Research agenda for analysing online climate and weather information in the process of vacation planning

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Abstract

This research note aims at setting the research agenda for analyzing climate and weather information available online in the process of vacation planning (PVP). Tourists are more and more flexible and opportunistic in their process of vacation planning, with an increasing willingness to change plans also while they are already at destination. In this context, climate and weather conditions can be among the causes that affect the PVP. Tourists can be exposed to weather and forecast information published online not only by professional services but also on social media. However, the effect of such information in the PVP is still under research. This research note identified several type of digital data needed for research on climate and weather data, the related information process and their potential data sources. In particular, three research agenda are discussed, namely: data modelling of online weather-related data and touristic flows; online representation of weather and climate information; and the role of online weather data on PVP.

Keywords: meteorological information; weather; process of vacation planning; social media; network analysis

1 Introduction

Tourism is one of the largest and fastest growing global industries and recognized as a socio-economic activity sensitive to weather and climate conditions (Alvord, Udall, Long, and Pulwarty, 2008; Sookram, 2009). Unfavorable climate and weather conditions can reduce tourism-related businesses profit-making periods, and sometimes businesses are forced to raise prices or invest in other sectors to cover the economic losses due to the downturn in tourism (Alvord et al., 2008). In this context, weather and climate terms are often confused, therefore a clarification of their meanings is needed: *climate* as defined by Becken (2010) is "the prevailing condition observed as a long term average in a location", while for *weather* it is intended as "the manifestation of climate at a specific point in time and place" (p. 2). The issue of climate change is becoming more and more relevant to the tourism industry, which is

likely to have an impact on tourism and its related sectors (Hamilton, Maddison, Tol, 2005; UNWTO, 2007). From a tourist's perspective, climate is what a tourist would expect to experience at a certain time in a particular destination, but he/she might be faced with the actual weather, which might differ from the climatic forecast (Scott and Lemieux, 2010). Moreover, climate and weather conditions are one of the key elements for the Planning Vacation Process (PVP), which can influence tourist destinations and activity choices, experience and satisfaction (Hamilton et al., 2005; Martín Gómez, 2005) as well as the extent of the expenditure and the enjoyment of the trip (Curtis, Arrigo, Long, and Covington, 2009). Tourists are more and more flexible and opportunistic in their PVP, with an increasing willingness to change plans also while they are already at the destination. Not only are spatial aspects (i.e. visited place) relevant to explain and show tourists' behavior patterns, but also virtual elements (Stienmetz and Fesenmaier, 2013), such as online data as user-generated content that are publishing online real time updated information about several topics, among which it is possible to identify weather conditions (Sironi, Marchiori and Cantoni, 2017), traffic and public transportation situations, etc. Therefore, this research note wants to shed light on the role of climate and weather factors in the PVP within a travel network framework by proposing three research agenda.

2 Proposed Research Agenda

As emerged from the previous introduction, there are online several sources containing weather-related data. Thus, it is argued that transforming raw weather-related data into meaningful and useful information will create value for both tourists and professionals. Online data sources can be grouped in the following three areas of online indicators, namely indirect, behavioural based, and direct indicators:

i) *(online) Indirect indicators* are intended as data not originating from the touristic environment (e.g. offline: domestic waste tonnage at a resort, cash register receipts at supermarkets, number of vehicles on the road, etc.) (Scaglione and Doctor, 2011; Scaglione, Baggio, Favre, and Trabichet, 2016), but data left online by people on social media. Indeed, social media data, namely User Generated Contents (UGCs) can be used as valuable indicators for the analysis of sentiments or intention flows, and can be considered to belong to the indirect indicators group (Marchiori and Cantoni, 2015).

ii) *(online) Behavioural based data* and analysis include digital traces either obtained through Volunteered Geographical Information such as geo-tagged photos on social media platforms (e.g. Instagram, Flick, etc.), or non-volunteered such as aggregated data of passive mobile positioning data, or loyalty smart guest cards such as «be my guest» developed by Union Fribourgoise du Tourism (Union Fribourgeoise du Tourisme, 2015). Other analysis methods include either data mining analysis methods or advanced graph mathematical methods (Baggio and Del Chiappa, 2016; Scaglione et al., 2016; Steiner, Baggio, Scaglione, and Favre, 2016).

iii) *(online) Direct indicators* are intended as weather data provided by professional meteorological databases, and/or open source databases such as online weather forecasts services, for example: accuweather.com and weather.com. The current trend of providing Open Government Data (OGD) creates opportunities for improving processes in the tourism sector (Kalbaska, Janowski, Estevez, and Cantoni, 2017). In

this context, OGD involve also meteorological information (Pan and Yang, 2017), and will provide unlimited opportunities for research and testing of models. Among the main advantages, those meteorological sources of information are available worldwide, had accumulated data for long periods, should remain available in the future, are well documented, and freely available. Hence, those kind of weather-related data enable to build inexpensive, international and robust scenarios for weather data inspections and data modeling.

The analysis and the value generation of the identified indicators posits three main research agenda for researchers interested to further investigate this topic, they are:

Research agenda 1: Data modelling of online weather-related data and touristic flows.

