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## Article

# Exploring the Tourist Experience of the Majorelle Garden Using VADER-Based Sentiment Analysis and the Latent Dirichlet Allocation Algorithm: The Case of TripAdvisor Reviews

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**Abstract:** The allure of urban green spaces has captured the attention of researchers, especially in regions abundant in botanical wonders worldwide. Surprisingly, the case of Morocco, a country with a strong botanical tradition, has received little attention from researchers. Here, we explore the unique case of the emblematic “Majorelle Garden” in Marrakech, southern Morocco, through the reviews of its many visitors posted on the TripAdvisor platform. This article looks at the question “to what extent can a garden—such as the Majorelle—be a major attraction in a cultural tourist destination?”. Methodologically, we adopted a quantitative approach, examining visitors’ sentiments using the VADER tool from 2006 to 2023, and classifying them into three categories: negative, neutral, and positive. Furthermore, by utilizing LDA (latent dirichlet allocation), we uncover key topics running through visitors’ experiences. Our findings show that positive sentiments prevail, given the culturo-historical and symbolic quality of the garden as a crucible and vector of creativity, with the emergence of sub-corpus that highlight certain divergences and convergences around the “Majorelle” case. This insight supports sustainability efforts by empowering the managers of the garden studied and industry professionals to develop and implement relevant strategies for managing and marketing the garden tourism attraction experience. In addition, this case study shows how a private urban garden reveals its key role in preserving cultural and botanical heritage, essential for future generations. It shows the garden’s positive impact on sustainable tourism through its ability to attract cultural visitors who appreciate and respect the local environment.

**Keywords:** tourist experience; Majorelle Garden; private urban garden; garden tourism attractions; Marrakech; VADER-based sentiment analysis; latent dirichlet allocation; natural language processing; TripAdvisor reviews



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## 1. Introduction

In the urban tourism experience, gardens and green spaces are thematics that are emerging as major attractions in some destinations [1,2]. The role of these spaces in visitors’ well-being and their perception of the urban environment is a recurring theme [3].

Generally speaking, the tourist experience involves sensory and emotional engagement, to a greater or lesser extent, on the part of the tourist with the tourist destination [4]. In the case of themed gardens and public green spaces, particularly after the COVID-19

pandemic, visitors expressed positive emotions towards green spaces, indicating a shift in preferences towards exploring the less-visited areas of the hinterland, offering insights for urban planners and tourism operators [5]. Other research explores how visitors interact with these natural and urban spaces, examining the factors that influence their experience, such as environmental features, seasonality, and the ethnic and artistic aspects of these spaces [6].

This research aims to investigate a particular case in a city emblematic of tourism as well as a garden, a major tourist attraction. This is the Majorelle Garden, created in 1931 by the French Orientalist artist Jacques Majorelle, which covers 8000 square meters and reflects the traditional Moroccan style, with its use of bright colors, geometric patterns, and a mix of 300 plant species from five continents. It is now owned by the Fondation Yves Saint Laurent et Pierre Bergé. The Majorelle Garden is also home to the Yves Saint Laurent Museum and the Museum of Berber Arts, featuring a vast collection of over 600 objects divided into four themes [7].

However, the question remains: “to what extent can a garden be a major attraction in a cultural tourist destination?”. In fact, according to historical texts dating back to the Middle Ages, Marrakech, or the “Garden City”, is viscerally linked to its ubiquitous gardens, which house both stately residences and ordinary homes in the medina. Marrakech, before it was a city, was the name of a continuous, open, shared garden covering 16,000 hectares at the foot of the Atlas Mountains, where nourishing trees—palms, olives, oranges, and almonds—grew, green grass for the herds, fruit and vegetables to feed an entire region and beyond, for all those who stopped here on the Trans-Saharan trade route. Marrakech is one of Morocco’s great cities, which has developed along the classic lines of the garden city [8,9]. It is world-renowned for the density, diversity, and richness of its vegetation, which boasts a variety of species and garden diversity despite its semi-arid climate due to its geographical position in the interior of the country.

In Marrakech’s upscale districts, close to tourist sites, the presence of urban green spaces combines harmoniously with lush private gardens [10]. Among them, the Majorelle Garden in Marrakech, though small, offers a haven of peace in the heart of urban bustle, and its fame extends far beyond Morocco’s borders [11].

In this vein, this article proposes an innovative approach to the study of the tourist experience at Majorelle Garden. Using sentiment analysis applied to a corpus of tourist reviews, drawn from TripAdvisor over an 18-year period from 2006 to 2023, we explore visitors’ sentiments in depth. This provides an in-depth understanding of the tourist experience at this historic and cultural site. This method, centered on actual visitor data, allows us to explore the complex dynamics between the garden environment and the tourist experience, an approach newly adopted in tourism studies. Furthermore, this research has the potential to have a direct impact on the management and marketing strategy of Majorelle Garden. By analyzing the experiences expressed by visitors, we can identify key trends and insights into what enhances or, conversely, could be improved. The findings of this study are crucial to optimizing the visitor experience, guaranteeing the garden’s sustainability and ensuring its international tourist appeal.

To this end, we propose the following dual research question: “How is the Majorelle Garden experience described by its visitors on TripAdvisor? What sentiments predominate during and after their visit to the garden?”

In terms of the organization of this article, we will begin with a review of the academic literature on urban gardens, focusing particularly on the content analysis of social platforms specialized in tourism, such as TripAdvisor. Next, we will present a synthesis of previous work on this topic, followed by an explanation of the methodology used, a presentation of the findings, then a discussion, and finally the elaboration of conclusions including the limitations and implications of the research.

## 2. From a Literature Review to Related Studies

This second part presents a conceptual review of the touristic experience and its evolution, its components, and its discursive appropriations by social networks such as TripAdvisor. A synthesis of the literature and work on the tourist review through/on urban gardens will also be presented.

### 2.1. *Urban Gardens: From a Centuries-Old Tradition to a Tourist Attraction*

Tourism is seen as the sum total of phenomena and relationships that result from interactions between tourists, suppliers, governments, and host communities [12]. Considered a pioneering example of the experience economy [13], it is closely linked to the various experiences that places can offer, whether in terms of visiting, learning, researching, feeling, or immersion, as indicated in the study by Bagheri et al. [14] and Safaa et al. [15]. In addition, Yahaya and Mohd [16] highlight the central role of gardens in leisure and tourism activities. These green spaces, according to Athanasiadou [17], clearly illustrate the harmonious relationship between man and nature, underlining the magnificence of this interaction.

Gardens provide a refuge from crowds, work, and technological stress, where people can relax and unwind with family and friends. A space such as a garden could also be a mine of mentally and emotionally restorative activities, of great importance for improving quality of life, self-awareness, spiritual satisfaction, learning, and its transfer to other areas of life in general [18]. Tourists visiting gardens participate in the economic dynamics of local populations and contribute to cultural identity and sustainable regional development [19]. The upgrading of green spaces, intrinsically linked to the enhancement of natural heritage, is seen as a restorative element that will become embedded in the human experience through place, culture, and historical context [20].

Gardens are frequently regarded as restorative spaces, attracting people who visit them primarily for their restorative value alone. Even short periods spent in a restorative environment can have significant effects on both cognitive ability and quality of life [21]. A unique feature of gardens, unlike commercial or private enterprises, is that the visitor experience is determined by the visitor rather than the operator [22]. Regular visitors tend to seek a sense of renewal and a soothing spiritual environment [23]. This awareness helps garden developers and managers to proactively create and manage desirable visitor experiences [24].

Garden visits often take place at a slow, nonchalant pace, which leads us to engage in a sensory ontology, in this case, the touch, and even the taste and smell of the natural world and cultural landscape [25]. These slow-paced visits make it possible to savor the time [26] when the traveler will intuitively seek out enriching experiences by drawing inspiration from it and regaining positive attitudes and state of mind [27]. All this proves that the quality of the garden tour experience is not a matter of speed. Indeed, gardens illustrate a clear example of the human–nature relationship in all its splendor [17]. In this sense, the emergence of new forms of sustainable tourism focused on visits to urban green spaces, such as rivers, valleys and caves, nursery sites, geological features, engravings, etc. These areas are generally quite precarious and suffer from the stress of recreational activities and the massive influx of visitors [28]. Thus, tourists visiting gardens participate in the economic dynamics of local populations and contribute to cultural identity and sustainable regional development [19,29,30].

Visits to gardens and urban green spaces often take place at a slow, leisurely pace, fostering a more human and environmentally friendly experience. This approach also emphasizes a city's natural landscapes, as well as its traditional features, uniqueness, and authenticity [31,32]. This new perspective for visitors looks promising: reduced noise and traffic, the democratization of green landscapes, improved quality of life, support for local agriculture and commerce, the adoption of environmentally friendly technologies, the preservation of local esthetic and culinary traditions, the promotion of a spirit of hospitality

and good neighborliness, and so on [33–35]. This unquestionably benefits residents and tourists, as well as the environment and the region in which these towns are located.

## 2.2. Sentiment Analysis of Online Tourist Reviews

For tourists, the tourist experience of an urban destination is made up of both good and bad surprises. But some things lie on the borderline between success and failure, and it is ultimately very difficult to differentiate between the two types of experience. In reality, success or failure often comes down to a few things: sentiment.

User-generated content on destinations and tourism experiences is a means of influencing tourist choices [36–39] in the face of an overwhelming abundance of opinions that can sometimes lead to confusion and suboptimal decisions [40,41]. These users rely on the social proof heuristic by evaluating the negativity and positivity of aggregated opinions, or the so-called valence, based on the experiences of the evaluators [42,43]. In the context of tourism, the terms “positive” and “negative” can generally refer to “satisfied” and “dissatisfied” [44]. In more depth, sentiment polarity detection involves classifying opinions into semantic classes, such as positive, negative, or neutral, or into other emotion classes (anger, sadness, joy, and surprise) [45]. On TripAdvisor, reviews contain a great deal of information [46], but the platform preserves its reputation by policing the system against false reviews [47], enforcing professional email addresses or issuing zero-tolerance warnings for spam in the hope of deploying credibility and veracity to the tourists’ reported experiences.

Posted complaints represent negative reviews, occurring when expectations have been violated by incompetence, inefficiency, irresponsible attitudes, tactics or strategies, or substandard products [48]. To avoid potential travel risks, tourists often gravitate towards negative reviews [47], as the more considerable the attributes discussed in the negative review, the more useful advice they can infer preventing the risk of choice failure [49]. Indeed, people have a stronger tendency to avoid losses than to seek gains [50] but also to decide based on negative opinions because they are more credible, useful, diagnostic, informative, persuasive, trustworthy, and valuable than positive opinions [51].

Shared compliments are positive reviews issued by all the tourists when they are satisfied with an experience [52], as they are considered a powerful tool to effectively promote offers and improve brand recall [48]. Positive reviews are essential when users consider products and services for hedonic consumption [53], as they not only provide informational value for decision making but also give them pleasure and amusement by reading about the experiences of others [54].

## 2.3. Mapping Empirical Explorations of Gardens and Green Spaces on Tripadvisor

This paper proposes an innovative approach to studying the tourist experience at Majorelle Garden using sentiment analysis and topic modeling via latent Dirichlet allocation (LDA) applied to a corpus of tourist reviews drawn from TripAdvisor over 18 years from 2006 to 2023. This methodology, centered on real visitor data, enables us to explore their feelings in depth, thus providing an in-depth understanding of the tourist experience at the Majorelle Garden.

Furthermore, an emerging trend in tourism studies is being followed in our approach, where a visitor data-driven method is adopted to explore the complexity of the relationship between the garden environment and the tourist experience. Innovatively, this approach, while new to the field, draws on previous work that has used similar methods in a variety of contexts, including urban green spaces, national parks, theme parks, and historic sites.

Indeed, reviewing previous work, it was found that an ARIMA model was developed by Yang et al. [55] to analyze the seasonal use of urban green spaces in Okinawa, highlighting the influence of climatic factors and the notable impact of the COVID-19 pandemic. The results of the study showed a marked drop in visitor enthusiasm for these spaces during the pandemic, suggesting that COVID-19-related restrictions significantly

reduced park attendance. Similarly, in a study by Yang [5], changes in tourist use and experiences in 40 urban green spaces in the city of Ishigaki during the pandemic were analyzed using Pearson correlation tests and text-mining methods. These analyses revealed a significant drop in the use of green spaces during periods of health restrictions, accompanied by a shift in tourist experiences as visitors sought quieter, more secluded experiences. In addition, the study highlighted an increase in the use of small local parks compared to large urban parks, suggesting a preference for less-frequented spaces during the pandemic.

Nonetheless, Huai and Van de Voorde [6] make an important contribution to understanding the perceptions of urban parks in China and Belgium using advanced natural language processing techniques to analyze online reviews from 2015 to 2020. This research identified 15 clusters of environmental features influencing the positive and negative perceptions of parks. Among these features, it was found that water features and colors are perceived positively in Shanghai, while tranquility and crowds are appreciated in Brussels. Furthermore, this study showed that visitation, surprisingly, also had a positive impact on perceptions in Brussels, which could indicate potential use conflicts between different user groups in urban parks. In parallel, Sergiacomi et al. [56] studied the reviews of visitors to Plitvice Lakes National Park in Croatia, identifying the main topics of interest and strengths/weaknesses on the basis of positive and negative sentiment. The analysis revealed that visitors particularly appreciate the natural landscapes and the management of itineraries, while expressing concerns about overcrowding and waste management. The park's strengths are its natural beauty and well-maintained landscapes, while the weaknesses highlighted mainly concern accessibility and crowd management during peak periods.

