

The use of photos of the social networks in shaping a new tourist destination – Analysis of Clusters in a GIS environment

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Abstract

The use of new photo sharing services in social networks has favoured a perception of the interests of locals and visitors. The photos presented in these networks are geocoded by the users, residents or visitors, allowing extensive databases to be obtained.

The research that was conducted between 2015 and 2016 followed an essentially quantitative approach. Based on the georeferenced photos on social networks, the main distribution patterns of places of interest to tourists, visitors, and residents were analysed in a rural emergent tourist destination in northeastern Portugal. We used geographical information systems (GIS) to apply various spatial and statistical analysis techniques. Among the main conclusions was that there is a high number of natural and cultural heritage locations with tourism potential, and, in some cases, their accessibility standards make them favourable destinations for tourists.

Keywords: Rural tourism, Spatial analysis, Accessibility, Photo-sharing services, GIS.

1. Introduction

The development of new methods of analysis of the images of various destinations has accompanied the emergence of extensive research that uses the method of analysing photos [1–5]. Another fact is due to the massive use of the Internet, which is increasingly introducing significant changes in the way people interact in society [6, 7]. This new dimension of communication has made the expression of multiple cultural values possible [8]. Because of the evolution of the Internet and the advent of smart technology, the proliferation of the number of photos registered per trip has occurred in recent decades [9].

However, the habit of sharing them with co-workers, family, and friends, as well as in the broader media, comes as a result of online sharing, often in real time and synchronously on various websites, such as Flickr, Picasa, Facebook, Panoramio, and Pinterest [4, 10–15].

Images have assumed a fundamental role in the dissemination of the dimensions and amplitudes of tourist spaces. The sharing of photos of a place through social networks has an increasingly strong power in promoting tourism, where the dissemination of the tourist image has an effective and lasting role. Different social media platforms have been accommodating new features and coupled with their simplicity of handling and attractiveness, they are competing increasingly with traditional travel guides or leaflets because they allow people to post photographs on the internet immediately after they are taken [4, 12, 13, 16–21]. However, it should be noted that these platforms still tend to be used by the younger age groups and by groups with higher socioeconomic characteristics.

Conversely, research centred on the analysis of online images of rural destinations has not been explored extensively [22–24]. Increasingly, urban dwellers' interest in staying overnight and visiting rural areas shows that it is essential to market and promote rural destinations online [18, 25–29].

With the evolution of geographic information technologies, it is possible to analyse distribution patterns (intensity, concentration, and dispersion) of tourism resources in different spaces through density maps, central trend measures, or with the use of indicators of distribution patterns (e.g., Getis-Ord General G or Moran's Index).

Based on these assumptions, the main objectives of this research are: (i) to identify the spatial distribution patterns of the photos of visitors and residents; (ii) to characterize the different "looks" of the tourist destination, and (iii) to contribute to the development of a tourist image that is closer to the interests of visitors and locals. This study complements other approaches undertaken in the territory, resulting mainly from an exploratory analysis of existing and potential tourism resources, the results of the focus group that was conducted, and the results of a self-administered survey [30, 31].

This article consists of four sections. After the introductory section, the second section presents the main methods and sources used to acquire the data that were used. Section three is a summary of the main results that were achieved, and it highlights the main potentialities of the analysis of the images and how they can contribute to the segmentation of the visitors. The section four presents our discussions. The section five presents the conclusions concerning the main results, proposes some challenges for future research, and identifies the main limitations that were intrinsic to the study.

2. Material and Methods Used in the Study Area

Geographical context

The case study was based on the municipality of Boticas, which is located in the Nomenclature of Territorial Units for Statistics (NUTS) III of Alto Tâmega in the northeast of

Continental Portugal. According to the Typology of Urban Areas (TIPAU) of 2014, seven of the parishes are considered Medium Urban Areas (MUA) and three as Predominantly Rural Areas (PRA) [32]. The area is subdivided into 10 parishes, with an area of 322 km² (Figure 1). In 2011 (last census), the population of the municipality of Boticas was 5,750, of which 1,510 residents (26.3% of the population) lived in Boticas and Granja. In fact, this municipality, like other territories located in the interior of the country, has lost its vitality. One of the municipality's main potentials is the use of its endogenous resources to attract tourists, associated economic activities, and to enhance its population.

