

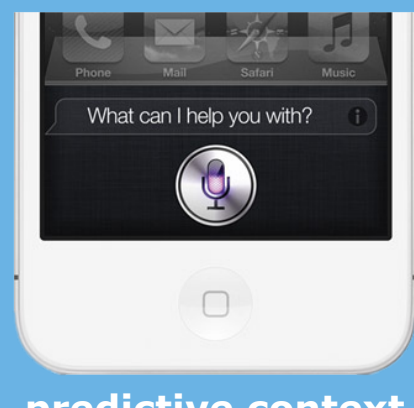
1. Introduction

- The **daily and weekly routines** of individuals results in **regular patterns of visits** at a subset of locations.
- Identifying and understanding cases where an **individual visits a location** with **high regularity** provides insights into human behaviour.

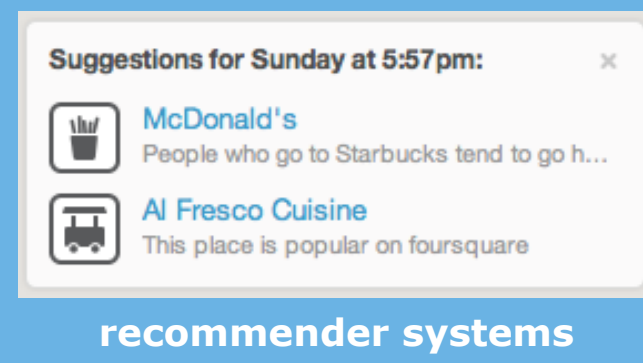
Applications include...