Viewing it from another perspective, Ghahramani, Galle, and Duarte et al. [57] analyzed citizens' reviews on urban green spaces in Ireland using artificial intelligence techniques for text processing. They found that citizens' reviews were overwhelmingly positive, highlighting the importance of green spaces for urban well-being. The analysis revealed that green spaces are highly valued for their ecological and recreational contributions, and participants expressed an increased need to maintain and improve these areas to foster a better quality of life in urban areas. Moreover, in their other study, Ghahramani, Galle, and Ratti et al. [58] applied topic modeling to examine online reviews about green spaces in Dublin. This analysis identified specific topics related to the perception of green spaces, such as their natural beauty, maintenance, and importance as places for relaxation and social gatherings. The results showed a general appreciation of current park management, but also suggestions for improving accessibility and facilities, indicating a clear need for targeted action to optimize these green spaces in line with citizens' expectations.

The investigation by Bornarel et al. [59] into the experiences of travelers visiting the Verdun battlefield in France revealed significant differences in the way tourists report their experiences according to the different battlefield sub-sites, such as memorials, forts, and trenches. By analyzing online reviews posted on TripAdvisor, the study identified salient relational and emotional dimensions in visitors' experiences. The results suggest that the degree of the obscurity of the site and its level of commercialization influence these dimensions by generating or not a deep empathic relationship. Despite the time that has elapsed since the First World War, the emotional dimension of the experience remains intense thanks to the preservation of the site's dark attributes.

Nevertheless, Albayrak et al. [60] explored the competitive positions of two theme parks in Hong Kong: Ocean Park (HKOP) and Disneyland Hong Kong (HKDL). Using a big data approach and online comment analysis, this study identified the strengths and weaknesses of Hong Kong's Ocean Park using performance analyses such as Importance Performance Analysis (IPA) and Asymmetric Impact Performance Analysis (AIPA). The results revealed that urgent action was needed on staff attributes, fast passes, catering, and pricing, as these are key elements with poor performance. To refine the analysis of

HKOP's competitive position in relation to HKDL, comparative analyses such as Competitor Performance Importance Analysis (CPIA) and Asymmetric Competitor Impact Analysis (ACIA) were carried out. The IPCA highlighted shows the time spent in the park and weather-related attributes as the strengths of HKOP over HKDL. However, the IPCA indicated that urgent action was needed to improve aspects relating to childcare, waiting times, catering and pricing, staffing, and accessibility. Similarly, Song et al. [61] examined the perceived qualities and experiences of urban public spaces, focusing specifically on Bryant Park in New York using natural language processing techniques, including topic modeling. The results of the study identified five main themes representing different experiences and characteristics of Bryant Park: amenities, vacationer's favorite place, summer vacationer's favorite place, place to relax, and overall experience. These themes highlight how visitors perceive the park through a variety of activities, from relaxation to specific seasonal events.

On the other hand, Ma and Jiang [62] analyzed the visitor reviews of urban parks in China from a variety of platforms, including Weibo, ctrip, TripAdvisor, Baidu, mafengwo, dianping, qunar, ly, and tuniu. They used text-mining techniques to identify key park attributes that influence visitors' behavioral intentions. The results revealed several important dimensions that affect visitors' experience of urban parks. The themes identified by the analysis include environmental quality, accessibility, facilities, and activities available. The study also highlighted the variability of visitor preferences and behaviors according to China's different cultural and regional characteristics. In the study by Niezgoda and Nowacki [63], visitor experiences in Poland's Tatra National Park were analyzed using the reviews posted on TripAdvisor. This research uncovered how tourists perceive their interaction with this protected natural area, shedding particular light on their physical involvement and the tensions caused by overcrowding. The results show that visitor experiences are predominantly marked by high levels of physical activity, with tourists actively seeking out experiences of hiking and intense physical exploration, reflecting a growing trend to seek health and regeneration in natural environments. However, a small proportion of reviews express a deep connection with nature, indicating that ecological engagement is not the primary motivation of most visitors. In addition, the sense of tension caused by outdated carrying capacity was frequently mentioned, underlining the challenges of managing tourist flows in crowded natural areas.

Prakash et al. [64] focused on the causes of visitor dissatisfaction in Sri Lanka's national parks by examining comments on TripAdvisor. She revealed that visitors' main concerns related primarily to park management, including overcrowding and heavy traffic inside the parks, as well as misconduct by safari organizers. Nearly 75% of the negative reviews related to park management, including entry fees deemed unreasonable, the poor implementation of visitor policies, and park management's lack of consideration for the environment and wildlife. Furthermore, Catahan and Woodruffe-Burton [65] explored the perceptions of botanical gardens in the United Kingdom by analyzing online reviews on TripAdvisor. Using content analysis, they identified key strengths and areas for development for two specific botanical gardens. The results revealed that in contrast to the scientific, conservation, exhibition, and educational mission of botanical gardens, visitors focus primarily on esthetic aspects, facilities, and services. These observations highlight the mismatch between garden objectives and visitor expectations, and underscore the need for garden managers to better communicate their core objectives while meeting visitors' desires and needs for enjoyable and enriching experiences.

In summary, Table 1 presents an overview of previously discussed studies on green spaces and gardens based on comments from TripAdvisor visitors. This mapping positions our study in line with the work carried out in this field in recent years, while also providing an overview of the practical implications already suggested.

**Table 1.** Summary of previous studies on the tourist reviews of gardens and green spaces in the context of TripAdvisor.

Authors	Research Purpose	Fieldwork	Reviews	Applied Methodology	Practical Implications
Yang et al. [55]	Analyze how the use of urban green spaces in Okinawa varies seasonally and how it has been affected by the COVID-19 pandemic.	Japan	19,475	The development of an integrated autoregressive moving-average model (ARIMA)	Contribute to local managers' ability to better plan and allocate resources according to tourist seasons and pandemic conditions.
Yang [5]	Analyze changes in the use and experience of urban green spaces for tourism in Ishigaki City, Okinawa, before and during the COVID-19 pandemic.	Japan	5569	Pearson correlation tests and text-mining approaches	Helping urban planners and tourism operators to draw up crisis response strategies and guide the sustainable development of urban tourist areas.
Huai and Van de Voorde [6]	Evaluating the perception of urban parks and understanding the links between the environmental characteristics of these parks and visitors' perceptions of them.	China Belgium	21,462 28,398	Combining sentiment analysis and word2vec models	Help Park managers adapt park features to local preferences to improve visitor satisfaction.
Sergiacomi et al. [56]	Analyze visitor judgments from Plitvice Lakes National Park in Croatia to identify the park's strengths and weaknesses.	Croatia	15,673	A combination of multidimensional scaling, sentiment analysis, and natural language processing approaches	Provide the managers of UNESCO World Heritage-listed national parks with an understanding of the aspects most appreciated and the problems perceived by visitors
Ghahramani, Galle, Duarte et al. [57]	A quality assessment of St Stephen's Green garden square and public park.	Ireland	16,613	Supervised text classification using natural language processing (NLP)	Supply local authorities and stakeholders with an innovative and effective method for assessing the quality of green spaces
Ghahramani, Galle, Ratti et al. [58]	Exploring the features of urban green space in Dublin.	Ireland	16,613	Thematic modeling using latent Dirichlet allocation (LDA)	Inform local authorities and planners about how green spaces are perceived by the public, enabling a more informed and targeted planning of future investment in these areas.
Bornarel et al. [59]	Analyze how tourists experience and describe their visit to the various sub-sites of the Verdun battlefield landscape in different ways.	France	1581	A structural analysis of thematic meaning and textual analysis of emotions	Help managers understand how to enhance the authenticity and emotional engagement of historic green sites, ensuring that visitors leave with a deep and respectful understanding of history.



Table 1. Cont.

Authors	Research Purpose	Fieldwork	Reviews	Applied Methodology	Practical Implications
Albayrak et al. [60]	The assessment of the competitiveness of Hong Kong's Ocean Park compared with its competitor Disneyland.	China	13,398	Latent Dirichlet allocation (LDA) and sentiment analysis	Assist Ocean Park's management in developing an understanding of its strengths and weaknesses relative to its competitors, enabling it to develop a targeted strategy to improve the customer experience and strengthen its market position.
Song et al. [61]	Analyze perceived quality and visitor experiences at Bryant Park, New York.	United States	11,419	Latent Dirichlet allocation (LDA), natural language processing, and machine learning techniques	Assist the managers and designers of Bryant Park to improve their management, planning, and configuration, making them more attractive and functional.
Ma and Jiang [62]	The identification of the attributes of a popular urban park and the examination of their specific role in shaping visitors' behavioral intentions.	China	2435	The construction of a structural equation model combining natural language processing techniques and psychometrics with exploratory and confirmatory factor analysis	Provide urban park managers with analytical facilities enabling them to better understand visitor preferences and adapt services to improve satisfaction and increase repeat visits.
Niezgoda and Nowacki [63]	Analyze the experiences of tourists visiting one of Poland's most visited protected areas, the Tatra National Park.	Poland	624	Mixed quantitative (Text mining and co-occurrence network analysis) and qualitative (narratives research) methods	Assist Tatra National Park in adopting strategies to enhance the visitor experience while managing the park's carrying capacity to reduce stress and enrich the experience of contact with nature.
Prakash et al. [64]	Identifying the main causes of visitor dissatisfaction with their tourism experiences in five popular national parks.	Sri Lanka	206	Mixed methods	Provide information to protected area managers to enable them to adopt measures to improve visitor experience, reduce congestion, and adapt pricing strategies to increase visitor satisfaction and promote sustainable tourism.
Catahan and Woodruffe-Burton [65]	Exploring the perceptions of botanical garden visitors.	United Kingdom	582	Qualitative methodology combining manual and automated text analysis	Help botanical garden planners understand and manage visitor expectations so as to better align public perceptions with the gardens' core missions of conservation, education, and scientific research.

### 3. Materials and Methods

#### 3.1. Case Study

The Majorelle Garden is associated with the story of its founder, French Orientalist painter Jacques Majorelle, born in Nancy on 7 March 1886. The garden at his villa in Marrakech became known as the Majorelle Garden [66]. Today, the garden is the property of the Yves Saint Laurent and Pierre Bergé Foundation. The Majorelle Garden is also home to the Yves Saint Laurent Museum and the Museum of Berber Arts, which boasts a vast collection of over 600 objects divided into 4 themes: initiation to the Berber world, tangible and intangible know-how, ornaments and jewelry illustrating the beliefs and knowledge accumulated over the millennia, and finally, the pomp and pageantry of costumes, weapons, weavings, and decorated house doors (Figure 1) [7].



**Figure 1.** Presentation of the Berber Museum on the garden's tourist brochure.

Marrakech's Majorelle Garden ranks as the second most beautiful garden in the world, after Gardens by the Bay (Singapore), according to the data collected by Housefresh in 2021. The survey results are based on the number of times the word "beautiful" appeared in comments posted by tourists on TripAdvisor. France's Luxembourg Gardens came third, followed by the Bellagio Conservatory & Botanical Garden (USA) [67]. The Majorelle Garden, which today employs 200 people [68], is Morocco's most visited tourist attraction, receiving

over 900,000 visitors every year. In 2011, the garden was awarded the “Maisons des Illustres” label [69], and due to the high demand for visits, tours are managed by online booking, being content to welcome a precise number of visitors each day given the limited space of the entire garden [70]. Marrakech’s emblematic Majorelle Garden is a perfect illustration of the city’s evolution, combining esthetics and cultural heritage [71]. The Majorelle Garden is the most emblematic example of this trend in the city over the years. The success of this garden lies in its ability to stand out for its esthetic and ornamental function, which meets the expectations of international tourists in search of the exotic and oriental. In 2023, the year the Majorelle Garden celebrated its 100th anniversary, it was also ranked first among tourist attractions in Marrakech, Morocco, and Africa on TripAdvisor. Marrakech’s garden sector encompasses a diverse group of attractions, each distinguished by its ethno-historical, artistic, and cultural attributes. For example, private gardens can form the main or secondary part of an attraction, or be a cultural attraction in their own right. The Majorelle Garden is an example of this diversity, housing the Berber Arts Museum and offering a variety of services to enrich visitors’ experience, as shown in Figure 2.



Figure 2. Detailed map of the Majorelle Garden since 2014.

### 3.2. Data Preparation Process

The first step was to extract data from the Jardin Majorelle TripAdvisor page on 5 December 2023. In this experiment, each TripAdvisor page, whether for an attraction or a green space such as Majorelle Garden, follows a standard format. This format includes several sections such as Overview, More Exciting Ways to Experience, Reviews, Nearby, Questions and Answers, and FAQ. The focus section is where users post their reviews of the garden. Each review consists of the following elements:

- **User name**—reviewer’s name;
- **User location**—reviewer’s location;
- **User information**—the user’s level, the date he joined the community, the number of helpful votes, and review distribution;
- **Bubble rating**—score given by the user to determine his level of satisfaction;
- **Review title**—title of the review;
- **Review date**—review detailed time;
- **Date of experience**—user’s experience date;
- **The review**—the main text of the review.

All the English-only reviews were included in our study, from the first published on 4 June 2006 to 4 December 2023, and were collected. For data collection, Python was used with the “Requests” and “BeautifulSoup” libraries. The “Requests” library was used to send HTTP requests to retrieve HTML pages from TripAdvisor. The “BeautifulSoup” library then analyzed and extracted the relevant information from the HTML content. This dual approach streamlined the automation of TripAdvisor data extraction, making it easy to extract and store 20,461 reviews in a CSV file for later analysis.

The second step consisted of the adoption of a pre-processing process carried out by natural language processing (NLP) comprising six main steps as follows:

- **Normalization**—This allows all the words to be treated uniformly, because in NLP, upper and lower case are generally treated differently;
- **The removal of emojis and non-alphanumeric characters**—This includes the removal of punctuation, as these elements can interfere with text analysis by introducing noise;
- **Lemmatization**—This is a linguistic process that reduces words to their basic form;
- **Tokenization**—This involves dividing text into words or “tokens”;
- **The removal of empty words**—Empty words are very common words in a language, such as “the”, “and”, “in”, “is”, and “at”, which are generally removed because they are not very informative;
- **Remove duplicates**—Following the previous steps, we removed 1776 duplicates. After careful checking of the uniqueness of the reviews according to several criteria such as “Username”, “User location”, “Review date”, and “Date of experience”, we discovered that many users had submitted the same review several times on the same day, either intentionally or by mistake. This created a snowball effect over a long year of a significant number of duplicates.

