Analyzing the spatial and temporal dynamics of Snapchat

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Abstract

Snapchat is a widely popular social-media platform among young people. In an update in February 2018, a web-based version of Snap Map was released. Besides using Snapchat for peer-to-peer chatting, users can submit photos and short videos to this feature. Snap Map was found to be useful for the dissemination of breaking news (e.g. protests) and the identification of local events (e.g. house fires) in quasi real-time. In order to understand the potential of the Snap Map feature for automated event extraction and answering societal questions, a better understanding of the characteristics of Snapchat data is necessary. Therefore, this paper conducts an analysis of spatio-temporal contribution patterns to Snap Map to provide a first insight into how Snapchat users use the service. The study focuses on three major metropolitan areas in the United States (Miami, Los Angeles, and New York) and analyzes Snapchat data between February 23 and March 3 2018. The analysis suggests that Snap Map contributions are spatially concentrated around Downtown areas and major attractions and that Snapchat users contribute more actively on the weekends. The least active periods are during the early morning hours, whereas the observed activity peaks are in the evening and early at night.

Keywords: social media, spatio-temporal dynamics, VGI, Snapchat, spatial analysis

1 Introduction

Snapchat is an Instant Messaging social app that focuses on photo and video sharing. It is available for mobile devices only and gained wide popularity since its launch in 2011. The user base of Snapchat grew from 10 million in 2012 to 100 million in 2015 (Billings et al., 2017). For Q4 of 2017, Snapchat reports 187 million active daily users (Techcrunch, 2018). 41% of Snapchat users are young adults between 18 and 25 years of age, and 17% of adult smartphone users use Snapchat (Duggan, 2015). The term "snapping" is used to describe the process of sending messages (i.e. "snaps") between users. The process involves taking a photo or short video, optionally applying filters on it or adding a small text, and sending it to another user. Upon viewing it, these snaps automatically disappear from the receiver's device. Another original Snapchat feature is called "My Story", which consists of consecutive snaps from a user over a period, which play like a slideshow. Stories are available to view for the user's friends for 24 hours, after which they disappear. Snapchat users generally use Snapchat for sending funny things, selfies or pictures of their activities to each other (Utz et al., 2015), more so between people close to each other rather than between strangers (Vaterlaus et al., 2016).

In June 2017, Snapchat released in an update a new feature called "Our Story" which allows users to submit snaps to it. These snaps are available to anyone to view and they are browsable on a map interface (Snap Map) in the mobile apps. Since February 2018, Snap Map has also been available on the web at https://map.snapchat.com. The snaps automatically disappear after 24 hours from the map. By allowing users to create, browse and view geotagged posts Snapchat produces user-generated content. The primary goal of Snapchat users is to interact and communicate with others, and not to create and contribute geographic information to a database that will be mapped and analysed by third parties. Whereas deliberately collected and shared geographic information through voluntary individuals is often referred to as Volunteered Geographic Information (VGI) (Goodchild, 2007), several terms have been suggested in the literature to describe passively collected data (like with Snapchat), including contributed geographic information (Harvey, 2013), ambient geographic information (Stefanidis et al., 2013), or involuntary geographic information (Fischer, 2012). However, for terminological simplicity, this paper does not distinguish between actively and passively collected information, but rather refers to Snapchat as a VGI source from here on. First reports of Snapchat users reporting from a major local incident appeared after the Parkland shooting in Florida on February 14, 2018. This was noticed by popular media (Geoawesomeness, 2018) and microbloggers as well (Figure 1). In this regard, Snapchat is similar to other VGI platforms, such as Twitter, which can be used for real-time event identification (Becker et al., 2011, Sakaki et al., 2013) and the dissemination of news (Phuvipadawat and Murata, 2010). Snapchat is also mentioned as one of the prominent social life data sources (besides Twitter, Flickr, etc.) that can be analyzed by social network analysis methods and tools (Tsou, 2015) complementing other new VGI data sources, such as PokéStops (Juhász and Hochmair, 2017).

