cohen's kappa statistic (Landis & Koch, 1977).

Reliability, Validity and Limitations

Platform Selection Bias: Since the study only collected data from X, Instagram and Facebook platforms, user interactions on channels such as TikTok and Snapchat were ignored; this may limit the generalizability of the themes obtained.

Linguistic Limitations: The analysis was conducted only on Turkish and English texts; posts in languages other than these two languages were excluded from the scope of the study, preventing a full representation of linguistic diversity.

Timing and Moment Analysis: Since the data collection period was limited to a specific time period, the impact of seasonal or periodic fluctuations on the analysis results could not be fully evaluated.

FINDINGS

The research, which examines social media data on Ankara’s prominent cultural tourism destinations, Hamamönü, Ankara Castle, and the Museum of Anatolian Civilizations, is based on data obtained from comments and visual content shared by users and visitors on popular digital platforms such as X, Instagram, and Facebook. The collected data was analyzed in depth through visual semiotic analysis and sentiment analysis methods, and the findings were supported by qualitative data sets and systematized in a more comprehensive manner.

The analytical framework of the study was structured to answer specific questions about the digital representations of these cultural destinations. The analysis is organized along three main axes, and each axis crystallizes the results obtained during the data analysis process and offers important implications for the visibility of destination identity in the digital environment. The findings reveal how social media posts shape the image of Ankara in both cultural and touristic terms and the role of digital platforms in destination branding from an empirical perspective (Table 5).

Insert Table 5 here.

1. Visual Content Analysis Findings

Insert Table 6 here.

The analysis of visual data revealed three main dimensions of how destinations are represented on social media: the use of color, compositional structure and thematic coding. In the case of Hamamönü, nostalgic architectural elements (wooden bay windows, restored street texture) and representations of cultural performances (traditional festivals, handicrafts) in the visuals create an "emphasis on authenticity" in line with Bourdieu's (1977) concept of "cultural capital". These themes were frequently associated with the metaphors of "time travel" and "cultural belonging" in visitor comments (Table 6).

In the data on Ankara Castle, panoramic view-oriented posts (sunset, night lighting) reinforce the destination's perception of "historical power" and "esthetic sublime". The use of the walls of the castle as a "photogenic background" on social media reflects the transformation of space into a consumption object in the context of Urry's (1990) "tourist gaze" theory (Table 7).

Insert Table 7 here.

Insert Table 8 here.

In the data set of the Museum of Anatolian Civilizations, the way archeological artifacts are visualized (Hittite lion sculptures, Phrygian tablets) constructs a mythic narrative of a "hierarchy of civilizations", while the museum's modern display techniques give the impression of "scientific authority" and "pedagogical communication" (Duncan, 1995), (Table 8).

2. Emotion Analysis Findings

Sentiment analysis on user reviews revealed the perceptual strengths and weaknesses of destinations. The analysis was performed with the VADER algorithm and manual validation, and the results are summarized below. It was observed that the order of access was Ankara castle, Museum of Anatolian Civilizations and Hamamönü. The Museum of Anatolian Civilizations has the greatest access-to-comment ratio at 0.15 per thousand, followed by Ankara Castle at 0.06 per thousand and Hamamönü at 0.04 per thousand, as indicated by Table 9.

Insert Table 9 here.

a) Distribution of Positive Emotions: Among the destinations examined within the scope of the research, the Museum of Anatolian Civilizations stands out as the location with the highest number of positive emotion expressions. The analyses show that museum visitors describe their experience in positive terms such as "impressive", "educational" and "connecting with cultural heritage". This suggests that the historical and esthetic value of the museum plays a decisive role in visitor satisfaction.On the other hand, the intensity of positive emotions was found to be the lowest in Hamamönü destination. This

finding suggests that there may be deficiencies in the promotional strategies of the region or that visitor expectations do not match the current service quality (Table 10).

b) Analysis of Negative Emotions: Negative sentiment expressions are significantly higher at the Museum of Anatolian Civilizations compared to other destinations. This can be attributed to factors such as "crowded environment", "ticket fees" and "lack of information". The popularity of the museum and heavy visitor traffic may have increased negative feedback. On the other hand, the lowest level of negative sentiment was observed in Hamamönü destination. This result can be explained by the fact that the region is exposed to less touristic pressure or that the visitor profile is more homogeneous. However, it should be noted that low negative feedback may also be due to low overall interaction volume (Table 10).

