



## 1. Introduction

This research principally aims to portray that, proper analysis and geovisualisation of spaces based on emoji usage in social media would aid not only to get a unique idea about the perception of the city and the characteristics of the places but also would help to shape planning decisions and evaluate them in the long term. Research objectives were determined as follows:

- Finding suitable approaches for filtering emojis and assigning the related emojis into three categories; objects, activities, sentiments.
- Developing an informative geovisualisation of LBSM posts based on the use of emojis.
- Discussing the usability and limitations of analysing emojis in social media with a case scenario.

## 2. Background and Related Work

Location Based Social Media (LBSM) refers to the social media application integrated with the position of the user. Economists, politics, governments, urban planners, commercial organisations, along with many other organisations, have taken advantage of LBSM for analysis and development of plans.

Previous investigations implemented diverse approaches to use LBSM data in urban studies and other fields. Geo-referenced social media data was used to discover urban dynamics (Dunkel 2015; Frias-Martinez et al. 2012; Hasan, Zhan, and Ukkusuri 2013; Anselin and Williams 2015; Williams 2012). Researchers indicated that the analysis of urban areas through information collected from LBSM has gained significant attention as a promising technique for applied research. An increasing amount of LBSM data has provided researchers a fresh and important information source to understand the city, citizens, and the relationship between them.

Emojis are smileys or ideograms which are widely used in several devices and applications. Emoji usage was analysed for obtaining sentiments by scholars (Fernández-Gavilanes et al. 2018; Wood and Ruder 2016; Ayvaz and Shiha 2017; Novak et al. 2015; Hauthal, Burghardt, and Dunkel 2019). These researches indicated that the evaluation of sentiments using emojis has a unique ability, but it can be misleading and challenging if the weaknesses and limitations of using social media data are not taken into consideration.

## 3. Methodology

The data used in this study contains 1,073,095 posts, which were posted between the years 2007 – 2018 in Dresden. After the processing, the size of data was reduced, and analysis was performed. An emoji taxonomy was created to provide the most meaningful interpretation of emojis for urban studies. Firstly, main categories as objects, activities and sentiments, then subcategories were determined and emojis were assigned in these categories. An interactive web map was set up to visualise Dresden LBSM posts based on the emoji taxonomy and the categories they were assigned to. The map for this research was created in RStudio Leaflet library was used and integrated into a Shiny web application. Created web map can be found under this link: "https://elifcanozyildirim.shinyapps.io/mapemoji/" and from QR-code. to give more insight about emoji usage in Dresden social media posts, a word cloud was generated with pictorial symbols of emojis and emoji names.



Figure 1: Word Cloud of Most Used Emojis as Graphics and as Text

Emoji Name	Emojis
<b>eat &amp; drink</b>	
face savoring food	🍴
<b>outdoor activities &amp; sports</b>	
flexed biceps	💪
<b>basic entertainment</b>	
camera	📷
<b>mental activity, relaxation</b>	
musical notes	🎵
<b>shopping</b>	
shopping cart	🛒
<b>work</b>	
laptop computer	💻

Table 1: Activities' Subcategories and Example of Assigned Emojis

Emoji Name	Emojis
<b>built-up &amp; residential</b>	
church	⛪
<b>commercial &amp; services</b>	
bus	🚌
<b>recreational &amp; open space</b>	
national park	🌲
<b>transportation &amp; utilities</b>	
bicycle	🚲

Table 2: Objects' Subcategories and Example of Assigned Emojis

Emoji Name	Emoji
<b>negative</b>	
loudly crying face	😭
<b>neutral</b>	
smirking face	😏
<b>positive</b>	
smiling face with sunglasses	😎

