

# Quantifying the associations of social infrastructure on human networks

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Methods

#### Introduction

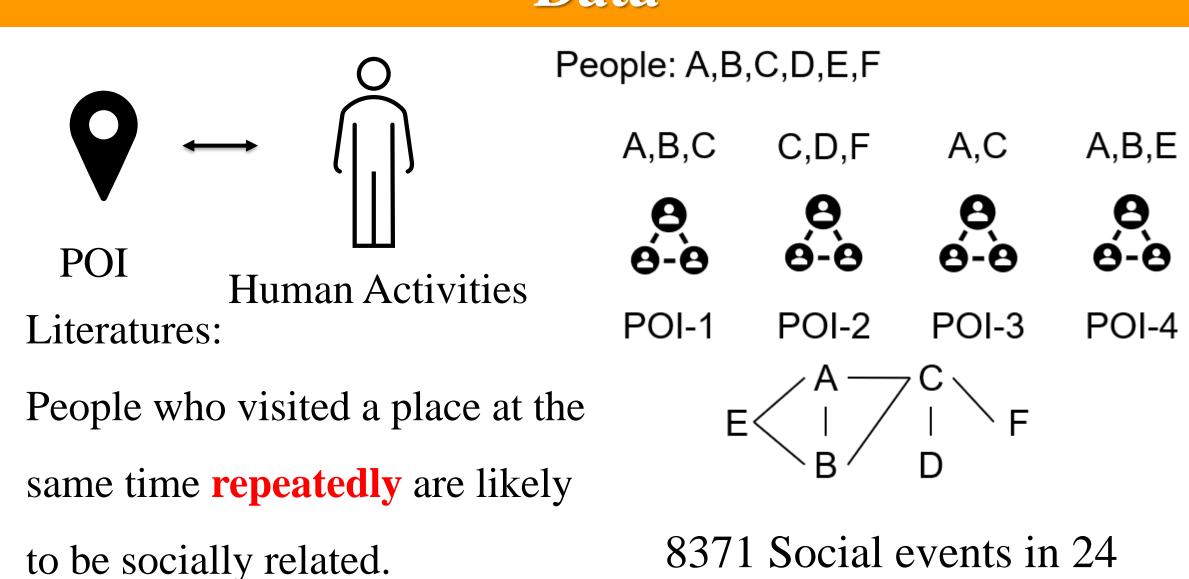
Assumption: Assumption: POI (points of interest) afford social

actives. And social events raise new relations.

In this study, we ask the **following research question**: Does the built environment have spatial associations with social events? If so, how to quantitatively measure it.

We employ POI data from Maptitude to describe the site characteristics and utilize the social events records from meetup to address the spatial associations between human activities and surrounding physical facilities.

#### Data



8371 Social events in 24 categories from meetup.com from Feb 26, 2020, to Jan 30, 2021, at 1434 locations (unique Lat/Long pairs)

Maptitude) of POI

into 13 categories

Education: 19,686

Business: 1,247

Car: 10,508

have been reclassified

Outdoors & adventure, Social:

Dallas Rooky Mountain Backpacking and Fly Fishing Group

62 types (preclassified by Book, Sci-Fi& Games, Writing Health & Welliness Adver Career, Business

**Happy Hour at Goodfriend Beer Garde** 

Finance: 12,663 Food: 9,037 restauran Hotel: 3,254 Medical: 4,307 Appearance: 16,833 Parking: 515 Party: 7,348 Public-Transportation: 205 Shopping: 20,633

#### **Data Preparation**

- Data collecting by web crawling
- 2. Geo-coding and referencing

#### Spatial Association

- 1. Monte Carlo simulation for background probability calculation
- Spatial association mining between POI and social events using **Apriori algorithm**
- Measure the interestness of discovered rules using the lift metric

#### Open to public developing

- Build a **REST API** Cdata (up to date)
- 2. Build the Client interface using **ArcGIS Webapp builder** and experience builder

# 1191 and POI data ArcGIS Online Items

Web app Interface

The State of the S

### Results

#### **Co-location Analysis**

#### Spatial statistics-based approaches

X-axis Spatial autoregressive model + spatial regression, Ripley's K function, Gravity model,