Data pre-processing generated a filtered corpus comprising a total of 18,865 reviews. The distribution of these reviews over the years is clearly illustrated in Figure 3.

This figure clearly illustrates the evolution of tourist opinions from 2006 to 2023. There is a gradual increase in reviews between 2012 and 2019, with a notable peak in 2016. This period of high tourist activity can be attributed to the garden’s growing popularity and greater visibility on the TripAdvisor platform. However, from 2020 onwards, reviews drop dramatically, reflecting the impact of the COVID-19 pandemic on global tourism. In 2021 and 2022, the number of reviews remains low, indicating a slow recovery. In 2023, a slight increase in reviews is perceptible, suggesting the start of a recovery in tourism.

The third step is to convert our texts into numerical form using two techniques: Term Frequency (TF) and Term Frequency-Inverse of Document Frequency (TF-IDF). TF counts the number of occurrences of a term in a document. IDF measures the importance of a term. By combining TF and IDF, the TF-IDF score, representing the importance of a word in a

corpus document, is obtained [72]. The TF-IDF score for word  $i$  in document  $j$  is defined by the following equation:

$$\text{TF-IDF}(i, j) = \text{tf}(i, j) \cdot \text{idf}(i) \quad (1)$$

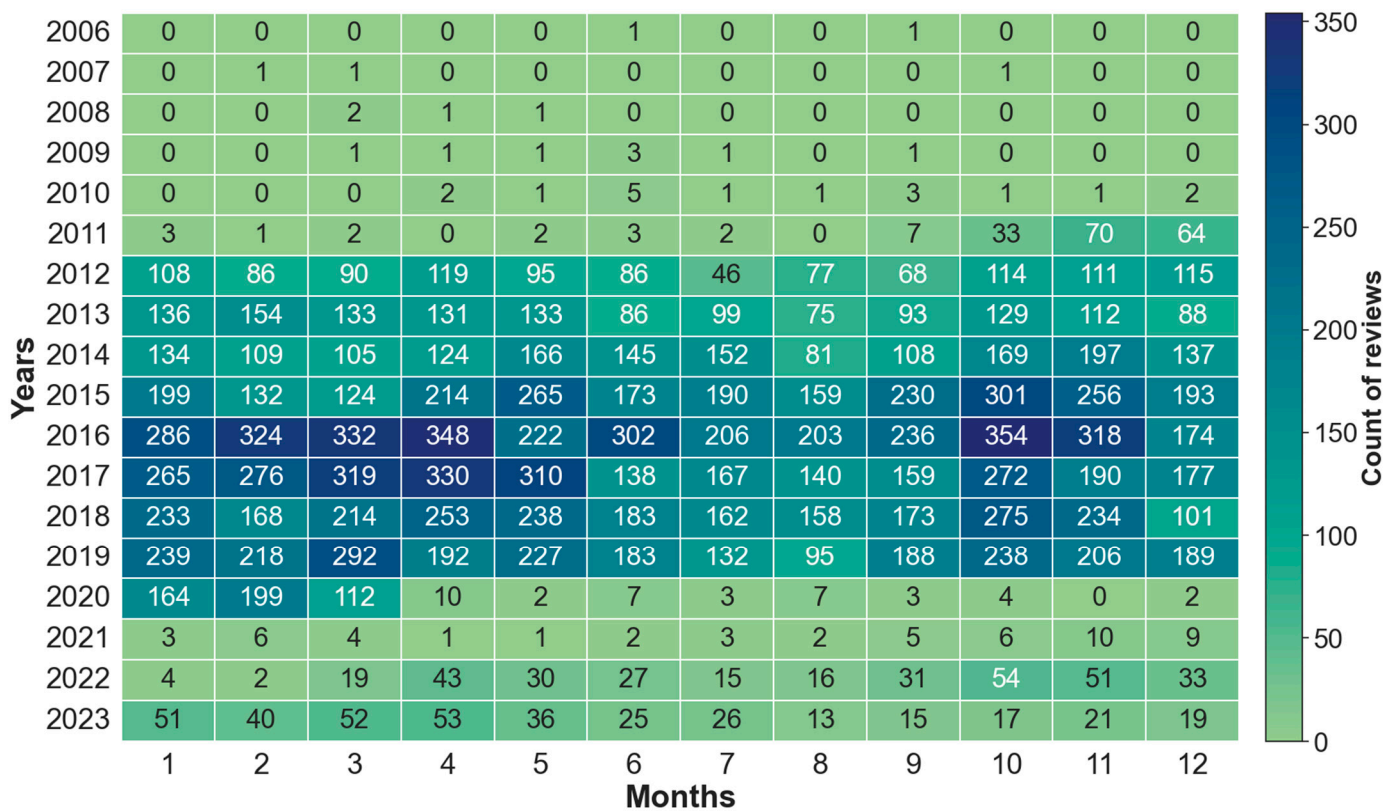


Figure 3. Review count over time.

### 3.3. Exploratory Data Analysis

Two exploratory data analysis techniques were used to explore our corpus. A detailed understanding of the frequent expressions of visitors to the Majorelle Garden will be provided by these approaches, while the experiential and contextual trends will be revealed.

The first exploratory analysis focuses on revealing the most frequent terms using *N-grams*, as explained by Tripathy et al. [73], which are the contiguous sequences of  $n$  elements in a text whose mathematical form is as follows:

$$N\text{-gram}(w_i) = (w_i, w_i + 1, \dots, w_i + N - 1) \quad (2)$$

An *N-gram* is a sequence of  $N$  elements, where  $N$  represents the size of the sequence. In the context of a text, the term " $w_i$ " designates the  $i$ -th word of the text, while " $w_i + 1, w_i + 2, \dots, w_i + N - 1$ " represent the following words of the text, thus forming a sequence of  $N$  consecutive words. The size of the *N-gram* can adopt different naming conventions. In the exploration, the 30 most frequent *N-grams* are considered in the corpus.

The second analysis of the corpus involves determining co-words. This shows how terms are associated with each other [74]. A dendrogrammatic co-word matrix was created to explore the *N-grams* using Ward's method, a hierarchical clustering technique that progressively merges clusters by minimizing the increase in the sum of squared errors at each step [75]. Ward's method merges clusters by minimizing the increase in the sum of squared errors (SSEs), aiming for maximum cluster homogeneity [76]:

$$\Delta(SSE) = \frac{|C_i| \cdot |C_j|}{|C_i| + |C_j|} \cdot d(C_i, C_j)^2 \quad (3)$$

where  $\Delta(SSE)$  is the increase in the sum of squared errors due to the merging of two clusters;  $|C_i|$  and  $|C_j|$  are the sizes (number of observations) of the clusters  $i$  and  $j$ , respectively;  $d(C_i, C_j)$  is the distance between the centers of gravity (or centroids) of the clusters  $i$  and  $j$ ;  $d(C_i, C_j)^2$  is the square of this distance.

Similarity within the dataset was assessed using the Euclidean distance measure. The corpus is made up of continuous data. Therefore, Euclidean distance is used to measure the distance between each pair of continuous points [77]. In an  $n$ -dimensional space, the Euclidean distance between two points  $p$  and  $q$  is calculated using the following formula [78]:

$$D_{Euclidean}(p, q) = \sqrt{\sum_{i=1}^n (p_i - q_i)^2} \quad (4)$$

where  $p_i$  and  $q_i$  are the coordinates of the points in each dimension.

### 3.4. Proposed Method

Sentiment analysis was used in our methodology to divide the reviews into three categories (positive, negative, and neutral), and the LDA method was then applied to extract specific themes from each category. This multidimensional approach provides a holistic understanding of the subjects of the visitors' experience of the Majorelle Garden and their sentiments towards it.

#### 3.4.1. VADER-Based Sentiment Analysis

It is the computational study of people's opinions towards entities such as products, services, problems, events, topics, and their attributes [79–81] based on user-generated content [82]. This is a multidisciplinary field, encompassing psychology, sociology, natural language processing, and machine learning [83] through general sentiment extraction based on the subjectivity and linguistic features of words in unstructured text [84]. In the field of tourism, sentiment analysis aims to identify the feelings of tourists in an environment different from their everyday lives, thus involving a subtle consideration of contextual and cultural filters [85]. Methodologically, sentiment analysis deals with a polarity classification problem, which can be binary, ternary, or ordinal depending on the number of classes. In binary classification, text is categorized as predominantly positive or negative [44]. For ternary classification, the classifier implicitly differentiates between objective and subjective sentences, assigning labels such as "positive", "negative", or "neutral". Ordinal classification uses a rating scale to assess the strength of sentiments [86]. A ternary classification approach was adopted in our study using the sentiment analysis tool VADER (Valence Aware Dictionary and sEntiment Reasoner).

VADER, a sentiment analysis tool, uses qualitative rules and quantitative calculations to generate sentiment scores (positive, negative, or neutral) for each text. The evaluation of the distribution of compound scores as illustrated in Figures 4 and 5 and Table 2 guided the development of our tool. The compound score, a metric normalized between  $-1$  and  $+1$ , is utilized as an essential means for classifying sentences as positive, neutral, or negative [87]. The typical thresholds are as follows: positive sentiment: composite score  $\geq 0.05$ ; neutral sentiment: composite score  $> -0.05$  and  $< 0.05$ ; negative sentiment: composite score  $\leq -0.05$  [88]. The VADER composite score is the result of a specific formula that takes into account the valence scores of each word. This formula normalizes the sum of the valence scores, guaranteeing a constant scale regardless of text length. The normalized formula is as follows:

$$\text{Compound Score} = \frac{\sum \text{Valence}^2}{\sum \text{Valence} + \alpha} \quad (5)$$

where  $\sum \text{Valence}$  is the sum of the valence scores and  $\alpha$  is a normalization parameter (usually a small constant).

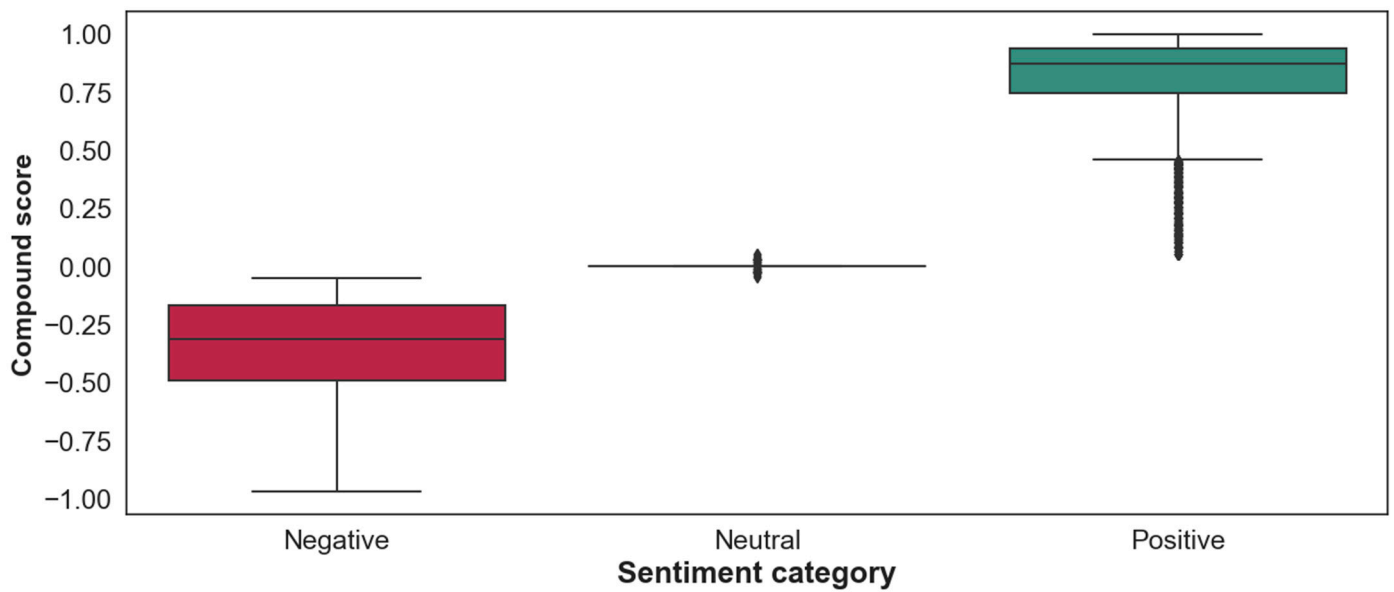


Figure 4. Compound score distribution assessment.