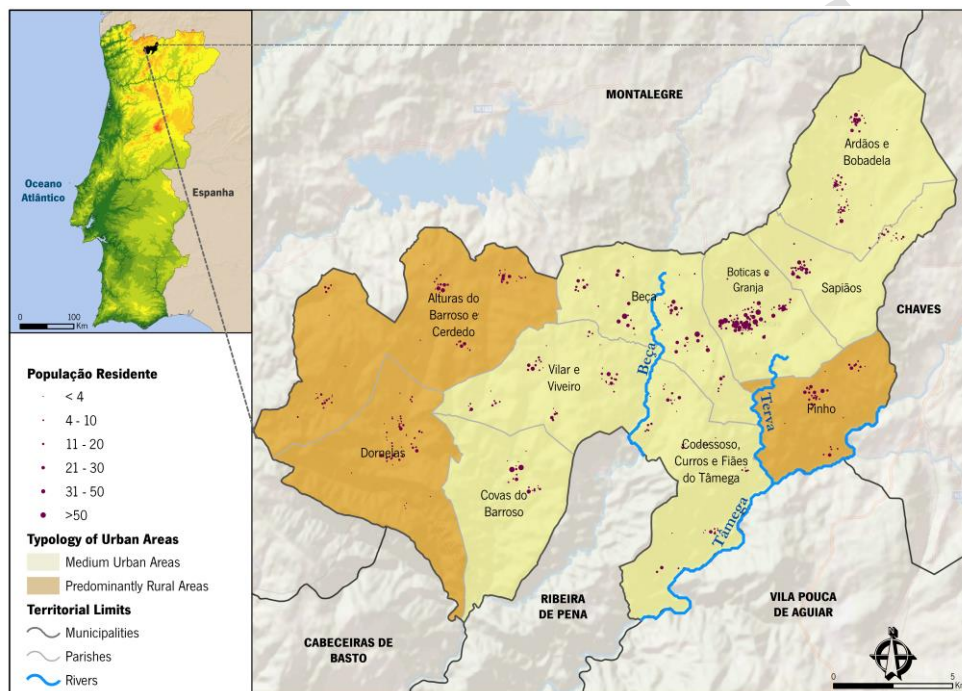


Figure 1. Geographical context of the municipality of Boticas: Population by subsection, TIPAU and MDT

Source: Own elaboration [based on the Census, 2011; TIPAU 2014 (INE) and Atlas of the Environment].

Materials and Methods

The database used in this research was constructed with data from Panoramio's photo platform, Google Earth. The period from January 2005 to March 2016 was used, and 728 photos were used. The photos were analysed by two quantitative methods, i.e., (1) univariate and multivariate statistical analysis using the SPSS 22.0 statistical package and (2) geospatial analysis using the ArcGIS 10.3 package. The data were grouped into several typologies considering the assumptions defined in previous studies [3–5]:

(i) four categories – 1) built heritage (e.g., monuments, historic buildings, churches, and typical homes); 2) nature (landscape, fauna, and flora); 3) culture (combining expressions of local culture, traditions, or festivals); and 4) tourist services (comprising all forms of tourism equipment and infrastructures, such as accommodations, catering, and signs). The situations in which images with more than one set of elements were verified always opted for the predominant set.

(ii) zoom of the image - this was analysed by checking the following assumptions: (1) if the image is focused on a single element (e.g., a window of a dwelling or a church), (2) in its context (a church in the housing complex), or (3) whether it is a panoramic view or scenery (e.g., a mountain or a river).

(iii) presence of people.

(iv) origin - whether the image originates from locals or visitors.

After defining the cataloguing criteria of the images, the main assumptions that are inherent to the analysis of the spatial distribution of the photos should be emphasized:

1. the data were aggregated in hexagons with 150 m of side and 300 m of diameter;
2. Standard distance calculations were performed to infer the degree of concentration or dispersion of resources around the mean geometric centre;
3. Two indices were used to determine global localization patterns, i.e., Getis-Ord General G and Global Moran's I. These served to identify the degree of agglomeration of high and low values and the spatial correlation based on local resources and attribute values;
4. Anselin Local Moran's statistics (LISA statistics) were used, making it possible to determine emerging local trends for the intensification of Boticas' tourism.

These typologies were the basis of the identification of clusters. This technique allows the identification of groups with high homogeneity within the group as well as intergroup heterogeneity [3]. The k-means method was used considering the following assumptions: (i) the choice of sample was made based on a sample in each group, from a group of groups (2 to 5); (ii) minimum loss of information through the merging of the elements; and (iii) instead of considering the categories *per se*, items were used to segment the groups. After obtaining the clusters, an ANOVA test was performed to determine the differences between the groups.

3. Results

The destination image can be promoted based on the sets of photos that residents and visitors take, considering their ability to become souvenirs, postcards, or tourists' objects. Photo density analysis of Sightmaps (<http://www.sightsmap.com/>, developed by [33]) clearly showed a density of photos in more urbanized areas [e.g., Oporto Metropolitan Area (OMP), Braga, Guimarães, Viana do Castelo, Chaves, and Bragança] in the course of the

Douro River (in Portugal, Barca d'Alva to the mouth between Porto and VN Gaia) or in the Peneda and Gerês National Park (PNPG), which was different from what occurs in territories such as Boticas.

In the municipality of Boticas, as with the other municipalities of Alto Tâmega (with the exception of Chaves), there is a density of photos that were much smaller and circumscribed to the central area of the municipality. Figure 2 summarizes the distribution of the photographic series, differing according to whether they were taken by residents or visitors. In general, there is a concentration of photos in the northwest and central areas of the municipality of Boticas, although most of the photos are distributed somewhat throughout the municipality, mainly along the main axes of the road network.