Table 3: Sentiments' Subcategories and Example of Assigned Emojis

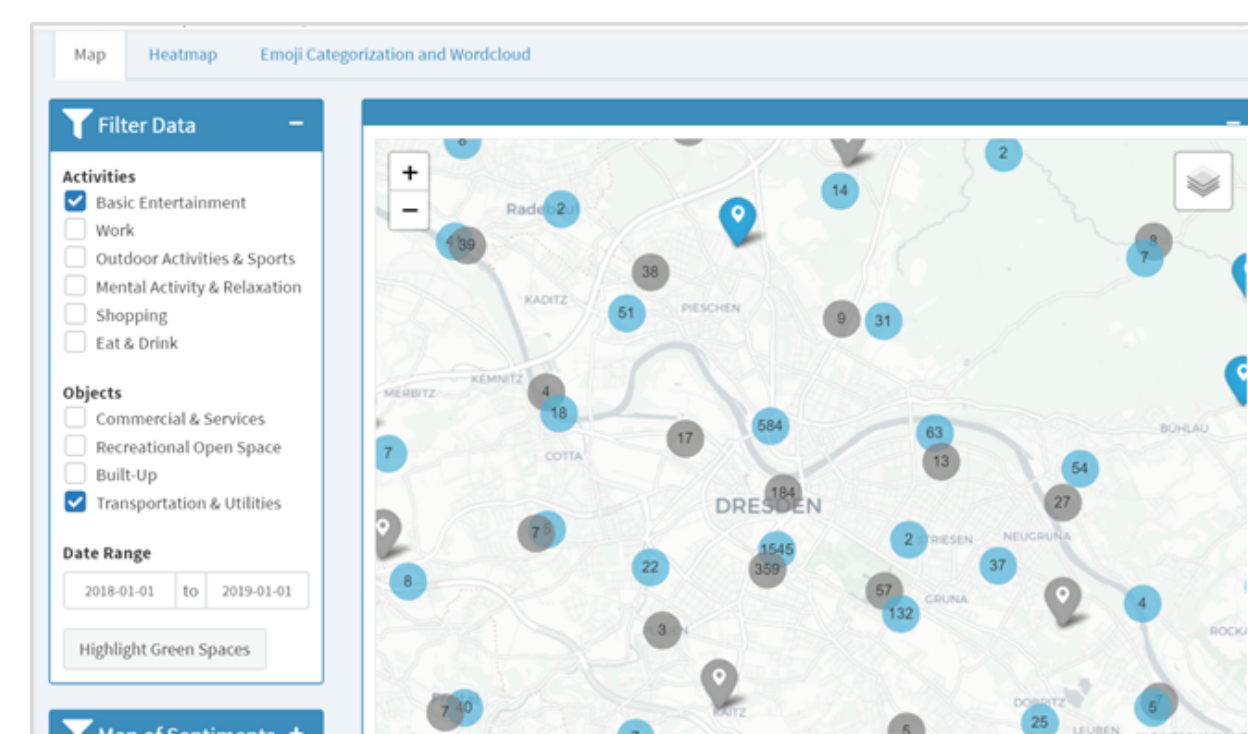


Figure 2: Interface of the Map Application

## 4. Use Case Scenarios

Parks in Dresden were characterised according to the map based on emoji usage on social media, with the help of filtering options of activities category. Different parks could be easily compared in terms of the number of visitors and the type of activities performed. Distinctive activities were noted, such as swimming and fishing. By the help of the heatmap, the temporal changes in "Outdoor Activities & Sports" were observed. Observation and profiling of parks contribute to the creation of citizen-centred approaches when planning landscape areas.

