USING PUBLIC WI-FI NETWORKS TO UNDERSTAND TOURISTS' BEHAVIOURS

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Abstract

Tourists are deeply engaged in looking to be online wherever they go, either for communication purposes or simply to share that beautiful photo or video. With the proliferation of smartphones and means to access the Internet the uses tourists make allow for better understanding of their behaviours while on vacations. City public Wi-Fi networks make it easy for them to be online and the analysis of such activity in the network may provide insights that allow to understand what type of activities they do online and how that changes in different moments of the day. A large statistical analysis was carried with data retrieved from the logs of a public Wi-Fi network in Spain in May 2017. More than 13.000.000 interactions were analysed and the results show that tourists are heavy users of Social Networks, search engines and chat applications. They are also very active in sharing content while visiting the attractions. The insights provide relevant information towards developing better suited communication services that respond to tourists' needs either in touristic attractions or hospitality facilities.

Index Terms— Internet uses, tourism, public Wi-Fi, social metrics.

I. INTRODUCTION

With the proliferation of smartphones enriched with communication and photographic features, tourists are becoming heavy users of such devices while visiting attractions or during their stays

abroad. If supported by connectivity options, the mobile devices become fundamental tools for communication purposes, for sharing photos or videos of the visited places or to look for places to eat or services to rent. But, when visiting foreign countries tourists usually face limitations regarding the access options due to high communication roaming costs. Because of such limitations, major touristic destinations, mainly cities, have been providing public Wi-Fi connections. The information provided by these networks allow to get profiles of its users and can be very useful information to understand what motivates tourists for online behaviours or what can trigger a content share. Additionally, understanding the activities of tourists will allow to design applications that better suit their needs or demands.

This context motivated the research project reported by this paper. By analysing the uses of a public Wi-Fi network in Mallorca, by tourists, the study tried to understand which were the main activities carried online, how it can be correlated with daily routines and how motivated tourists can be for sharing activities. The paper presents the methodology and the main results achieved.

II. RELATED WORK

According to Coussement and Teague [1], tourists are now making their own options and decisions regarding how and where to travel and it has been profoundly transforming traditional relationships between tourists and companies. Therefore, it is highly important to understand how tourists use the technologies prior, while and after their travel activities. The focus on academic works have been mostly on the uses of the Internet towards the preparatory tasks carried prior to travelling, namely reservations, reviewing, planning or just looking for information. Xiang, Magnini and Fesenmaier [2] focused on looking for insights from travel planning using the Internet, Bonn, Furr and Susskind [3] analysed the way tourists used the Internet to prepare their trips and Duman and Tanrisevdi [4] used a similar approach to define profiles of English tourists' based on a study of their Internet uses for the vacation decision making before going to Turkey. Three main uses of the Internet were identified: information search, comparison of alternatives, and reservation–contact–purchase. Related with traveling issues is the hotel booking activity and Varkaris and Neuhofer [5] tried to understand how social media influenced this activity showing that contemporary decision-making is not static, being influenced by positive and negative aspects of social media. Therefore, they underlined the need of hotels to be aware of the related content on social media, integrating this knowledge in their "digital strategies" and facilitating the creation of User Generated Content (UGC), especially in real-time and on-site (e.g. via free Wi-Fi access) which can stimulate, by means of engagement and reward strategies, positive feedbacks posted to social media.

As referred, the research has been mostly focused on the uses of Internet in the preparation of trips with a limited number of research projects aiming to understand how tourists use Internet while in vacations, showing it may become a highly demanding task. Some exceptions include the work of Varkaris and Neuhofer [5] that also alluded to the need to understand its uses, related to the hotels and Ribeiro, Fonseca Amaro, Seabra & Luís Abrantes [6] highlighting the need to look for UGC contributions related with travel experiences by determining the profile of

the users that most probably will share their feedback on their trips. Other studies focus on the use of public Wi-Fi networks, like the study from Ojala, Hakanen, Salmi, Kenttala, Tiensyrja & Narhi [7] with the characterization of the uses of a large municipal Wi-Fi network, (panOULU) provided via a public private partnership in the city of Oulu, in Northern Finland. This Wi-Fi was implemented to serve local communities and not specifically to be used by tourists. Considering public Wi-Fi networks available at touristic destinations, one of the few studies was carried by Picco-Schwendener and Cantoni [8] and aimed to understand the uses of the open Wi-Fi network available at the touristic city of Lugano (Switzerland). With the data from the log files and from a survey, researchers aimed at creating a profile of users (personas), and of their usage-patterns. The results showed that the majority of users were business tourists. The e-mail was the most used application and users connected mainly from the city centre.