dynamics of virus spreading



predictive context for digital assistants

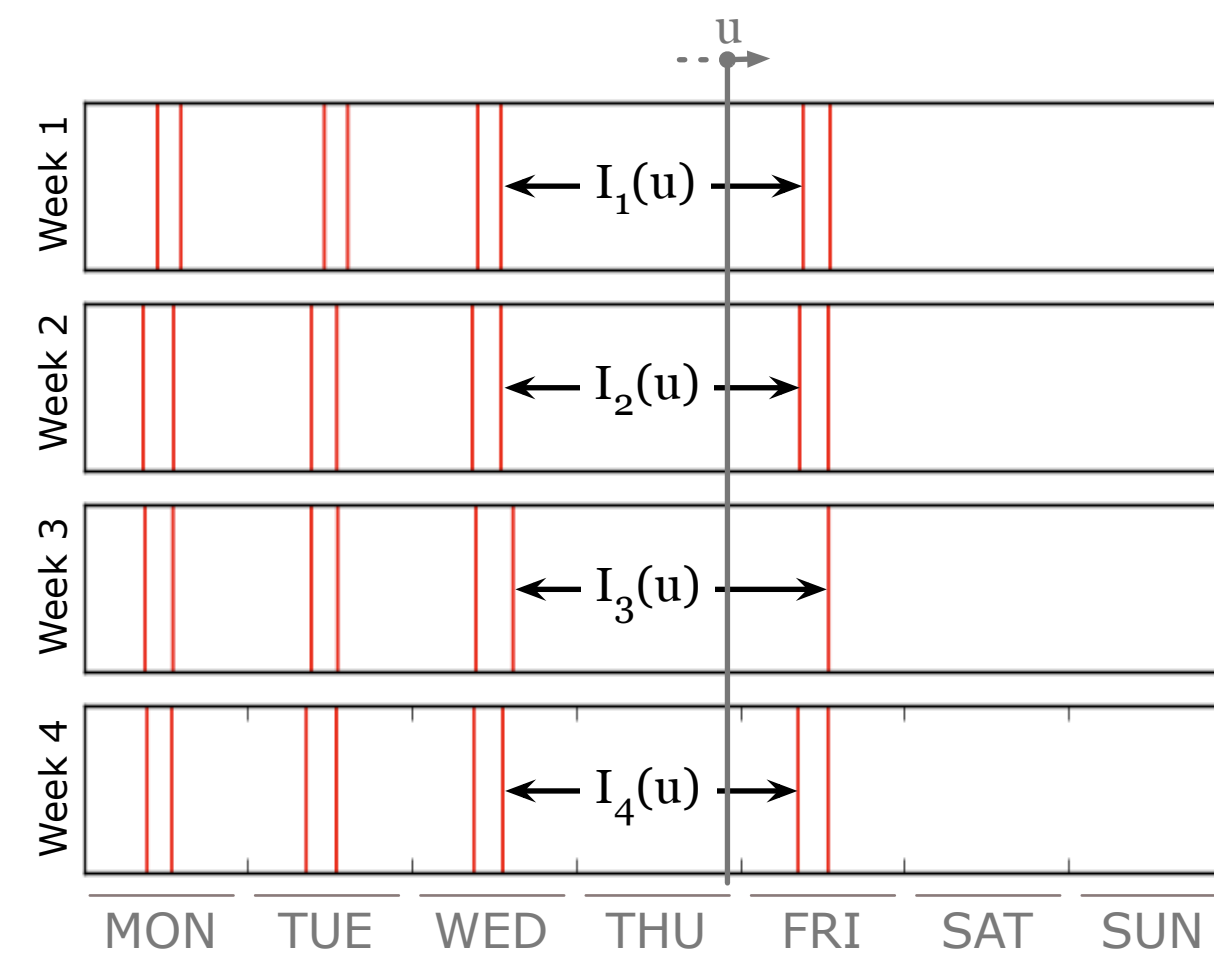


recommender systems

- We introduce a new metric for regularity (ISI-Regularity) in point data and apply it to visits from a mobile online social network (Foursquare).

2. ISI-Regularity

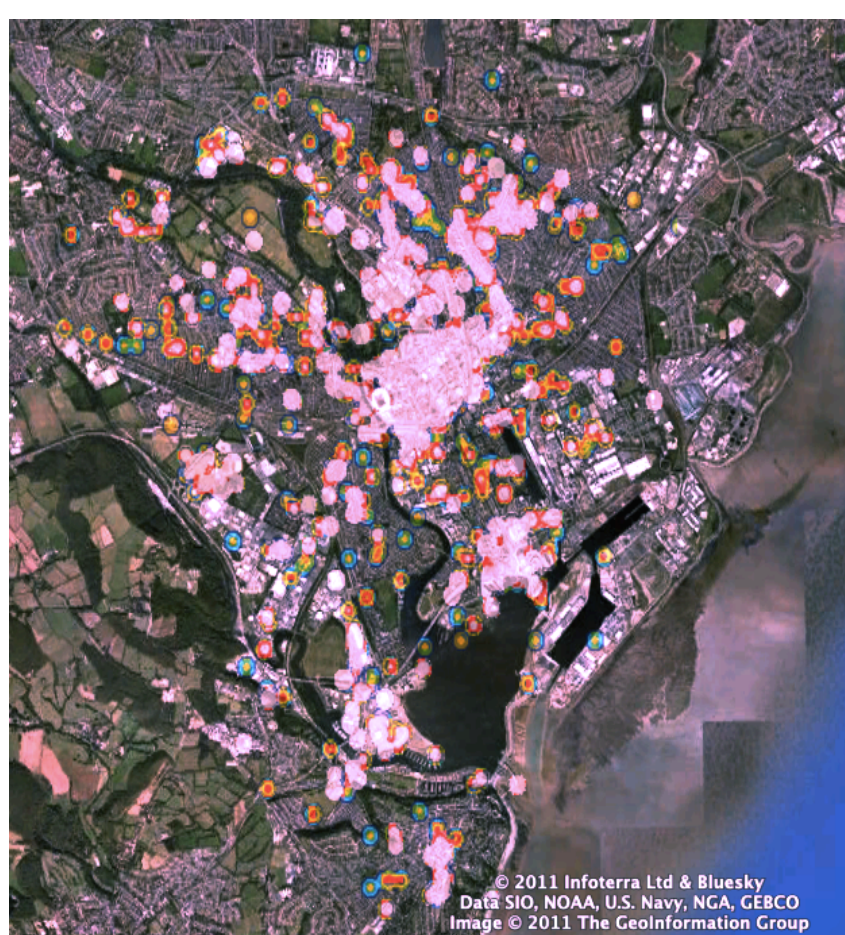
- Based on the concept of **spike train synchrony** in neuroscience.
- Visits over four weeks represented as four **spike trains**.
- Inter-spike interval (ISI)** is the time between two consecutive spikes. $I_n(u)$ denotes the ISI value at offset u in train n .



