Location Analytics and Social Media

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Workshop on GIS, Location Analytics, and Digital Convergence:
Social Media, Blockchain, and Internet of Things
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Topics covered

- Background on social media and GIS
- Research in social media and GIS – overview
- 3 Examples
  - Twitter data credibility, with Hurricane Harvey as an example
  - Solutions to competitive location problems, with social media data based on local sensitivities of customers
  - Social media use in American counties: geography and determinants
- Convergence of GIS and Social Media. Special Issue of *International Journal of Geo-Information*. Call for papers.
- Summary

Background on social media and GIS

Convergence of social media and GIS

- Social media has become more and more location-enriched, for purposes of communications, marketing as well as for data-sharing, checkins, customer tracking, and police tracking.
- **Social media** is defined as “online forms of communication through which users can share content within networks of individuals and groups” (Kaplan, 2018).
- **Social media is pervasive**. 2.41 billion users in June, 2019 (Statista, 2019)
- **Social media uses:** personal messaging; exchange of photos and videos; content creation and distribution; business advertising, branding and marketing; and mapping
- **Locational social media** raises ethical problems.
  - Privacy invasion, identity theft, data quality, digital inequality, digital divide.

Types of Social Media and examples of inclusion of location

Type of Social Media	Inclusion of Location
Social Networking	Foursquare
Collaborative projects	Esri Living Atlas
Blogs, microblogs	Esri blogs, blogs with mapping
Content communities	YouTube - mapping related
Virtual social worlds	Social worlds which have geography

(Source: modified from Kaplan, 2018)

Time sensitivity for social media. Speed of social media's impact on decision making

- If social media is time sensitive, it can rapidly inform spatially-referenced decisions.
- Foursquare allows a person to checkin to locations so others know the person's location and can quickly decide whether or not to checkin at the same location. Checkin process needs to be fairly synchronous and have a quick time response.
- Example of a social media message that is location-sensitive, but not time-sensitive, is social media used by outdoor equipment companies in which customers indicate through social media their favorite camping location, which is web-posted.
- Example of social media that is not time-sensitive nor location-sensitive is news being sent on social media about a non-urgent locational matter, such as a city's business environment.

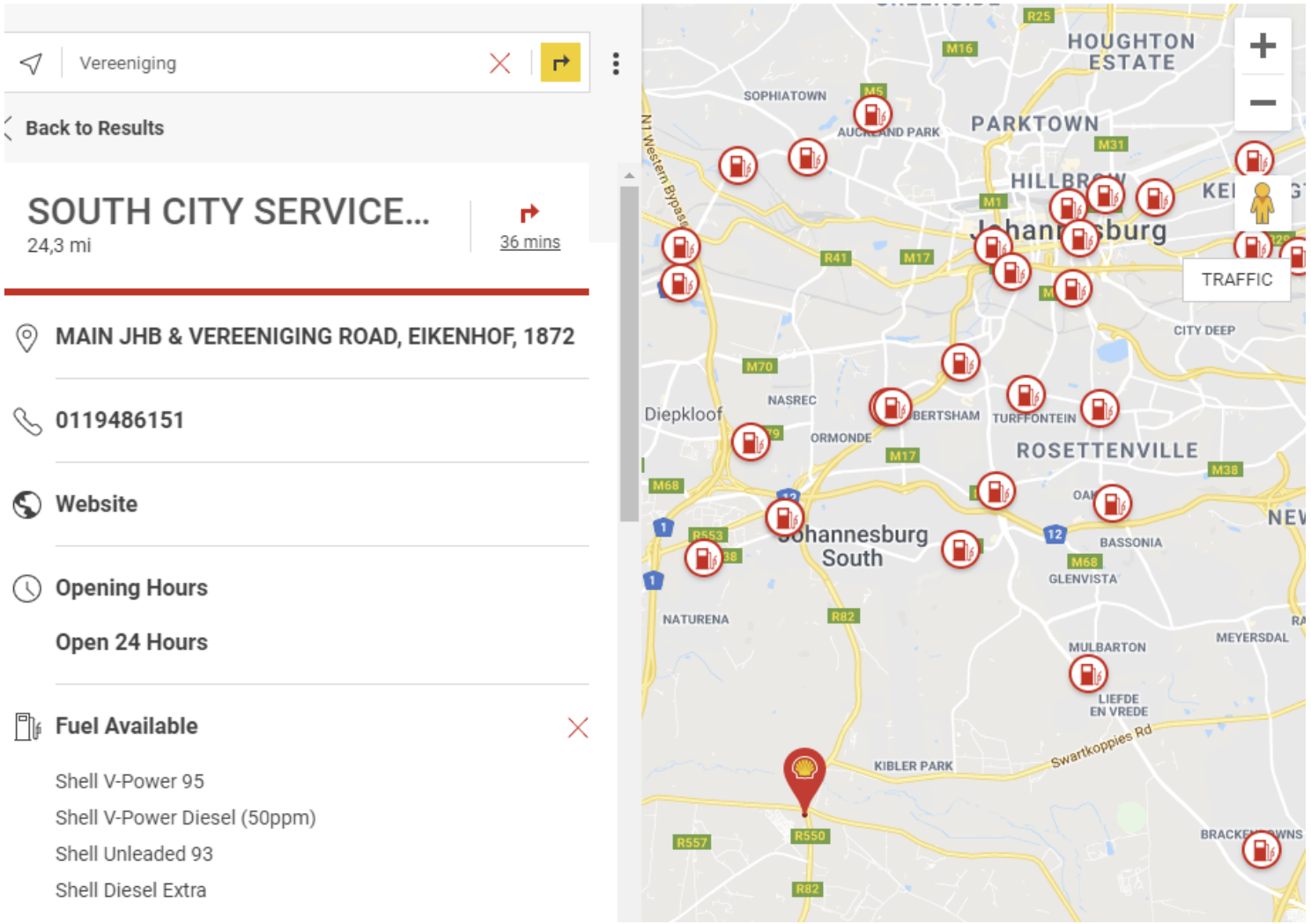
Social media mapping on smartphones

- Smartphones offer mobility for the sender of social media posts as well as for the recipient of posts, which in turn can indicate the mobility of business stakeholders or assets.
- Example. In the oil industry, companies and trade consultants map social media to convey the natural geography and geology, transportation, as well as retail outlets of the oil supply chain, for example @Shell in Twitter, which shows the spatial distribution of retail marketing of Shell service stations.