Insert Table 10 here.

c) Distribution of Neutral Sentiments: The destination with the highest rate of neutral sentiment expressions was the Museum of Anatolian Civilizations. This suggests that visitors tend to share their experiences in a neutral language or that the museum exhibits an "informative" but "non-emotional" profile. Hamamönü, on the other hand, has the lowest rate of neutral sentiment distribution. This finding implies that either the posts about the region contain a distinctly positive/negative attitude or the dataset is too small to cover neutral statements (Table 10).

3. Comparative Analysis Across Destinations

Thematic Differences: Hamamönü is identified with cultural heritage and gastronomy, while Ankara Castle focuses on historical and esthetic themes, and the museum on educational and scientific themes.

Emotional Gap: There was a 28% difference in the rate of positive emotions between the museum and the castle ($\chi^2 = 45.32$, $p < 0.001$). This difference shows that infrastructure investments directly affect destination satisfaction.

Insert Table 11 here.

The main differences between the three destinations are evident in the forms of cultural representation and visitor expectations. While Hamamönü differs in the performative representation of local identity and everyday culture, Ankara Castle stands out with its historical sublimation and esthetic consumption-oriented experience. In the Museum of Anatolian Civilizations, differences in scientific authority and pedagogical communication were identified. In line with Gunn's (1972) theory of "primary and secondary destination images", this categorization reveals the multi-layered structure of Ankara's cultural tourism image on social media (Table.11).

Visual representations and color psychology, the warm color palette of Hamamönü enhanced the perception of "comfort" and "invitingness" as emphasized by Lo et al. (2011). As for the emotion-experience relationship, the concentration of high positive emotions in the museum supports the "linear

relationship between experience quality and emotional connection" proposed by Xiang et al. (2015). In Hamamönü posts, the main triggers of positive emotions (68%) were "peace" and "excitement of discovery". while negative comments (12%) focus on infrastructure deficiencies (parking problems, crowding). In the case of the Ankara Castle, the emphasis on the "fascinating view" feeds positive emotions (74%), while the negativity (8%) is based on criticism of "lack of protection". As for the Museum of Anatolian Civilizations, the perception of "educational experience" stands out with 82% positive emotions, while the negativity (7%) is limited to lack of promotion and lack of interactivity.

The study aims to integrate the findings with interdisciplinary theoretical frameworks and position the research contribution in the academic literature in accordance with the principles of methodological transparency. Limitations of the study include the data collection period (01 January 2024-01 January 2025) not covering seasonal tourism fluctuations and platform-based algorithmic biases (Instagram's image-heavy filtering). The findings provide evidence of the symbiotic influence of visual and emotional elements in shaping the destination image of social media. However, the study is at risk of demographic and cultural bias due to the exclusion of youth-oriented platforms such as TikTok and the limitation of bilingual data. Future studies can overcome these limitations with multilingual data sets and neuro-tourism techniques (eye tracking).

CONCLUSIONS AND RECOMMENDATIONS

This study demonstrates that the conceptual expressions highlighted in the theoretical section—such as “methodological innovation,” “emotional structure mapping,” and “critical hermeneutics”—must be explicitly linked to practical applications to analyze social media-based destination image. The findings revealed the spatial, cultural, and emotional dimensions of digital representation and user interactions at Hamamönü, Ankara Castle, and the Museum of Anatolian Civilizations, illustrating how theoretical approaches can be translated into concrete tourism management strategies (Echtner & Ritchie, 2003; Stepchenkova & Zhan, 2013; Liu, 2012). In this context, recommendations such as infrastructure improvements, interactive museum content, and social media literacy programs not only address practical needs but also reinforce the theoretical framework in the context of digital public diplomacy and cultural heritage management. Thus, abstract concepts are directly integrated with findings and recommendations, providing a robust foundation for sustainable tourism strategies based on multidimensional analyses of social media-based destination image.

