77 Exploring human–nature interactions in national parks with social media photographs and computer vision

Tuomas Väisänen[1,2], **Vuokko Heikinheimo**[1,2], **Tuomo Hiippala**[1,3,2], **Tuuli Toivonen**[1,2,4], [1]Digital Geography Lab, Department of Geosciences and Geography, University of Helsinki, Finland. [2]Helsinki Institute of Sustainability Science, University of Helsinki, Finland. [3]Department of Languages, University of Helsinki, Finland. [4]Conservation Science Group, University of Cambridge, United Kingdom

Understanding the activities and preferences of visitors is crucial for managing protected areas and planning conservation strategies. User-generated geographic information such as photographs shared on social media have emerged as new data sources to complement more traditional visitor information such as on-site surveys. However, analyzing large volumes of photographs manually is a laborious task. Automated analysis of the rich textual and visual content on social media data offers new opportunities for understanding human presence and activities in nature (Toivonen et al. 2019). Approaches for textual and content analysis have been widely developed under the umbrella of 'conservation culturomics' (Ladle et al. 2016). They have been recognized as a useful data source for nature conservation. At the same time, automated analysis visual content has remained rather underexplored when mapping human activities in nature.

In this presentation we present our findings of using computer vision methods to explore human-nature interactions from social media photographs and their applicability to visitor monitoring of protected areas. Our main questions are: What types of information can off-the-shelf computer vision methods extract from social media photographs, in terms of activities and preferences of people? Do different visitor groups share different types of photographs from national parks? How does photographic content vary between different types of national parks?

To answer these questions, we collected geotagged Flickr data from the 20 most popular national parks in Finland measured based on Flickr data. We classified the users into national and international visitors based on available profile information. We examined the application of three state-of-the-art computer-vision methods to studying human–nature interactions, namely semantic clustering, scene classification, and instance-level object detection, and evaluated their applicability to visitor monitoring of protected areas. Semantic clustering enabled us to get a general overview of the semantic structure and visual themes of all photographs. Scene classification enabled us to understand landscape preferences across the visitor groups and national parks, while instance-level object detection enabled us to understand what the activity preferences of the visitor groups are.

Our results show that human–nature interactions can be extracted from user-generated photographs with computer vision. Photographic content differed between domestic and international visitors, which indicates differences in activities and preferences. Semantic clustering revealed broad visual themes in the visual data set as a whole and distinct visual content is shared from different landscape regions and by visitor groups (see Figure 1). Scene classification results show how international visitors prefer wintery and touristic landscapes, while domestic visitors enjoy scenes relating to summery forests and autumn colors. Instance-level object detection revealed several objects associated

with activities such as bicycles, skis, and backpacks. Based on the detected objects we found bicycle and dog sleigh riding more popular with international visitors, while domestic visitors shared more cross-country skiing, orienteering and pet dog pictures. As with all social media data sources, the Flickr data contains biases. For instance, we identified 79% of the users as male, and only 10% as female.

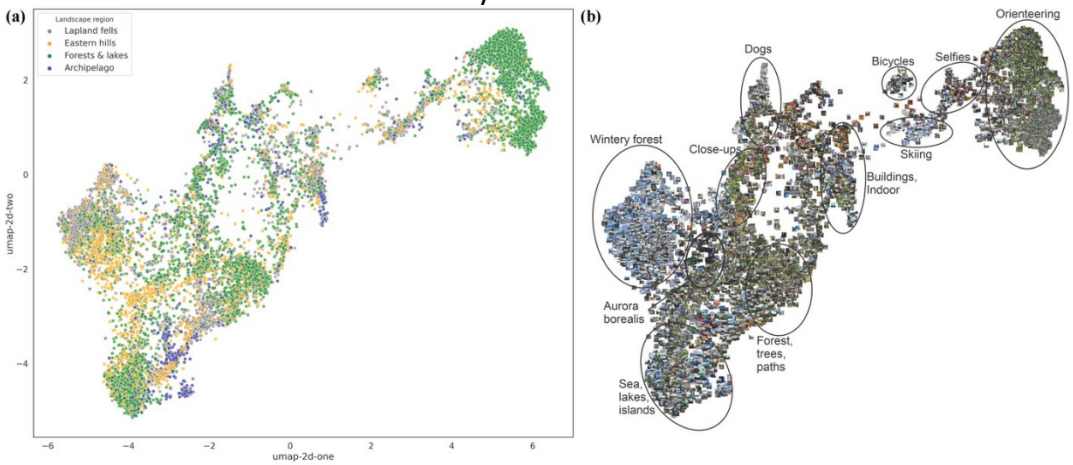

Figure 1. Semantic clustering of Flickr photos placed in UMAP (unifom manifold approximation and projection)-plots (a) as dots color-coded by their landscape regions (images similar in their vector representation are placed close to each other) and (b) as thumbnails and ellipses delineating clusters of similar photo content (labeled by the authors after visual examination).

The different methods complement each other by revealing broad visual themes related to level of the data set, landscape photogeneity, and human activities. The results partly confirm previous insights from visitor surveys, but also provide a completely new level of detail at various geographical scales and temporal resolutions such as emerging and event-type activities. Geotagged photographs revealed distinct regional profiles for national parks (e.g., preferences in landscapes and activities), which are potentially useful in park management and conservation marketing.

Information extracted automatically from photographs can help identify preferences among diverse visitor groups, which can be used to create profiles of national parks for conservation marketing and to support conservation strategies that rely on public acceptance. Considering high costs involved with traditional visitor surveying, our positive experiences suggest that these methods may considerably improve understanding of visits to protected areas and human–nature interaction in general, particularly in areas where detailed monitoring of visitors is not feasible. The application of computer-vision methods to automatic content analysis of photographs should be explored further in conservation science, particularly in combination with rich metadata available on social media platforms.

References

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