This social media map locates Shell states on southern outskirts of Johannesburg, South Africa

SHELL STATION LOCATOR

Find your nearest Shell Station using our station locator tool, and plan your route.



Heineken example of Marketing campaign with GIS and social media

- Heineken sought to market its beer brand to a target of 21 to 26-year-old millennial men, who provided real-time suggestions of night spots that were trending in their cities.
- Heineken offered its @WhereNext marketing campaign in Twitter, Instagram, or Foursquare, in order to assist young men to find out about nightlife in a city and its location. At the time, many young males felt they were missing out on niightlife by not being informed.
  - Twitter-based service went further by sorting and ranking night spots using aggregates of geo-referenced tweets, Instagram photos and Foursquare checkins.

Pluses of Heineken's service to customers and to the company

Pluses to customers

- Young, male customers received an enhanced set of information about night spots and their locations.
- The source went was beyond traditional outlets such as magazines and blogs.
- Prioritization was provided by Twitter service.
- Service could be applied in any of 15 large cities globally

Pluses to Heineken's company

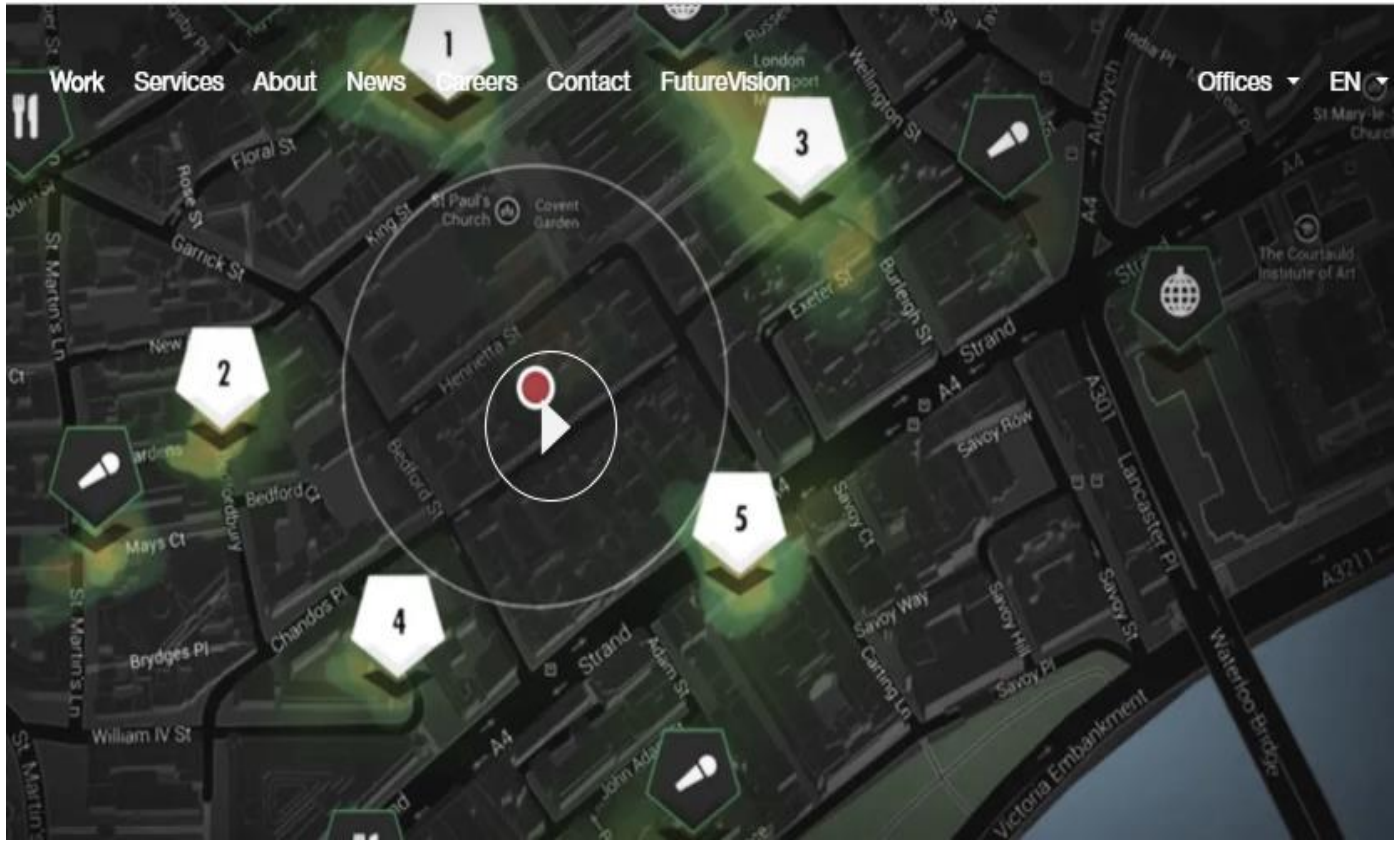
- Young male demographic was drawn in as and converted to customers.
- Heineken's image improved by being "hip" with youth and social media.
- Data gathering effort was free, since it was outsourced to social media users on voluntary basis.

Map of Heineken @wherenext Locations Relative to User in a Major City

Five night spot venues are shown relative to a service customer, for a major city.