To understand how effective Snapchat can be in real-time event detection and in disseminating breaking news, analysts need to understand the spatial and temporal characteristics of the "Our Map" feature of Snapchat. Therefore, this paper analyzes the spatial distribution and temporal characteristics of posted snaps in three U.S. metropolitan areas.

The remainder of the paper is structured as follows. Data access and dataset description are provided in Section 2. Analysis results are divided into spatial (Section 3.1) and temporal (Section 3.2) aspects of activity patterns. A summary of results and directions for future work are presented in Section 4.

Figure 1: A tweet showing the efficacy of Snap Map in gathering first-hand information of events in real-time

Source: Twitter: @_esaliba

2 Study setup and dataset description

Snaps submitted to "Our Map" were collected from the web interface of Snap Map (https://map.snapchat.com). The communication between the web browser and Snapchat's internal API was reverse engineered and a python tool was developed to continuously collect points from the current content of the map. Data collection utilized Web Map Tile Service (WMTS) tiles on the 14th zoom level. On this level, a tile covers approximately an area of 2.4 km x 2.4 km. The tool collected data between mid-February and mid-March 2018 for different areas in Europe and in the United States. Individual points do not contain a unique identifier or timestamp. However, since each data collection run results in a snapshot of all posts available on the map at a specific point in time, in another step, a timeline of events was reconstructed based on unique locations. Only the first occurrence of a point was kept, resulting in the timestamp of snap creation. This exploratory study was limited to three major U.S. metropolitan areas, namely Miami, Los Angeles, and New York. Points were analyzed for the period between February 23 and March 3. For the spatial analysis presented in this research, point counts were aggregated by WMTS tiles. Further, to compare the temporal activity between different cities, timestamps were converted to local times. Table 1 lists the summary statistics of the final dataset used in this study. Outlines of study areas for which points were collected are shown as red rectangles in Figure 2a. The obtained point dataset lacks metadata, such as snap title, keywords, topic, or user name. This limitation prevents an intrinsic thematic analysis of obtained point clouds or trajectory extraction of individual snapchat contributors.

Table 1: Summary statistics of the analyzed dataset (February 23 – March 3)

Metro area	# of tiles (area [km^2])	# of snaps	Avg. daily density [points/km^2]
Miami	457 (2860)	25,155	1.0
Los Angeles	1,029 (6395)	77,426	1.3
New York	514 (3105)	54,243	1.9

3 Results

3.1 Spatial distribution

Figure 2a illustrates the spatial distribution of snaps submitted to Snapchat's "Our Story" between February 23 and March 3, 2018. Data points were rendered with 2% opacity and the values of overlapping point markers were summed up. This means that at least 50 points are needed in close proximity of each other for a location to appear in plain yellow at full opacity. As can be seen, points are not evenly distributed but rather spatially concentrated around certain locations. These location include Downtown areas and areas with tourist activities, as well as smaller but still visually discernable local clusters of significant activity. Two of such local clusters in Miami are highlighted in Figure 2a, namely an indoor arena and outlet mall in Sunrise, FL (#1) and the main campus of the Florida International University (#2).

