Store buildings as tourist attractions: mining retail meaning of store building pictures through a machine learning approach

Abstract.

The aim of this paper is to understand the extent to which a store building can function as a tourism attraction, using a large luxury department store as case research. The study draws upon the idea that people complete a hermeneutic circle to create an extraordinary tourism experience to share with others. The data gathering is based on the collection of pictures posted online on Flickr and and analysed using a machine learning approach. A sample of 1,557 pictures related to a specific area in London (UK) were collected and analysed by means of a cluster analysis in order to determine which objects are most photographed. Findings reveal that the store building of a luxury department store is the central object in the majority of pictures within a 1km radius of the store main entrance, which demonstrates the role of store building attractiveness in tourism experience. The **theoretical contribution** is that this is the first paper adding the exterior of the building as attribute of the department store, and demonstrating the role of department stores in place attractiveness.

Keywords. big data analytics; retail store buildings; place attractiveness; tourism behavior; consumer behavior

1. Introduction

Recent advances in computational capabilities provide new tools and methods to analyse large amounts of data that are available from user-generated content posted online (big data). Such big data is becoming a key differentiator for marketing managers, retailers and tourism managers who can use emerging technologies to collect insights on consumers and adjust management strategies

accordingly (Balomenou, Garrod, & Gerogiadou, 2017; Balomenou and Garrod, 2019; Bradlow et al., 2017; Pantano, Priporas & Stylos, 2017). Indeed, marketers are encouraged to exploit the variety, velocity and volume of big data to gain competitive advantages through the extraction and interpretation of insights about consumers available from the use of big data analytics (Bradlow et al., 2017; Erevelles, Fukawa, & Swayne, 2016; Germann, Lilien, & Rangaswamy, 2013; Onder, 2017; Pantano, Giglio, & Dennis, *in press*.). To this end, retailers might collect and interpret big data available on the different social networks and social media platforms to drive new revenue streams, to capture consumers' perceptions of brands, their satisfactions and expectations, to predict their behavior towards a new or unfamiliar product and so on (Balducci and Marinova, 2018; Konijin, Sluimer, & Miras, 2016; Lo and McKercher, 2015; Tirunillai and Tellis, 2014; Xu, Frankwick, & Ramirez, 2016). Since these data are unstructured, additional computational capabilities are required before they can be effectively converted into useful consumers insights. Methods of enquiry based on unstructured data such as video, images (photos, pictures, etc.), audio and texts (consumers' posts) are fast acquiring the attention of marketing and retailing studies, with many applications in different subsectors (Balducci and Marinova, 2018; Balomenou and Garrod, 2019; Pantano, Giglio, Dennis, *in press.*).

Previous research recognizes shopping as one of the oldest tourism activities, and tourism shopping attracts the attention of scholars in tourism and retail literature (Choi, Law, & Heo, 2016; Kemperman, Borgers, & Timmermans, 2009; Moscardo, 2004; Murphy et al., 2011; Park, Reisinger, & Noh, 2010; Shin and Santos, 2014; Turner and Reisinger, 2001; Zaidan, 2016). Certain stores attract considerable tourists attention, for example the Tiffany store on the 5th Avenue in New York (US) daily attracts hundreds of visitors who want to take pictures in front of the store windows. Similarly, some store buildings attract tourists on account of the external shape or architecture, as exemplified by the Selfridges building in Birmingham. For instance, a tourist from The Netherlands left a review (with 4-stars rating) on TripAdvisor declaring that "that is what we were told! The

architect's wife had bought a designer handbag and he found it so exclusive that he copied it and made this building! The contrast with old brick buildings all around is very nice".

Store buildings can be a major draw for tourists to photograph and take selfies but this important effect has been little-studied to date. Big data analytics and machine learning methodologies are ideal to study this effect but to our knowledge, no prior research has done so. Specifically, to the best of authors' knowledge no previous studies have directly examined the extent to which big data analytics and machine learning methodologies might support understanding the effect of retail store buildings on place attractiveness, with emphasis on luxury store buildings. Therefore, the current study aims at answering the following research questions:

RQ1: To what extent do store buildings play a role in place attractiveness?

RQ2: How can tourists' pictures be systematically analysed to provide insights into tourism behaviour?

Drawing upon the analysis of pictures that consumers post on Flickr (social media for photo sharing), the aim of this paper is to understand the extent to which a large luxury department store affects place attractiveness, using Harrods (London, UK) as case research, and the Flickr API (Application Programming Interface) to collect pictures uploaded by users within 1km of the famous Harrods building between the 1st of January 2016 and the 31st of August 2017.

The emerging 1,557 pictures have been analysed through *Wolfram Mathematica* software, and distributed across a map that identifies the exact location of the pictures. Findings show the extent to which the building of Harrods is central on the majority of the pictures posted online, representing the main photographed point within a radius of 1 km. Results contribute to the literature on the importance of applying big data analytics to social media to illuminate tourists' and consumers' behavior in depth. The theoretical contribution is that this is the first paper adding the exterior of the building as attribute of the department store, and demonstrating the role of department stores in place attractiveness. The analysis also indicates useful suggestions for marketing managers to develop more personalized retail strategies.

The paper is structured as follows: the next section comprises the brief literature review of place attractiveness, with emphasis on shopping place attractiveness for tourists. The subsequent section focuses on the case research, data collection and procedure. Finally, results are discussed, and implications for scholars and practitioners are illustrated.