The possible spread of free Wi-Fi networks with programs like free WiFi4EU, a European Union initiative that aims to bring free Wi-Fi hotspots to major tourists' areas in Europe by 2020 and expecting to impact at least 6,000 to 8,000 local communities and up to 40-50 million connections per day [9] or the WiFi UAE initiative aiming to provide broad Wi-Fi access in United Arab Emirates [10], challenges us to better understand its uses and how these uses may be important insights for better and more suitable services to be designed to aid tourists.

III. GOALS

The goal of this research was to understand the tourists' uses of a public Wi-Fi network in Mallorca, specifically in the Palma area. For this, the data from the free Mallorca Wi-Fi network was analysed. Specifically, it aimed to understand: i) the most used applications (Apps) or websites and its correlation with the most relevant activities; ii) the type of consumption and sharing behaviour; iii) periods of connection, the engagement and how this changes during the day and/or week. Finally, the study tried to understand if these behaviours change according to the tourist profile in what relates with the duration of visit.

IV. METHODOLOGY

To carry this research a large statistical analysis of big data retrieved from the logs of the uses and traffic of the free Mallorca Wi-Fi (MWF) network from 6 to 16th of May 2017 was carried. This time of the year is already very active in terms of tourist activity. The MWF network is a private run infrastructure that provides free Internet access to users in main touristic sites all around Mallorca. The city of Palma concentrates the higher number of covered areas. It is structured in eight networks (areas) in the main city and four in a close beach, the S'Arenal. Each network has a variable number of access points (ap) with an average for each network of 17 ap. All the aps provide a wide Wi-Fi coverage targeted at public streets and squares. No relevant coverage is done inside surrounding buildings. Users may connect to MWF through Facebook authentication, by installing an App, through a sponsored browser based connection or through the network portal (in non-smartphone devices). The Wi-Fi allows for unlimited connections

providing access to all the major information or communication services. Only peer-to-peer services, like torrents are blocked. The MWF network infrastructure gathers data from the different access points in its API and through data scrapping on logs the remaining information was retrieved. A combined total of around 20 million interactions from 206 ap were analysed for that time period using the Tableau desktop data analysis application. This preparation included determining the dimensions of data, the measures and the parameters to use.

As referred, the focus was on the analysis of the tourists' activity. To isolate data from residential users or long term tourists a filtering criteria was adopted and an anonymization process was done on the data. The total amount of records analysed for this study included the information about 5 597 452 visits to online destinations carried by a total of 103 135 different users. Additionally, individual URL related actions were also analysed – sent and received data, engagement time, visitor and instant of visit. Considering the geographical distribution of the interactions, they were mostly concentrated in the central part of the city, Passeign del Born and the Cathedral area (the main touristic area in the city), Plaza d'Espana (the main city transportation hub) and in some locations on the beach of S'Arenal. Finally, it is also important to refer that Mallorca is visited mostly by German tourists, followed by English and Spanish from the mainland.

V. RESULTS

The tourists use MWF mostly from their smartphones (99%) with 47,1% coming from Apple devices and the remaining mostly form Android devices or unknown ones.

Since the research was focused on the activities tourists do online in their smartphones, while in vacations, the first analysis was on the applications used.