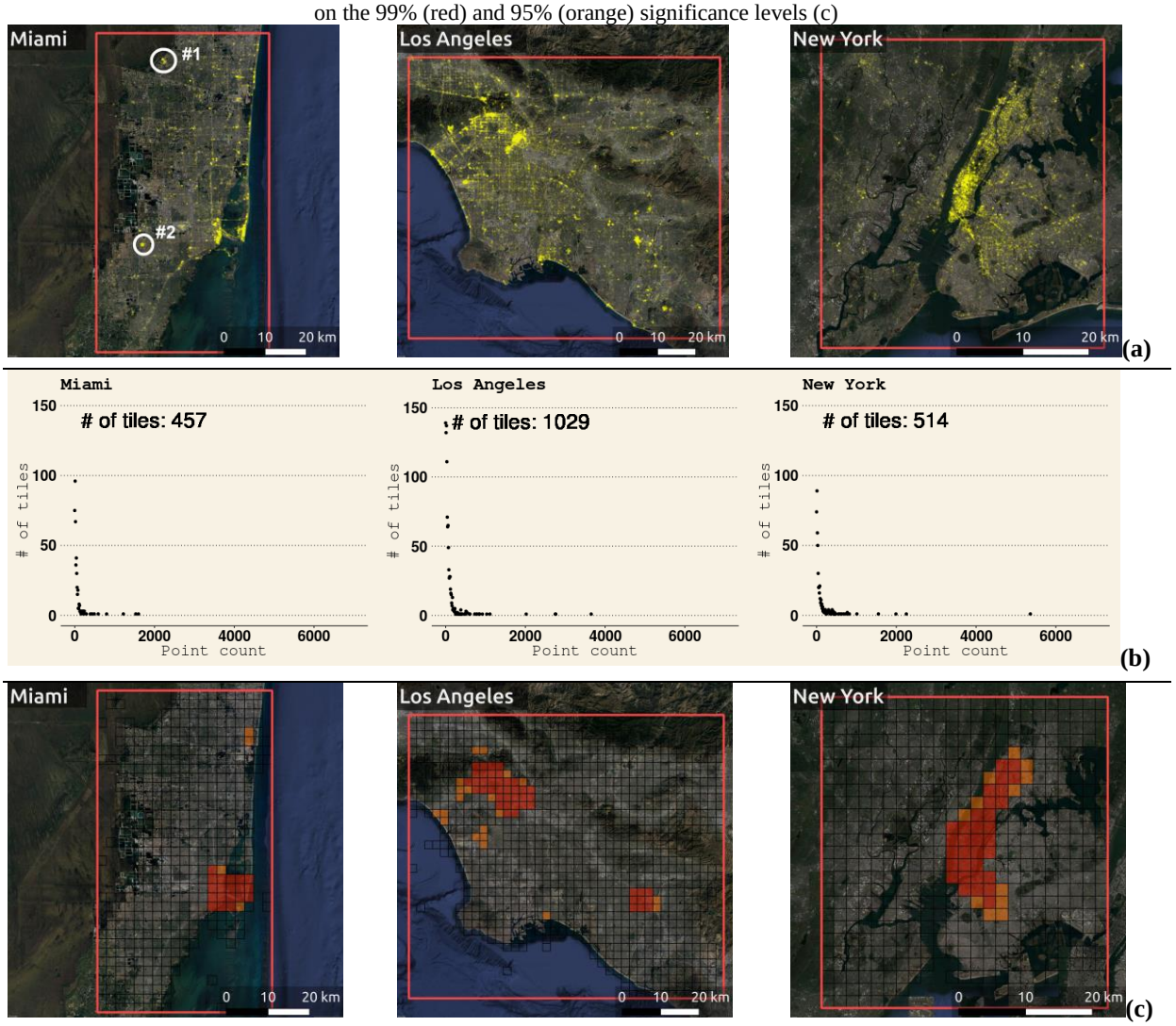
Frequencies of point counts aggregated by tiles follow right skewed distributions (Figure 2b), which also suggests that Snapchat activity is spatially concentrated. The maximum numbers of snaps within a tile were 1,597 for Miami (N_{tiles}=457, $SD_{snap\ count}$=135, $mean_{snap\ count}$=55), 3,646 for Los Angeles (N=1,029, SD=202, mean=75), and 5,363 for New York (N=514, SD=305, mean=106). The high concentration of activities is also illustrated by the fact that nearly one quarter of total snaps submitted in these cities originated from just 1% of the most active tiles in each of these cities.