2. Theoretical background

2.1 Shopping malls attractiveness

Place, location and destination attractiveness form the foundation of the tourism industry, with respect to the attractions available in any particular place as able to solicit tourists flows (drivers of tourism intention to visit a certain destination) (Cheng, Wu, & Huang, 2013; Cho, 2008). Tourism place attractiveness can be defined as the sum of tourists' perceptions of the destination's capability to deliver value for tourists (Hu and Ritchie, 1993). In particular, tourism place attractiveness consists of a set of attributes including natural and cultural resources (e.g. landscapes, museums, archaeological parks, etc.), transportation and infrastructure (e.g. highways and roads, health services, communication and public transport, etc.), environmental services, recreational and shopping facilities such as souvenir and gift shops (Gearing et al., 1974; Giglio et al., 2015; Reitsamer and Brunner-Sperdin, 2015; Stylidis, 2018).

Marketing and retail literature specifically stresses the characteristics of shopping malls and retail agglomerations to be perceived as shopping destinations for domestic consumers, by identifying the drivers of attractiveness of these places as (i) the number of shops, favoured shops, and anchor stores (Dennis, Marsland, & Cockett, 2002; Dolega, Pvlis, & Singleton, 2016); (ii) retail tenant mix (including the plurality and diversity of shops) (Blut, Teller, & Floh, 2018; Dolega, Pvlis, & Singleton, 2016; Teller and Elms, 2010; Teller et al., 2010); (iii) entertainment and leisure activities (including cinemas, restaurants, etc.) (Dolega, Pvlis, & Singleton, 2016; El-Adly, 2007; Sit, Merrilees, & Birch, 2003); (iv) convenience in terms of distance from consumer' place, openings,

parking availability, etc. (Dolega, Pvlis, & Singleton, 2016; El-Adly, 2007; Reimers and Clulow, 2009); (v) image (including popularity and external atmosphere) (El-Adly, 2007; Sit, Merrilees, & Birch, 2003); and (vi) atmospherics (Teller and Elms, 2010; Teller et al., 2010) (Table 1).

Study	**Methodology**	**Antecedents of shopping malls/retail agglomerations attractiveness**
Blut, Teller, & Floh, 2018	Literature review	Tenant mix
Dennis, Marsland, & Cockett, 2002	Questionnaire survey with 287 consumers	Number of (favoured) shops
Dolega, Pvlis, & Singleton, 2016	Theoretical	Size (total shops), retail mix (including the plurality and diversity of shops), entertainment (leisure activities), number of anchor stores, number of vacant spaces (unit not occupied by any store/activity), distance from consumer' place
El-Adly, 2007	Questionnaire survey with 404 consumers	Comfort (i.e. security in the mall, car parking, etc.), entertainment, diversity (i.e. plurality and variety of restaurants, cinemas, etc.), mall essence (i.e. product quality, plurality and variety of stores, etc.), convenience (i.e. ease of reaching to the mall, late working hours in the mall, etc.), and luxury (popularity of the mall, and external appearance of the mall).
Reimers and Clulow, 2009	Questionnaire survey with 541consumers	Time convenience (i.e. extended trading hours, locations close to consumers' place, etc.)
Sit, Merrilees, & Birch, 2003	Questionnaire survey with 503 consumers	Shopping centre image, entertainment elements (i.e. cinemas) and food court
Teller and Elms, 2010	Questionnaire survey with 1008 consumers	Retail tenant mix, product range and atmospherics
Teller et al., 2010	500 face-to-face interviews	Retail tenant mix and atmospherics

Table 1. Studies of the antecedents of shopping malls/retail agglomerations attractiveness.

Although tourists and residents share shopping places, they might perceive them differently (Snepenger, et al., 2003), which could represent a confounding factor in place attractiveness studies. Moreover, the place attractiveness studies referred to above investigate domestic consumers' perceptions of shopping malls and retail agglomerations through methodologies that involve researcher interaction with consumers (i.e. surveys, questionnaires, and interviews), which might influence and bias their answers. Moreover, when considering the characteristics of these places, only one study (El-Adly, 2007) considered the importance of the store building as an influencing factor. Accordingly, this current study aims to illuminate the role of a store building without directly communicating with respondents.

2.2 Shopping destinations attractiveness

Research sheds light on shopping as an important tourism activity (Choi, Law, & Heo, 2016; Kemperman, Borgers, & Timmermans, 2009; Hsieh and Chang, 2006; Oh et al., 2004; Tosun, 2017; Yu and Littrell, 2003). As a tourism activity, shopping includes the purchase of goods during travel to take home (Jin et al., 2017). Shopping motivation can be so important to tourists that it can influence the choice of destination (Choi, Law, & Heo, 2016; Moscardo, 2004).

With the above considerations in mind, several destinations now organize shopping festivals to attract more tourists, such as the "Great Singapore Sale (GSS)", which carries the strapline "66 days to please all shopaholics" and takes place annually; "The Magnificent Mile Shopping Festival" (staged occasionally in Chicago); and the "Fashion Night Out" hosted in different cities every year (e.g. Milan in Italy, London in UK, etc.). Similarly, places like the Grand Bazaar in Istanbul (Turkey) are usually listed at the top of "things to do" in the city according to travel portals such as TripAdvisor. Tourists can have a more positive evaluation of a shopping destination than do locals (Dennis, Brakus and Alamanos, 2013). Accordingly, tourist shopper segments are an attractive market for shopping malls and retail agglomerations managers (LeHew and Wesley, 2007). Studies on retailing and tourism make some attempts to understand shopping malls' characteristics as antecedents to increasing

tourists' perceptions of retail destinations as possible tourism destinations (Choi, Law, & Heo, 2016; Moscardo, 2004; Park, Reisinger, & Noh, 2010; Rasouli and Timmermans, 2013; Shin and Santos, 2014; Yamamoto et al., 2014) (Table 2). In particular, prior research highlights the role of trust in the destination (Choi, Law, & Heo, 2016), prices (Kim, Timothy, & Hwang, 2011), tourists' personal traits including individual characteristics such as cultural background, social obligation and importance of shopping (Moscardo, 2004; Park, Reisinger, & Noh, 2010), image of the place (Shin and Santos, 2004), travel distance (Rasouli and Timmermans, 2013), and expected benefits (Yamamoto et al., 2014).