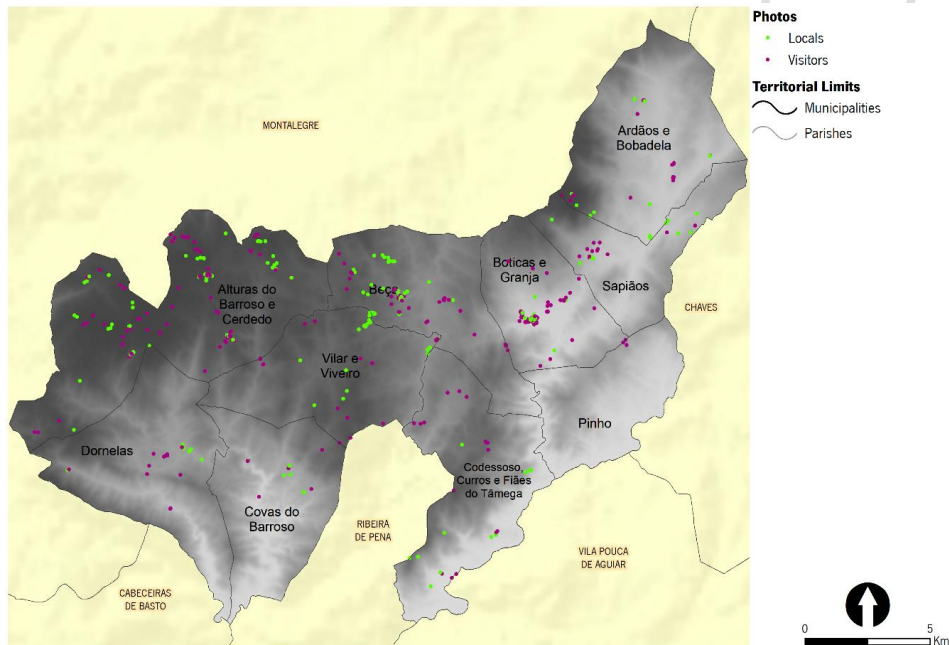


Figure 2. Geographic distribution of photos of visitors and residents

Source: Panoramio photos, collected during the period from January 2003 through March 2015.

However, it is in the parish of Boticas and Granja that there was a greater density of photos, which was due to the amount of equipment available to visitors. For this reason, in all parishes, there are more photos of visitors than residents (258 for locals and 470 for visitors – Table I).

Table I. Distribution of photos by parish (in number and percent)

Parish	Locals		Visitors		Total	
	Nº.	%	Nº.	%	Nº.	%
Alturas do Barroso and Cerdedo	85	32,9	105	22,3	190	26,1
Dornelas	7	2,7	16	3,4	23	3,2
Ardãos and Bobadela	15	5,8	15	3,2	30	4,1
Boticas and Granja	49	19,0	201	42,8	250	34,3
Beça	38	14,7	72	15,3	110	15,1
Pinho	0	0,0	3	0,6	3	0,4
Codessoso, Curros and Fiães do Tâmega	15	5,8	14	3,0	29	4,0
Covas do Barroso	10	3,9	9	1,9	19	2,6
Vilar and Viveiro	28	10,9	24	5,1	52	7,1
Sapiãos	11	4,3	11	2,3	22	3,0
Total	258	100	470	100	728	100

Source: Panoramio photos, collected for the period from January 2003 through March 2015.

The maximum of photos recorded per hexagon for this group was 55 photos (Table II).

Table II. Statistics of photos taken by visitors and locals

	Number of photos	D.P.	Maximum of photos per hexagon
Total	728	1,56	66
Locals	238	0,43	17
Visitors	490	1,22	55

Source: Panoramio photos, collected for the period from January 2003 through March 2015.

The grouping of the photos in hexagons shows a concentration of photos to the north of the municipality, and the areas with the lower densities of photos are located to the south, especially in the parish of Pinho (three photos - Figure 3).