- Coefficient of variation $C(u)$ of ISI values provides **measure of dispersion** in the four ISI values at offset u . Averaging $C(u)$ over the whole train duration gives an irregularity measure.
- Normalising and inverting produces a **regularity score** in the range $[0.0, 1.0]$.
- 1.0 indicates perfect regularity (i.e., identical week-on-week patterns).

3. Foursquare

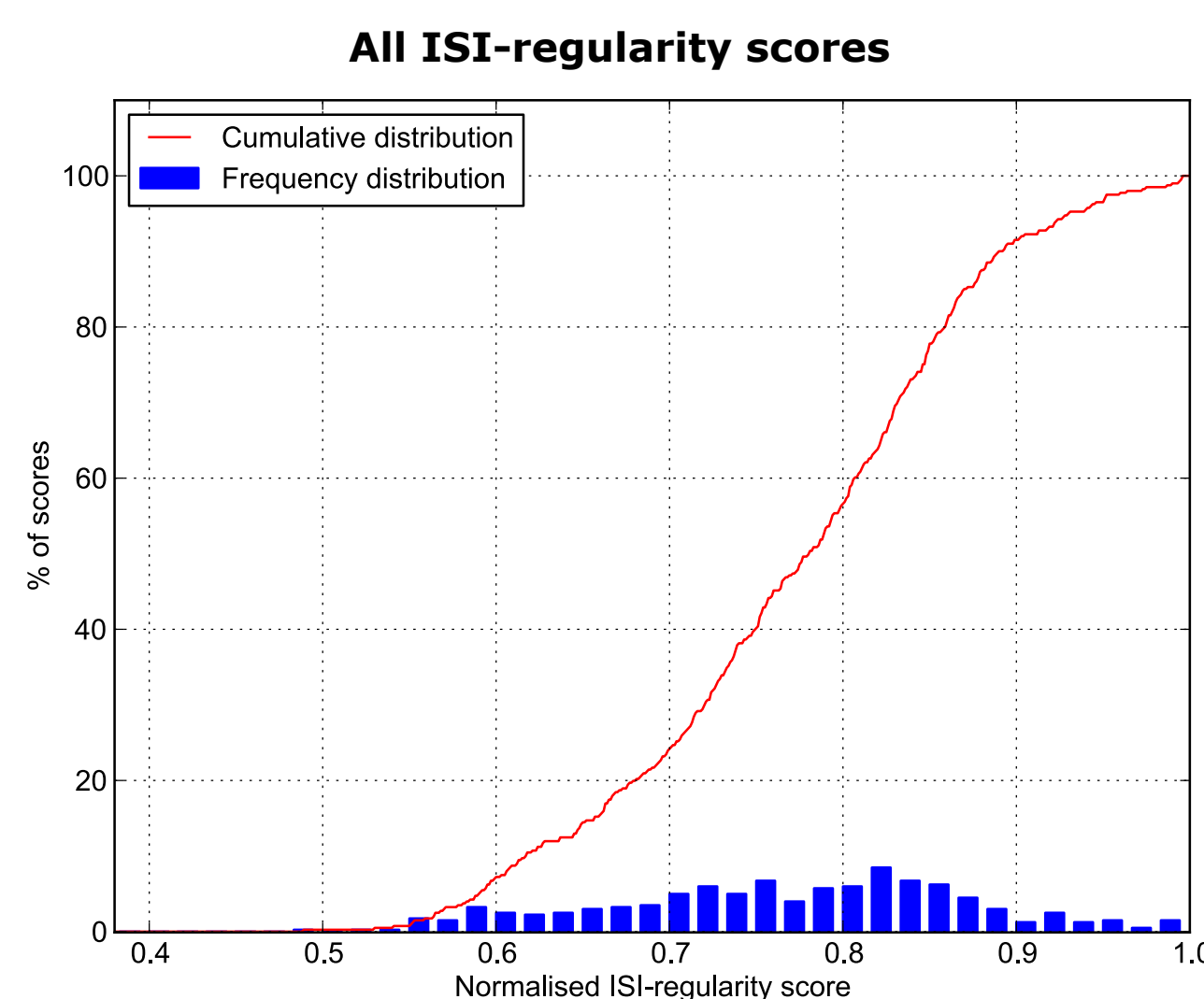
- Foursquare is a service that allows users to record their movements by '**checking in**' to venues using their GPS-enabled mobile phones.
- We apply ISI-regularity to a dataset consisting of checkins in **Cardiff, Bristol, and Cambridge** over a period of **54 days**.