Study	**Methodology**	**Antecedents of shopping destinations attractiveness**
Choi, Law, & Heo, 2016	Survey questionnaire with 708 tourists	Trust in the shopping destination
Kim, Timothy, & Hwang, 2011	Survey questionnaire with 300 domestic tourists	Companion, guarantee of product quality and cheaper prices than home country
Moscardo, 2004	Survey questionnaire with 1,630 domestic and international tourists	Individual characteristics (cultural background, social obligations, personal values, and type of travel)
Park, Reisinger, & Noh, 2010	Survey questionnaire with 275 tourists	Demographics factors, frequency of shopping and importance for shopping
Shin and Santos, 2014	Semi-structured face-to-face interviews with 26 respondents among international tourists, residents and shop owners	Image of the place

Rasouli and Timmermans, 2013	Simulation models	Travel distance
Yamamoto et al., 2014	Survey with 3047 domestic tourists	Expected benefits

Table 2. Studies of the antecedents of shopping destinations' attractiveness.

Destination image and convenience in terms of distance from shoppers' origins play a similar role both when considering the shopping mall attractiveness (for domestic consumers) (Table 1) and when considering shopping destination attractiveness (Table 2).

Past studies on the antecedents of shopping destinations' attractiveness tend not to focus on the extent to which a particular shopping place (e.g. a mall or department store) might be considered as the main tourist attraction in a certain area, but rather, they mainly consider factors related to tourist characteristics and utilitarian values (Table 2). In order to address this research gap, this paper seeks to evaluate the role of a retail store as a tourist attraction.

3. Method

3.1 Harrods building as case research

The world-famous Harrods store opened in the present building occupying a prime five-acre site along Brompton Road, in Knightsbridge (London, UK), in 1849. Harrods is recognized as one of the world's few single-site department stores. However, the headquarters has moved to Hammersmith (London, UK) and the distribution centre to Thatcham (west of London), in order to enable the historic building to be fully devoted to retail, showcasing 330 departments and 28 restaurants distributed among 7 floors. Despite being a 'single-site' major store, Harrods recently opened 'little Harrods' stores in London Heathrow and Gatwick Airports Terminals. TripAdvisor considers the Knightsbridge store to be one of the main tourist attractions to visit in London, providing about 17,000

tourists reviews and 8,990 tourist photographs, rated on average of 4.5 stars (out of 5). TripAdvisor lists Harrods as #25 of 1,853 things to do in London.

Figure 1 shows the Harrods area on the London map, emphasizing other stores and possible attractions located nearby (e.g. Harvey Nichols, Bulgari Hotel, Mandarin Oriental Hyde Park, etc.).

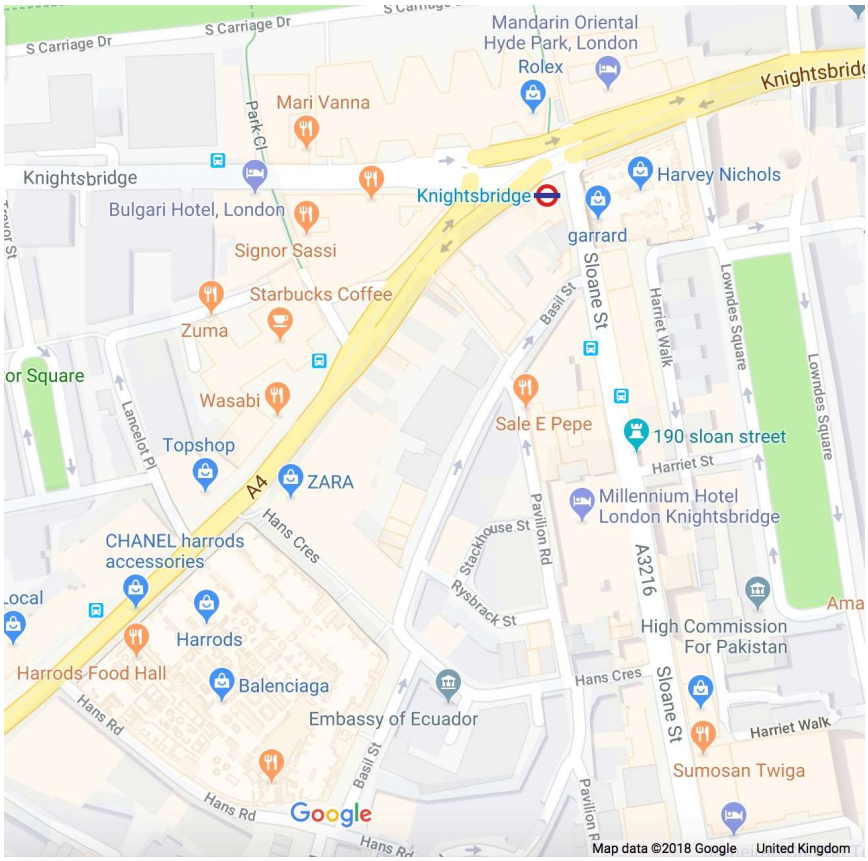

Figure 1: A view of the area where Harrods is located obtained through Google maps.