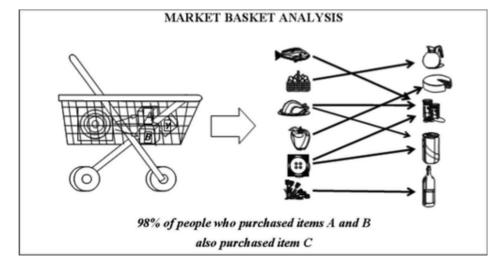
Data mining approaches

Buffer from MCS Points with walkable scale (200m) Association rule mining

Social

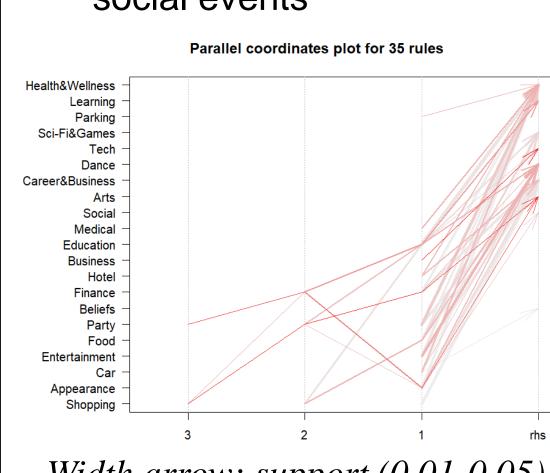
events as

 $X \to Y(p, cp)$ , Both X and Y can be set of items



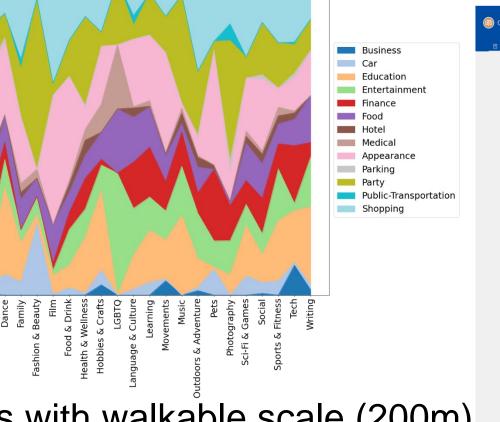
## **Spatial Association Rules**

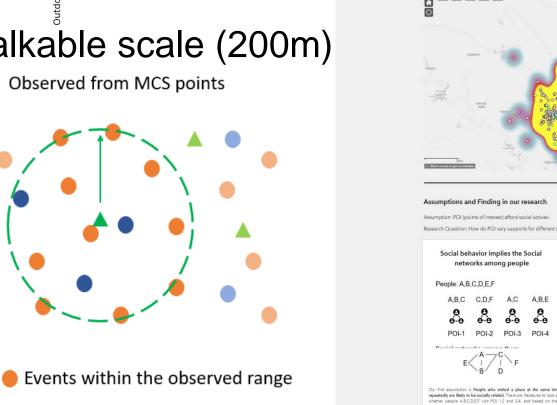
- Detect 35 rules with  $Support_{treshold} = 1\%$  and  $Confidence_{treshold} = 10\%$
- > The popular Lift measure in literature suggests 29 significant among the POI and # social events