Theoretical Contributions

Public relations in tourism should be redefined as a multidimensional field that goes beyond mere promotion and marketing and includes power dynamics, ethical responsibilities and media interactions (L'Etang et al., 2007). This study examines the social media images of three prominent tourism destinations in Ankara, namely Hamamönü, Ankara Castle and Museum of Anatolian Civilizations, through visual content and sentiment analysis methods on platforms such as X (Twitter), Instagram and Facebook, and provides important findings on how destination image is shaped on digital platforms. The

research findings prove that the way destinations are represented on social media varies significantly in terms of both visual elements and user emotions. The study revealed that Hamamönü was identified with the theme of "cultural heritage" on social media, while Ankara Castle received negative criticism due to infrastructure problems. The museum, on the other hand, achieved high satisfaction with education-oriented content. These results support Echtner & Ritchie's (2003) thesis on the multidimensional nature of destination image.

The study examines how the visual elements used in the research convey the cultural and political messages of destinations and how these messages are perceived by the public. In the context of sentiment analysis, the linguistic and visual elements of media content can affect viewers' perception of places by evoking positive or negative emotional reactions. In the context of digital images, how content published on digital media platforms affects the digital image of places and how this effect is perceived by the public. From a destination image perspective, the role of PR strategies in building and strengthening the image of places is discussed. These strategic findings are similar to those of Page et al., 2023.

According to the research, Hamamönü has gained a "nostalgic" identity on social media with the themes of traditional architecture (62%) and local cuisine (23%). This agrees with the findings of Pan et al. (2007) that images emphasizing authenticity increase destination attractiveness. Although Ankara Castle stands out with its historical walls (45%) and panoramic views (32%), users 28% gave negative feedback due to infrastructure deficiencies (inadequate signage, lack of recreational facilities). This result supports Govers et al.'s (2007) criticism that social media simplifies the destination image and makes problems visible. The Museum of Anatolian Civilizations, on the other hand, created a perception of "education" and "professionalism" with content focused on archeological artifacts (78%) and a high positive sentiment rate (82%). This finding echoes Stepchenkova & Zhan's (2013) finding that DMOs tend to emphasize "informational" themes.

Echtner & Ritchie's (2003) cognitive-affective model was extended in this study by analyzing visual and textual data together. For example, negative feelings toward Ankara Castle epitomized how infrastructure problems undermined the destination image. The warm color palette of Hamamönü confirms Lo et al. 's (2011) thesis on the relationship between color psychology and destination personality. Similarly, the symmetrical compositions of the museum reflect Garrod's (2009) view that professional shots create a perception of "credibility". Analyses using Liu's (2012) methodology showed that high positive emotions (82%) in museum content are directly related to experience quality. This result supports Xiang et al.'s (2015) argument that emotion-analytic approaches are critical for service improvement.

In this respect, the study is in line with the current debates in the digital public relations literature on strategic content production, visual storytelling and multi-platform representations. The visual semiotics and NLP-based analysis of the representation of cultural heritage in digital media fulfills Cheng's (2018) call to examine longitudinal relationship structures in the context of destination image. Focusing on the

representation of user-generated content and modes of interaction, this study intersects with Allagui & Breslow's (2016) emphasis on digital storytelling and timing strategies by revealing how digital OPR (organization-public relationship) relationships are reconfigured in social media environments. Thus, it is shown that the digital image of cultural heritage sites is constructed not only through visual representations, but also through digital traces of public emotions and experiences.

In a comparative and interdisciplinary approach, comparative analysis of Ankara's cultural destination image with other Turkish cities (e.g. Istanbul, Nevsehir, Diyarbakir) or similar destinations on a global scale (e.g. Rome, Kyoto, Berlin) reveals the universal and local dynamics of cultural representations as well as the strategic leverage of destination branding not only for the tourism sector but also for increasing the export potential of national products and services. This can reveal the universal and local dynamics of cultural representations in the same way as Gnoth, 2002, who concludes that destination branding serves as a strategic lever not only for the tourism sector but also for increasing the export potential of national products and services, and that tourism and foreign trade should be considered in the context of an integrated brand strategy in line with the sustainable economic development goals of nations.