3.2 Data Collection and procedure

People are said to complete a "hermeneutic circle" to create a meaningful tourism experience to share with others through photographs, such that the photographs themselves and the appreciation of them by others contribute to the experience (Garrod, 2008; Balomenou and Garrod, 2019; Lo and McKercher, 2015; Mang, Piper and Brown, 2016; Nikjoo and Bankhshi, 2019). Understandably, an increasing number of recent studies exploit the pictures taken by tourists as rich data sources for tourism research (Balomenou and Garrod, 2019; Balomenou, Garrod, & Gerogiadou, 2017; Donaire,

Camprubi, & Gali, 2014; Konijin, Sluimer, & Miras, 2016; Kim and Stepchenkova, 2015; Nikjoo and Bankhshi, 2019; Pearce and Wang, 2019). Moreover, analyses of visual images based on their manifest content can be directly observed and quantitatively summarized with acceptable reliability (e.g. of co-occurrences and clustering) (Kim and Stepchenkova, 2015).

For the current study, data have been collected through the Flickr API. Flickr is an open platform where all the contents posted are completely public. In other words, Flickr allows any internet user to access its contents without a previous registration (registration is compulsory for accessing other social media like Facebook and Twitter). A query to Flickr API can build a dataset including all information related to the image (i.e. name of the uploader, location in terms of latitude and longitude , date, image, etc.). Flickr automatically assigns a specific location (geo tag) to each picture. For comparison, pictures available in other social media (such as Facebook) have a geotag only if one is explicitly set by an uploader. The current research focuses on pictures referring to a certain geographic area, by setting the constraint of 1km radius from the Harrods building (main entrance), with the selection of images limited to those uploaded from January 2016 to August 2017 for system performance purposes.

This process produced 1,557 images. The subsequent step consisted of the identification of the image place on the map through the latitude and longitude parameters of each picture. To this end, *Wolfram Mathematica* software was applied to import data from the dataset and automatically place each image in the map.

The resulting neighbourhood includes Kensington Gardens, Knightsbridge, South Kensington, Mayfair and Belgravia. Each picture is located on the map as a red point (Figure 3).

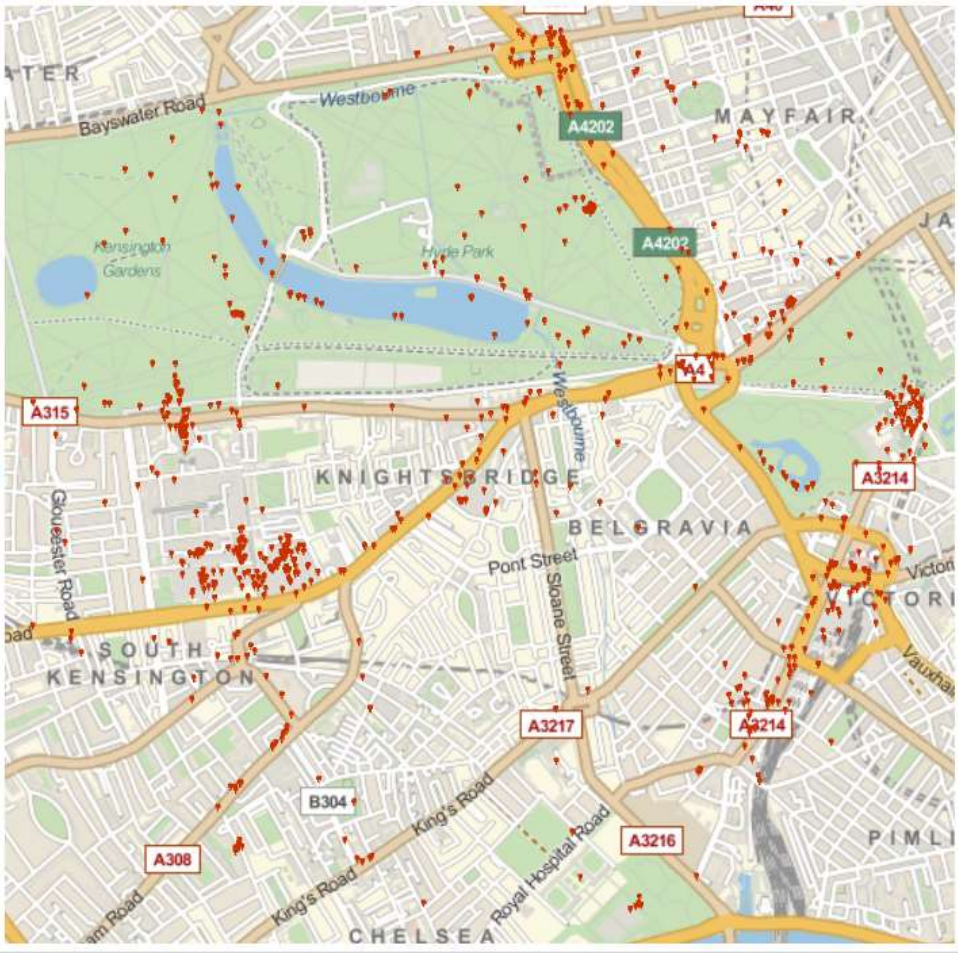

Figure 3: Map indicating the position of each collected picture, based on a radius of 1 km from Harrods main entrance.