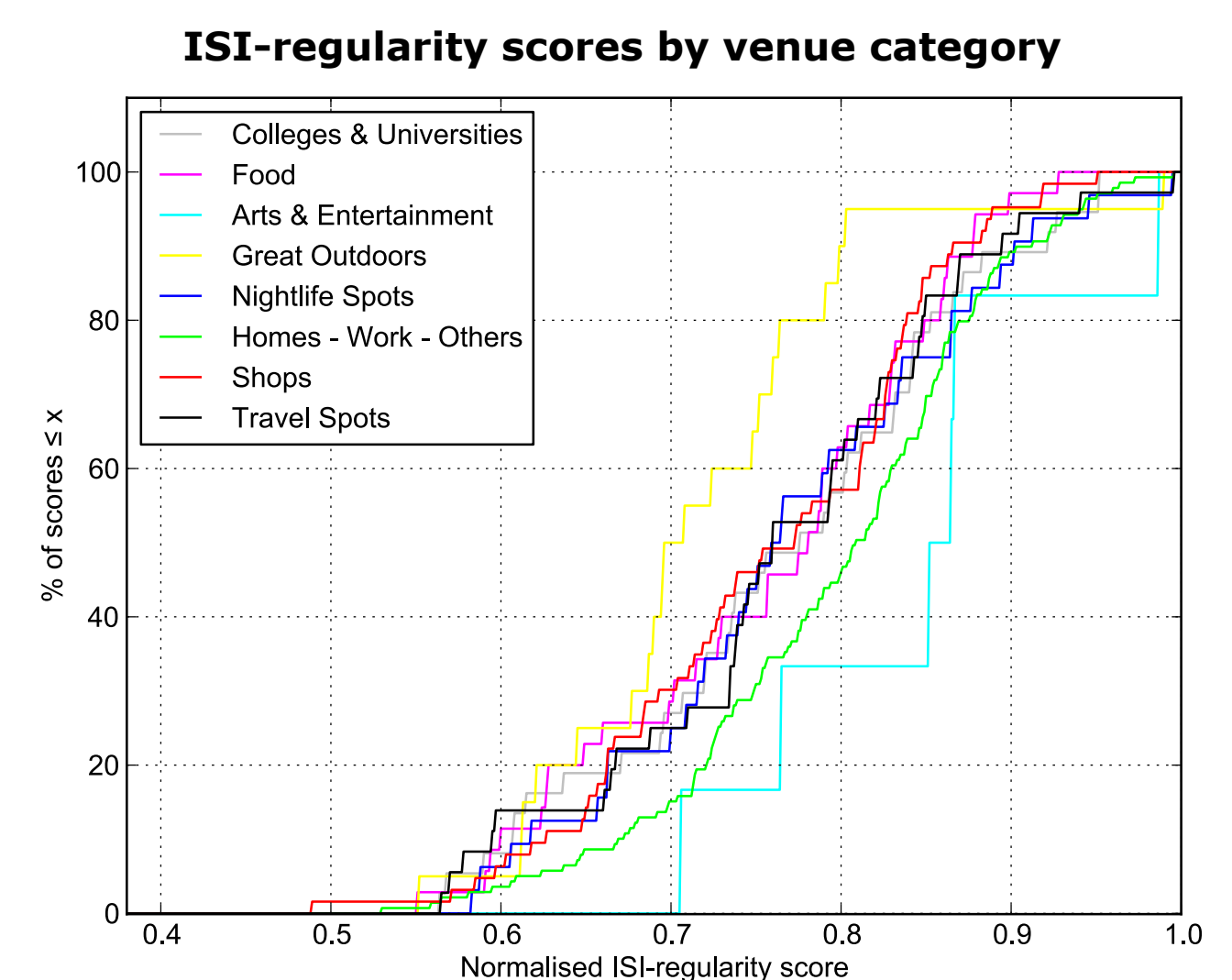
Heat map of checkins in Cardiff

- The dataset contains a total of **6,163 users**, **4,774 venues**, and **43,767 checkins**.