Furthermore, in line with Pink and colleagues (2016), who present digital ethnography not only as the observation of online content but also as a multifaceted methodology of how individuals make sense of their daily lives through digital technologies and conclude that digital ethnography, when supported by methods such as visual analysis, sentiment analysis and multi-platform tracking, can provide a powerful methodological framework for analyzing cultural representations, it may be possible to examine the user motivations behind social media data in depth with the addition of qualitative methods such as digital ethnography and participant observation. Comparing local and international tourists' perceptions of destination image in terms of visitor segmentation and cultural perception differences is critical for understanding the dynamics of cultural translation and global localization. For example, an analysis of the linguistic diversity of international visitor comments may reveal intercultural communication conflicts or adaptation strategies, or studies can be conducted in this sequence in the perspective of Reisinger & Turner, 2003, where they argue that cultural differences are determinant of the touristic experience and conclude that service design and destination marketing in the tourism sector should be shaped by intercultural understanding.

This study examines the social media representations of three cultural heritage sites in Ankara with a holistic approach using visual semiotics and NLP-based sentiment analysis to reveal the impact of digital transformation on destination image. In light of these findings, future research should focus on longitudinal analyses to better understand the temporal dynamics of digital public relations and social media representations of cultural heritage. In particular, a comparative analysis of the differences between the visual expression strategies and emotion coding of different social media platforms would provide important insights into how digital image-making processes are shaped on a platform-by-platform basis.

Moreover, the integration of artificial intelligence and Internet of Things technologies will increase the effectiveness of social media representations by enabling the personalization and real-time optimization of digital experiences of cultural heritage. In this context, the diversity of user emotions and semiotic elements revealed by our study provide a theoretical foundation for further research analyzing the multi-layered and multi-actor nature of digital publics. Comparative studies that take into account geographical and cultural contextual differences will contribute to the development of both universal and unique strategies in the image management of global tourism destinations. The blending of visual semiotics and NLP-based emotion analysis methods with psychological and sociocultural dimensions will allow for a more comprehensive understanding of the impact of emotional dispositions in social media on tourism destination perceptions and behaviors.

As in Higgins-Desbiolles' (2020) study on the disruption caused by the COVID-19 pandemic in the global tourism sector and concluding that the future of tourism should be considered not only with economic efficiency but also with social equality and environmental sustainability, the role of social media in shaping destination image for the relationship between sustainable tourism and digital representation should be addressed in the context of sustainable tourism policies. Especially in destinations at risk of overtourism (e.g. Ankara Castle), the impact of digital posts on physical space can be modeled quantitatively. The impact of seasonal, cultural, or political events (e.g. exhibition changes at the Museum of Anatolian Civilizations) on destination image can be monitored by extending the data collection period to examine temporal and spatial dynamics.

Moreover, mapping the spatial distribution of social media data with Geographic Information Systems (GIS) can visualize the relationship between tourist density and image formation. Garcia- Palomares et al., 2015, in their study, emphasized that the combination of social media and GIS data provides valuable information about the visitor density and popularity of tourist destinations and that this data has great potential not only for tourism research, but also for urban planning and local economy strategies, and also concluded that social media posts, especially with the influence of visual content, have created a new paradigm in the promotion of destinations and play an important role in shaping the tourist identity of cities. It will be possible to demonstrate that the integration of social media data and GIS, such as the work of the authors, provides a powerful tool for understanding the popularity, visitor density and spatial organization of tourist destinations and contributes to the development of a broader strategic perspective for urban planning. The integration of GIS and social media data is an important tool for spatial analysis of tourist destinations and understanding visitor density and image building processes. It reveals that such data contribute not only to tourism research but also to urban planning and local economic strategies. Images shared on social media platforms create a new paradigm in the promotion of destinations and shape the touristic identities of cities. With the effect of these images, the image of a destination spreads rapidly on a global scale, reinforcing the cultural and touristic perception of cities. The integration of social media and GIS makes it possible to analyze the popularity, visitor density and spatial layout of destinations in more depth.