TABLE I. SERVICES AND APPLICATIONS USED BY TOURISTS

Google & HTTPs			Social Networks						
Google HTTPS	Google	Google Maps	Facebook	Whatsapp	Instagram	Snapchat	Instagram	Tw itter	Google+
68,78%	57,84%	2,44%	**59,98%**	44,39%	17,82%	14,06%	17,82%	6,85%	3,23%
Miscellaneous		Portals					Email		
Misc. w eb	Misc. sec. w eb	apple.com	Yahoo	Live.com	microsoft.com	amazon.com	Gmail	Hotmail,Outlook	POP3/IMAP
68,78%	34,31%	**35,88%**	8,61%	6,07%	5,29%	3,15%	**17,70%**	8,86%	12,32%
Video & Img Platforms			Streaming services		Cloud Storage & Apps			AV Conf.	Other
YouTube	Picasa	Pinterest	iTunes	Spotify	iCloud	Dropbox	Google Drive	Skype	Non-w eb TCP
24,27%	14,43%	2,11%	**26,47%**	2,51%	**7,41%**	3,48%	3,61%	**9,87%**	**60,33%**

Google applications and search engine appear as the top destinations along with Miscellaneous web. Facebook appears as the most used individual application. Taking in consideration that Google & HTTPS also include the Android interactions, that Miscellaneous web includes multiple HTTP destinations, and Apple.com includes iOS services, the Social Networks (SN) stand out as the most relevant type of applications. Besides Facebook, WhatsApp has also a high percentage of users. Facebook is used by almost 60% of all tourists and WhatsApp by 44,4%. In

this category, and considering Facebook, WhatsApp, Snapchat, Instagram and Twitter, more than half of the tourists that used any SN, during the stay in Palma, did it with only one SN (53,3%), 27,7% used two SN, 13,4% three, 3,8% four and 1,5% used all five SN. Email applications, Video & Image platforms (specially YouTube) and iTunes get between 17,7% and 26,5%. It is important to highlight that this does not reflect on the intensity of use but the number of accesses to each application or website.

Concerning the differences between the type of tourists, identified based on the number of days interacting with MWF, as expected, up to 1 day tourists have lower activity in all sort of online destinations. Tourists in the group of 2-3 days and 4-7 days are the most active ones on the network with significant increase in the uses of SN, Video & Image Platforms and Streaming Services. Concerning touristic related Apps, Google Maps is preferably used by 4-7 days' tourists.

The research also looked to variations concerning the periods of use (Fig. 1) and how traffic changes along the day. To make this analysis the data from 8 to 14 of May was used.

We may notice a similar use pattern each day but with variations along the week. The most active periods are in the end of the day until the middle of the night (7PM to 4AM). The activity remains high during the morning and eases during the afternoon. At Sundays the activity reduces considering that many touristic cultural sites and some shops are closed. Some other variations result from the cruises activity in Palma that bring a high number of tourists and the fact that Thursday is the most active day for leaving and arriving at Mallorca reducing the touristic activities in that day. In an overall analysis it may be observed that tourists are more active in the morning and night and, probably, travel for other destinations in Mallorca mostly in the afternoon.
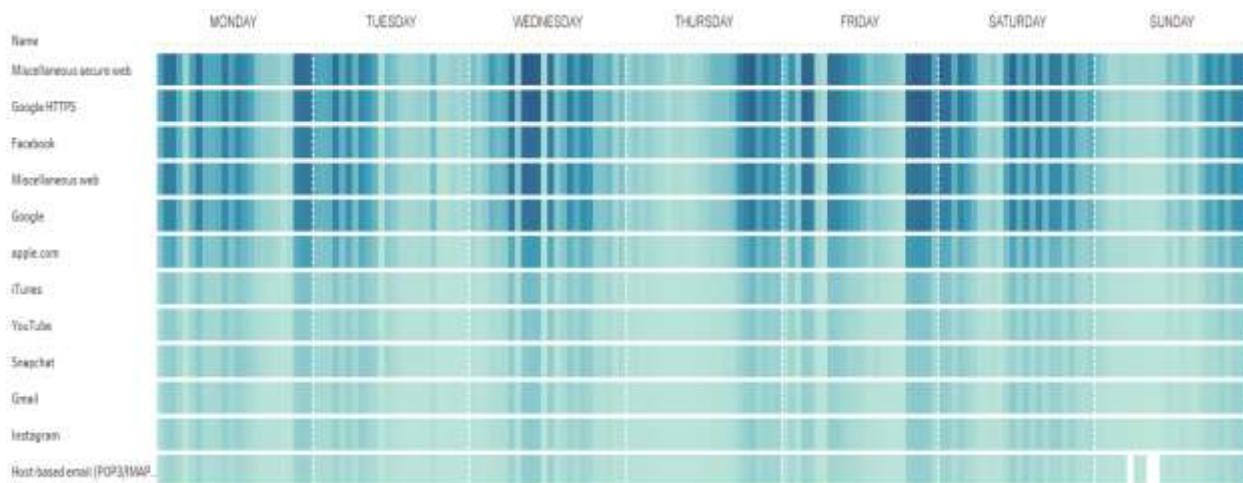