To confirm these observations statistically, the G_i* local statistics was calculated for the tile grid (De Smith et al., 2015). The G_i* statistics allows the extraction of Snap Map hotspots, i.e. to identify tiles where high point counts cluster spatially. Figure 2c shows the results of the hotspot analysis and illustrates significant clusters at the 0.01 (red tiles) and 0.05 (orange tiles) level. Identified hotspots correspond closely to visually prominent areas in Figure 2a. In the Miami metropolitan area, the largest cluster corresponds to Downtown Miami, Brickell (financial district) and Miami Beach. A smaller cluster is also apparent in Downtown Fort Lauderdale, which is another principal city of the metropolitan area. The Los Angeles metropolitan area shows similar signs of spatial clustering. A major cluster can be observed containing neighborhoods from Beverly Hills to Downtown Los Angeles (including Hollywood, CA). There is also another disjoint cluster in Anaheim, CA, which is home to a major attraction, Disney's California Adventure, and a ballpark, which is the home of a professional baseball team. The only cluster in the New York metropolitan area covers the entire Manhattan Island and adjacent areas in Brooklyn and The Bronx. Other principal cities of the metropolitan area, such as Jersey City do not seem to have a large number of Snapchat activity when compared to the most active areas.

3.2 Temporal dynamics

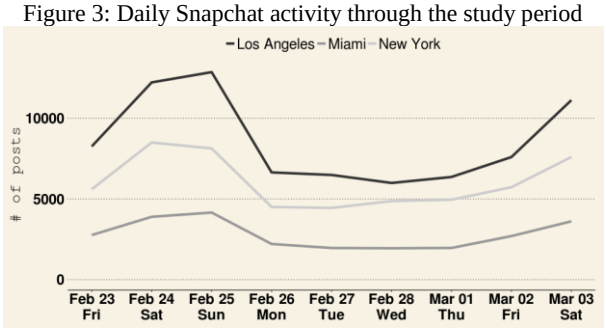
The temporal dynamics of Snap Map can be explored through time series visualization. Figure 3 shows increased Snapchat activity over the weekends (February 24 – 25 and March 3), with increase rates between 61% (New York) and 75% (Los Angeles) compared to weekdays. Two-sample t-tests revealed that the difference in the average number of daily snaps

Figure 2: Spatial distribution of Snap Map (a), frequency distribution of point counts by tiles (b), and identified hot spots on the 99% (red) and 95% (orange) significance levels (c)



between weekdays and weekends is significant for Miami [$t(5.7) = -7.9$, $p < 0.001$], Los Angeles [$t(4.0) = -8.4$, $p = 0.001$] and New York [$t(4.9) = -9.0$, $p < 0.001$]. This effect can potentially be attributed to young adults using the service for fun activities primarily on the weekends. It is different from what has been found for Twitter, where users tweet 11% less on the weekends (Gao et al., 2012).

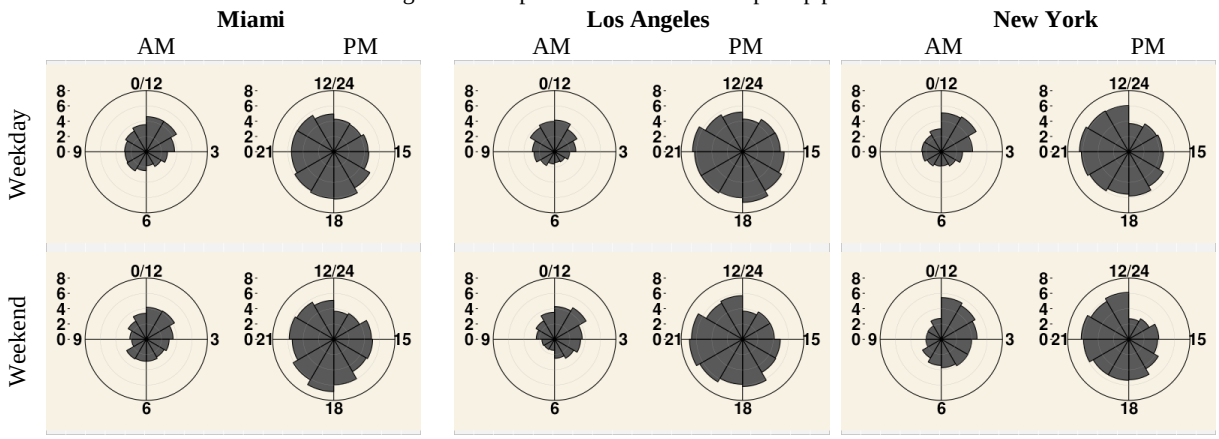
Figure 3: Daily Snapchat activity through the study period