Clicking on icon gives further information about the venue. Venues and their information are updated by volunteers (free crowd-sourcing) on a voluntary basis.

This map is conveniently displayed as part of social media messaging.



(Source: RGA.com, 2019)

Social media and GIS for meet-ups and check-ins

- Social media mapping apps can be used to arrange meet-ups of business people, friends, and/or family.
- Foursquare Swarm is an active community where users can “checkin” to a location in order to conduct a business get-together or meet-up socialy with friends or family. “Check-in” refers to a user registering a time and place (coordinates) where the user is located. A simple analogy is “checkin” to a hotel, which has a geo-location and involves several people, at its simplest the guest and hotel check-in clerk.
- WeWork allows groups of customers to plan the joint use of rooms or larger venues for meetings.

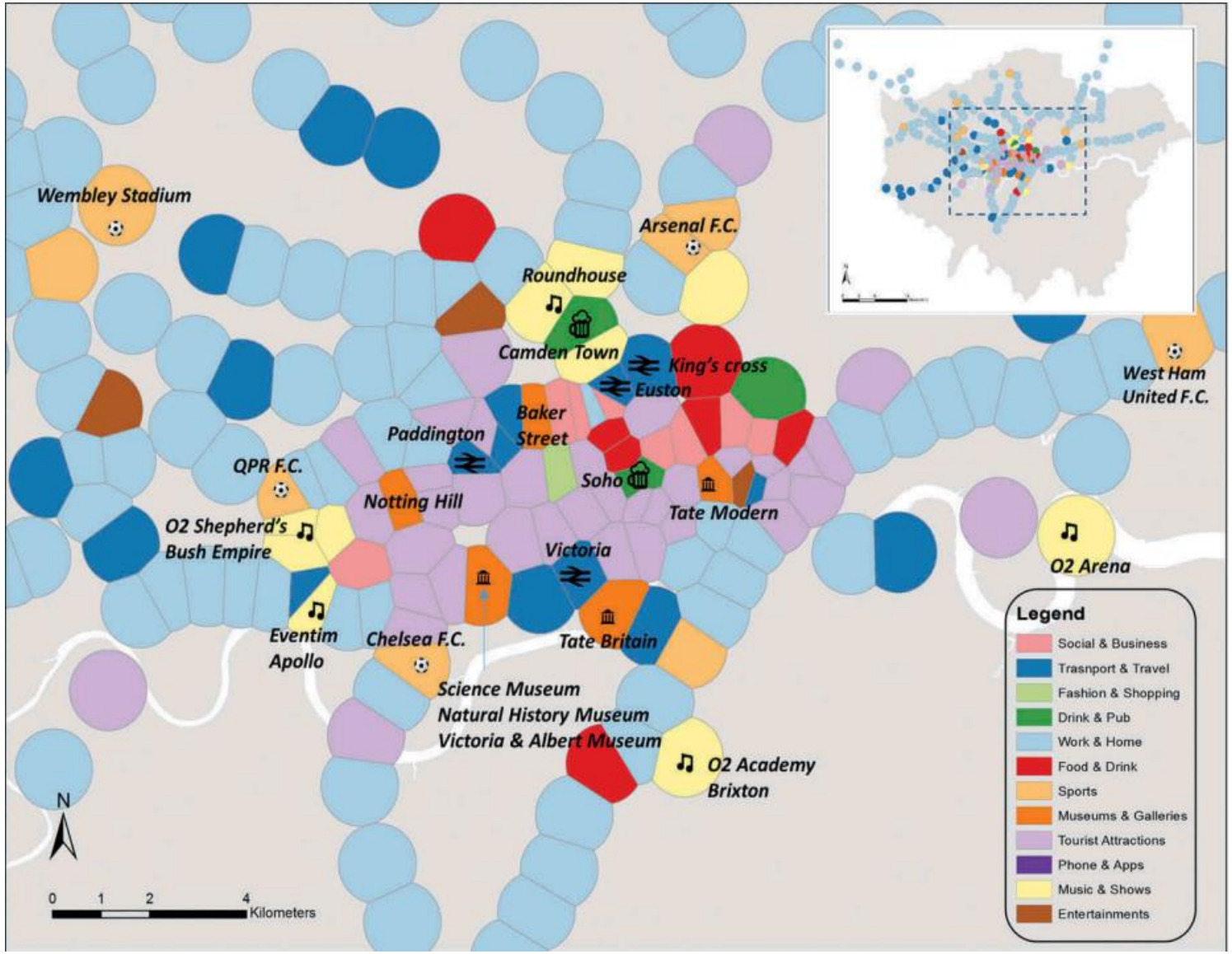
Research example – study of customers tweets on the London Underground depending on location.

- This study by Lai et al., 2017, posited that a close resemblance of Underground customers' Twitter topics on-board trains as they approached stations to the physical advertising outside the station entrance as they exited would imply that outdoor advertisers could use social media to sense the market pulse on what to display.
- Favorite Twitter topics change as an underground passenger travels on an underground line from the network center of its peripheral arms.

(Source: Lai et al., 2017)

Dominant Tweet Topics for Station Segments of London Underground, Averaged over the daily and weekly period

Note: hourly patterns of tweets reveal a complex patterns of changes in dominant tweet topics from hour-to-hour. Weekdays patterns differ from Weekend ones..



(Source: Lai et al., 2017)

Convergence of Social media and GIS – present state

- Social media and GIS are converging,
- Convergence is for a variety of personal uses albeit with exposures to privacy threats.
- This is partly driven by business marketing purposes, as social becomes a larger advertising and marketing channel.
- Although dynamically changing, combining social media and location analytics is here to stay.
- It can be a source of locational value.