Fig. 1. How online traffic changes during the day and during the week

Tourists' sharing behaviours

The following figure (Fig. 2) shows the uses of social networks (SN) in the relation between the average percentage of data downloaded vs uploaded. The analysis allows to get some insights

on the type of uses. Facebook is mostly used for data consumption, also driven by the fact that the application downloads a large amount of data in background. But the sharing activity on this SN is 100% or more higher in certain moments of the day. A peak is seen in the period from 10PM to 4 AM (8% to 12% dedicated to upload activity). Facebook appears to be used for sharing purposes mainly after the experiences (end of the morning or end of the day). Twitter (the least used SN not shown on figure) has a different pattern. It has the biggest peak from 8 to 10 AM seeming to be used to inform on what users will do on that day instead of what they did.
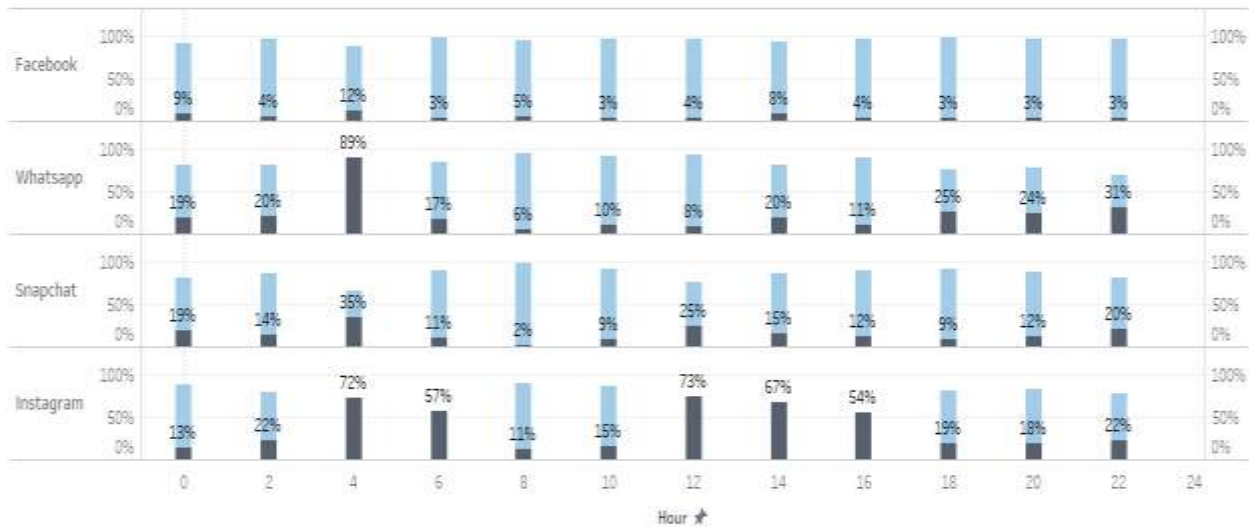

Fig. 2. Relation between downloaded and uploaded data in each session along the day

Instagram and Snapchat have different percentages since sharing behaviours (upload) get higher relevance. Instagram shows intensive sharing behaviours in the periods: 2 to 6 AM and from 10 AM to 4 PM with percentages ranging from 54 to 73%. Considering that a normal use will have more downloaded data than uploaded, it seems users of such SN are highly engaged in sharing their daily experiences, probably sharing photos and videos of the nightlife (2 to 6 AM) or doing real time sharing when engaged in the touristic activities (enjoying the beach or visiting the city). Snapchat is more diversified but has also a high overall sharing behaviour, with an average of 15,25% of uploaded ratio. In the case of WhatsApp, the data upload ratio is high, but this application is used also intensively for communication purposes.