The first research challenge foresees the issue of extracting data from different databases and sources, e.g. database for weather forecast, data provided directly from hotels and destinations, databases for events/things to do at a destination, and social media. Indeed, the optimization of format raw data process (storage and runtime) from the data sources is considered as critical in this research proposition. Moreover, data extracted should be standardized in an *ad-hoc* database that allows to perform data modelling (Pan and Yang, 2017). Creation of algorithms (i.e. machine learning, graph analysis) are needed for patterns detection among the collected data sources. The kind of pattern flows can be the analysis and interpretation of social media contents and visitors' flows in relationships with weather-related information. Results generated by such analysis might help in understanding which kind of weather forecasts are more sensitive to specific markets, touristic activities, and seasons. Results can contribute to integrate these data techniques to associate specific weather forecast to specific activities at a destination. Moreover, it is argued that this kind of research can be a valid aid for destinations in generating semi-automatic marketing messages in response to weather forecasts. A validation of the data modelling is suggested to be checked against human-coding analysis in order to test the accuracy of the identified patterns among tourism flows and the data gathered from the online network.

Research agenda 2: Online representation of weather and climate information.

As emerged from the literature, the online channel is growing in its relevance among the tools tourists and prospective can use for collecting weather-related info. Thus, how to communicate online such information represents a challenge in the tourism context (Sironi et al., 2017). Indeed, a weather icon depicting the forecast of a cloudy day can be interpreted by someone as "good weather" (intended here as a favorable weather condition), or at the opposite as "bad weather" (intended here as a not-favorable weather condition). The perception of a favorable weather condition can depend indeed by many factors (e.g. country or origin, age, things to do at a destination, etc.) and in turn can affect the PVP. Therefore, future research could focus on investigating the online representation of weather conditions for tourism purposes, and the perception from different tourism segments should be investigated. For example, a person coming from a rainy-based place can perceive an icon with a cloud as favorable weather, at the contrary, a person coming from a sunny-based place can perceive the same icon as an unfavorable weather condition. User tests which foresee the exposure of different tourism segments to the same weather icons are thus suggested in order to investigate their reactions/perception and their

willingness to perform specific tourism-related activities. Furthermore, knowing what weather data are relevant for different tourism segments, can help in the design of ad-hoc marketing messages and to better display online such weather information.

Research agenda 3: The role of online weather-related data on PVP.

The third research proposition foresees the investigation to test the effectiveness of introducing online weather-related data as a variable to increase booking and optimize tourism flows. A survey with tourists and tourism operators is suggested in order to test the effect of manipulating online weather-related information, that is: test the relevance/effectiveness for tourists to be exposed to prompt information regarding weather conditions and related things to do at the destination. The survey can also help to define a model of the customers' needs (e.g. hotel guests, day trippers, and prospective tourists), collect new sources of information regarding online weather-related information, and tourists' perceptions in terms of weather conditions and tourism activities. Furthermore, interviews with tourism operators (e.g. a selection of hotel and other suppliers of the tourism sector for example, restaurants, transportation companies, etc.) are suggested in order to gather their perceptions regarding the role of weather and its impact on their businesses. It is finally suggested to compare destinations performances among different type of destinations, mature tourism vs. newer tourism destinations, nature-based destinations vs. urban destinations, and destinations with different socio-economic conditions in order to yield relevant insights both from the supply and demand characteristics of those markets.

3 Discussion and conclusion

This research note aims at setting a research agenda for analyzing climate and weather information available online in the process of vacation planning. The scientific contribution of this investigation is twofold. On the one hand, the inter-disciplinarily of this kind of research line relates to social sciences, ICTs, and natural sciences, representing a challenging perspective for the subject studied. On the other hand, the holistic analysis of PVP is taking into account not only spatial elements of the travel networks but also virtual ones such as social media. Moreover, practical implications are foreseen: in the short-medium term, the network analysis (geo-localization flow and virtual elements) will not only show the impact of weather conditions on tourism frequentation and attraction interests, but also settle proactive marketing actions. In the long run, climatological aspects crossed by specific variables such as statistics of frequentation, social media comments, etc., will shed light on the image of the destinations under study in the past, present and foreseen time periods.

Practitioners can benefit from this study in order to put the basis for the creation of a business intelligence tool that makes prompt scenarios on current weather forecasts about destinations. Indeed, as emerged from the literature, this aspect is still under-explored in the tourism market. Several professional tools (e.g. weatheranalytics.com; enterprisesolutions.accuweather.com; bliasolutions.com, etc.) are emerging with the idea to use weather related data as a business competitive advantage. Those tools so far demonstrated to have not only an impact on the market, attracting investments and clients from all around the world, but also providing innovation in many domains. However, the tourism and hospitality sector is still under-explored and such tools generally consider companies in other sectors (e.g. Insurance, Engineering, Energy,

Risk Trading), which use weather data to support business operations. Therefore, a business intelligence tool for the tourism and hospitality sectors will be able not only to support business operations, but also provide prompt communication messages to people, moving from a B2B use of the weather data to a B2C impact. Thus, findings from the implementation of the proposed research propositions can provide evidence and guidelines on treating online weather forecast data as a variable that might substantially affect the business in the tourism and hospitality sector.

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