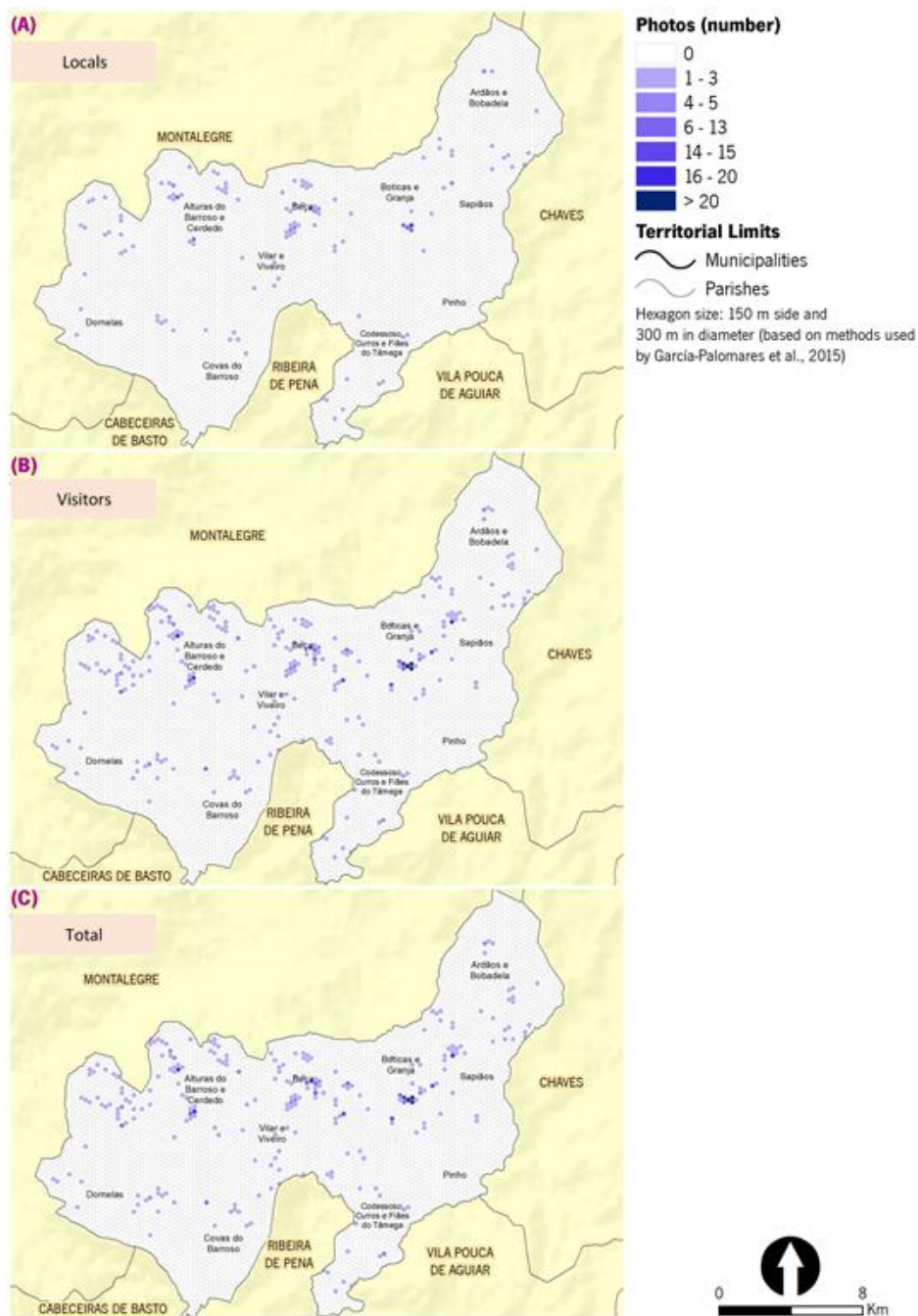


Figure 3. Density of photos - (A) Locals, (B) Visitors, (C) Total

Source: Own elaboration, based on Panoramio photos for the period from January 2003 through March 2015.

To identify the clusters, the G-statistics were analysed, and the Moran index was used. The G-statistics indicated that there was a tendency for the concentration of values (high-clusters), with high levels of significance (p-value <0.01). Likewise, the Moran index indicated a very strong spatial correlation for the formation of spatial agglomerates (p-value <0.01 - Figure 4).

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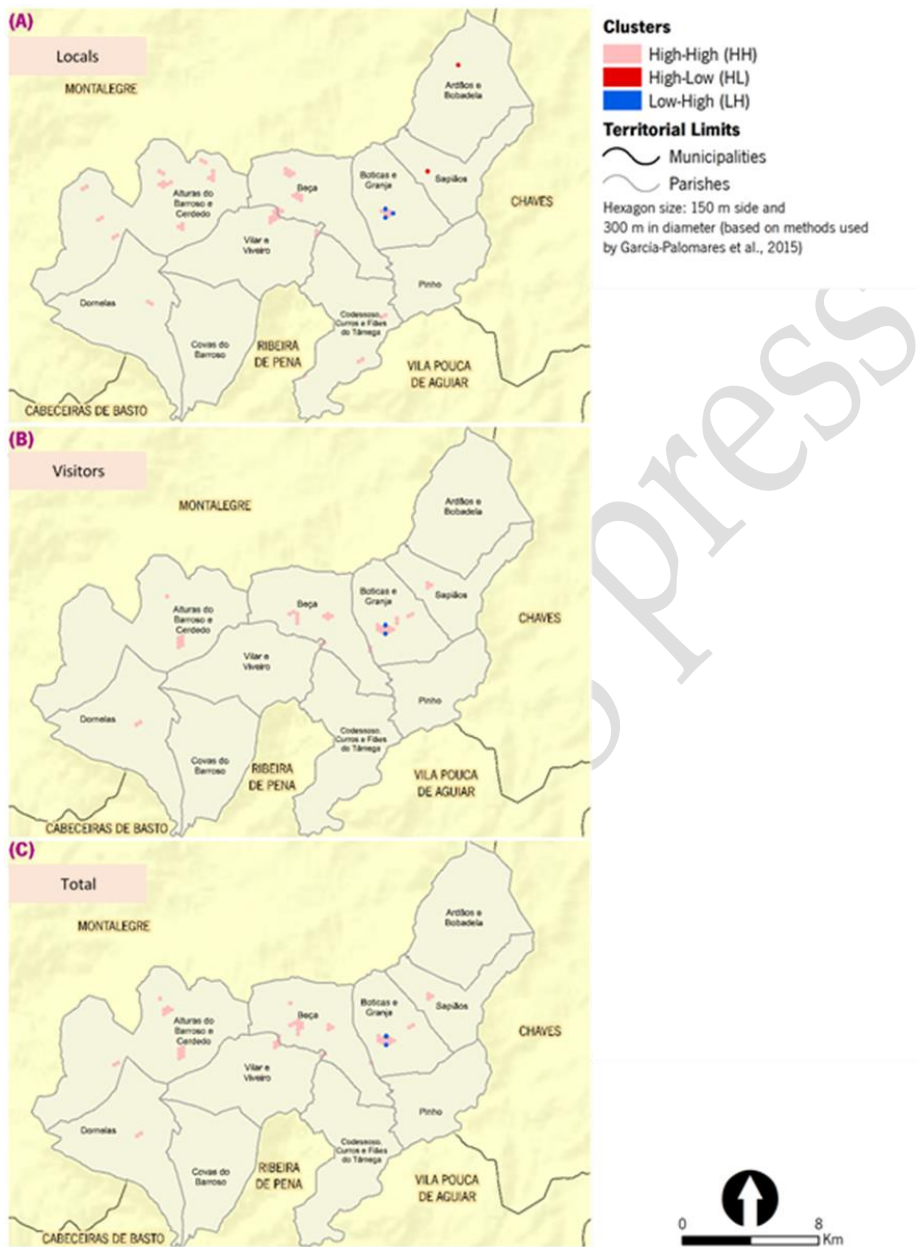


Figure 4. *Anselin Local Moran's Statistics*

Source: Own elaboration, based on Panoramio photos for the period from January 2003 through March 2015.