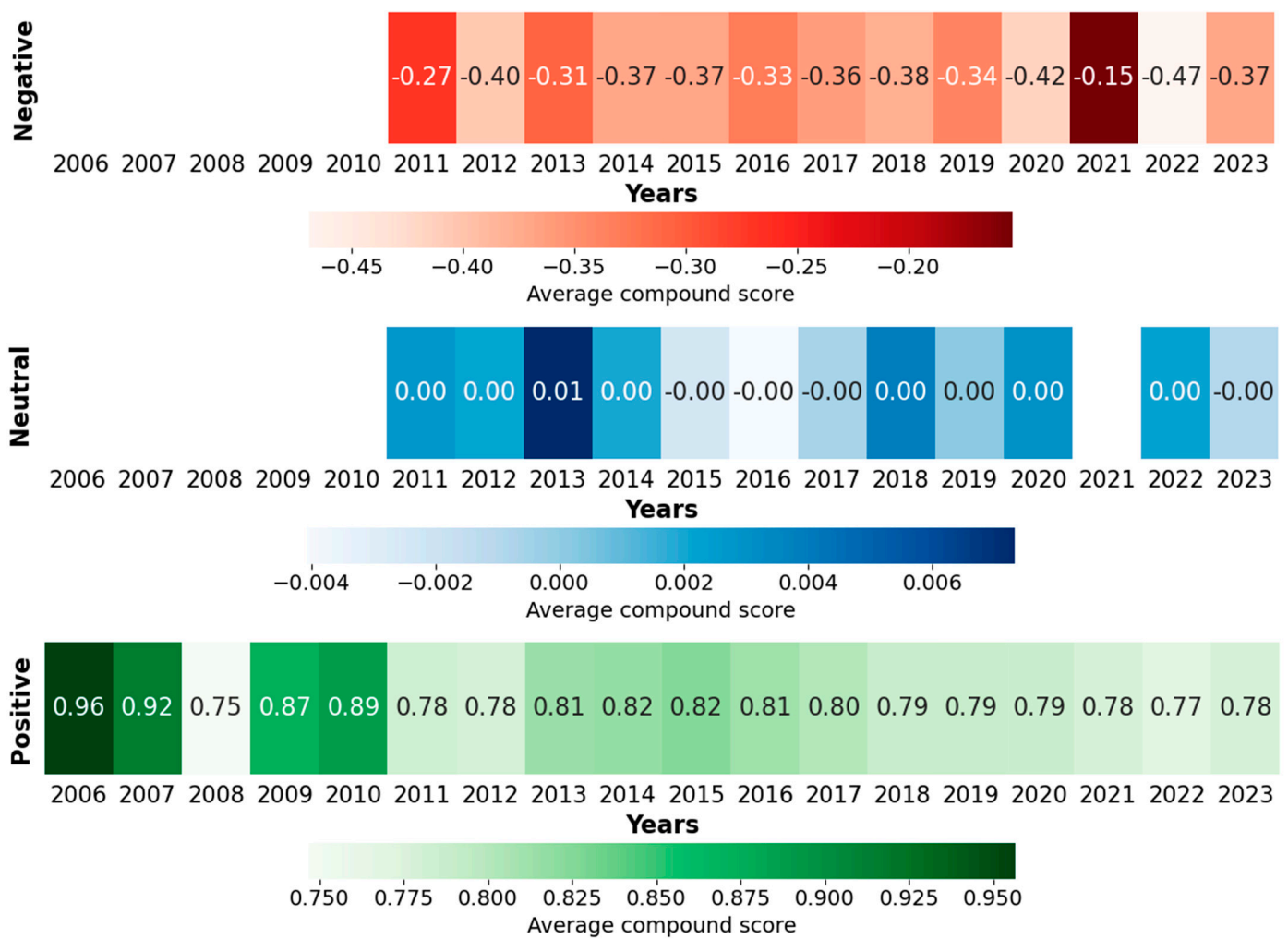


Figure 5. Annual trend in average compound scores.

**Table 2.** Descriptive statistics for review sentiment scores.

Category	Reviews	Mean	Std	Min	25%	50%	75%	Max
Negative	562	−0.360914	0.226922	−0.9727	−0.4939	−0.3182	−0.1695	−0.0516
Neutral	333	0.000830	0.013404	−0.0498	0	0	0	0.0485
Positive	17970	0.802455	0.187414	0.0516	0.7425	0.8689	0.9337	0.9965

The analysis in Figure 4 and Table 2 summarizes the global trends in sentiments expressed in the tourists' reviews. The negative reviews show great variability, with a median below  $-0.25$ , indicating a general trend towards strongly negative sentiments. This wide dispersion suggests that although some reviews are moderately negative, a significant proportion of the reviews express severe criticism. On the contrary, the neutral reviews show a noticeable uniformity, with little or no variability. This uniformity may indicate either a consensus among the neutral reviews, or a small sample size for this category. The neutral reviews remain very close to zero on the composite score scale, reflecting the absence of strong sentiment, either positive or negative. However, the positive reviews stand out with a median above  $0.5$  and a relatively low dispersion compared to the negative reviews. This reveals a trend towards moderately strong positive reviews, reflecting the visitors' general satisfaction. The consistency of the positive reviews shows that the majority of the visitors have had a pleasant experience and are inclined to share positive reviews.

To enhance our overall understanding, Figure 5 highlights the three sentiments by showing the variations in their average compound scores over time.

The average compound score was obtained mathematically using the following equation:

$$\text{Annual Average Compound Score}_{category, year} = \frac{\sum_{i=1}^{n_{category, year}} \text{Compound Score}_{i, category, year}}{n_{category, year}} \quad (6)$$

where category can be positive, negative, or neutral; Year is the specific year for which the average is being calculated;  $\sum_{i=1}^{n_{category, year}} \text{Compound Score}_{i, category, year}$  represents the sum of all compound scores for a given category (positive, negative, or neutral) and year;  $n_{category, year}$  is the total number of compound scores for that specific category and year.

The tourists' reviews on Majorelle Garden reveal a predominance of positive sentiments over the years, although these have fluctuated. Initially very high in 2006 with an average composite score of  $0.96$ , positive sentiments declined slightly after 2010, stabilizing around the average scores of  $0.78$  to  $0.82$  from 2011 onwards. Since 2017, the positive reviews have remained constant, reflecting an overall positive and stable tourism experience. At the same time, negative sentiments fluctuated between 2011 and 2020, with a peak in dissatisfaction in 2021 with an average score of  $-0.15$ . However, a downward trend in negative sentiments is observed after 2021, suggesting an improvement in the visitors' perceptions. As for neutral sentiments, they remain generally stable, with no significant variations over the years, indicating a constant proportion of visitors with a neutral experience.

### 3.4.2. Topic Modeling Based on Latent Dirichlet Allocation

Latent Dirichlet allocation (LDA) assumes that each document can be represented as a probabilistic distribution over latent topics, and that its distribution across all the documents shares a common Dirichlet antecedent. Each latent topic in the LDA model is also represented as a probabilistic distribution over words. LDA generates a vocabulary from the terms in the set of documents, which are then treated as an amalgam of topics, where each topic is a probability distribution over this set of terms. Each document is, therefore, treated as a probability distribution over a set of topics [89]. More specifically, LDA illustrates a probabilistic generative corpus model in terms of big data management [90],



and being a machine learning algorithm, it is involved in the efficient discovery of hidden structures in a set of opinions [91].

LDA is a three-level hierarchical Bayesian model for automatically classifying documents and estimating their relevance to various topics. The basic assumption of LDA is that the words in each opinion are extracted independently from the entire corpus [92] while following an inference process for sentiment analysis [93]. In this study, the aim of LDA model is to discover latent topics within our inferred corpus (positive, negative, and neutral) in the sentiment analysis stage using VADER. With this in mind, the implementation of LDA begins by determining the optimal number of themes for each sentiment category.

The consistency score measures the quality of the topic model by assessing how similar the words in a topic are to each other, which is a good indicator of topic relevance [94]. Theoretically, the consistency score of the LDA model varies with the number of topics. The maximum score indicates the optimal number of topics, suggesting that the model offers the best consistency for grouping words. Beyond this point, the score decreases, indicating that adding subjects does not improve consistency, or even deteriorates it. The formula for the consistency score is as follows:

$$\text{CoherenceScore} = \sum_{i < j} \text{similarity\_score}(w_i, w_j) \quad (7)$$

$i < j$  means that summation is performed for all the distinct pairs of terms; similarity score  $(w_i, w_j)$  is the similarity measure between terms  $w_i$  and  $w_j$ .

An analysis of topic consistency across the sentiment categories shows significant variations depending on the tonality of the reviews. For the positive reviews, topic consistency reaches its highest level with six topics, where the consistency score is 0.434. For the neutral reviews, the optimum number of topics is five, with a consistency score of 0.286. Finally, for the negative reviews, the coherence peak is set at four topics, with a score of 0.378.

#### 4. Results

This section is divided into two main subsections. The first subsection presents the various data mining results, revealing the most frequent terms and their co-occurrences, as well as the impact of visitor comment titles. The second subsection deals with the identification of topics in the different sentiment categories, providing details of the topics emerging in positive, negative and neutral reviews, with concrete examples illustrating each topic.

##### 4.1. Results of Exploratory Data Analysis

Figure 6 illustrates the predominance of the term “garden” in the corpus. The analysis identified the ten most frequent co-words associated with this term, which can be grouped into four main categories. Firstly, it appears alongside “museum” in reference to the “Berber Museum” (12,027 co-words), and with “Marrakech” (4900 co-words). Similarly, it is linked to the term “place” (5802 co-words), suggesting areas designated for specific activities. In addition, it evokes terms of appreciation such as “beautiful” (7429 co-words), “worth” (6080 co-words), “well” (5059 co-words), and “great” (5270 co-words), emphasizing the garden’s esthetic appeal and value. In addition, it is associated with activities through terms such as “visit” (8340 co-words) and “get” (5081 co-words), indicating visitor engagement. Finally, it is linked to nature through the term “plant” (5028 co-words), which emphasizes the garden’s lush vegetation.

In addition to these results, the titles visitors give to their reviews play a crucial role. They provide others with an idea of their overall experience. Overall, Figure 7 illustrates a positive experience, highlighting the natural beauty and cultural significance of the site. At the heart of this representation of words, the terms “garden” and “beautiful” clearly stand

out. This predominance reflects not only the importance of the garden itself but also the esthetic appreciation it evokes in visitors.

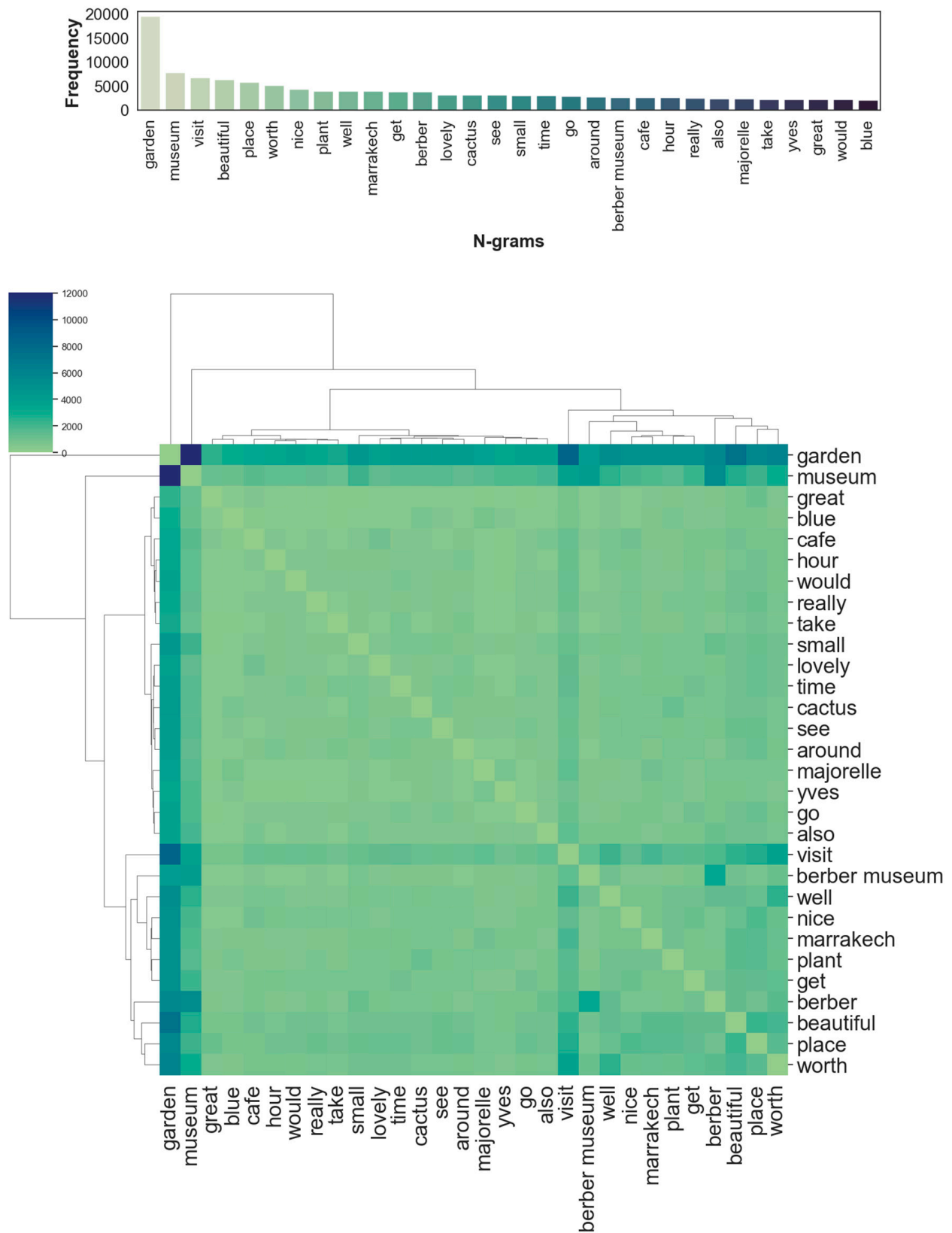


Figure 6. Top 30 most frequent N-grams and their dendrogrammatic co-word matrix.