Research in social media and GIS – overview

Research Opportunities with Location Analytics and Social Media

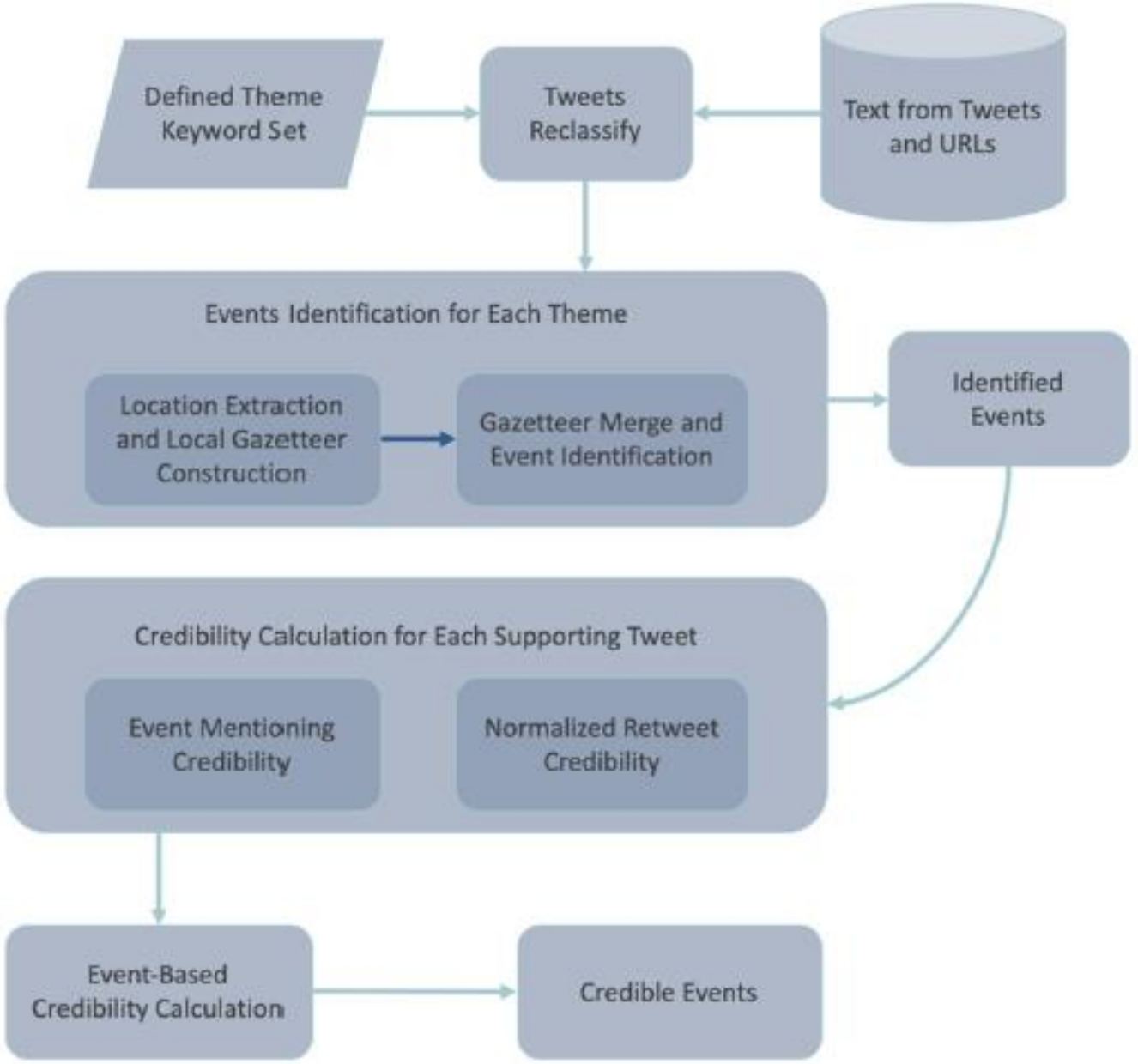
- Social media and location/geography has been an area of research study during this decade, although academic research has been done mostly by geographers including Michael Goodchild and colleagues (e.g. Goodchild and Glennon, 2010; Goodchild and Li, 2012); Ming-Hsiang Tsou and colleagues (Tsou and Leitner, 2013; Tsou, 2015).
- Occasionally this research has been contributed by MIS/IS scholars, e.g. researchers at UT Austin studied how a location-based social network went through its formation. Lee, Qiu and Whinston, 2016) , Liangfei Qiu, and Andrew B. Whinston. 2016. A Friend Like Me: Modeling Network Formation in a Location-Based Social Network. *Journal of Management Information Systems* 33(4), 1008-1033.

3 Examples of research on GIS and social media

Twitter data credibility, with Hurricane Harvey as an example (Yang et al., 2019)

- A Twitter credibility framework is posited in the context of awareness of disaster situations.
- The framework comes from crowdsourcing inputs. This implies that errors propagated for volunteered information are reduced as the number of contributors increases.
- The framework was tested with Twitter data from Hurricane Harvey.
- Tweets that informed situation awareness were extracted using a set of pre-defined keywords such as “power, shdlter, damage, casualty, and flood.”
  - For every tweet extracted, text messages and URLs referenced in the Tweet are integrated to enlarge information completeness.
- Credibility of an event was calculated and analyzed on spatial, temporal and social-impact scales.
- Practically, the framework can be used in emergencies allowing screening of messaging to yield the most important and trustworthy events in progress.