Since the placement of the photos on the map is based on the latitude and longitude associated with each photo, more pictures might take the same object from different points of view. To clarify the presentation, Mathematica software supports the use of plots to better distribute the pictures related to the same objects in the same place (point of interest). The plots show the density of the images within the area within a radius of 1km from the Harrods building, graphically indicating that in this area there are some smaller zones that tourists photographed more. In other words, the peaks represent the points of interests (Figure 4). The highest peak coincides with the Harrods building.

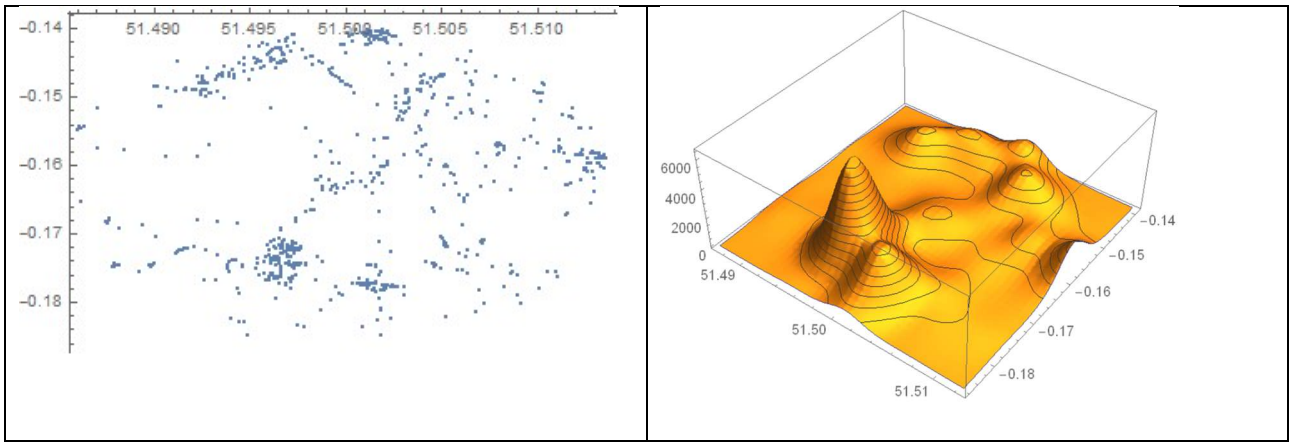

Figure 4: Plots (2D on the left and 3D on the right) representing the number of pictures in the area within 1km from Harrods building.

In order to better identify the emerging points of interest, the software provides an unsupervised machine learning algorithm to define clusters with the geographical data. This cluster analysis allows isolation of different groups (clusters) within a sample by examining the common features (Perez and Nadal, 2005), and is largely used in the analyses of pictures (Nikjoo and Bankhshi, 2019). The process of clustering can be considered as an unsupervised data-analysis technique employed to elicit hidden patterns in datasets (Hodeghatta and Nayak, 2017), where the researchers do not provide the algorithm with input of how to identify the cluster (no training), but rather, the algorithm discovers patterns in the data (image in this case) automatically (Balducci and Marinova, 2018). Such machine learning techniques are especially effective when working with nonnumeric data (highly unstructured data) (Balducci and Marinova, 2018). These kinds of machines are called predictors as they can build functions from any Input-Output sequence. Unsupervised classification systems include K-Means, Spectral methods and Gaussian Mixture, nonlinear fitting methods, Gradient, Newton, and N-minimize methods (Rasmussen, 2004).

Thus, the software allows clustering of all the pictures included in the dataset based on their geographic location and the object(s) in the picture.

Among the available methods, Wolfram Mathematica automatically selected the best one for the selection of the identification of the clusters, through the command FindCluster (*f*) (1). This is a non-hierarchical clustering method that divides data (pictures in the area) into a list of clusters (we limited the choice of clusters to ten in total for system performance purposes). In other words, given the pictures distributed in the map, the system divides the map into 10 segments by clustering uniformly distributed points of the map (pictures):

$$f[\{e_1, e_2,\ldots\}] \quad (1)$$

where the function *f* represents the partitions of the e_i into clusters of similar elements.

The emerging 10 clusters are shown in Figure 5; Harrods is the central one.

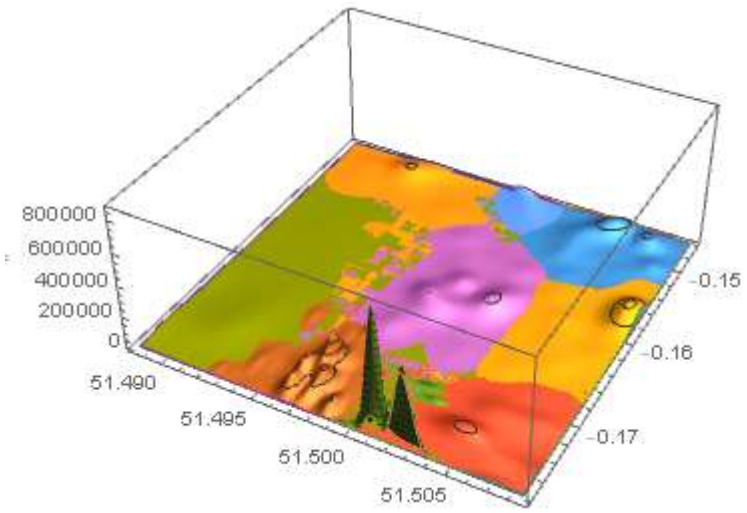

Figure 5: Ten clusters obtained through Mathematica represented by different colors.