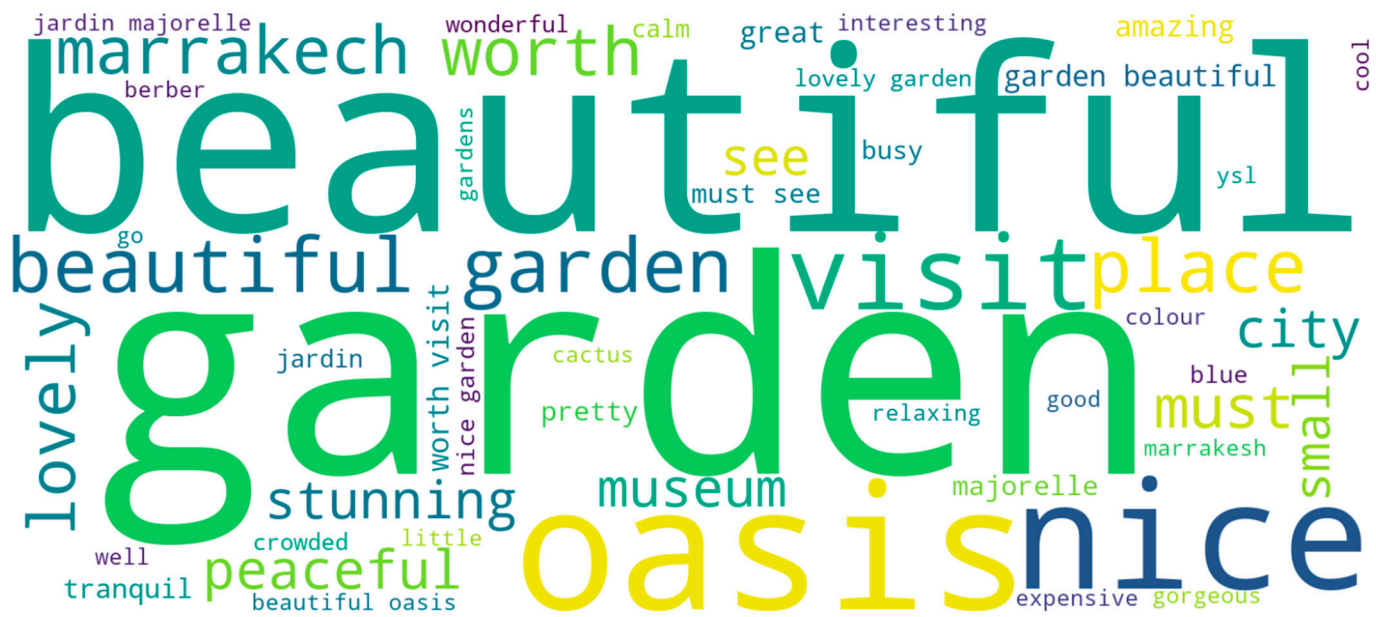


Figure 7. Top 50 N-grams of review title.

#### 4.2. Results of Topic Modeling

After identifying the topics associated with each sentiment category, we select the relevant reviews for each topic. These selections are recapitulated in Tables 3–5 for the positive, negative, and neutral reviews, respectively. Each table is accompanied by examples of visitor reviews to illustrate the themes in a concrete way. The key topic terms and their respective scores, obtained using our topic modeling methodology, are presented in each table. Figures 8–10 correspond to the positive, negative, and neutral topics, respectively.

Table 3. Mapping and thematization of positive topics.

Topics	Thematics	Reviews
1	Fruitful morning visit	“This is a treat, but arrive early in the morning, or you will queue for a long time. Beautiful gardens and colors, a masterpiece in the design of space between and within objects and views. It also houses a Berber Museum that feels as if it is under a celestial realm of stars—fabulous. There is also an Yves shop and a pretty garden cafe with shade for the summer and chiminea fires for the winter. This isn’t cheap, but the coffee is excellent. Fifty meters down the road is the Yves St Laurent Museum and cinema, which has to be experienced—no words are sufficient here. Your ticket includes both for a cost of around £10—so worth it.”
2	The unparalleled appeal of the Berber Museum	“The garden itself is nice, but the majority of the French crowd seem to be there for the YSL reference. The highlight is the Berber Museum, and it’s well worth the visit.”
3	Photographic charm	“Beautiful small botanical garden. The electric blue throughout makes for great photos. Definitely purchase the Berber Museum ticket with your admission.”
4	Cultural and visual discovery	“A symphony of colors, Majorelle Garden is an attraction that you should not miss. Cool and colorful, it’s a serene and lush space in the busy, crazy town of Marrakesh. The museum, although small, offers an interesting exhibition of Berber culture, artifacts, and history. The cafe inside the gardens is also a great spot for a light lunch and refreshments. Overall, Majorelle Garden is a great little trip and attraction.”

Table 3. Cont.

Topics	Thematics	Reviews
5	Berber heritage and Yves Saint Laurent identity	“What a gorgeous museum and gardens. I am not sure which is more impressive, and of course, with the stamp of YSL, it cannot miss. The Berber Museum is filled with the most amazing finds of the Berbers, making both a joy beyond compare.”
6	Souvenir shopping during the sightseeing	“I’m not one to specifically visit gardens while traveling; however, I’m glad we visited Majorelle Garden. Some of the items I bought from the gift store were the best quality gifts I purchased in Morocco! There are also some lovely shops just outside. The gardens were lovely.”

Table 4. Mapping and thematization of negative topics.

Topics	Thematics	Reviews
1	Disappointing expectations	“This was a cactus garden with lots of primary colors on the walls, bridges, etc. It wasn’t amazing, exciting, or even unusual. I was disappointed as I knew this was ranked third on TripAdvisor, but I spent at most 20 min walking around. It would have been interesting if it were free, but otherwise, it wasn’t worth the taxi ride out there, let alone the entry fee.”
2	Overcrowding and unattractiveness	“Although of historic importance, this was a major disappointment. Overcrowded and not very interesting. Skip this and go straight to the YSL museum.”
3	Expensive entrance fees and linguistic mismatch on entry	“For the price you pay, you might as well visit mosques around the Medina and the city. All you will encounter is a rude French lady at the counter who must think French is the only language in the world. Sorry, lady, if you can afford to visit other countries in your life; it’s called English. There are bamboo trees and some fountain in the middle. Oh, and some colored pots. 70 Dh per person for the garden only. Good luck.”
4	Disappointing queue management	“We queued for 45 min in the sun, only to find out we had to get the garden ticket to go to the Berber Museum, so it cost 130 Dh to see the museum, which is advertised as 30 Dh. Plus, the YSL museum was closed, so half the people waiting were holding up the line because they were angry and confused when they finally got to the front, as there was no indication of it being closed at the location or online. I have a feeling a lot of people came to Morocco just to see that museum. Overall, unprofessional, unclear, and a waste of time for people who don’t want a package. If you have to get the garden ticket to see the museum, just say so. Don’t pretend like it’s 30 Dh when it’s actually 130 Dh.”

Table 5. Mapping and thematization of neutral topics.

Topics	Thematics	Reviews
1	The bustle of the medina * and calm of the garden	“After spending time in the intense setting of Marrakech’s medina and the constant hard-sell, it is a pleasant respite to visit Jardin Majorelle. It is a peaceful oasis with an interesting history. Before or after your garden visit, spend some time in Marrakech’s New Town; it has a totally different character than the medina.”
2	Recommended visit to the Majorelle Garden and Yves Saint Laurent Museum	“If you go to Marrakech, make sure you visit these gardens, which belonged to Yves St Laurent. Exquisite, although not very big, an hour or two is enough to be enthralled. Not to be missed.”

Table 5. Cont.

Topics	Thematics	Reviews
3	Desert botanical allure	“These gardens were awesome. The array of desert plant life alone was worth the trip. The price is a little high, and you can expect a crowd, but overall, if you enjoy a good garden walk, it’s worth it.”
4	Preference for the allure of Moroccan ceramics	“My only reservation is that, although the whole point of the place is the brightly colored Moroccan-style ceramics, I couldn’t help feeling that I would prefer the garden to consist only of plants!”
5	Urban oasis	“I went here on the last day of a 12-day tour. I didn’t know much about it, but a friend told me not to miss it. The garden is really stunning and truly an oasis in the city. Don’t miss it!”

\* A medina refers to the old part of a city, in contrast to the modern European-style neighborhoods. This term is mainly used in the Maghreb countries and to a lesser extent in the Mashreq, in Spain, in West Africa, in East Africa, and in the Mediterranean, notably in Malta.

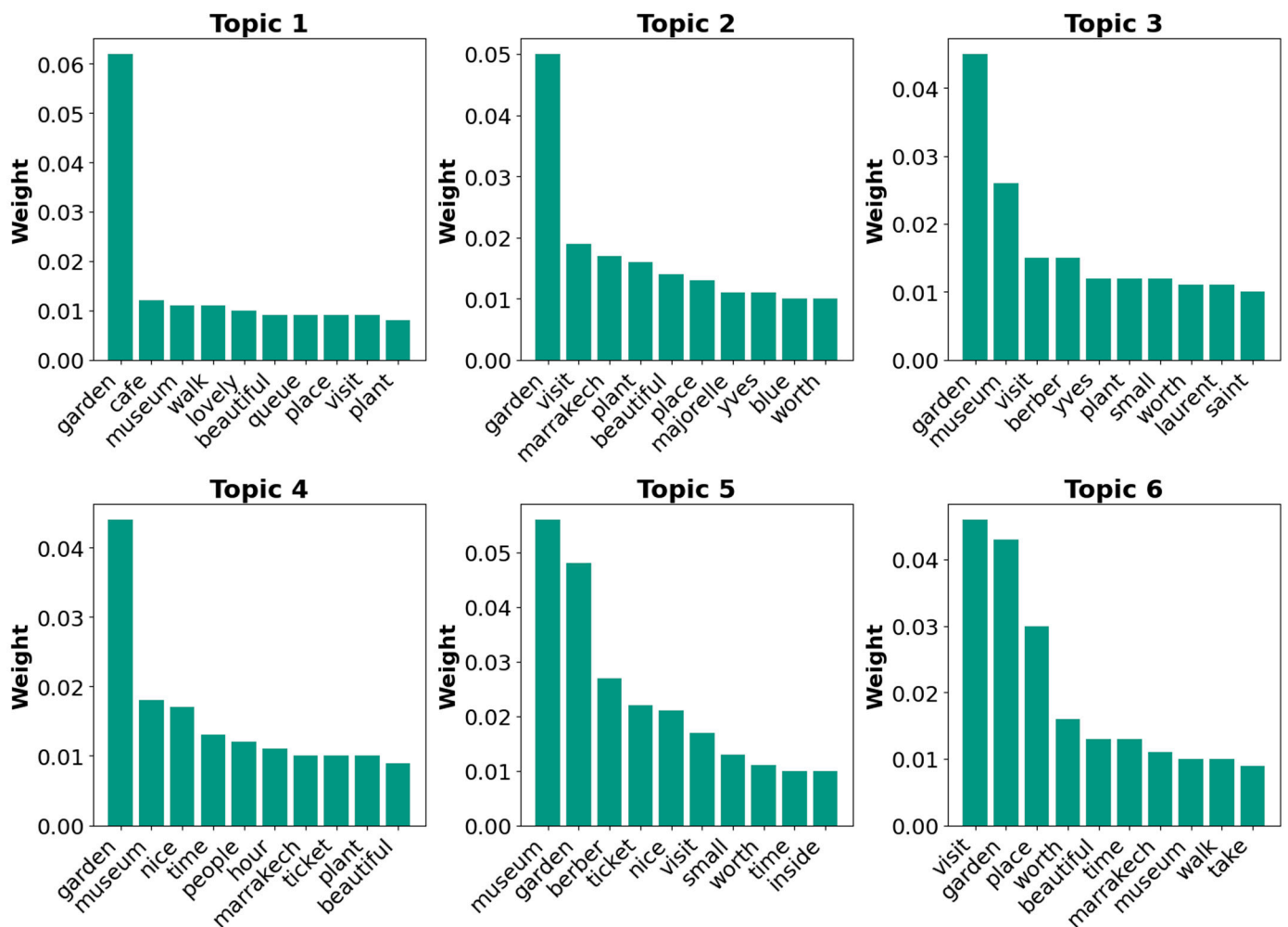
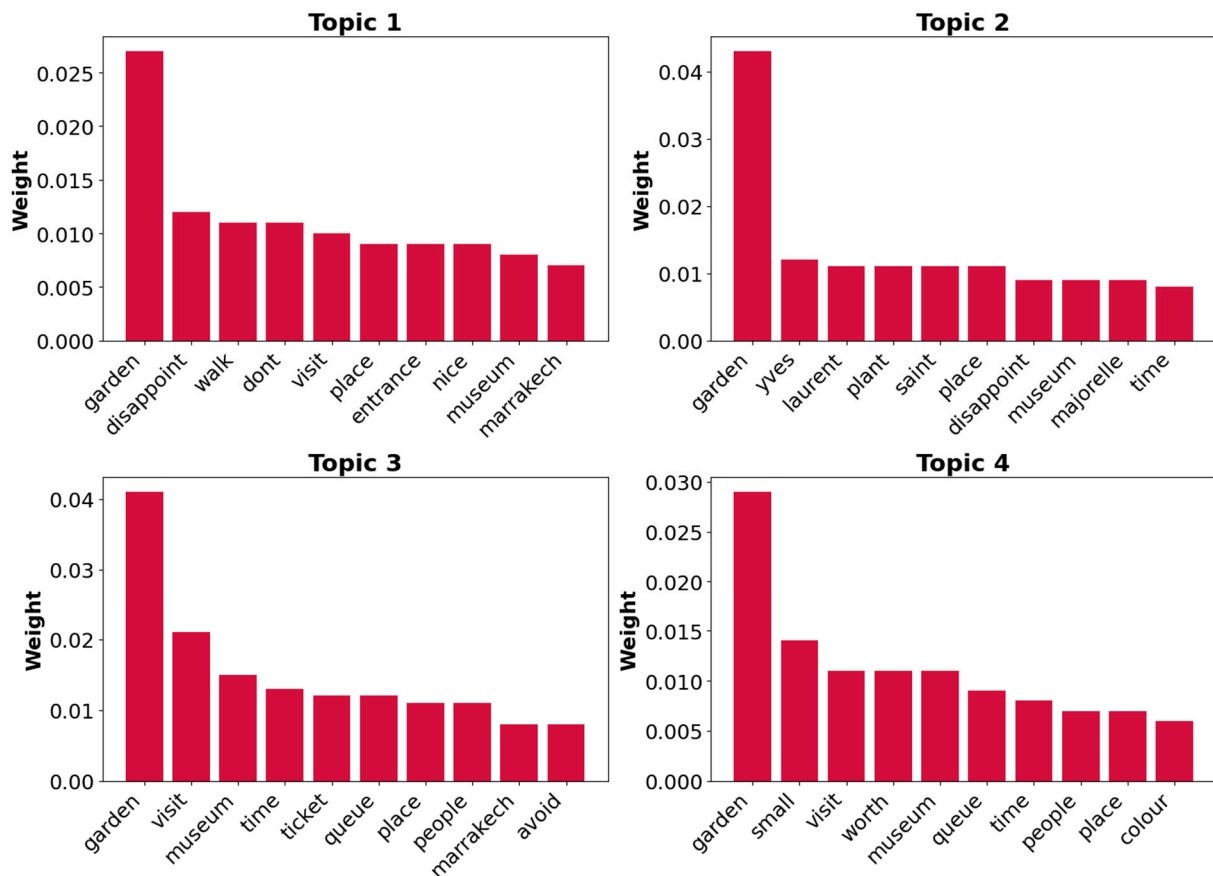


Figure 8. Topic modeling of positive reviews.