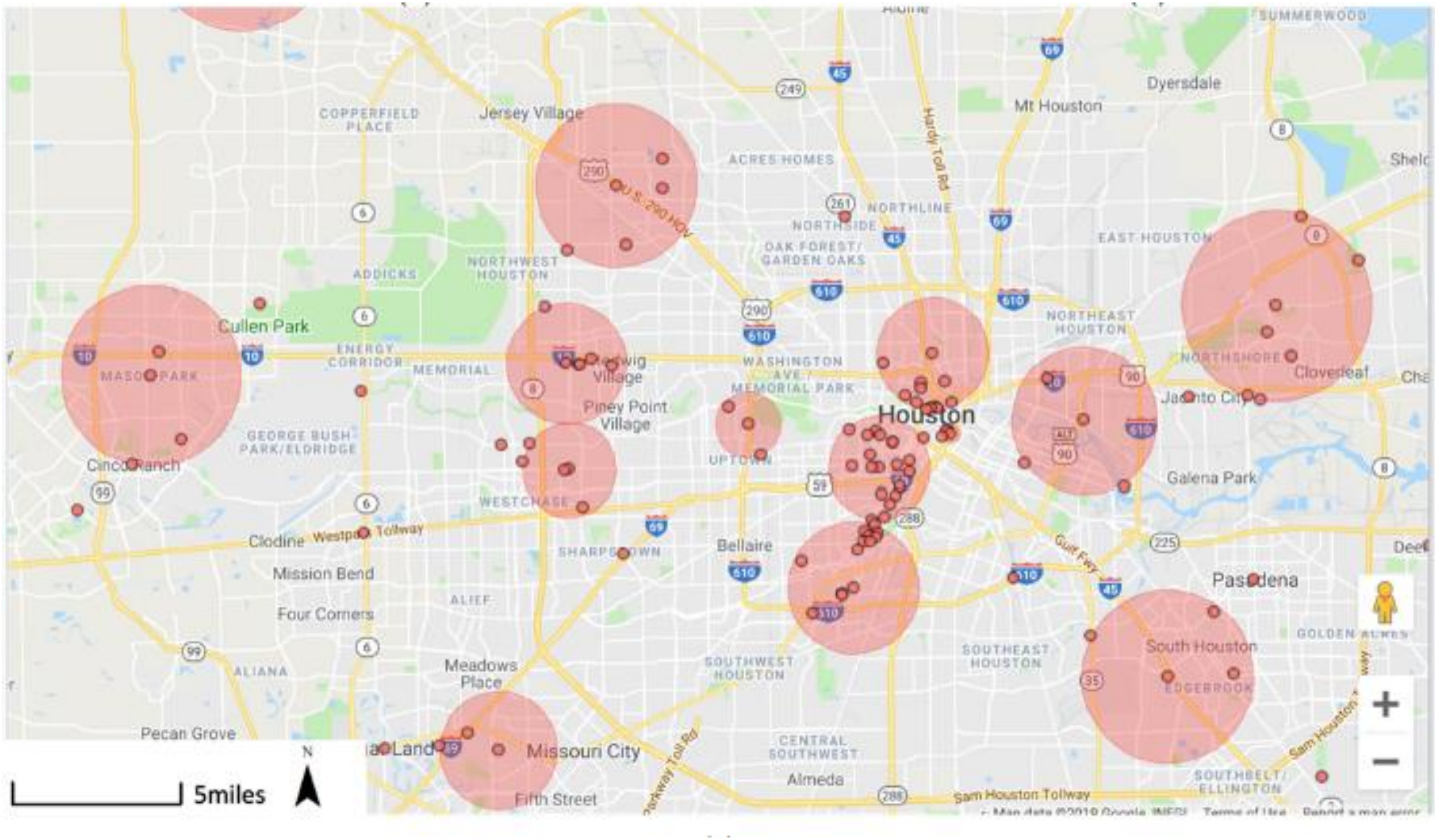
Structure of the Credibility Framework for Disaster Situation Awareness



(Yang et al., 2019)

Space-Time Aggregation of Twitter-based Events are shown for Hurricane Harvey.

Credibility scores can be assigned



(Yang et al., 2019)

Summary from Hurricane Harvey Study

- The credibility framework was tested on post-hoc data collected following Hurricane Harvey. The framework "reliably identified events with the highest scores and analyzed their spatiotemporal characteristics and social impacts."
- The paper combines crowdsourcing inputs, with Twitter reliability estimates and dynamic space-time cluster displays.
- The information flow is one not pre-planned from government disaster agencies, but rather can contribute significantly through voluntarism to emergency management information.