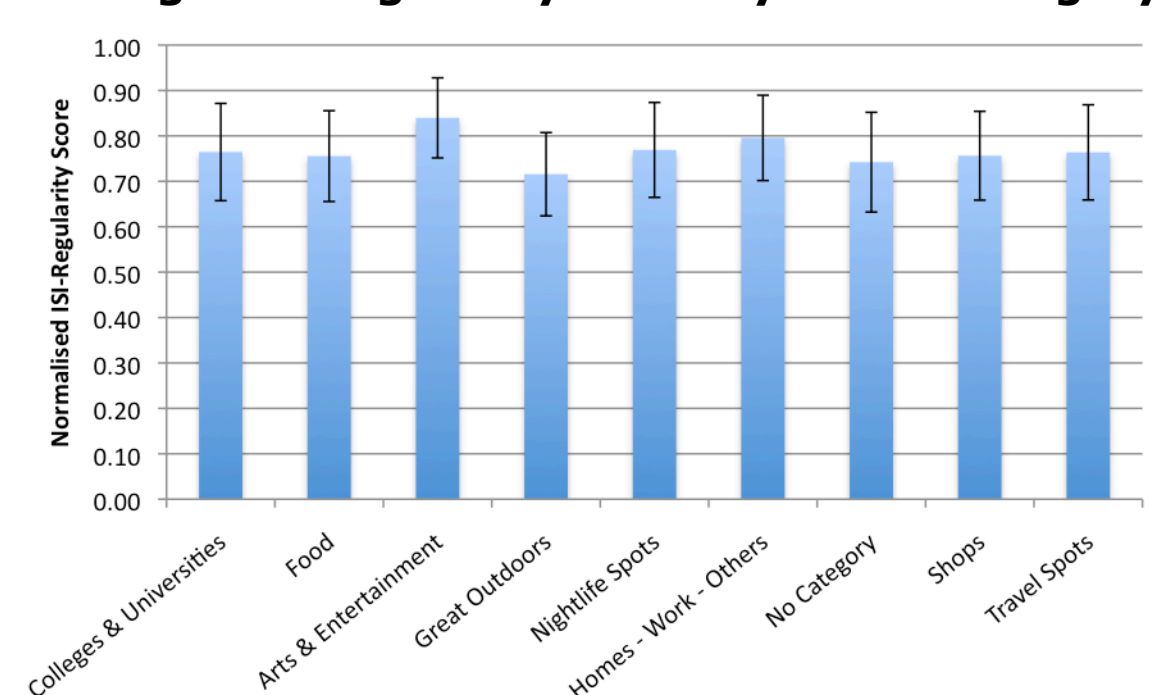
4. Results



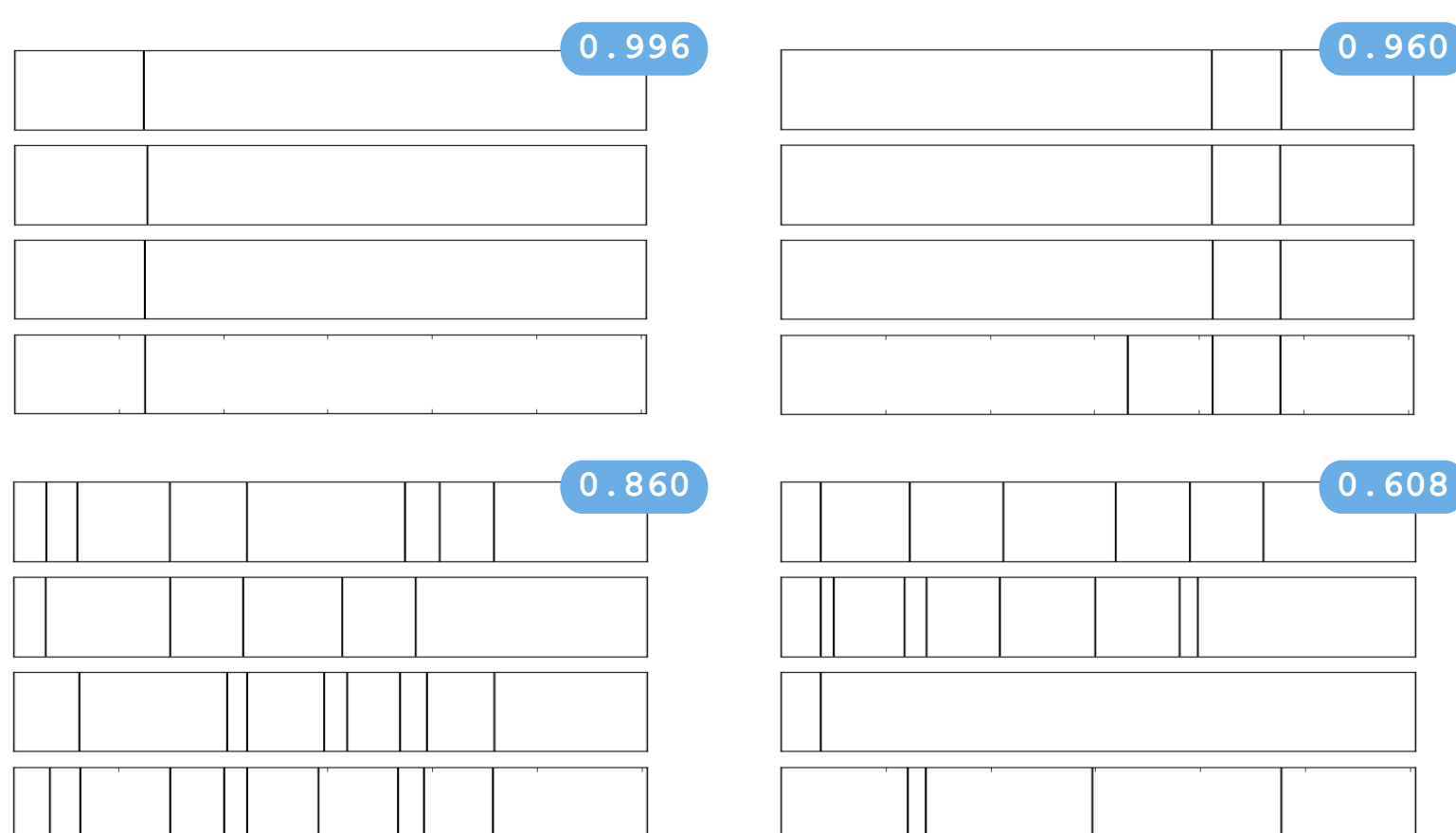
- Visit traces were built for all **user-venue pairs** in a chosen four week period.
- Only traces with at least one visit in each week were considered.
- 400 user-venue pairs were scored.



Average ISI-regularity score by venue category



5. Example Patterns



6. Observations

- Venues in the '**Home-Work-Others**' category have high regularity. This is intuitive, since we'd expect **stricter routine** to be prominent in the cases of *Home* and *Work* travel.
- '**Great Outdoors**' venues (e.g., parks) have lower regularity. **Recreational activities** are perhaps more sporadic in nature.
- There is still much variation in regularity scores within the same category.