As shown in Figure 5, six topics emerged in the positive sentiment category. Similarly, Table 3 summarizes all these topics and their inferred reviews.

In the category of negative sentiments, Figure 6 highlights the emergence of four topics. In parallel, Table 4 brings together all these topics and the reviews drawn from them.

Within the category of neutral sentiments, Figure 7 highlights the emergence of five themes. Table 5 brings together all these themes and the reviews they generate.



**Figure 9.** Topic modeling of negative reviews.

The category of positive sentiments reveals a diversity of topics. The first underlines the successful morning experience in the garden, before the afternoon tourist rush. The second reveals the unparalleled appeal of the Berber Museum. The third evokes the garden's photographic charm for Instagrammable memories. The fourth highlights cultural and visual exploration in the midst of urban hustle and bustle. The fifth spotlights the Berber heritage and Yves Saint Laurent's identity in the museum environment. The sixth evokes the pleasurable souvenir purchases made during the visit. It is clear that this category has strong emotional, esthetic, and culturo-historical dimensions.

The negative sentiments also reveal a variety of topics reflecting operational issues that lead to an unsatisfactory visit for certain tourists. The first expresses disappointment with expectations, describing the garden as a simple cactus garden with nothing exceptional despite its reputation on TripAdvisor. The second pointed to the garden's overcrowding and lack of appeal, suggesting that visitors should go straight to the Yves Saint Laurent Museum. The third criticizes the high entrance fees and lack of language correspondence at the entrance, denouncing a disappointing experience for the cost. The fourth highlights queue management problems, with visitors waiting a long time to discover that access to the museum requires an expensive additional ticket, leading to confusion and frustration among visitors.

The neutral sentiments, meanwhile, reveal a variety of topics. The first describes the garden as a peaceful refuge from the hustle and bustle of Marrakech's medina, offering interesting history and a calm atmosphere. The second highly recommends a visit to the Majorelle Garden and the Yves Saint Laurent Museum, praising their exquisite character despite their modest size. The third expresses appreciation for the diversity of desert plants in the garden, despite high prices and expected crowds. The fourth expresses a preference for Moroccan ceramics over garden plants. And the fifth is more interested in the beauty of

the garden as an urban oasis, which is recommended even at the end of a stay in Marrakech. Clearly, this category has strong advisory and storytelling dimensions.

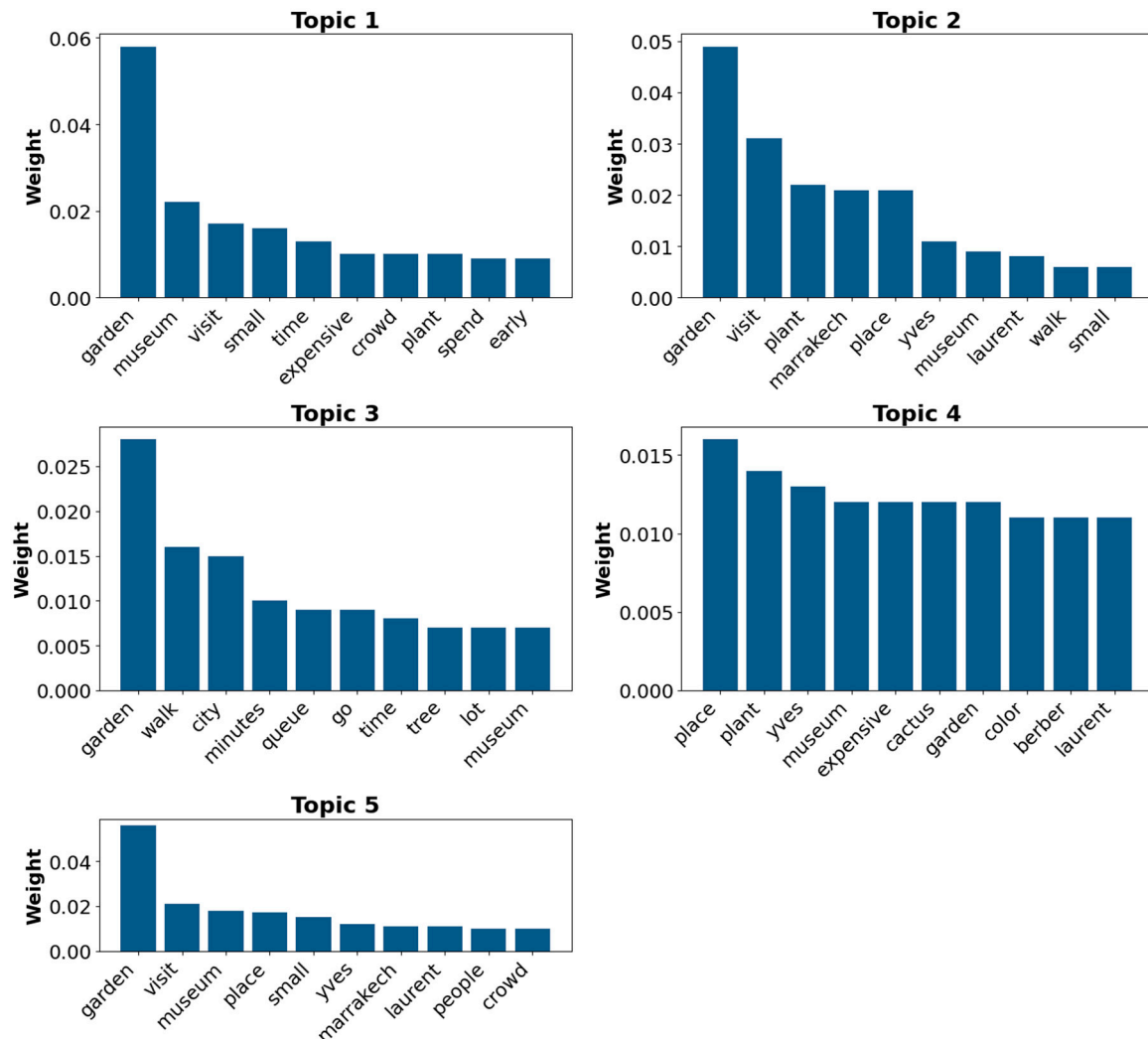


Figure 10. Topic modeling of neutral reviews.

## 5. Discussion

The sentiment analysis carried out with the VADER tool on Majorelle Garden shows a clear predominance of positive sentiments among the visitors. This conclusion is supported by the average scores: the positive reviews have a high average score of (0.8025), illustrating a remarkably high level of satisfaction and appreciation among the majority of the visitors. The negative reviews, on the other hand, with an average score of (−0.3609), are less frequent and reflect moderate negativity, indicating that the points of dissatisfaction are generally not extremely serious. The neutral reviews, with an average rating close to zero (0.0008), are rare and demonstrate almost perfect impartiality, reflecting very balanced and moderate impressions.

The results of the topic modeling reveal the diversity of the visitors' experiences at Majorelle Garden, highlighting the positive, negative, and neutral aspects of the attraction. Three matrices in Appendix A assess the validity of the topic modeling in identifying the topics of each sentiment category. The predominantly negative and weak correlations between the topics suggest a low correlation, demonstrating effective differentiation between the topics, a key objective of the LDA analysis.

### 5.1. About Positive Sentiments

#### 5.1.1. Fruitful Morning Visit of Garden

Morning visits to the garden are especially appreciated for their tranquility, offering visitors the opportunity to savor the serenity before the crowds arrive. This preference is not just a question of comfort. It also responds to a universal search for moments of peace and connection with nature, particularly appreciated in dense urban environments such as the city of Marrakech. Research by Carrus et al. [95] highlights that those early interactions with green spaces can significantly improve mental health by reducing stress and promoting a sense of well-being. These effects are accentuated in a context where social distancing has become an increased priority, as Yang et al. [5] point out following the impact of the pandemic. This morning period naturally offers easier social distancing, contributing to a safer and more comfortable experience for visitors.

To maintain this positive experience, it is essential that the garden's managers continue to promote early morning visits and make visitors aware of their benefits. Initiatives such as special sunrise programs and flow management recommendations can help maximize the benefits of this special time, particularly for older tourists. By integrating these practices, the garden can not only improve visitor satisfaction but also enhance its reputation as an urban destination where nature and well-being go hand in hand.

#### 5.1.2. The Unparalleled Appeal of the Berber Museum

The appeal of the Berber Museum, nestled in the heart of the garden, is undeniable for its central role in showcasing the Berber culture. It also fulfills a mission of education and reflection for its visitors. Dushkova et al. [96] point out that green spaces enriched with cultural and educational elements not only attract a wider but also a more engaged public. By integrating deep cultural elements, the museum not only preserves artifacts but also establishes a dialogue with diverse audiences, introducing them to an exotic culture. However, as Huai and Van de Voorde [6] explain, the perception of these cultural facilities can vary considerably depending on the cultural background of visitors. This diversity of viewpoints underlines the importance of the museum sensitively and appropriately navigating through different cultural interpretations in order to maintain its appeal and authenticity.

To maximize its impact, the Berber Museum could consider several strategies. First, diversifying its exhibits to include multiple perspectives on the Berber culture could enrich the visitor experience while offering a more nuanced and inclusive understanding. Secondly, investing in interactive educational programs and specialized guided tours could enhance visitor engagement and participation, encouraging a deeper, more personal exploration of the Berber culture.

#### 5.1.3. Photographic Charm in a Garden Atmosphere

The photographic dimension of the garden is fundamental to its identity, with visitors actively using their cameras to capture and share the garden's unique visual essence. Garrod [97] underlines how photography enriches the tourist experience by enabling visitors to create lasting visual memories and indirectly helping to enhance the reputation of the tourist attraction. However, Sergiacomi et al. [56] introduce an important paradox: the influx of visitors attracted by shared images can compromise the quality of the future photographic experience. Each shared photo helps to shape the collective perception of the garden, influencing the expectations of the subsequent visitors. This phenomenon raises crucial questions about the management of the visual space and crowds in order to maintain the integrity of the photographic experience and the overall quality of the visit.

To enhance this photographic aspect while preserving the quality of the visitor experience, several strategies can be considered. Firstly, establishing specific zones or time slots for professional photographers or special photo shoots could mitigate the negative impact on other visitors, while allowing amateur photographers to capture the garden at its best.



Secondly, proactively managing visitor traffic and carefully planning peak times could help minimize crowding and ensure the garden's serene ambiance for all the visitors.

#### 5.1.4. Cultural and Visual Discovery

Cultural and visual discovery enables deep immersion, an escape from mundane experiences to a different, spellbinding experience. According to Chen and Chen [98], urban gardens play a crucial role as educational spaces that enrich the lives of city dwellers by offering them a meaningful connection with nature and local culture. The sense of discovery at the heart of the Majorelle Garden makes it a place of cultural awakening, where every element, from plants to architectural features, is worthy of curiosity. Ghahramani et al. [58] point out that becoming engaged with local history through place can not only strengthen visitors' cultural identity but also encourage more respectful and informed tourism.

However, to maintain the impact of this cultural sense of discovery, it is essential to take two aspects into account. Firstly, it is essential to continue to develop and diversify the educational programs and interactive activities offered to visitors in order to deepen their understanding and appreciation of the cultural aspects of the garden. Secondly, the careful management of the indoor amenities is essential to preserve their authenticity and integrity, particularly the exoticism of the vegetation in the context of increasing visitor numbers with each passing year.

#### 5.1.5. Berber Heritage and Yves Saint Laurent Identity

The interplay between Yves Saint Laurent's identity and Berber heritage represents a captivating aspect that transcends mere cultural appropriation to become a celebration of the convergence between fashion and local heritage. This unique fusion enriches the visitor experience by offering a profound perspective on the interplay between artistic creativity and ancient cultural heritages. However, as Bornarel et al. [59] point out, this link can be at times criticized for its authenticity. The way in which cultural heritage is presented and integrated into broader tourism narratives, encompassing both fashion and local culture, is a sensitive component, as it is essential to reconcile the commercialization necessary to promote the garden with the rigorous preservation and respect for the cultural integrity of Berber heritage and the legacy of Yves Saint Laurent. Indeed, this strategy protects the integrity of the experience and makes the Majorelle Garden a real place of cultural discovery, far from being reduced to a mere commercial showcase of environmental, ethno-historical, cultural, and artistic aspects.

#### 5.1.6. Souvenir Shopping during the Sightseeing

The purchase of souvenirs at Majorelle Garden, often considered incidental to the tourist experience, is actually of significant importance in the way visitors perceive and extend their experience. According to Torabian and Arai [99], the purchase of souvenirs is not limited to a simple commercial transaction; adding to this, Vega-Vázquez et al. [100] stress that souvenirs play a crucial role in improving tourist satisfaction by enabling them to extend their emotional connection with the place well beyond the visit itself. This dimension helps to enrich their overall experience and strengthen their attachment to the garden. However, to preserve the integrity of this experience, it is essential to ensure that the souvenirs on offer are authentic and truly reflect the identity of the garden.