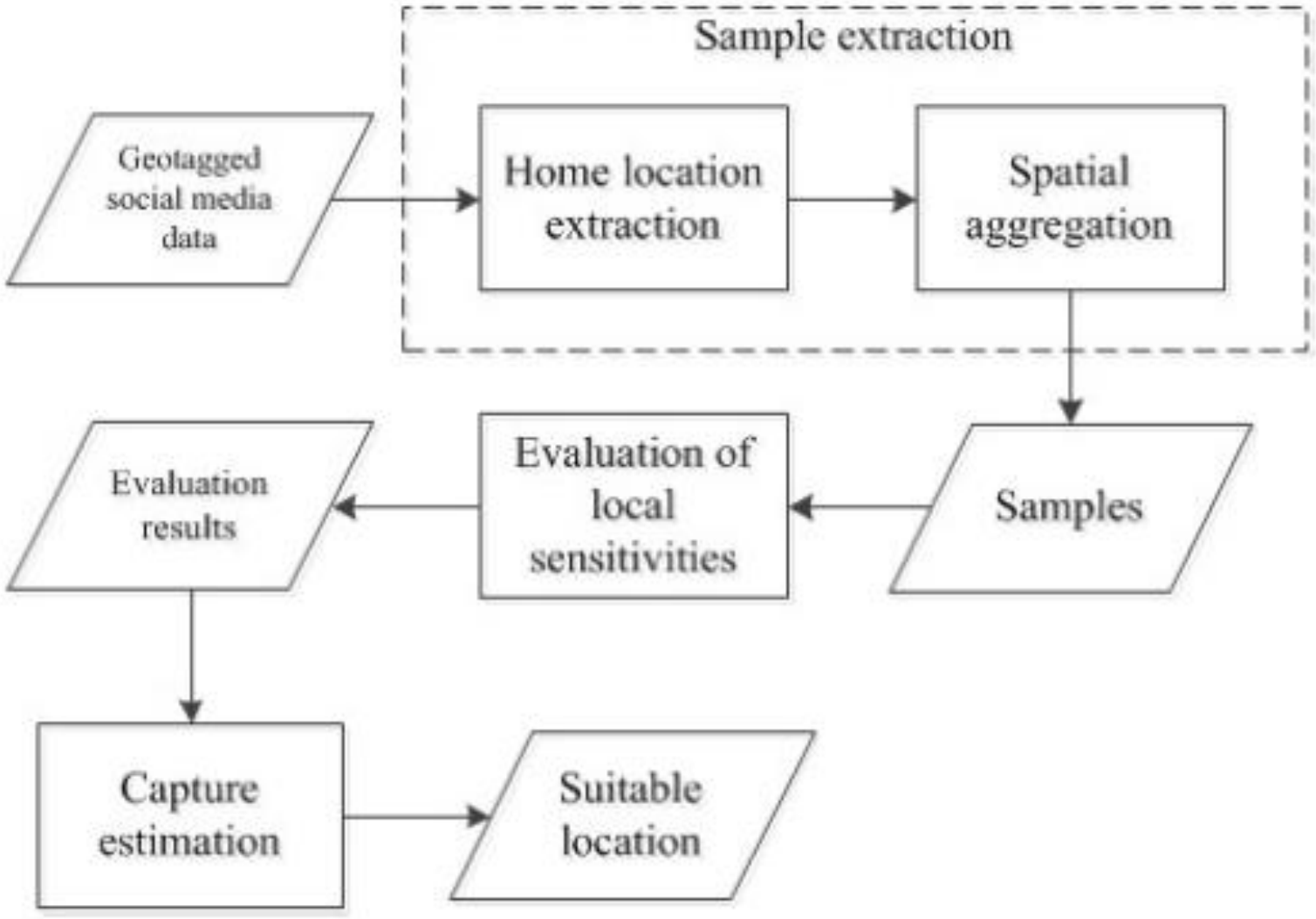
(Yang et al., 2019)

Solutions to competitive location problems, with social media data based on local sensitivities of customers (Jiang et al., 2019)

- Businesses need to solve competitive location problems (CLPs).
- This can be best done by evaluation of the customer reactions to the attractions of different facilities (e.g. distance, business zone, etc.)
- Social media information can be used for solution of CLPs, based on customer sensitivities.
- Social media data were extracted in samples for a uniform spatial distribution.
- Geographically weighted regression (GWR) and the Huff model* of customer attraction to store locations were combined, in order to measure the customer sensitivities and determine the optimal location for a new retail location.
- Using the present 5 biggest agglomerations of retail business in Beijing, China, a prospective new location was predicted, using algorithms presented in the paper.

** The Huff model of spatial interactions computes gravity-based probabilities of consumers at each origin location patronizing each store in the store dataset. From these probabilities, sales potential can be calculated for each origin location based on disposable income, education, population, and other economic and social variables.*

Framework that uses social media inputs to determine the optimal competitive location of a new retail area in Beijing



(Source: Jiang et al., 2019)

Study used a social media model to predict most feasible locations for a new retail agglomeration

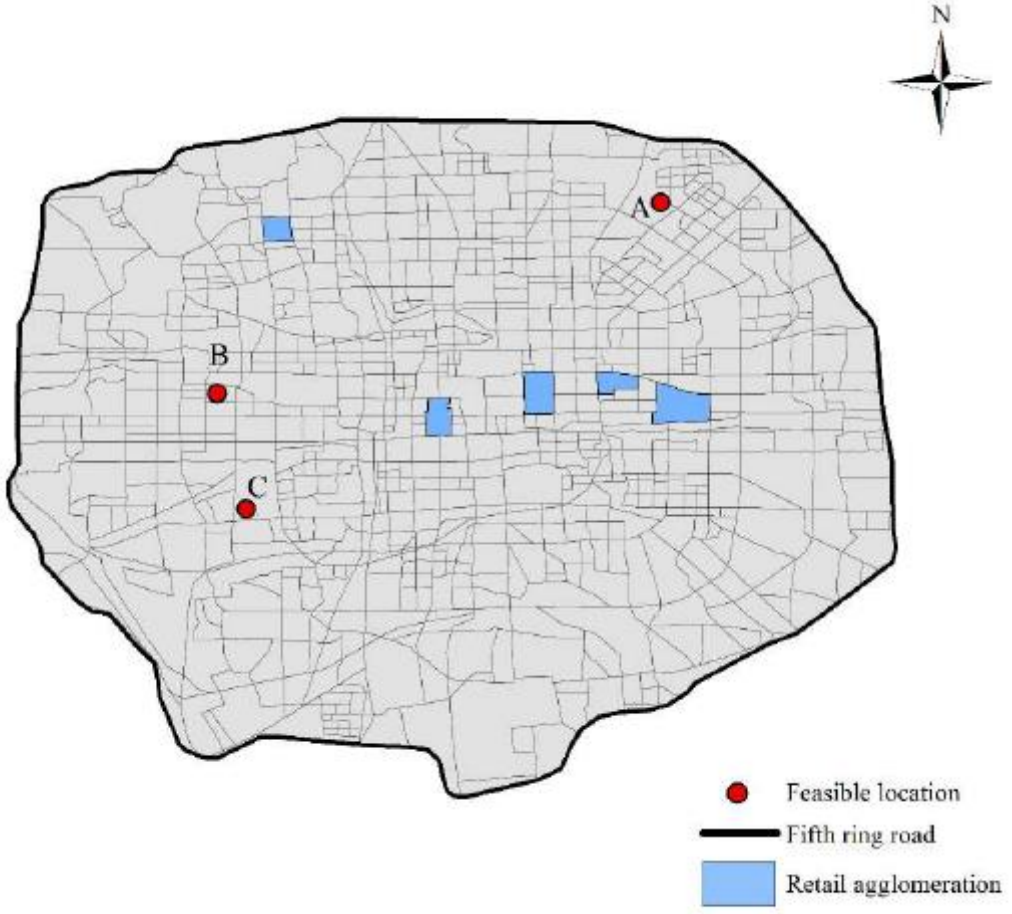


Figure 3. Feasible areas for a new retail agglomeration in the study area.