7. Ongoing Work

Other datasets...

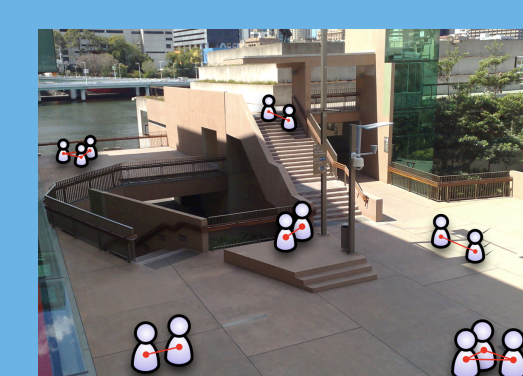


visits to London Underground stations



WiFi device sightings at Dartmouth College Campus

Regularity in encounter patterns...



- Find regularly meeting pairs and groups of individuals.
- Study their influence on the propagation of digital content and viruses (e.g., over Bluetooth).



Recognition

Relevance and cognition for self-awareness in a content-centric Internet

www.recognition-project.eu

Acknowledgements

Foursquare data collection carried out with Martin Chorley and Walter Colombo.

Attribution

London Underground: <http://www.flickr.com/photos/c0t0d0s0/241657494/>
Crowd with masks: <http://www.flickr.com/photos/jaafarm/>
Courtyard: <http://www.flickr.com/photos/nevolution/2906377551/>