In overall, tourists seem actively engaged in sharing their experiences, showing different patterns along the day according to the SN used. SN typically used by younger generations get an average sharing behaviour much higher than Facebook with Snapchat getting 300% more sharing behaviour and Instagram with 726% increase over Facebook upload vs download ratio.

VI. CONCLUSIONS

With touristic areas providing increasing options for users to be online, the data that these initiatives may generate provide insights to understand their behaviours with a non-intrusive

data collection method. From the analysis of a popular touristic destination, like Palma, it is perceived that social networks are dominant applications in the daily routines, with the higher number of accesses and engagement (time spent in the application) along with Google services, namely for search purposes. Most users focus their attention to only one SN and 27,8% to two SN. Tourists also use other applications or websites for weather information, recommendations (e.g. for places to eat), location based services (e.g. GPS applications), search or manage house renting but also to look for information of the places they visit. Tourists with stays between 2 and 7 days are the most active ones, while 1 day tourists are light users of such open networks and tourists with longer stays probably relying on other complementary Internet access means.

Understanding the sharing behaviours of tourists is highly important since pictures or videos of touristic sites may have great impact in the promotion of those sites. The results demonstrate that sharing is much more intensive and in real time in SN targeted at younger audiences (Snapchat or Instagram) than Facebook (with delayed sharing behaviours). From this research we may perceive that tourists are deeply engaged in sharing their experiences and deeply engaged on social interaction, communication or information search. Understanding how tourists use public Wi-Fi networks may be of great relevance to any city or area in order to be able to provide better and more personalized services including recommendation services based on their routes and behaviours.

REFERENCES

[1] Anne Coussement, M., & J. Teague, T., "The new customer-facing technology: mobile and the constantly-connected consumer", Journal of Hospitality and Tourism Technology, 4(2), pp. 177-187, 2013.

[2] Xiang, Z., Magnini, V. P., & Fesenmaier, D. R., "Information technology and consumer behavior in travel and tourism: Insights from travel planning using the internet", Journal of Retailing and Consumer Services, 22, pp. 244-249, 2015.

[3] Bonn, M. A., Furr, H. L., & Susskind, A. M., "Predicting a behavioral profile for pleasure travelers on the basis of Internet use segmentation", Journal of Travel Research, 37(4), pp. 333-340, 1999.

[4] Duman, T., & Tanrisevdi, A., "Profiling of English tourists visiting Turkey based on attitudes toward Internet use in vacation decision making", Journal of Hospitality Marketing & Management, 20(5), pp. 525-550, 2011.

[5] Varkaris, E., & Neuhofer, B., "The influence of social media on the consumers' hotel decision journey", Journal of Hospitality and Tourism Technology, 8(1), 2017.

[6] Ribeiro, H., Fonseca Amaro, S., Seabra, C., & Luís Abrantes, J., "Travel content creation: The influence of travelers' innovativeness, involvement and use of social media", Journal of Hospitality and Tourism Technology, 5(3), pp. 245-260, 2014.

[7] Ojala, T., Hakanen, T., Salmi, O., Kenttälä, M., Tiensyrjä, J., & Närhi, P., "Characterizing the usage of a large municipal WiFi network", Proceedings of ACM MobiCom 2007/Crawdad Workshop, 2007. Montréal, QC, Canada.

[8] Picco-Schwendener, A., & Cantoni, L., "Tourists and Municipal Wi-Fi Networks (MWN): The Case of Lugano (Switzerland)". In Information and Communication Technologies in Tourism 2015 (pp. 565-578), 2015, Springer International Publishing.

[9] European Commission, "WiFi4EU | Free Wi-Fi for Europeans. European Commission", 2017, https://ec.europa.eu/digital-single-market/en/wifi4eu-free-wi-fi-europeans (verified 13 February 2018).

[10] WiFi UAE Initiative, 2018, http://www.wifiuae.ae/en/ (verified 13 February 2018).