4. Harrods as case research

Transfering the clustering results on to the map produces Figure 6, which synthetizes the detail of the cluster referring to the Harrods building. This figure also shows to what extent the Harrods building is the *object* with the major number of images taken, considering the exterior of the building (both in front of the main entrance and the rear of the building), and inside the building. These findings show to what extent Harrods has become a tourist attraction for the whole area. In particular, in the area

of 1km radius from the main entrance of the building, Harrods is the most photographed object, with the highest number of clusters (colored in red) on the emerging map (Figure 6). These results demonstrate that the Harrods store is one of the most meaningful attractions for tourists in the area.

Figure 6: Detail of the map with the Harrods building cluster.

Evaluating the high number of these photographs related to the exterior of the building, we might assume that the building (with emphasis on the exterior) is an attractive element for tourists to be added to the characteristics of image, atmospherics, popularity of the luxury department store, etc. The clusters synthesize the attention tourists gave to the possible "attractions" in the area (e.g. the entrance of the Kensington Gardens), by emphasizing the greater attention paid to the Harrods building.

5. Discussion and Conclusion

The aim of this study was to examine the role of store buildings in place attractiveness, using a large luxury department store in London (UK) as case research. To this end, our research used an emerging methodology based on visual analysis of tourists' pictures through a machine learning approach.

The contributions of our findings are manifold. First, our paper contributes to the literature on shopping malls and retail agglomerations attractiveness, by extending previous works (Blut, Teller, & Floh, 2018; Dennis, Marsland, & Cockett, 2002; Dolega, Pvlis, & Singleton, 2016; Reimers and Clulow, 2009; Sit, Merrilees, & Birch, 2003; Teller and Elms, 2010; Teller et al., 2010) considering the store building exterior as an additional antecedent. Indeed, our study adds new knowledge regarding the physical appearance of the store building as a characteristic able to influence the attractiveness. Tourists took pictures of the interior and exterior of the building and shared the pictures synthetizing the exceptional tourism experience through a specific platform (Flickr). The unstructured data emerging from the analysis of the photographs provides additional insights on what tourists like most in a vacation that needs to be included in the picture. Thus, the observations emerge as manifest content of the tourist expectational experience while visiting the building, which might integrate with other characteristics of a store mall and retail agglomeration and be added to previously-established constructs of image, trust and travel distance. This result further confirms the preliminary work of El-Adly (2007) focusing on the building attractiveness through a new effective research methodology based on the analysis of pictures posted by tourists based on machine learning. The subsequent cluster analysis provides insights into the role played by the building in the place attractiveness, which indicates Harrods as the most photographed object in the area (an area that would also include Kensington Gardens). Moreover, this finding provides evidence of actual behaviour in the retail setting as tourism destination as opposed to (for example) intentions to visit elicited from traditional methods for data collection based on questionnaires or interviews. Indeed, our visual analysis of uploaded pictures helps understanding of actual patronage behaviour rather than intentions. In sum, as mentioned in the Introduction, the theoretical contribution is that this is

the first paper adding the exterior of the building as attribute of the department store, and demonstrating the role of department stores in place attractiveness.

Further, our results extend previous work on the importance of shopping for tourism (Choi, Law, & Heo, 2016; Kemperman, Borgers, & Timmermans, 2009; Hsieh and Chang, 2006; Oh et al., 2004; Yu and Littrell, 2003), and the shopping mall as venue for tourists (Choi, Law, & Heo, 2016; Moscardo, 2004; Park, Reisinger, & Noh, 2010; Rasouli and Timmermans, 2013; Shin and Santos, 2014; Yamamoto et al., 2014), by analysing the number of pictures, which could be compared to those taken in front of monuments, museums, and other tourism attractions.

Finally, the machine learning approach employed for data collection and analysis overcomes traditional limitations of methodologies for the analysis of unstructured data such as photos (Balducci and Marinova, 2018; Pearce and Wang, 2019), by allowing the systematic analysis of a large number of pictures. Thus, our results indicate the extent to which tourists' pictures can be systematically analysed to provide insights into tourism behaviour. This new methodological approach can access into pictures taken by tourists as rich data sources for tourism research (Balomenou and Garrod, 2019; Balemenou et al., 2017; Donaire, Camprubi, & Gali, 2014; Konijin, Sluimer, & Miras, 2016; Kim and Stepchenkova, 2015; Nikjoo and Bankhshi, 2019; Pearce and Wang, 2019).

From a managerial point of view, this research might be further used to elicit the exact part of a building that attracted most tourists' attention with which specific objects dominating as objects in the pictures, providing an evaluation of their effectiveness. If compared with other possible attractions in the area, such as other luxury buildings, gardens, etc., our method can highlight which are most favoured by tourists. Moreover, our study supports the understanding of store external appearance (based on the pictures taken of the exterior of the building, see figure 6) as a factor in attracting more tourists and consumers, confirming the importance of providing specific souvenir areas to support tourists' shopping. The practical and managerial implications for tourism and the economy include that destination management organisations and policy makers can build photo and selfie opportunities

of iconic retail buildings into strategies and marketing communications. Further, big data analysis such as reported in this paper can evaluate the effectiveness of such measures, not only in respect of retail buildings but also for any visual attractions. From a social point of view, this paper demonstrates that photos of iconic retail buildings are wanted by consumers. Therefore, improving the communication and provision of photo opportunities can improve consumer satisfaction. From an economic point of view, improved consumer satisfaction, provision and communication of such opportunities should lead to higher visit rates and spending.