The Anselin Local Moran's statistic was calculated with the intention of mapping the presence of these groups, and it was found that the number of clusters with High-High (HH) values was not very significant. Concerning the distribution of these clusters, there was a spatial agglomeration in several villages typical of the municipality (e.g., Vilarinho Sêco, Coimbró), in places of landscape-natural interest (e.g., Carvalhelhos, Mosteiró, Vilarinho de Mó) and in the village centre, either by locals or visitors. There are some differences between places photographed by locals and visitors. The former has High-High (HH) clusters in Coimbró, Serra do Barroso Wind Farm and in Fiães do Tâmega, while the latter have an agglomeration in Sapiãos (e.g., anthropomorphic graves, some typical houses, river beach), which are not present in the photographs made by the residents. It should be noted, however, that there were small clusters expressed in Low-High values, which correspond to atypical values.

Figure 6 presents the typologies created for the photos. The concentration of photos is strongly associated with two types of characteristics, i.e., built-heritage (57%) and natural elements (35%). Tourism services (5%) and local culture (4%, Figure 5A) appear less often.

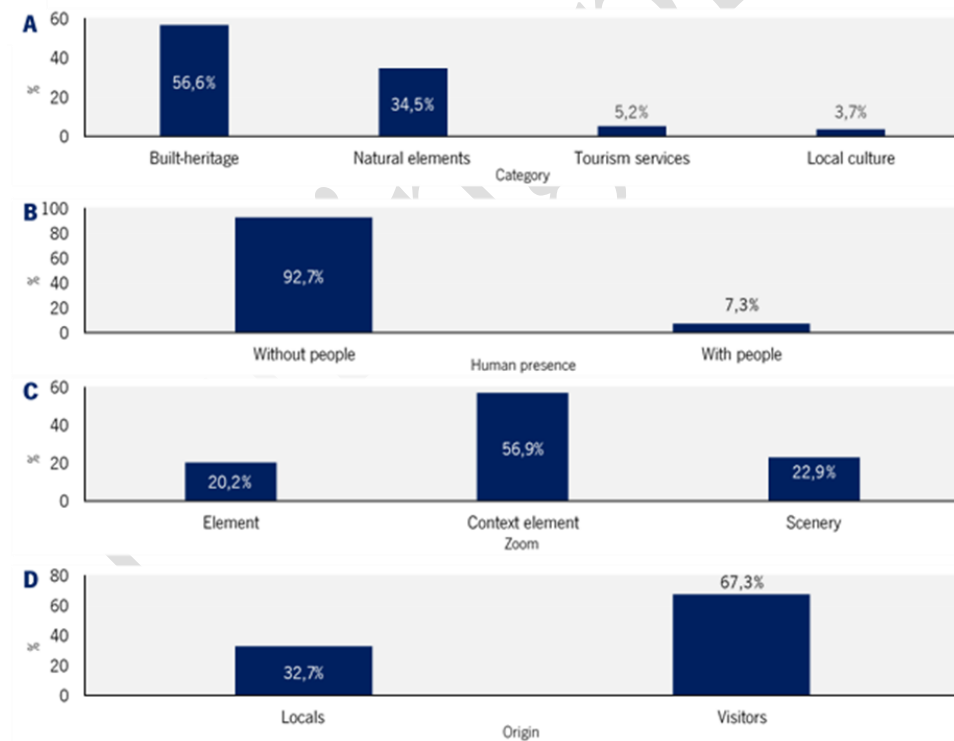


Figure 5. Typologies of photos (%): (A) Category, (B) Human presence, (C) Zoom, and (D) Origin

Source: Own elaboration, based on Panoramio photos for the period from January 2003 through March 2015.

The distances from which the images were photographed were very different. In some cases, the person taking the photos focused only on the details, while, others sought to take photographs of the entire scene. Therefore, we chose to classify the photographs into three subgroups, as shown in Figure 5(B). The results allowed us to conclude that 57% of the sites/visitors photographed elements in the context, which reflected the demand of visitors and residents to capture what is within a context, so that it can be recognized easily. Another element used for analysis was the degree of the presence of people in the photos (Figure 5C). The most common circumstance for visitors and residents was to take photos without the presence of people (93%; Figure 5D), and only 7% of the photos included people. In addition, 67.3% of the photos were taken by visitors, showing their renewed interest, which is perfectly understandable. In fact, it is surprising that there were a significant number of locals placing Panoramio photos, which may indicate the recognition of the natural and built heritage that exists in the municipality.

Figure 6 represents the temporal distribution of the photos taken by visitors and locals. It should be noted that the figures do not refer to all of the photos sent to the Panoramio platform over the review period; rather they refer only to the photos that contain information concerning the dates they were taken.