(Source: Jiang et al., 2019)

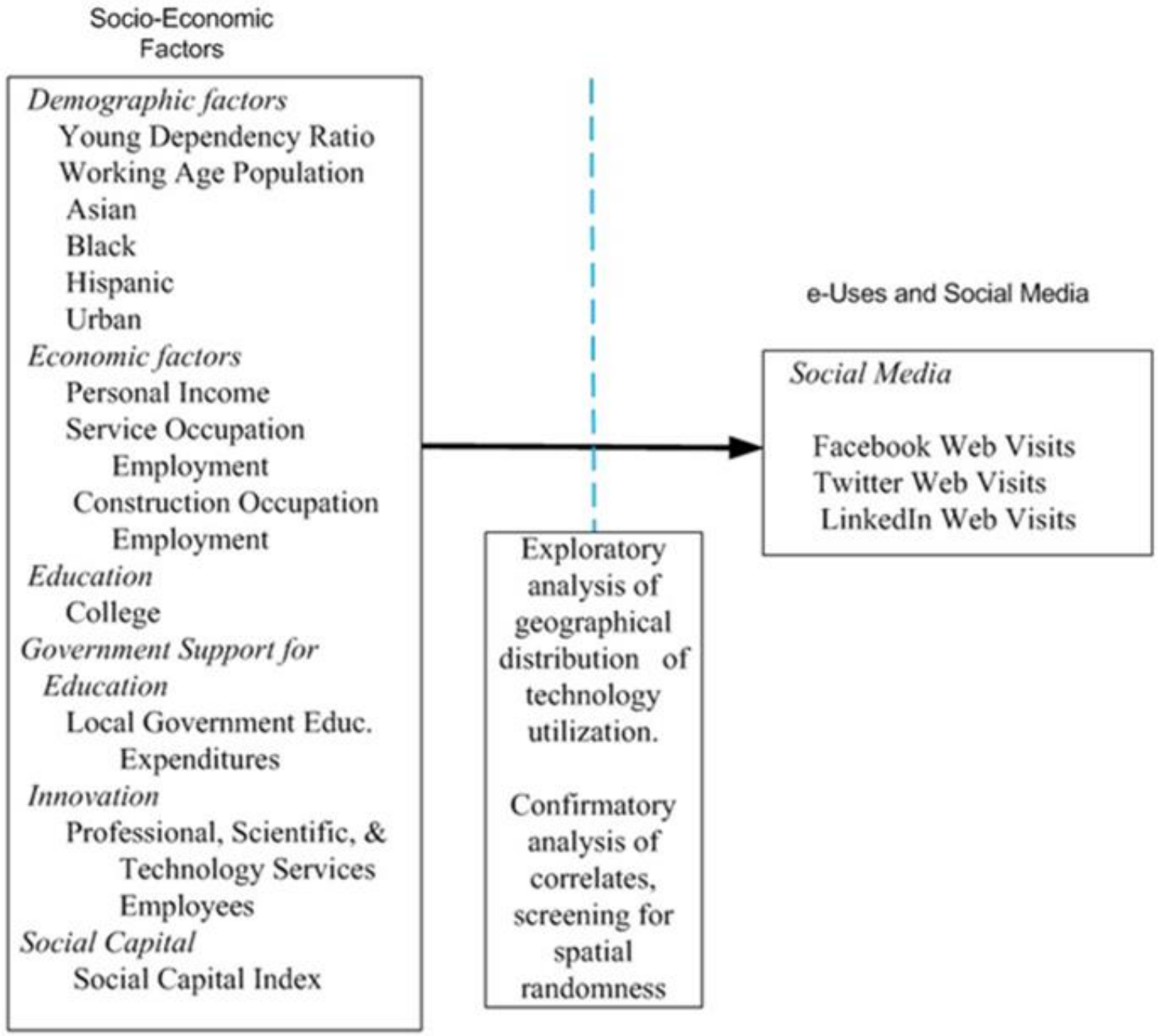
Conclusions on Jiang et al. competitive location study

- The method for predicting competitive location decisions uses geo-referenced social media data as input for deciding on where to location new retail facilities.
- The predictive model is powered by the Huff Model and Geographically Weighted Regression.
- Some challenges for future expanded reearch.
  - Social media information is biased towards youth.
  - The emotional sentiments ("valence") in social media text are not included in the model currently, but could be added.
  - Exrtracting home locations from geo-tagged social media may not represent the real location of homes.
  - Privacy issues. Social media contain considerable private information, so data research analysis of social media messages poses ethical issues.

