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Introduction

Tourism scholars and practitioners have long recognized the importance of visual data (Feighey 2003). Specifically, researchers have devoted substantial attention to the relationship between destination imagery and tourist photography (Garrod 2008). In an increasingly digital world, where seemingly each moment of one's life is documented, photographed, and shared with others, tourism imagery emerges as one of the field's most relevant topics of study (Dolnicar and Grün 2012, Echtner and Ritchie 2003, Jenkins 1999, MacKay and Couldwell 2004, Reilly 1990). Consequently, tourism scholars have made significant contributions towards visual methods research, with a solid canon now well established both theoretically and methodologically (e.g., Rakić and Chambers 2011, Ritchie et al. 2005).

One of the most interesting developments in tourism image research has to do with computer-assisted analysis of destination images (Li and Stepchenkova 2012, Stepchenkova and Morrison 2008; Ribeiro and Foemmel, 2012). Drawing on photo elicitation procedures, tourism scholars have made increasing use of visitor-generated photography via computer algorithms that allow for: a) the analysis of large volumes of visual data in a more convenient and speedier manner (Andrienko and Andrienko 2007, Goodrich 1978), and b) the generation of additional insights via mapping of commonalities and differences between different tourists' photos (Li and Stepchenkova 2012, 2012a). Nonetheless, existing visual tourism methods rely heavily on human participation in the data analysis process, simultaneously enriching it but also making it more cumbersome and subjective (Matteucci 2013, Scarles 2010). What occurs when such human input is unavailable? In other words, are computer-analyzed images sufficient to draw insights about tourism destinations without human intervention? Furthermore, how do such analyses compare with more traditional, human-input based visual ones?

Methodology and Key Findings

The present study sought to answer the questions posited above. The data presented herein is part of a large multi-year research project on hedonistic tourism (2008-present) and was collected in a well-known Southern coastal tourism destination in the United States. Eight participants (six males, two females; mean age = 22) were provided with disposable cameras (with each carrying a maximum of 28 exposures) and asked to document 24 hours in their holiday experience. The participants were told to take photographs that were representative of an average 24-hour period in their vacation and, if possible, to space the photographs within equal intervals (i.e., one photo per hour). The eight participants produced an average of 26 photos each, with a total of 208 photographs being collected. Of these, 194 were suited to being analyzed while 14 blackout photos were excluded from analysis. In an initial stage, one of the authors, unfamiliar with the destination and the data, conducted a content analysis (Stepchenkova et al 2009) on the data using QSR NVivo 10 for Windows, following ethological procedures (Lehner 1996). Table 1 provides a sample of those findings:

Nodes	*Number of sources*	*Percentage (%)*
1. Built environment	**129**	**66.5**
1.1. Hotels and Motels	87	44.8
1.1.1. Photos taken inside the guest rooms	28	14.4
1.2. Roads (Car and pedestrian roads)	26	13.4
1.3. Parking lot	16	8.2
1.4. Shopping center (Malls)	16	8.2
1.5. Restaurant	4	2.1
1.6. Others	6	3.1
2. Natural environment	**115**	**59.3**
2.1. Sky	92	47.4
2.2. Sea	36	18.6
2.3. Sand	62	32.0
2.4. Trees	24	12.4
2.5. Birds	2	1.0
3. Human existence	**133**	**68.6**
3.1. Alone	55	28.4
3.2. With others (relationship)	47	24.2
3.3. Other people or visitors	46	23.7
4. Risky Behavior	**22**	**11.3**
4.1. Alcohol consumption	8	4.1
4.2. Adult shop: sex toys	4	2.1
4.3. Body exposure	4	2.1
4.4. Urinating outside	2	1.0
4.5. Tattoo shop	2	1.0
4.6. Water pipes (bong)	1	0.5

Table 1 – Partial results from content analysis of visual data

In a second stage, all 194 photos were analyzed using the image recognition software Clarifai (demo version; see http://www.clarifai.com/), which compares each two-dimensional image with similar ones on the web, recognizing and classifying objects contained in each image. The results for each image from Clarifai were then compared with the content analysis results done previously by the one of the researchers. A sample of those comparative findings can be found in Table 2 below:

Photo ID	*Clarifai coding*		*Researcher coding*	
2A 	Recreation Motion Airplane Transportation Nobody	Balloon Aircraft Vehicle Reflection Airport	Two females pushing a ball Sculpture (big ball) Sand Tree	Hotel area Two females Buildings
2B	Beach Surf Seascape Sunset Wave	Sea Ocean Coast Water Sand	Beach scenery Sky	Sea Sand

		
2C 	Portrait Sitting One Female Room Retro Two Furniture Music Fashion	Inside a hotel room Male Drinking Bed Alcohol consumption Light Framed painting

Table 2 – Partial results from image recognition software analysis of visual data

The results show a surprising amount of agreement in regard to simple images (photo 2B), but become muddier when the images are complex and/or involve human behavior (photo 2C). Predictably, the level of agreement between software and human coding was much higher for simpler images, as well as for images that contain easily recognizable non-human elements (e.g., sand, vehicles, water). Nonetheless, the image recognition software provided acceptable descriptions of what was occurring in each image and, more importantly, provided the captions/tags/descriptions of similar images in the web. Interestingly, computer generated nodes for each image vastly surpassed the number of nodes generated by human coding, perhaps due to the fact the image recognition software uses the web as its database, whereas the human coder must make do with his cognitive abilities and personal experience. Lastly, it should be noted that the image recognition software provided a great deal of "false positives", as it suggested a number of captions that, while related on some level to the image at hand, did not described it accurately (e.g., 2A) – this was particularly evident in the case of large structures that correspond to easily recognizable objects (e.g., a large beach ball sculpture suggests aviation and transportation, as it is similar to a sculpture at a famous airport). Thus, it should be noted that the software utilized not only uses its own algorithms to recognize and identify object(s) in each image, but is also greatly dependent on existing identifiers of similar images.

Applications and Implications

Findings from this study show that there is indeed a great deal to be garnered from visitor-generated imagery without resorting to costly and time-consuming methods that require extensive human input. While still in its infancy, image recognition software represents an immense boon for tourism researchers and practitioners. It seems likely that tourism scholars and computer engineers would do well to collaborate together and improve existing image recognition technologies in light of its obvious tourism applications: one has only to think of the benefits that DMOs would obtain if photographs taken by visitors to a given destination could be identified and linked to specific landmarks and marketing efforts suggested by the DMO itself. Correspondingly, the increasing refinement of computer-assisted visual methods is likely to facilitate significant inroads of measurement accuracy of tourist behavior. As we move from expensive custom-designed software (e.g., http://www.mathworks.com/discovery/object-recognition.html and http://objectrecognitionsoftware.com/ and http://www.imagutech.com/), where specific code is written for each dataset, to readily available, not-so-costly programs such as Clarifai, tourism researchers will have another tool to analyze visual tourism data on a grander scale.

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