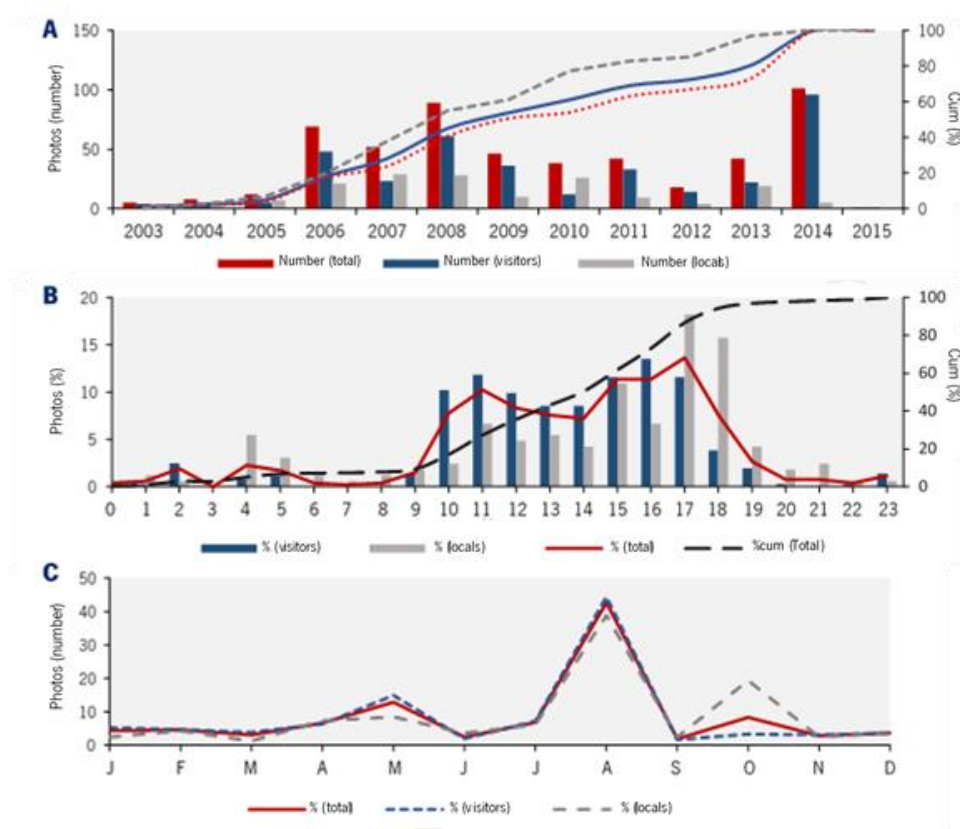


Figure 6. Temporal patterns of locals' and visitors' photos: (A) Photos taken per year with registration of the number of photos and cumulative percentage (% cum) for locals, visitors, and both; (B) Photos taken per month with percent (%) recorded for locals, visitors, and both; (C) Photos taken per hour with percentage (%) for locals, visitors, and both and cumulative percentage (% cum).

Source: Panoramio photos collected for the period from January 2003 through March 2015.

There were 528 photos with year-to-year, intra-annual, and intra-day information that were included among the 729 previously classified photos. In fact, the year with the highest number of photographs taken by visitors was 2014, while in the case of locals the highest number of photographs taken occurred in previous years, i.e., between 2006 and 2008 (Figure 6A). Thus, in cumulative terms, there has been a redoubled interest in taking photographs by visitors in recent years. However, when analysing the values recorded monthly in the period from 2013 through 2015, there is a seasonality of the photos records, with a concentration in August (Figure 6B). Concerning the hourly range, these photographs generally were taken between 10:00 am and 5:00 pm (Figure 6C).

It should be noted that residents contributed most to post-5:00 pm photographs, which may be due to the return of excursions to the place of departure after an overnight visit to the Boticas municipality, indicating that the municipality had visitors but not tourists. There are some records during the night period, but they should be viewed with caution because there may have been errors associated with the instruments' recordings of the time when the photographs were taken.

An analysis also was conducted for the areas with the highest concentration of photos [i.e., the areas classified in Figure 7 with High-High (HH) clusters].

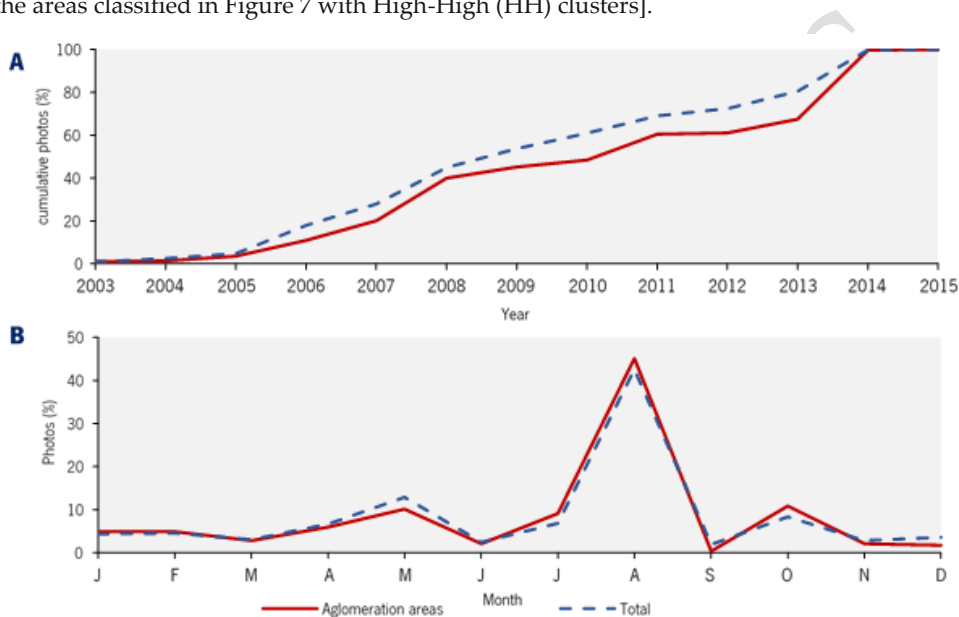


Figure 7. Time patterns in photos in agglomeration areas [High-High (HH) clusters] in comparison with all photographs: (A) Cumulative percentage (% cum) of captured photos per year from 2003 through 2015; (B) Percentage (%) of photos per month
Source: Own elaboration, based on Panoramio photos for the period from January 2003 through March 2015.