### 5.2. About Negative Sentiments

#### 5.2.1. Disappointing Expectations

A significant gap between high expectations and the actual experience is a source of disappointment. Often, this gap is mainly fueled by representations on social networks and local travel blogs, which tend to exaggerate what Majorelle Garden is actually like, thus raising unrealistic expectations among visitors. Murray et al. [101] point out that these disappointments are exacerbated when the representations of attractions do not match the actual experience. The prevalence of online reviews also contributes to this phenomenon, as

they can amplify expectations to levels that are not always achievable. Furthermore, Smith and Richards [102] stress the importance of transparency in communicating about tourist attractions to avoid such discrepancies between expectations and reality. Clear, proactive communication about what visitors can actually expect can mitigate such frustrations.

The gap between expectations and the reality of the experience can be explained by two factors. Firstly, inadequate marketing on the seasonal variability of flora and events can mislead visitors, leading them to expect to see the garden at its esthetic peak at any time of year. Secondly, the profile of the tourists themselves, often seasoned travelers in search of new experiences, can influence their perception. These visitors may feel that the garden lacks novelty or unexpected appeal, which can diminish their overall enjoyment.

### 5.2.2. Overcrowding and Unattractiveness

Overcrowding at the Majorelle Garden directly affects visitor comfort and satisfaction, a phenomenon confirmed by the study by Lam et al. [103]. A high visitor density can transform this space into a noisy, overcrowded place, considerably weakening its attractiveness. This finding is also supported by Zannin and Szeremetta [104], who observed that noise and congestion significantly reduce the quality of the visitor experience. The meticulous management efforts implemented at Majorelle Garden to moderate the influx of visitors have not entirely solved the problem of overcrowding.

This challenge is compounded by the absence of comparable gardens in Marrakech, which limits visitors' alternatives. Although the introduction of reserved time slots, limited visitor numbers, and guided tours has partially improved crowd management, the narrowness of the garden does not entirely solve this issue. Furthermore, even with proactive communication about peak periods aimed at directing visitors to less crowded times, overcrowding remains a major concern. This could particularly affect the experience of visitors who prefer the tranquility and intimacy of a less crowded garden. So, while the garden continues to attract many visitors thanks to its beauty and cultural significance, its appeal may be compromised for those looking to escape the urban bustle and find a haven of peace.

### 5.2.3. Expensive Entrance Fees and Linguistic Mismatch on Entry

High garden entry fees can be a heavy burden on the wallet, particularly of international visitors, who often already face significant expenses when traveling. As Pasha [105] notes, these costs can restrict access to a wide visitor base and reduce the garden's appeal to those who find the fees disproportionate to the quality and value of the experience on offer. Murray et al. [101] also emphasize the importance of perceived value in visitor satisfaction, warning that prices that are too high, if they do not match the actual quality of the experience, can lead to dissatisfaction and damage the attraction's reputation. To strengthen this perception of value, Majorelle Garden could consider introducing preferential rates for international visitors, students, and groups. Offering packages including guided tours or access to special exhibitions could also enhance the experience while justifying costs. Initiatives such as discount days or seasonal promotions could also attract a wider audience.

At the same time, language barriers are a major obstacle for many visitors, particularly those who do not speak English, a language widely used as a means of international communication. This language limitation can seriously restrict visitors' engagement with the garden's cultural and historical heritage, and reduce their ability to fully enjoy the experience. Faced with this diversity of visitors from the four corners of the world, it is essential for Majorelle Garden to improve its linguistic accessibility. An effective approach could include the expansion of multilingual digital services. For example, the provision of audioguides in several languages would enable non-French-speaking visitors to receive detailed, contextualized information during their visit with complete autonomy. These audioguides could offer captivating and informative accounts of the history of the plants, artworks, and buildings present in the garden, adapted to a variety of cultural contexts.

#### 5.2.4. Disappointing Queue Management

Queue management in the garden remains a major problem for many visitors, a finding confirmed by the studies by Zannin and Szeremetta [104] and Lawton [106]. Despite the use of modern technologies, the current measures are proving insufficient to effectively manage the influx of visitors during peak periods. Long waits, particularly pronounced during peak periods, can significantly alter visitors' overall experience, affecting their perception of site efficiency and organization. Moreover, prolonged waiting, often compounded by difficult climatic conditions such as the hot, dry summers typical of Marrakech, can lead to frustration and dissatisfaction.

To improve queue management and visitor experience, the garden could adopt more transparent communication about expected waiting times, even if a reservation system is in place. In addition, more comfortable waiting areas, equipped with shaded spaces and benches, could help alleviate visitor discomfort and improve their overall waiting experience. These adjustments would not only reduce dissatisfaction but also enrich the quality of the welcome offered by the garden.

### 5.3. About Neutral Sentiments

#### 5.3.1. Bustle of the Medina and Calm of the Garden

Visitors to the Majorelle Garden often welcome its peaceful atmosphere, which contrasts sharply with the hustle and bustle of Marrakech's medina. This perception is confirmed by previously published studies such as Carrus et al. [95] et Annerstedt van den Bosch et al. [107], which demonstrate that urban green spaces play a crucial role in reducing urban stress. They offer visitors a refuge where they can relax and recharge their batteries, which is particularly beneficial in a crowded and sometimes chaotic urban environment.

The stress of Marrakech's medina drives tourists to the Majorelle Garden for many obvious reasons. The medina is notorious for its incessant noise, with the calls of merchants and the hum of scooters creating an overwhelming cacophony. The density of crowds in the narrow streets, where pedestrians, hawkers, and tourists jostle one another, can also be oppressive. Intense heat, especially in summer, adds to the physical and mental exhaustion that exacerbates stress. Intense social interaction in the souks, with haggling and the incessant attention of vendors, can be mentally exhausting. Furthermore, cultural disorientation, with different languages and customs, can lead to feelings of bewilderment and discomfort.

#### 5.3.2. Recommended Visit to the Majorelle Garden and Yves Saint Laurent Museum

Recommending a visit to the Majorelle Garden and Yves Saint Laurent Museum, despite their relatively modest size, underlines the extent to which these spaces are capable of offering enriching and deeply meaningful experiences. These attractions are recognized not only for their visual beauty and exemplary management, as shown in the studies by Murray et al. [101] and Boffi et al. [108], but also for their powerful cultural and emotional impact. The Yves Saint Laurent Museum, located next to the Majorelle Garden, houses a remarkable collection that pays tribute to the famous designer Yves Saint Laurent.

The combination of fashion, art, and nature here creates a truly unique synergy, offering visitors a captivating experience. Even when confined to limited spaces, small gardens and museums can, according to Kaplan and Kaplan [109], offer an immersive experience that enriches the soul and awakens the spirit. This revitalizing capacity of small green spaces is also emphasized in discussions on the ecological and restorative role of gardens. The cognitive and emotional benefits they bring, even when small, are important, as shown by the work of Athanasiadou [17] and Hartig et al. [1]. These observations reinforce the idea that modest dimensions do not diminish the depth of the experience offered.

#### 5.3.3. Desert Botanical Allure

The diversity of plants, notably desert species, is an essential part of the appeal of the Majorelle Garden. This diversity offers visitors an immersion in the rich plant palette adapted to the Moroccan climate, adding to the unique experience offered by this iconic

garden. Research by Carrus et al. [95] and Southon et al. [110] highlight that the presence and perception of biodiversity, as well as the restorative effects of gardens, play a crucial role in visitor satisfaction. Indeed, these natural aspects not only beautify the landscape but also strengthen visitors' emotional connection and commitment to environmental conservation.

According to Fuller and Gaston [111], specific botanical diversity, such as that of desert species, enhances esthetic appeal while enriching visitors' educational and recreational experience. This perspective is reinforced by the work of Shang et al. [31], who highlight the growing importance of biodiversity enhancement in the context of urban ecotourism. By carefully integrating the planning and conservation of plant collections, the managers of gardens such as Majorelle not only preserve a precious botanical heritage, but also contribute to educating and inspiring visitors about the beauty and fragility of desert ecosystems.

#### 5.3.4. Preference for the Allure of Moroccan Ceramics

The growing interest in Moroccan ceramics within the garden, as opposed to a direct focus on the plants themselves, highlights the influence of cultural preferences on the visitor experience. Studies by Colléony et al. [112] and Hedblom et al. [113] show that integrating cultural or sensory elements significantly enriches interactions in green spaces. This approach is supported by Burls [114], who observes that the integration of cultural and artistic aspects can increase visitor satisfaction and engagement in these natural environments. The successful integration of local culture into urban gardens, as exemplified by the Majorelle Garden, is of crucial importance in attracting and captivating visitors. Research by Forje et al. [115] underlines that this cultural integration profoundly enriches the visitor experience. It creates environments where local history, crafts, and traditions blend harmoniously with the natural beauty of plants and landscapes. When visitors discover cultural elements such as Moroccan ceramics in the Majorelle Garden, they appeal not only to their esthetic sense but also to their intellectual curiosity and desire to learn more about the local context.

#### 5.3.5. Urban Oasis

Majorelle Garden is perceived as an urban oasis attributed to its ability to meet a contemporary need for connection with nature within urban environments. Studies by Wood et al. [116] and Irvine et al. [117] have clearly demonstrated that the biodiversity and ecological quality of green spaces in urban environments are essential for the psychological and emotional well-being of visitors. This recognition underlines the crucial importance of preserving and promoting urban biodiversity, transforming these spaces into beneficial resources for mental and emotional health. As a popular tourist attraction, the Majorelle Garden promotes a commitment to environmental sustainability, offering an oasis in the midst of Marrakech's frenetic urbanity.

## 6. Conclusions

The profiles of contemporary tourists place the experiential dimension of their activities at the epicenter of their preferences [118]. The reviews from the visitors to the Majorelle Garden bear witness to this trend, where the tourist's influence in understanding the tourist experience often outweighs that of the managers. Indeed, positive reviews enrich the understanding of the garden's attractions, while negative reviews reveal operational problems and highlight less satisfactory aspects, suggesting potential avenues for improvement. They provide contextual narratives and tips to help future visitors plan their visits effectively, highlighting strengths and suggesting scenarios to avoid potential drawbacks. As a result, the overall experience of the garden is primarily shaped by the reviews of previous visitors, minimizing the traditional role of managers in this dynamic.

### 6.1. Limitations

In TripAdvisor data, the risk of fake reviews is a major issue, accentuated by the volume of reviews. It is difficult to identify these false reviews, and the presence of dupli-

cates reveals that TripAdvisor's algorithms are not infallible, which can compromise the uniqueness of reviews on Majorelle Garden. Furthermore, although the study focuses on English-language reviews, it does not include the sentiment analysis of the reviews from visitors of other nationalities, which fails to reflect the linguistic diversity and international reach of the garden. In addition, the study is limited exclusively to TripAdvisor data, which restricts the diversity of the reviews collected. Indeed, this approach may overlook experiences shared on other sources, such as Google Reviews. In addition, certain demographic groups may be under-represented, such as those less inclined to use the Internet or share their experiences online, which is another limitation of the research.

A further limitation is the self-selection bias inherent in online reviews. This bias occurs because the people who choose to leave reviews are usually those who have had particularly positive or negative experiences, rather than a random sample of all the visitors. As a consequence, reviews may reflect perceptions that are more extreme than the average visitor's experience. For example, a visitor who has had an exceptionally wonderful or particularly disappointing visit is more likely to leave a comment than someone who has had an average experience. This means that the reviews collected may over-represent extreme points of view, sometimes distorting the perceived quality of the garden on the basis of these polarized experiences. We can also expect some of the visitors who leave reviews on TripAdvisor to have positive sentiments about the garden, for example, because they have heard of it before, liked what they saw, and are simply reiterating the general consensus they have read about the garden. This self-selection bias is common to many online review platforms, including TripAdvisor, and underscores the need to consider the nature of the sample when interpreting the overall representativeness of visitor reviews. In these scenarios, it is essential to take into account the possibility of self-selection collusion bias in online reviews. This bias emerges when the reviews left are not only influenced by the tendency of individuals to share particularly positive or negative experiences but also by concerted attempts at manipulation. For example, some visitors may be induced to leave positive reviews in exchange for advantages, or competitors may publish negative reviews in an orchestrated way to damage the garden's reputation. This mix of biases can affect the reliability and representativeness of the reviews collected.

In some cases, seasonal variations significantly influence the visitor experience, an aspect that was not taken into account in the analysis. For example, weather conditions, such as high temperatures in summer, and the increased number of tourists during vacations and peak periods, modify the visitor experience, which is another limitation of the study. Finally, the COVID-19 pandemic had a major impact on tourist behavior and attitudes. Therefore, an analysis of reviews segmented into periods before, during, and after the pandemic would provide valuable evidence of the trends and changes in tourist experiences, highlighting another research limitation of the study. In a nutshell, the limited generalizability of this study is due to the selective nature of online reviews sourced exclusively from TripAdvisor, which do not necessarily represent the perceptions of all the visitors. In any case, the subjectivity of reviews can also unintentionally introduce potential biases, including, to some extent, the validity and reliability of the results.

By acknowledging these limitations, both researchers and stakeholders can better contextualize the data and potentially supplement it with other sources to obtain a more well-balanced overall perspective.

## 6.2. Research Implications

Deploying a sentiment analysis and topic modeling approach to tourist reviews on TripAdvisor has provided several contributions, notably, methodological and managerial and for tourism industry players.

In terms of methodological implications, it should be emphasized that the combination of the VADER and LDA methods enabled us to gain a more comprehensive perspective. As advanced above, VADER enables us to understand the overall sentiment, while LDA can help identify specific topics addressed by tourists, thus providing a more in-depth

analysis. However, from a holistic perspective, it would be valuable in future studies to enrich this methodology by integrating an analysis of emotions. By investigating specific emotions (joy, sadness, disgust, fear, anger, surprise, etc.) we could determine which emotions predominate in the various reviews. This would make it possible to link specific emotions to specific topics, offering an even finer understanding of the visitors' reactions.