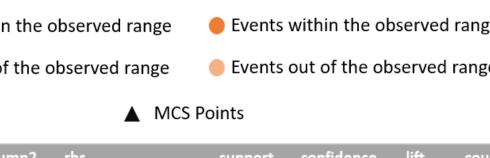


Width arrow: support (0.01-0.05) Color: confidence (0.1-0.22) lift: 1.07-3.8

# POI as X-axis







| Business}                     | => | {Tech}            | 0.0131 | 0.2259 3.8030        | 110 | Vow 1 Vow 2  |
|-------------------------------|----|-------------------|--------|----------------------|-----|--|
| inance, Party, Shopping}      | => | {Arts}            | 0.0105 | 0.1082 3.4051        | 88  | Q 85 47 - 13 boyer O Social@vents Canagory Fearures Gracky   |
| Appearance, Finance, Party}   | => | {Arts}            | 0.0114 | 0.1005 3.1625        | 95  | O Arm O Benth Ahren  |
| ducation, Finance}            | => | {Learning}        | 0.0176 | 0.1061 2.3922        | 147 | March Soft   |
| inance, Party, Shopping}      | => | {Dance}           | 0.0127 | 0.1304 2.3718        | 106 | Description of Section Control o |
| Education, Finance, Shopping) | => | {Dance}           | 0.0118 | 0.1200 2.1830        | 99  |  |
| Parking}                      | => | {Health&Wellness} | 0.0136 | 0.2036 2.1700        | 114 | Daily occurred to the control of the |
| Medical}                      | => | {Health&Wellness} | 0.0188 | 0.1990 2.1212        | 157 | States Co.   |
| ood, Shopping}                | => | {Dance}           | 0.0214 | 0.1108 2.0162        | 179 | A September 1  |
| Intertainment}                | => | {Dance}           | 0.0345 | 0.1105 2.0104        | 289 | One of the control of |
| Hotel}                        | => | {Health&Wellness} | 0.0200 | 0.1813 1.9329        | 167 | 15 km   Ch. of Grapeson   Description   Section   Present by Ear   Present |
| Appearance, Finance}          | => | {Dance}           | 0.0182 | 0.1059 1.9269        | 152 | Attribute Table of Social Events View 1 Query Results View 2 Query Results   |
| Hotel}                        | => | {Career&Business} | 0.0201 | 0.1824 1.8962        | 168 | OBJECTIO         0         Category         0         Group         0         Name         0         POI           1         Arts         Art With Intention         Beginners Salva / Bachsta         2801 ft   |
| ducation, Party}              | => | {Dance}           | 0.0177 | 0.1027 1.8684        | 148 | 2 Arts Ast With Intention Beginners Salas (Bachata 2801 F<br>3 Arts Art With Intention Beginners Salas (Bachata 2801 F<br>4 Arts Art With Intention Beginners Salas (Bachata 2801 F  |
| Car}                          | => | {Dance}           | 0.0151 | 0.1021 1.8575        | 126 | S Arts Artispace at Meropolitan Meropolitan Press Artispa Artispace de Meropolitan Meropolitan Press Artispa Artispace de Meropolitan Meropolitan Press Artispac Artispace de Meropolitan Meropolitan Meropolitan Press Artispac Artispace de Meropolitan Meropolit  |
| Appearance, Party, Shopping}  | => | {Social}          | 0.0136 | 0.1019 1.8216        | 114 | 7 Arti Aspocation of Crisind Frank. Unit Diseasey (Chrisin D.Ph. Soligite 8 Smith States of Trace Trace (State Control of Trace) - T |
| Appearance, Party, Shopping}  | => | {Dance}           | 0.0134 | 0.1001 1.8208        | 112 | ·  |
| ducation, Finance, Party}     | => | {Tech}            | 0.0110 | 0.1059 1.7825        | 92  | Explore the Association Pattern Between Social events and POI  Step 1: pick up one class of social events in the filter  |
| Car}                          | => | {Health&Wellness} | 0.0246 | 0.1669 1.7795        | 206 | Otep 1; puckup bit of the observation on on time to on time. Step 2 (option 1): Chaose the 1 current map extent option in spatial filter and apply it. Step 2 (option 2): Use the select widget (in the upper right corner of the map to choose feature by location, and then Step 3 (option 2): See a proper radius to biffer, and click apply button.  |
| Party}                        | => | {Health&Wellness} | 0.0441 | 0.1538 1.6396        | 369 | O B M H D · R  |
| Food}                         | => | {Sci-Fi&Games}    | 0.0314 | 0.1227 1.4755        | 263 |  |
| Appearance}                   | => | {Career&Business} | 0.0460 | 0.1247 1.2960        | 385 | - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1  |
| ducation, Shopping}           | => | {Sci-Fi&Games}    | 0.0250 | 0.1065 1.2801        | 209 | (a) Constitution (b) Constitution (c) Co |
| Car}                          | => | {Beliefs}         | 0.0163 | 0.1102 1.2651        | 136 |  |
| Education}                    | => | {Health&Wellness} | 0.0507 | 0.1186 1.2646        | 424 |  |
| Car}                          | => | {Sci-Fi&Games}    | 0.0151 | 0.1021 1.2276        | 126 | Support  |
| Intertainment}                | => | {Health&Wellness} | 0.0359 | 0.1147 1.2229        | 300 | 20 km Texas Ferni & Wilde Br. 1931   |
| inance}                       | => | {Career&Business} | 0.0376 | 0.1174 <b>1.2200</b> | 315 | Results  |
| Party}                        | => | {Career&Business} | 0.0333 | 0.1163 <b>1.2089</b> | 279 | ▶ KEG 1         08.8CTID         0 Category           1         Arts           ▶ SSC Weatherford Peach Tree Operating Company         2         Arts   |
| Food}                         | => | {Career&Business} | 0.0290 | 0.1134 1.1787        | 243 | Goodwill 3 Arts 4 Arts 5 Arts 6 Arts 7 Arts  |
| Food}                         | => | {Health&Wellness} | 0.0280 | 0.1092 1.1640        | 234 | ▶ General Mobile Housing         6         Arts           ▶ Lone Star Family Care         7         Arts   |
| Intertainment}                | => | {Career&Business} | 0.0344 | 0.1101 1.1448        | 288 | Lonestar Coatings  |
| inance}                       | => | {Health&Wellness} | 0.0338 | 0.1054 1.1240        | 283 | ■ 4 8  |
| Appearance}                   | => | {Health&Wellness} | 0.0379 | 0.1027 1.0943        | 317 | Opinion 2471   |
| Shopping}                     | => | {Career&Business} | 0.0431 | 0.1035 1.0762        | 361 | 10,000   |
|                               |    |                   |        |                      |     | Food 776/h   |

#### **Future Work**



Safegraph Building footprints (June 2020). Aggregated POI footprints to buildings:55,846 buildings had POIs POIs in August 2020 appeared in 51,893 buildings Meetup events were

within 730 buildings. March

Temporal trends of social events 25,000 social events data for over 2 years (2020-now)Address the impact from pandemic to local social networks

#### Conclusions

- Distinctive association patterns between different types of social events and POI
- > Food, shopping and party related POI actively contribute to the occurrence of social events.
- Pandemic and related policy have dramatically altered the distribution of social events, which implies the local social networks among participants

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Written Statement of Craig Fugate Administrator Federal Emergency Management Agency Evolution of Emergency