It should be noted that these concentration areas received a larger number of photos than the others, and it was decided to compare the evolutionary rhythms by year and month with respect to the total records of photos in the municipality.

Although there was a trend towards the concentration of photographs in some areas of the Boticas municipality, as was previously indicated, this centralization only began to occur in 2014 (Figure 7A). Even so, these photos were taken mostly in the summer months, with emphasis on the month of August, which should result from visitors to the country (Figure 7B).

Table III summarizes the results of grouping items into clusters. It was observed that the characteristics of the photographs indicated that there were two types of patterns, i.e., tourists and residents. Note that, during the analysis, it was verified that all the items presented a p -value ≤ 0.05 . The ANOVA test result also showed that the variables included in the model were sufficiently different for their grouping, and, thus, three groups were created. Cluster A ($n = 250$) essentially presents photographs of nature (100%), and the cluster is associated with photos that focus on scenarios (55.6%) and includes the visitors who most often take this type of photos. Cluster B represents only the class of visitors, highlighting the elements in the context (64.9%) and the built heritage category (89.8%). Cluster C represents the least expressive group and incorporates photographs that focus on elements located in the context (76.5%) and in the category of the built heritage (78.4%). Clusters B and C contain essentially photographs that do not include people.

Table III. Analysis of the clusters of the photos

	<i>Cluster A</i> (<i>n</i> = 250)	<i>Cluster B</i> (<i>n</i> = 325)	<i>Cluster C</i> (<i>n</i> = 153)	<i>F-ratio</i>	<i>p-value</i>
Built heritage	0	89.8	78.4	4698.348	0.000*
Local culture	0	2.5	12.4		
Nature	100	0	0.7		
Tourist services	0	7.7	8.5		
Element	10	29.2	17.6	163.294	0.000*
Element in Context	34.4	64.9	76.5		
Scenario	55.6	5.8	5.9		
Without people	96	93.8	85	3.008	0.050**
With people	4	6.2	15		
Residents	34	0	100	94.401	0.000*
Visitors	66	100	0		

Note: *, $p < 0.01$; **, $p \leq 0.05$.

Source: Own elaboration, based on Panoramio photos for the period from January 2003 through March 2015.

4. Discussion

As demonstrated during the study, Boticas is a tourist destination with seasonal demand, particularly during the summer period (Figure 8), a fact substantiated by the intersection of the number of visitors registered in Interactive Shop Porto and North Tourism and the

number of photographs available in Panoramio. In any case, it is important to mention that some of the rural tourism houses in the municipality have a higher number of visitors during the winter period, as was evident from direct observation and discussions with these local agents.

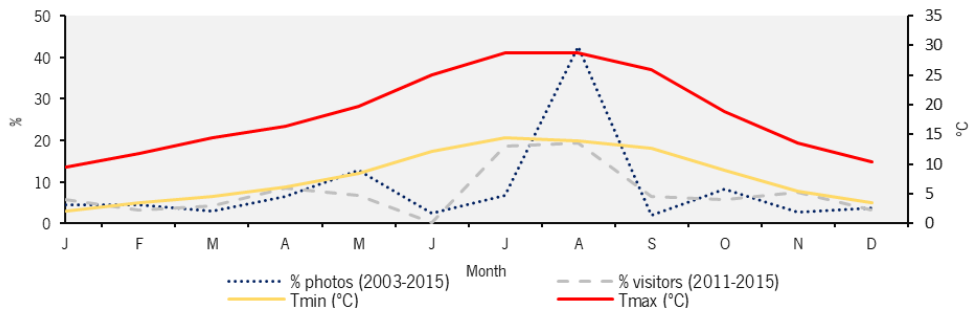


Figure 8. Photos recorded in the Panoramio (from 2003 through 2015) and visitors (from 2011 through 2015) in comparison with the minimum and maximum temperatures registered in the climatological normal for the period from 1971 through 2000 in Vila Real. Source: Own elaboration, based on Panoramio photos for the period from January 2003 through March 2015, in data from the Interactive Tourism Store and <http://www.ipma.pt/pt/oclima/normais.clima/1981-2010/023>.

The relationship between the photos that were taken and the promotion conveyed by various means of communication does not always present a direct relationship. In fact, although the Nadir Afonso Arts Center and the Boticas Nature and Biodiversity Park present a significant number of photographs and are key tourist resources for the promotion of the territory, there are other resources that the municipality presents that are underutilized due to the lack of the dissemination of information about their existence.

When the number of photographs is considered with respect to the tourist resources identified in the territory (Figure 9), it was verified that there are villages in which some of the traditional customs have been preserved, e.g., Vilarinho Sêco and Coimbró. Although such considerations also are woven by residents and other stakeholders (i.e., [23, 30, 31]) when they identify the valued tourist attributes or those with high potential for appreciation, they are still not as effective in the tourism promotion strategy.