However, our study is limited by considering pictures posted on only one social platform, Flickr. Future studies might consider the combining data from different media, such Twitter, Pinterest, Facebook, etc. and a combined analysis of the text associated with the pictures, to gain a more in-depth evaluation of the store building appearance on the attractiveness. Analysis of pictures in the light of the accompanying text will evaluation the effectiveness of storefronts and other objects for tourists and consumers. Indeed, this research focuses on the whole building (internally and externally) without analysing the different architectural elements of the building such as stairs, toilets, entrances, etc., which new studies might further explore.

Finally, we encourage retail and tourism managers to consider the integration of big data analytics into marketing and management strategies as a new data source that can be added into and combined with traditional strategies to achieve competitive advantage.

References

Balducci, B., & Marinova, D. (2018). Unstructured data in marketing. *Journal of the Academy of Marketing Science*, *46*, 557-590.

Balomenou, N., & Garrod, B. (2019). Photographs in tourism research: prejudice, power, performance and participant-generated images. *Tourism Management*, *70*, 201-217.

Balomenou, N., Garrod, B., & Gerogiadou, A. (2017). Making sense of tourists' photographs using canonical variate analysis. *Tourism Management*, *61*, 173-179.

Blut, M., Teller, C., & Floh, A. (2018). Testing retail marketing-mix effects on patronage: a meta-analysis. *Journal of Retailing*, 94(2), 113-135.

Bradlow, E.T., Gangwar, M., Kopalle, P., & Voleti, S. (2017). The role of big data and predictive analytics in retailing. *Journal of Retailing*, *93*(1), 79-95.

Cheng, T.-M., Wu, H., & Huang, L.-M. (2013). The influence of place attachment on the relationship between destination attractiveness and environmentally responsible behaviour for island tourism in Penghu, Taiwan. *Journal of Sustainable Tourism*, *21*(8), 1166-1187.

Cho, V. (2008). Linking location attractiveness and tourist intention. *Tourism and Hospitality Research*, *8*(3), 220-224.

Choi, M., Law, R., & Heo, C.Y. (2016). Shopping destinations and trust- tourist attitudes: scale development and validation. *Tourism Management*, 54, 490-501.

Dennis, C., Brakus, J., & Alamanos E. (2013). The wallpaper matters: digital signage as customer experience provider at the Harrods (London, UK) Department Store. *Journal of Marketing Management*, *29*(3-4), 338-355.

Dennis, C., Marsland, D., & Cockett, T. (2002). Central place practice: shopping centre attractiveness measures, hinterland boundaries and the UK retail hierarchy. *Journal of Retailing and Consumer Services*, *9*, 185-199.

Dolega, L., Pvlis, M., & Singleton, A. (2016). Estimating attractiveness, hierarchy and catchment area extents for a national set of retail centre agglomerations. *Journal of Retailing and Consumer Services*, *28*, 78-90.

Donaire, J.A., Camprubi, R., & Gali, N. (2014). Tourist clusters from Flickr travel photography. *Tourism Management Perspectives*, *11*, 26-33.

El-Adly, M.I. (2007). Shopping malls attractiveness: a segmentation approach. *International Journal of Retail and Distribution Management*, *35*(11), 936-950.

Erevelles, S., Fukawa, N., & Swayne, L. (2016). Big Data consumer analytics and the transformation of marketing. *Journal of Business Research*, *69*(2), 897-904.

Garrod, B. (2008). Exploring place perception. A photo-based analysis. *Annals of Tourism Research*, *35*(2), 381-401.

Gearing, C.E., Swart, W.W., & Var, T. (1973). Establishing a measure of touristic attractiveness. *Journal of Travel Research*, 1-8.

Germann, F., Lilien, G. L., & Rangaswamy, A. (2013). Performance implications of deploying marketing analytics. *International Journal of Research in Marketing*, *30*(2), 114-128.

Giglio, S., Gabiele, L., Tavernise, A., Pantano, P., Bilotta, E., & Bertacchini, F. (2015). Virtual museums and Calabrian cultural heritage: projects and challenges. *Digital Heritage*, IEEE.

Hodeghatta, U.R., & Nayak, U. (2017) Unsupervised Machine Learning. In: *Business Analytics Using R - A Practical Approach* (pp. 161-186). Apress, Berkeley, CA.

Hsieh, A.T., & Chang, J. (2006). Shopping as tourist night markets in Taiwan. *Tourism Management*, *27*(1), 138-145.

Hu, Y., Ritchies, J.R.B. (1993). Measuring destination attractiveness: a contextual approach. *Journal of Travel Research*, 25-34.

Kemperman, A.D.A.M., Borgers, A.W.J., & Timmermans, H.J.P. (2009), Tourist shopping behavior in a historic downtown area. *Tourism Management*, *30*(2), 208-218.

Kim, H., & Stepchenkova, S. (2015). Effect of tourist photographs on attitudes towards destination: manifest and latent content. *Tourism Management*, *49*, 29-41.

Kim, S.S., Timothy, D.J., & Hwang, J. (2011). Understanding Japanese tourists' shopping preferences using the Decision Tree Analysis method. *Tourism Management*, *32* (2), 544-554.

Konijin, E., Sluimer, N., & Miras, O. (2016). Click to share: patterns in tourist photography and sharing. International *Journal of Tourism Research*, *18*(6), 525-535.