The temporal activity pattern of Snap Map contributions can also be analyzed on a more refined scale, i.e. by hour. To elaborate on this, Snap Map points were aggregated by hour and plotted for weekdays and weekends separately for the three analyzed cities in Figure 4. These plots were furthermore subdivided into morning (before 12:00) and afternoon (after 12:00) hours. The height of each bar corresponds to the percentage of snaps created at that hour during weekdays or weekends. Therefore, for each city, both weekend and weekday plots add up to 100% separately.

Figure 4 suggests that users use Snapchat's "Our Story" feature similarly in major U.S. metropolitan areas. Users seem to be less active during the morning hours, and their activity start to build up in the afternoon until it peaks in the evening and early night. There is an apparent and rapid activity decrease after 2am on weekdays, which is less pronounced during the weekend, suggesting that Snapchat might be used by people in the party scene. This is also supported by Table 2 which lists the most and least active hours in each city. A slight shift in activity peaks towards later hours can be

Figure 4: Temporal distribution of Snap Map posts



observed from weekdays to the weekend suggesting that users are more likely to use Snapchat's "Our Story" feature later at night during weekends.

A similar shift is also noticeable for the least active periods, which are between 5am and 6am on weekdays, and later in the morning (between 8am and 10am) during the weekends. This is probably due to the fact that most people do not work during the weekend, and therefore start their days later.

Table 2: Most and least active hours of Our Story activity

		Miami	Los Angeles	New York
Weekday	Most active	17-18	17-18	21-22
	Least active	5-6	5-6	5-6
Weekend	Most Active	18-19	20-21	21-22
	Least active	8-9	6-7	9-10

4 Summary and future work

With a platform update to Snapchat in February 2018, a web version of Snap Map was released, which visualizes public snaps submitted to "Our Story". This feature has the potential to disseminate breaking news in real-time and to identify local events. This web-based interface also makes it possible to analyze Snapchat's spatial distribution, which was not previously possible from the mobile-only interfaces of Snapchat. In order to understand the usefulness of this feature for event extraction, this paper provides a first assessment of Snapchat data. It explored and analyzed the spatial and temporal Snapchat activities for the three major U.S. metropolitan areas Miami, Los Angeles and New York between February 23 and March 3, 2018.

Hot spots identified through visual inspection and the Gi* local statistics were found to correspond to downtown and touristic areas. In this regard, the spatial distribution of Snapchat reveals similar patterns as user generated data from other selected platforms, such as PokéStops that are also primarily found along businesses and touristic opportunities (Juhász and Hochmair, 2017). An activity increase between 61% and 75% between weekday and weekend suggests that Snapchat users are more active during weekends. Snapchat activity was found to peak in the evening and at early night, while the least active periods correspond to early morning hours.

For future work, we plan to provide a more comprehensive evaluation of results, including an analysis of multiple locations with different characteristics worldwide. Further, analyzing local clusters and cross-referencing them with events from news reports is also planned. Lastly, we aim to compare the activity patterns between Snapchat and Twitter to explore whether Snapchat is used by a different crowd (i.e. different age category) of users, which would help to understand what kind of information can be expected from Snapchat.

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