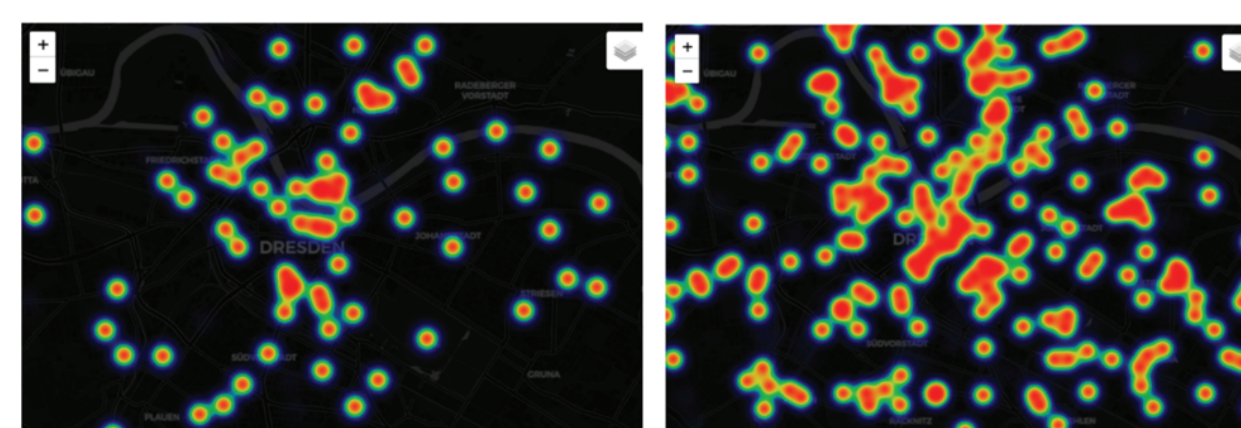


Figure 3: The heatmap created with points of "Outdoor Activities & Sports" for the years 2013-2016 (left) and 2016-2019 (right)

This research also investigated the neighbourhood Wilsdruffer Vorstadt in Dresden to learn about the features of the area and to test the interactive map usability. This neighbourhood was chosen because one study called USER (URBACT 2015) has already conducted surveys to assess the characteristics of the district. It was observed that, emojis were used in compliance with the locations, such as "train" emoji was found around train stations, "church" emoji was found around churches. This fact was found to confirm the adopted methodology of categorisation. More importantly, it proved that analysing the use of emoji could help identify landmarks in the city.

## 5. The Discussion

Previous investigations implemented diverse approaches to use LBSM data in urban studies and other fields. Geo-referenced social media data was used to discover urban dynamics but there has been an absence where emojis extracted from LBSM has been used and investigated for urban research, along with an interactive geovisualisation. Emoji usage was analysed for understanding sentiments by researchers but the use of emojis was not explored to detect activity and spatial patterns. Analysing emoji usage to determine activity and spatial patterns, and sentiments for urban planning applications was not elucidated before.

This research has contributed to the current research in the following ways. Firstly, a taxonomy of emojis for urban studies was generated. This taxonomy can be used by other studies aimed at exploring a city exploiting emoji usage. In addition to this, a new attempt was made to draw the symbols in a word cloud, rather than words and letters. Secondly, an interactive geovisualisation method was adopted to facilitate the exploration of the city through social media. Among other studies, it was the first attempt to visualise LBSM data according to the use of emoji, by creating a web map and providing filtering options.

Despite some disadvantages and weaknesses, two of the case scenarios have demonstrated that geolocated LBSM data creates a new information source about urban and social dynamics when it is processed and interpreted thoroughly.

Limitations and Weaknesses of the Study:

- The geographical position of the posts does not always match the emojis.
- Users tend to look positive to others in social media rather than sharing thoroughly honest opinions and sentiments.
- Because of the nature of using social media and the emoji usage, the map was not capable of giving one hundred percent accurate information.
- LBSM data does not represent the entire population (Quercia et al. 2013)

Further Improvements:

- There is a need for a better representation of clustering points.
- A finer investigation of emojis and their use in social media must be performed for a better assignment of emojis in subcategories.

## 6. The Conclusion

This study strengthened the position that LBSM is a useful resource for the urban planning profession. The use of emoji taxonomy and the geovisualisation have been shown to be advantageous to use as an information source. However, a few shortcomings were also identified.

It was concluded that proper care should be taken when taking emoji usage in social media as a source of information.

## 7. References

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