LeHew, M.L.A., & Wesley, S.C. (2007). Tourist shoppers' satisfaction with regional shopping mall experiences. *International Journal of Culture, Tourism and Hospitality Research*, *1*(1), 82-97.

Lo, I.S., & McKercher, B. (2015). Ideal image in process: online tourist photography and impression management. *Annals of Tourism Research*, 52, 104-116.

Mang, C.F., Piper, L.A., Brown, N.R. (2016). The incidence of smartphone usage among tourists. *International Journal of Tourism Research, 18*(6), 591-601.

Moscardo, G. (2004). Shopping as a destination attraction: an empirical examination of the role of shopping in tourists destination choice and experience. *Journal of Vacation Marketing*, *10*(4), 294-307.

Murply, L., Moscardo, G., Benckendorff, P., & Pearce P. (2011). Evaluating tourist satisfaction with the retail experience in a typical tourist shopping village. *Journal of Retailing and Consumer Services*, *18*(4), 302-310.

Nikjoo, A., & Bakhshi, H. (2019). The presence of tourists and residents in shared travel photos. *Tourism Management*, *70*, 89-98.

Oh, J.Y.-J., Cheng, C.-K., Lehto, X.Y. & O'Leary, J.T. (2004). Predictors of tourists' shopping behavior: examination of socio-demographic characteristics and trip typologies. *Journal of Vacation Marketing*, *10*(4), 308-319.

Onder, I. (2017). Forecasting tourism demand with Google trends: accuracy comparison of countries versus cities. *International Journal of Tourism Research, 19*(6), 648-660.

Pantano, E., Giglio, S., & Dennis, C. (*in press*). Making sense of consumers' tweets: sentiment outcomes for fast fashion retailers through big data analytics. *International Journal of Retail and Distribution Management*.

Pantano, E., Priporas, C.V., & Stylos, N. (2017). 'You will like it!' Using open data to predict tourists' attitude toward a tourist attraction. *Tourism Management*, *60*, 430-438.

Park, K.-S., Reisinger, Y. & Noh, E.-H. (2010). Luxury shopping in tourism. *International Journal of Tourism Research*, *12*, 164-178.

Pearce, P.L., & Wang, Z. (2019). Human ethology and tourists photographic poses. *Annals of Tourism Research, 74*, 108-120.

Perez, A.E., & Nadal, J.R. (2005). Host community perceptions: a cluster analysis. *Annals of Tourism Research*, *32*(4), 925-941.

Rasmussen, C.E. (2004). Gaussian processes in machine learning. *Lecture Notes in Computers Science*, *3176*, 63-71.

Rasouli, S., & Timmermans, H. (2013). Assessment of model uncertainty in destinations and travel forecasts of models of complex spatial shopping behaviour. *Journal of Retailing and Consumer Services*, *20*(2), 139-146.

Reimers, V., & Clulow, V. (2009). Retail centres: it's time to make them convenient. *International Journal of Retail & Distribution Management*, *37*(7), 541-562.

Reitsamer, B.F., & Brunner-Sperdin, A. (2015). Tourist destination perception and well-being: what makes a destination attractive? *Journal of Vacation Marketing*, *23*(1).

Shim, C. & Santos, C.A. (2014). Tourism, place and placelessness in the phenomenological experience of shopping malls in Seoul. *Tourism Management*, *45*, 106-114.

Sit, J., Merrilees, B., & Birch, D. (2003). Entertainment-seeking shopping centre patrons: the missing segment. *International Journal of Retail & Distribution Management*, *31*(2), 80-94.

Snepenger, D.J., Murphy, L., O'Connell, R., & Gregg, E. (2003). Tourists and residents use of a shopping space. *Annals of Tourism Research, 30*(3), 567-580.

Stylidis, D. (2018). Place attachment, perception of place and residents' support for tourism development. *Tourism Planning and Development*, *15*(2), 188-210.

Teller, C., & Elms, J.R. (2010). Managing the attractiveness of evolved and created retail agglomerations formats. *Marketing Intelligence & Planning*, *28*(1), 25-45.

Teller, C., Elms, J.R., Thomson, J.A., & Paddison A.R. (2010). Place marketing and urban retail agglomerations: an examination of shoppers' place attractiveness perceptions. *Place Branding and Public Diplomacy*, *6*(2), 124-133.

Tirunillai, S., & Tellis, G. J. (2014). Mining marketing meaning from online chatter: Strategic brand analysis of big data using latent dirichlet allocation. *Journal of Marketing Research*, *51*(4), 463-479.

Tosun, C., Temizkan, S.P., Timothy, D.J., & Fyall, A. (2017). Tourist shopping experiences and satisfaction. *International Journal of Tourism Research*, 9(2), 87-102.

Turner, L.W., & Reisinger, Y. (2001). Shopping satisfaction for domestic tourists. *Journal of Retailing and Consumer Services*, *8*(1), 15-27.

Yamamoto, T., Li, C., & Morikawa, T. (2014), An empirical analysis of the factors raising the interest in new shopping destinations. *Journal of Retailing and Consumer Services*, *21*(6), 950-957.

Yu, H., Littrell, M.A. (2003). Product and process orientations to tourism shopping. *Journal of Travel Research*, *42*, 140-150.

Xu, Z., Frankwick, G. L., & Ramirez, E. (2016). Effects of big data analytics and traditional marketing analytics on new product success: A knowledge fusion perspective. *Journal of Business Research*, *69*(5), 1562-1566.

Zaidan, E.A. (2016). Tourism shopping and new urban entertainment: a case study of Dubai. *Journal of Vocation Marketing*, *22*(1).