Emojis As Indicators Of Spatial-Temporal-Thematic Developments In Geo-Social Media

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Social media platforms like Twitter play an increasingly large role in the lives of over half of the world's population and present a unique opportunity for gaining insights into users' thoughts and ideas. Emojis are increasingly used in social media to convey meaning and can be leveraged to identify current events and other topics that attract large numbers of users, such as election results and natural disasters [1]. This study seeks to determine whether emojis can be used to identify relevant topics and their evolution in a non-topic-specific dataset.

METHODOLOGY

This study used a combination of exploratory analysis and emoji-specific analysis to identify topically consistent emojis and their use across time and space. The typicality measure was used to find the representativeness of an emoji for a given subset of the larger dataset. Typicality is the normalized difference of relative frequencies between a subset and total dataset [2].

DATA

Raw data was sourced using the Twitter API. The dataset was refined to include only tweets that were geotagged within Europe during the year 2020 and that contain at least one hashtag and one emoji. Notably, the dataset was not thematically filtered in any way. The HyperLogLog algorithm was used together with cryptographic hashing and spatial data aggregation to improve user privacy wherever possible.

TOPICAL CONSISTENCY

To test the semantic consistency of a selected emoji, a list of the 20 most frequently co-occurring hashtags was generated. Then, posts containing thematically similar hashtags were quantified and divided by the number of posts in the list. The result is the percent topical consistency of the emoji. The clapping hands emoji, for example, is 89% topically consistent regarding healthcare worker appreciation.

Co-Occurring Hashtags of the Clapping Hands Emoji 👏

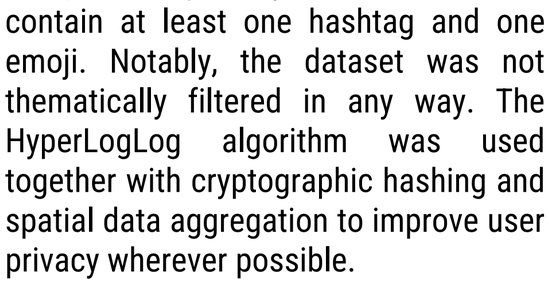

Figure 1: A word-cloud containing the top 20 co-occurring hashtags with the clapping hands emoji. Text size is proportionate to frequency of use.

TEMPORAL TYPICALITY

Typicality calculations were conducted using monthly subsets of the data for over 100 different emojis. Charts of these measurements illustrate temporal trends in emoji usage.

Temporal Typicality of Face with Medical Mask Emoji 😷

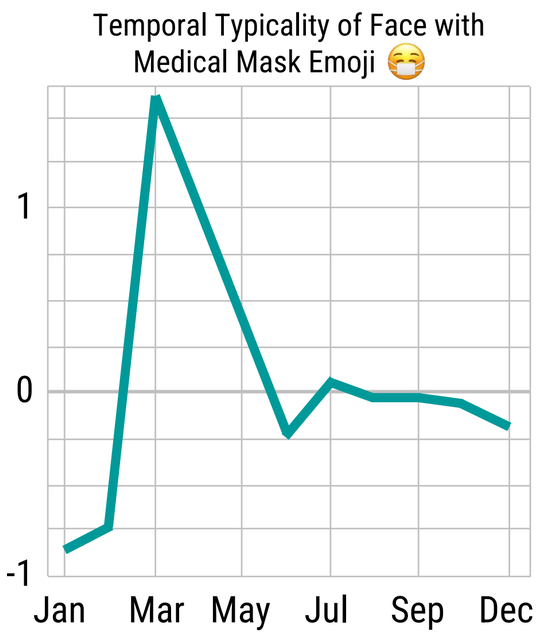

Figure 2: The temporal typicality of the face with medical mask emoji demonstrates a spike in March and April of 2020.

SPATIAL TYPICALITY

For the calculation of typicality across space, a 100 by 100 kilometer grid was superimposed on the study area. One subset in this case consists of all tweets that were geotagged within one cell. The resulting maps display the typical spatial distribution of emoji use.

SPATIAL-TEMPORAL TYPICALITY

To visualize changes in emoji usage over both space and time, spatial-temporal subsets of the data were created using the grid shown in Figure 3 for each monthly subset. For each emoji analyzed, the result is a series of maps that demonstrate the change in spatial typicality over time. The resulting animations can be viewed by scanning the Supplementary Materials QR code.

RESULTS

In addition to calculating spatial and temporal typicality on the top 100 emojis by user days, topical consistency and spatial-temporal typicality were calculated for 35 selected emojis. Relevant topics that were detected in the dataset fall into four main categories: the COVID-19 pandemic, healthcare worker appreciation, activist movements such as Black Lives Matter and LGBTQIA+ rights, and leisure activities.

CONCLUSION

This research took a novel approach to the analysis of emojis in geo-social media by 1) using a dataset that was not thematically pre-filtered, 2) analyzing trends in emoji usage across space and time simultaneously, and 3) using these trends to identify local topics in a geo-social media dataset. Methods were created for detecting the topical consistency of emojis and visualizing their use over both time and space. Ultimately, changes in the use of topically consistent emojis were leveraged to reveal relevant topics within the dataset.

Spatial Typicality of the Beer Mug Emoji 🍺

Spatial Typicality of the Wine Glass Emoji 🍷

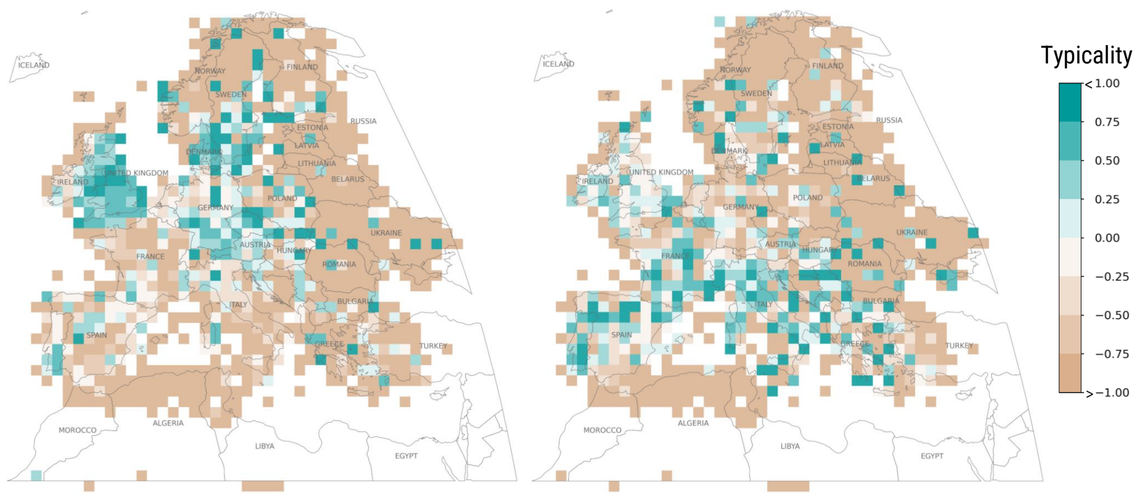

Figure 3: The spatial typicalities of the beer mug and wine glass emoji. One grid cell represents 10,000 km².

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geo-social media, location-based social media, emoji, spatial-temporal analysis, typicality

SUPPLEMENTARY MATERIALS

REFERENCES

[1] Dunkel, A., Andrienko, G., Andrienko, N., Burghardt, D., Hauthal, E., & Purves, R. (2019, 4). A conceptual framework for studying collective reactions to events in location based social media. International Journal of Geographical Information Science, 33, 780-804.

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