These analyses offer important strategic implications for destination management and urban planning by visualizing tourists' preferences, length of stay and hotspots. This method also contributes to making decisions regarding the sustainable development goals of cities. Thus, this integration enables a more effective and strategic decision-making process in both tourism and urban planning. To tackle ethical and data privacy issues, ethical permissions and user privacy protocols for the use of social media data should be more rigorous. Integrating regulations such as the European General Data Protection Regulation into research design will ensure the legal compliance of academic studies. Voigt & Von dem Bussche, (2017), in their study providing a comprehensive guide on the European Union's General Data Protection Regulation (GDPR), emphasize that it is a very important step towards the protection of personal data and provides an important model for ensuring data security on a global level.

Within the scope of recommendations for future research, it is important to integrate deep learning-based visual semiotic models into social media analysis processes. In this context, as emphasized by LeCun et al., 2015, the scientific infrastructure of deep learning and its application capacity in different disciplines make it possible to analyze visual symbols more systematically and objectively. In particular, the high accuracy rate of models such as Convolutional Neural Networks in analyzing symbolic, aesthetic and compositional elements in visual content may contribute to increasing methodological diversity in visual semiotic analysis. On the other hand, the integration of NLP tools in text-based data analysis is becoming increasingly critical. Bidirectional transformer architectures, such as the BERT model developed by Devlin et al. (2018), have the potential to detect contextual layers of meaning, irony and implicit emotions in textual content with high accuracy. The use of such models in the context of sentiment analysis in social media content makes it possible to evaluate comments within deep context structures rather than superficially. Accordingly, holistic methodological designs that use deep learning and natural language processing-based approaches together will enable multidimensional analysis of cultural and emotional representations derived from social media data.

Future research should prioritize longitudinal analyses to gain a deeper understanding of the dynamic nature of social media representations of digital public relations and cultural heritage. With this approach, temporal changes in destination image and evolutionary processes in user behavior can be comprehensively revealed. In addition, the unique visual narratives, content production mechanisms and emotional coding of different social media platforms should be analyzed comparatively, so that platform-specific strategies can be developed to increase the effectiveness and interactivity of digital public relations. The integration of artificial intelligence and the Internet of Things, enabled by technological advances, opens new research horizons for the digital transformation of cultural heritage, enabling the personalization and real-time optimization of visitor experiences. In addition, studies that take into account the multi-actor and multi-layered nature of digital publics and comprehensively analyze trust dynamics will contribute to filling existing theoretical gaps in organization-public relations. Comparative studies that take into account the diversity of geographical and cultural contexts are critical for balancing cultural specificity and universality in global tourism communication. In this context, the development of mixed methods that go beyond NLP techniques and include psychological and

sociocultural dimensions will enable a deeper understanding of the impact of emotional tendencies that emerge in social media content on perceptions and behaviors towards tourism destinations.

Furthermore, in future studies, the synergistic use of qualitative and quantitative methods can provide more holistic and in-depth analyses of the social media image of tourism destinations, as Creswell & Creswell (2023) emphasize that understanding the basic principles and methods of research design is the cornerstone of conducting effective and valid research. Each of qualitative, quantitative and mixed methods should be appropriately selected according to specific research questions and objectives. It is concluded that mixed methods can provide more comprehensive results by combining the advantages of both methods. This integration not only enhances data validity through methodological triangulation, but also provides theoretical contribution in analyzing the multi-layered dynamics of social media. The research design includes not only data collection and analysis but also ethics, reliability and validity.

Practical Contributions

Infrastructure improvements (signage, rest areas) should be urgently implemented in Ankara Castle, and this process should be shared transparently on social media. Visual content should emphasize the versatility of the destination, with more posts on events (e.g. open-air concerts) and historical fortifications. The Museum of Anatolian Civilizations should develop interactive content such as augmented reality applications and virtual tours to attract the younger generation. In Hamamönü, trainings should be organized to increase the social media literacy of local artisans, and handicraft workshops should be promoted through live broadcasts.

Limitations and Methodological Considerations

The findings of this study must be evaluated within the context of the selected methodological approach and data collection strategy. The most significant limitation concerns the demographic representativeness resulting from platform selection. The exclusive focus on X, Instagram, and Facebook systematically excluded content from platforms popular among younger demographics, particularly TikTok and Snapchat. Consequently, the findings potentially present an incomplete picture of destination perceptions among Generations Z and Y, limiting the demographic validity of the results.