In addition, the involvement of other data sources could greatly enhance the quality of the analysis. For instance, tourist demographics (age, gender, nationality, etc.) could provide valuable contextual evidence on visitor profiles and their various experiences. Similarly, weather data could offer interesting insights into the influence of climatic conditions on the sentiments, emotions, and topics raised in the reviews.

In terms of managerial contributions, sentiment analysis—particularly the category of negative sentiments (queuing, translation, pricing issues, etc.)—applied to the tourist comments on TripAdvisor is a valuable resource for garden operational managers. Lastly, all three provide broader information on “what can/should be done” for decision makers in the visitor attraction industry in Marrakech in particular, and in Morocco in general. These include the capture of transparent information to aid decision making, the improvement of ex post and ex ante visitor satisfaction processes, the optimization of online reputation, the personalization of the tourist experience, and, more broadly, the attractiveness of the destination through this original vector that is the “garden” object.

More broadly, sustainability is now a major concern for companies, researchers, political decision makers, and many sectors of activity [119], including the rapidly growing tourism industry [120]. The study of the Majorelle Garden makes a valuable contribution to these sustainability issues. Firstly, it highlights the importance of preserving cultural and botanical heritage, showing how a private urban garden can serve as a focal point for culture and biodiversity. Indeed, this garden, with its rich history and botanical collection, represents a crucial example of such preservation, ensuring the continuity of these elements for future generations. Secondly, the study enhances sustainable tourism by proving the positive impact of these green spaces on the tourism experience. Indeed, the analysis of the visitors' sentiments reveals that these spaces are key to attracting cultural tourism that both respects and values the local environment. Finally, the study raises public awareness of sustainability by illuminating the historical and symbolic aspects of the garden. This encourages the collective recognition of the benefits of maintaining and protecting these areas for their ecological and cultural value. In short, this research exemplifies how a private urban garden can play a crucial role in sustainability and sustainable development efforts while enriching the tourist experience and contributing to collective well-being.

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## Appendix A

This appendix is added to assess the effectiveness of our LDA model in significantly differentiating topics within each sentiment category. In our matrices, most correlations are negative and relatively weak, suggesting that topics within each category tend not to co-

occur strongly. Extremely low or negative correlations do not necessarily mean poor results but indicate that topics are well differentiated, which is often the goal of the LDA model.

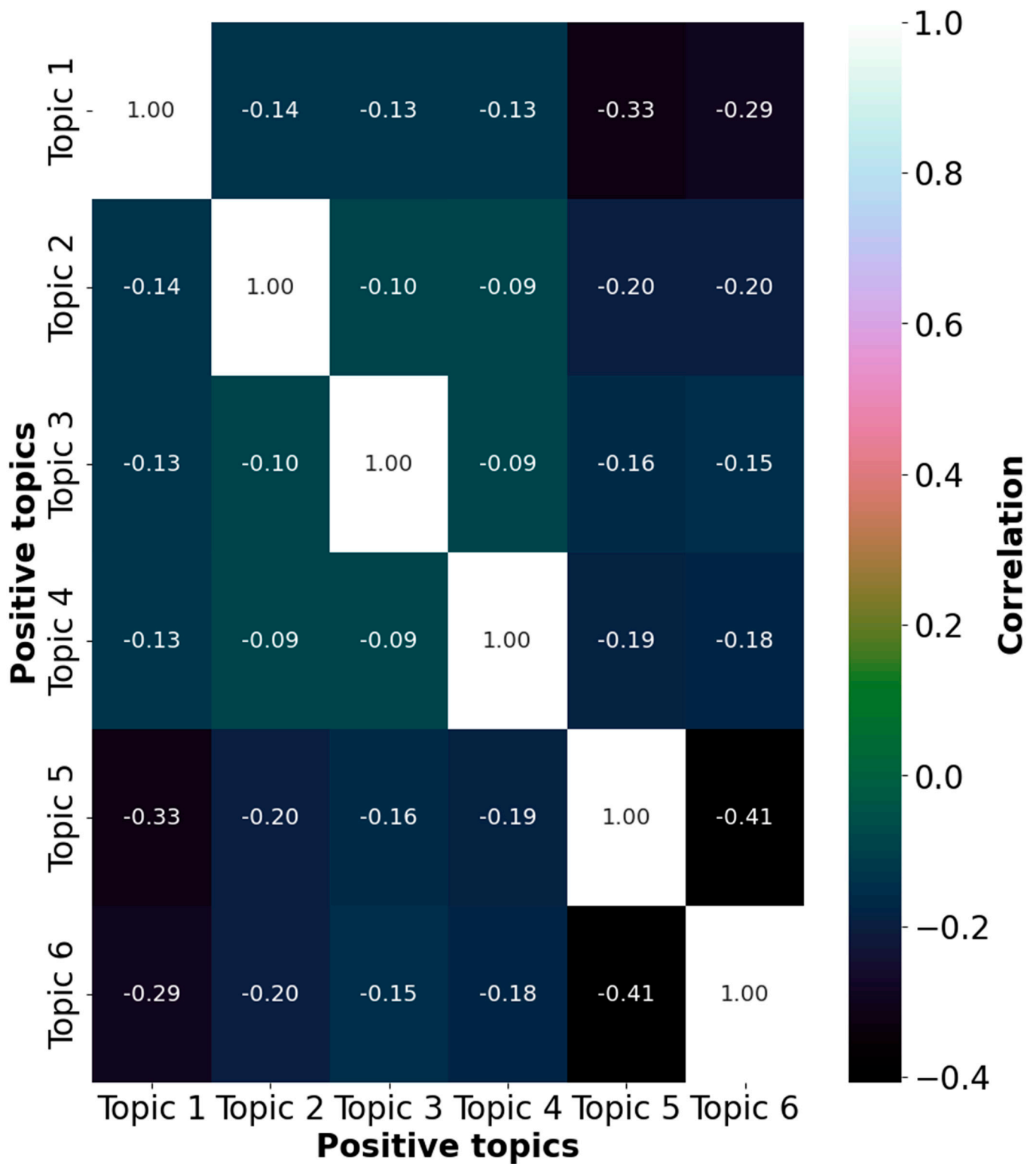


Figure A1. Evaluating the effectiveness of positive review modeling using the correlation method.

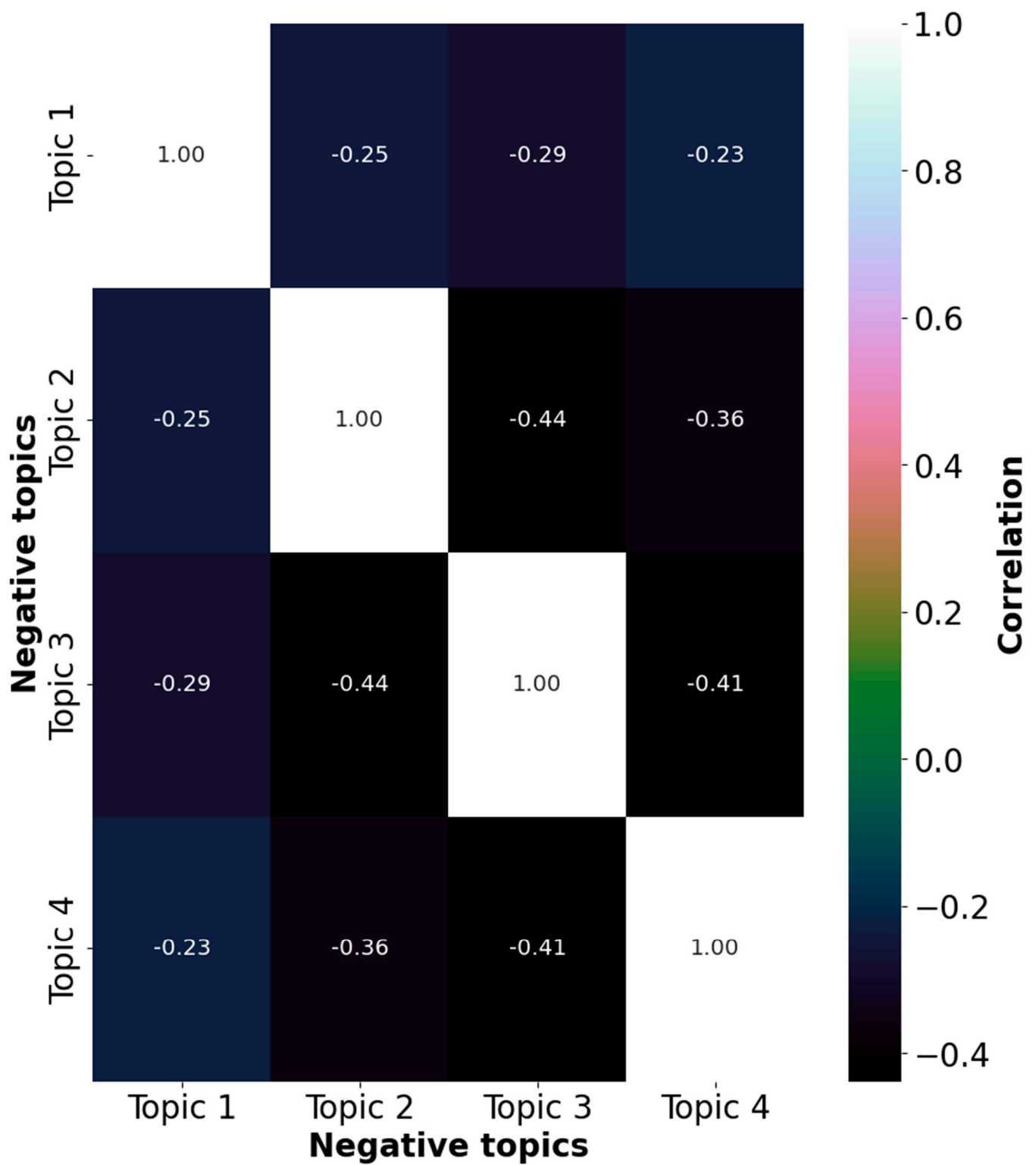


Figure A2. Evaluating the effectiveness of negative review modeling using the correlation method.



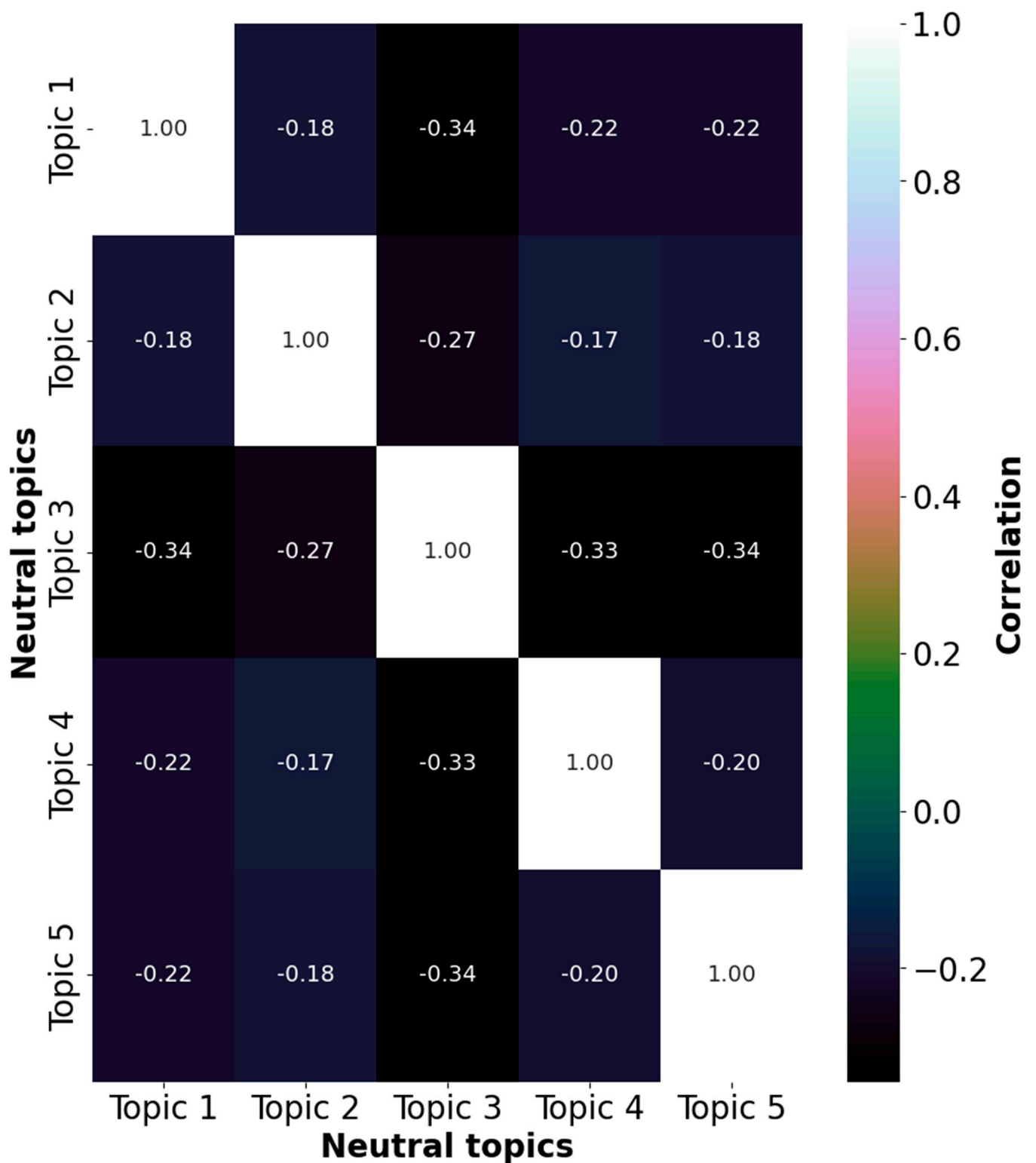


Figure A3. Evaluating the effectiveness of neutral review modeling using the correlation method.

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