Social media use in American counties: geography and determinants

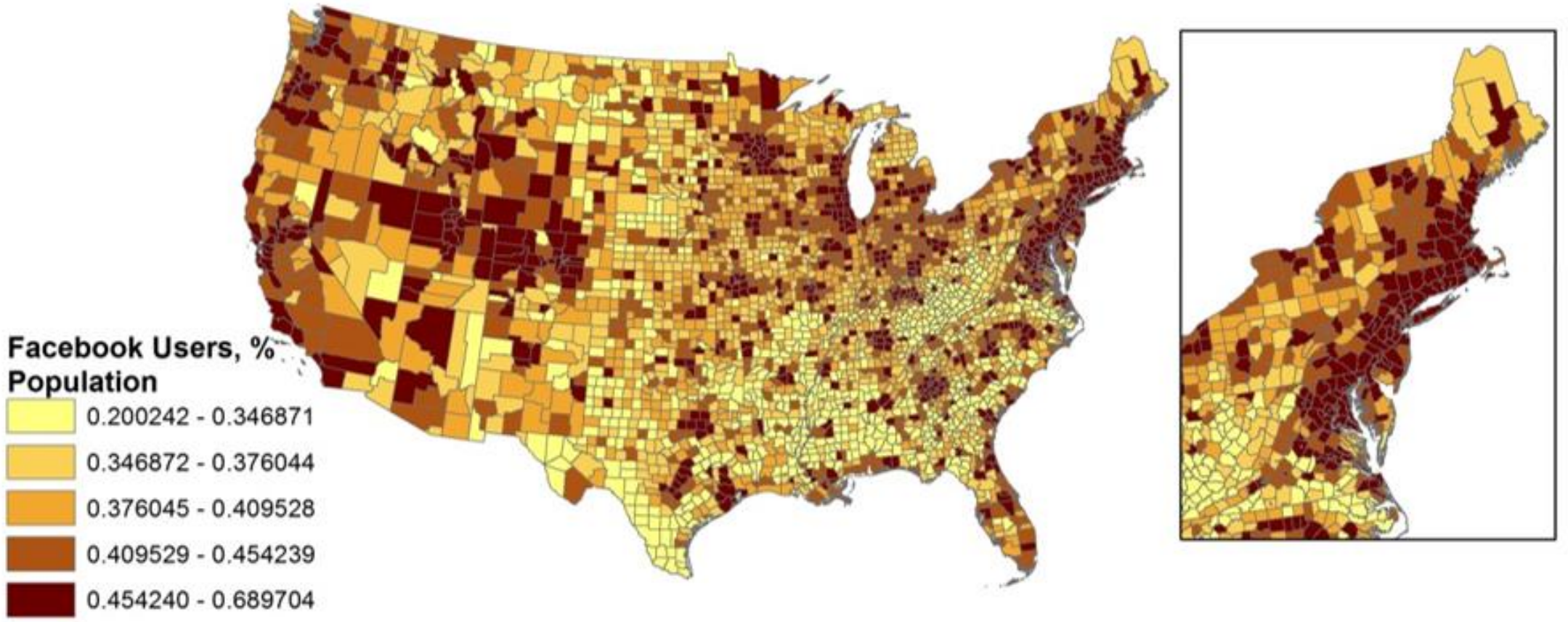
- This study shifts to a different research perspective on social media and geography, analyzing social media based on the spatial densities of its use by Facebook, Twitter, and LinkedIn throughout the U.S. at the county level.
- The SATUM model is utilized to analyze determinants of social media usage, in the contest of spatial agglomeration tendencies (i.e. like values of a variable to cluster together with similar like values, e.g. high-income households with like ones and low income with low-income households.)
- Spatial mapping reveals unique and previously unknown patterns of social media across 3,109 US counties.
- Policy implications for county governments and the US federal government are discussed.

SATUM Model of Determinants and Geography of Social Media in US Counties



(Pick, Sarkar, and Rosales, 2019)

Spatial Patterns of Facebook Use in US counties, 2012



(Pick, Sarkar, and Rosales, 2019)

Conclusions on determinants of social media use in US counties taking into account geographical agglomeration tendencies

- Key correlates of social media use were age structure, college education, young dependency ratio, working age population, and percent urban
- Geographically the U.S. was highly agglomerated in social media , especially highly agglomerated counties in the Northeast megalopolis and coastal southern California stretching up through San Francisco to Seattle. Another agglomerated area of high social media use centers on the Rocky Mountain region stretching from Denver to Salt Lake City. Areas of low clustering of social media use include the Great Plains, Appalachia, and the mid lower South.
- The SATUM model largely accounted for the geographic differences

Policy Implications of Study of Social Media at County level

- County and metropolitan governments can influence ICT policy, by providing their own public Internet services, fostering or supporting social media training for citizenry, encouraging the hiring of local ICT graduates (Kvasny and Keil, 2006), and offering incentives to stimulate service industries make greater use of social media including by small businesses.
- Regarding training in organizational use of social media, the governments need citizens to go beyond just completing courses or certificates, but to leverage the training for the “next step,” which might be further education or hiring or transfer into a job that includes social media (Kvasny and Keil, 2006).

Convergence of GIS and Social Media. Special Issue of *International Journal of Geo-Information*. Call for papers.

At *IJGI*, manuscripts receive quick but thorough reviews and if accepted are published online with several weeks of acceptance.

So far 2 of 7 submissions have been accepted with one in revision. One was referred to the main *IJGI* for submission since it was out of the special issue's purview.

Although *IJGI* has so far mostly received submissions from GIS, GISScience, and Cmoputer Science authors, the journal is seeking to more IS submissions.

Authors with relevant research are encouraged to submit manuscripts. – Deadline 31 December, 2019.

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Workshop Summary

- Social media, which is becoming pervasive worldwide, can be geo-referenced by the location of the sender. Consequently, mapping and location analytics can be applied, from diverse perspectives, to gain new insights on the "where" aspects of social media.
- Both social media and location analytics are undergoing rapid innovation advances, so new and unprecedented aspects of the convergence of these technologies are occurring, frequently with quick payoff to firms.
- This initial workshop segment started with some elementary concepts and simple examples of combining the two technologies, before proceeding to three examples from a growing body of research, which has a wide range of research questions and methods.
- The journal *International Journal of Geo-Information* is encouraging research advances on this convergence through a special issue that can include use IS theories and techniques, alongside geospatial concepts. Submissions to the special issue are encouraged.

Questions and Discussion ??

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