The language-based restriction presents a more profound methodological concern. The analysis exclusively incorporating Turkish and English comments led to the systematic exclusion of experiences from Asian (particularly Chinese, Japanese, and Korean) and Arab tourists visiting Ankara. This cultural limitation significantly restricts the cross-cultural analysis of destination image. Given the prevalence of indirect criticism expression in many East Asian cultures (Schuckert et al., 2015), the omission of these cultural perspectives potentially resulted in an underreporting of negative feedback.

The restriction of the data collection period to one year limited the ability to fully capture seasonal fluctuations. The inability to conduct a long-term analysis of the effects of cultural events and tourism seasons on destination image constrains the temporal validity of the findings. Furthermore, changes in

platform algorithms' content distribution policies and agenda-driven content prioritization may have influenced the natural composition of the dataset.

Finally, the qualitative-dominant mixed-methods design of this study prioritizes contextual understanding over statistical generalizability. While the findings provide in-depth insights within the context of Ankara's cultural destinations, they cannot be directly generalized to other destination types or different geographical contexts. This limitation simultaneously underscores the importance of comparative studies for future research.

In light of these methodological constraints, the findings should be interpreted with caution. The underrepresentation of younger demographics and specific cultural groups limits a holistic understanding of the destination image. However, these limitations also highlight the necessity for multi-lingual and multi-platform approaches in social media-based destination image research. Future studies would benefit from incorporating a wider array of platforms and languages to enhance the comprehensiveness and cross-cultural validity of findings. Additionally, longitudinal designs tracking seasonal variations and algorithmic impacts would strengthen the robustness of this research domain.

Recommendations for Future Research

Future studies should focus on longitudinal analyses to better understand the temporal dynamics of social media representations. Comparative analysis of differences in visual expression strategies and emotion coding across different social media platforms will provide important insights into how digital image-making processes are shaped on a platform-by-platform basis.

Neuro-tourism techniques (such as eye tracking) can be used to measure users' immediate responses to images. AI-based sentiment analysis models (such as BERT) can be used to identify cultural context-sensitive micro-emotions (nostalgia, admiration).

A comparative analysis of Ankara's cultural destination image with other Turkish cities (Istanbul, Nevşehir, Diyarbakır) or similar destinations on a global scale (Rome, Kyoto, Berlin) will reveal the universal and local dynamics of cultural representations. Comparing local and international tourists' perceptions of destination image in terms of visitor segmentation and cultural perception differences is crucial for understanding cultural translation and glocalization dynamics.

Regarding the relationship between sustainable tourism and digital representation, the role of social media in shaping destination image should be addressed in the context of sustainable tourism policies. In destinations at risk of overtourism (such as Ankara Castle), the impact of digital posts on physical space can be modeled quantitatively.

The synergistic use of qualitative and quantitative methods will enable more holistic and in-depth analysis of tourism destinations' social media image. As emphasized by Creswell & Creswell (2023), mixed methods can provide more comprehensive results by combining the advantages of both methods.

This integration not only enhances data validity through methodological triangulation but also provides theoretical contribution in analyzing the multi-layered dynamics of social media.

Beyond local management, these findings provide a strategic foundation for enhancing Turkey's digital public diplomacy through authentic cultural narratives. By leveraging the high positive sentiment found in museum interactions and the nostalgic appeal of districts like Hamamönü, national tourism authorities can counter generic digital stereotypes with data-driven, culturally resonant storytelling.

Funding Declaration

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declarations

Funding Declaration: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Author Contribution

A wrote the main text, B conducted the analyses together with A, and C and D prepared the figures. A and D performed language and literature review. All authors reviewed the article.

Data Availability

The data used in this study consist of publicly available social media posts related to cultural heritage. The dataset was collected in accordance with the terms of service and ethical research standards of the respective platforms. Due to platform policies and ethical considerations regarding user privacy, the raw dataset cannot be publicly shared. Aggregated data and analytical procedures are available from the corresponding author upon reasonable request.

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Tables

Table 1 to 11 are available in the Supplementary Files section.

Supplementary Files

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