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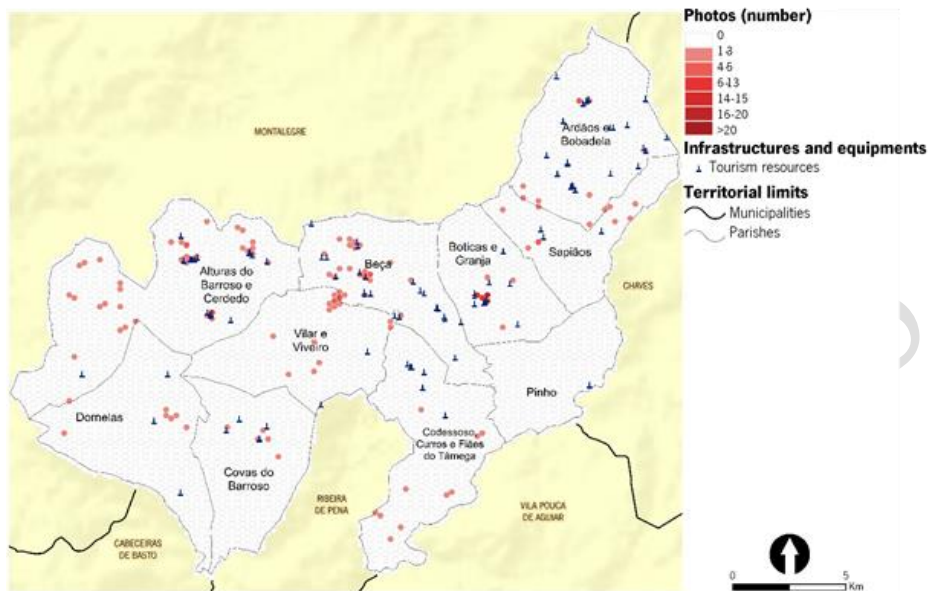


Figure 9. Relationship between the number of photographs and tourist resources identified in Boticas

Source: Photographs of Panoramio, collected for the period from January of 2003 through March 2015 and in the tourist resources referenced in <http://patrimonio.cm-boticas.pt> and in loco.

The results also show that visitors and local people more often have photographed patrimonial and natural elements. However, it should be noted that this difference was more significant in the case of the local people. Nevertheless, it is important to mention that these evidences present a high degree of similarity with the results obtained by [3]. The perceived image of Boticas is very much related to the built heritage rather than to nature, although the differences are not so significant when compared with the categories of tourist services and local culture. This was a surprising discovery, and, if it is true that this municipality has a unique built-heritage (especially churches and museums), there also were some atrocities committed during the patrimonial recovery processes with profound changes to the structures of churches and chapels. However, the relevance of nature, especially on the part of the visitors, is consistent with the reading made by the various stakeholders, considering the magnificence of the natural ecosystem, i.e., the mountains and valleys, of this territory.

Another element of analysis that allows us to infer the image of visitors is associated with the degree to which people are present in the photographs. While in some European destinations the captured heritage photographs do not have individuals present, in others they appear more frequently, especially in exotic or allocentric destinations. Photographs

with the presence of visitors occur commonly in destinations where there is a degree of interaction between the receiving community and visitors [3].

A careful analysis of the photographs allowed us to infer that those taken in the Boticas territory were largely free of the presence of both local people and visitors. This situation is not uncommon, as was evident in the investigations conducted in Girona [3, 34, 35] and Vale de Boí [3]. One of the reasons that supports the absence of people in the photos is the ideal of individual consumption of places, which is supported by the assertion that the presence of people in the photographs could represent a kind of alteration of reality [36].

Nevertheless, in most cases, tourists who visit a destination such as Boticas seek to eliminate any vestige of humanity to avoid detracting attention away from the element or the landscape, e.g., empty churches or the splendour of the landscape. These photographs usually also have a smaller focus, where the elements in the context (56.9%) are the most photographed, which may be due to the search for a broader framework than they are visiting (global vision of the place), to facilitate their later recognition.

In fact, visitors' behaviours may be framed in accordance with the photographs that are taken in the sense that the length of stay in the municipality is very small. Most of the photos with a visiting author occur between 10:00 A.M. and 4:00 P.M.), which may denote (i) the absence of tourist facilities that are open for a longer time period; (ii) the absence of other interesting activities in the municipality; (iii) the absence of catering services that are open until later hours during the weekly period; and (iv) the lack of desirable hotel accommodations that meet visitors' expectations.

Considering these elements, it would seem reasonable to start some efforts to counteract this trend and to create a precise and accurate image of this territory. This could be done in the form of tourism products, based, for example, on nature, health, and well-being. This approach could attract visitors who have an interest in these locations, and it may allow the maintenance of sustainable tourism practices.

5. Conclusion

The photos taken by locals and visitors show that there are certain observable distribution patterns and that these patterns have some similarities and some significant differences. In fact, visitors taken photos less concentrated in certain housing areas than locals, which shows a certain predisposition to value elements of the intangible heritage. It should be noted that 34.5% of the photos that were taken were associated with the natural component.

In some cases, there is a certain disarticulation between the promotion of tourism conducted by the municipality and the image of the destination based on photographs. In this way, there are some clues that can be put forward for future work, namely: (i) assessing the seasonality of photographs taken by residents and visitors and, thus, which potential sites to promote and at which time of the year; (ii) verification of the distribution of the photographs at the supra-municipal scale, given that this sample is incipient and that it is possible, based on photographs standards on a broader scale, to develop common strategies

with other adjacent territories; and (iii) objectives, goals, and strategies that can be outlined in the short-term and medium-term for the development of tourism.

Such research has some limitations. While it is critical to take into consideration that residents or visitors only share the photos they deem to be most relevant, only some groups are frequent users of these platforms. Nonetheless, these approaches must be used in combination with other approaches, such as surveys, focus groups, and interviews, to determine important information concerning the use of the territory's resources from the perspective of enhancing tourism.

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Conflict of Interest

The authors declares that there is no conflict of interest.

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