Foursquare App Checkin @ UCLA

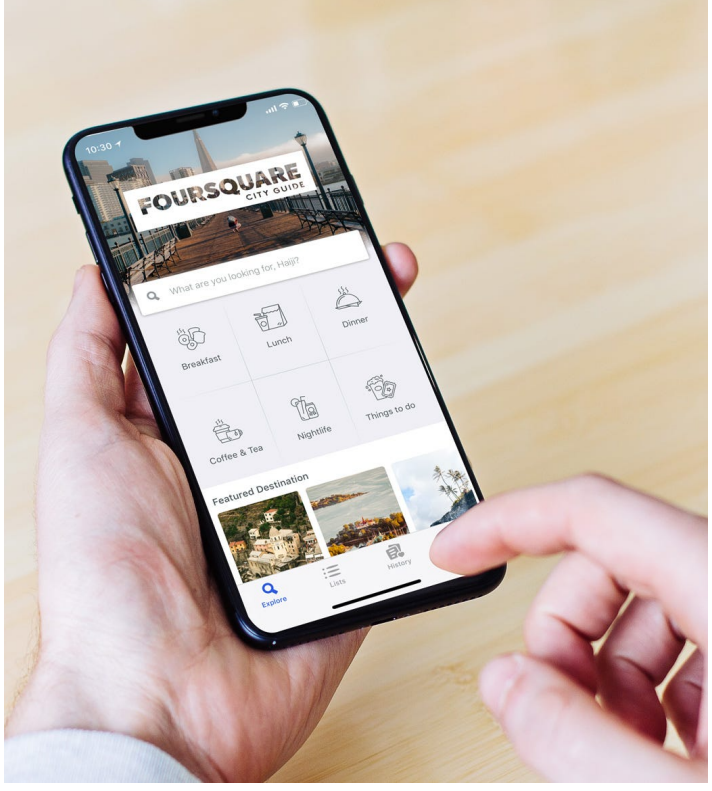
A Spatial-Temporal Analysis

Sheng (Tim) Chen

March 18, 2024

Introduction

Foursquare City Guide is a local search-and-discovery mobile app, providing personalized recommendations of places to go near a user's location.



Original Dataset Info

Time: April 2012 to September 2013

Location: 415 cities across 77 countries

Summary: 33,278,683 check-ins by 266,909 users

Data Exploration

We select the area containing UCLA Campus $(34.067089, 34.075976) \times (-118.445003, -118.439485)$, with 689 check-ins.

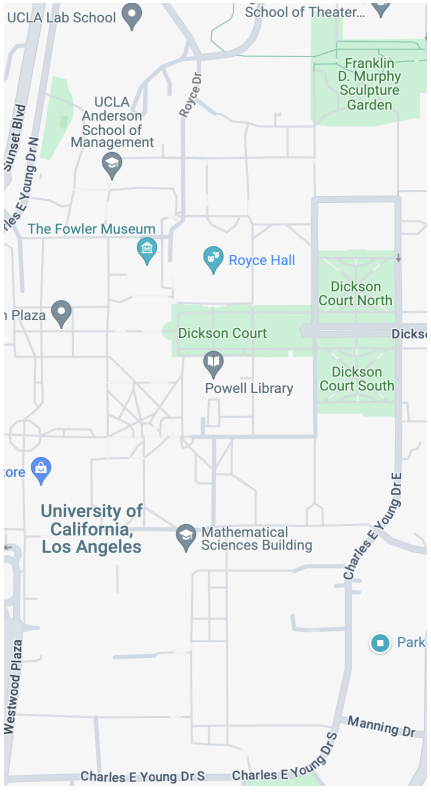


Figure: Campus Region

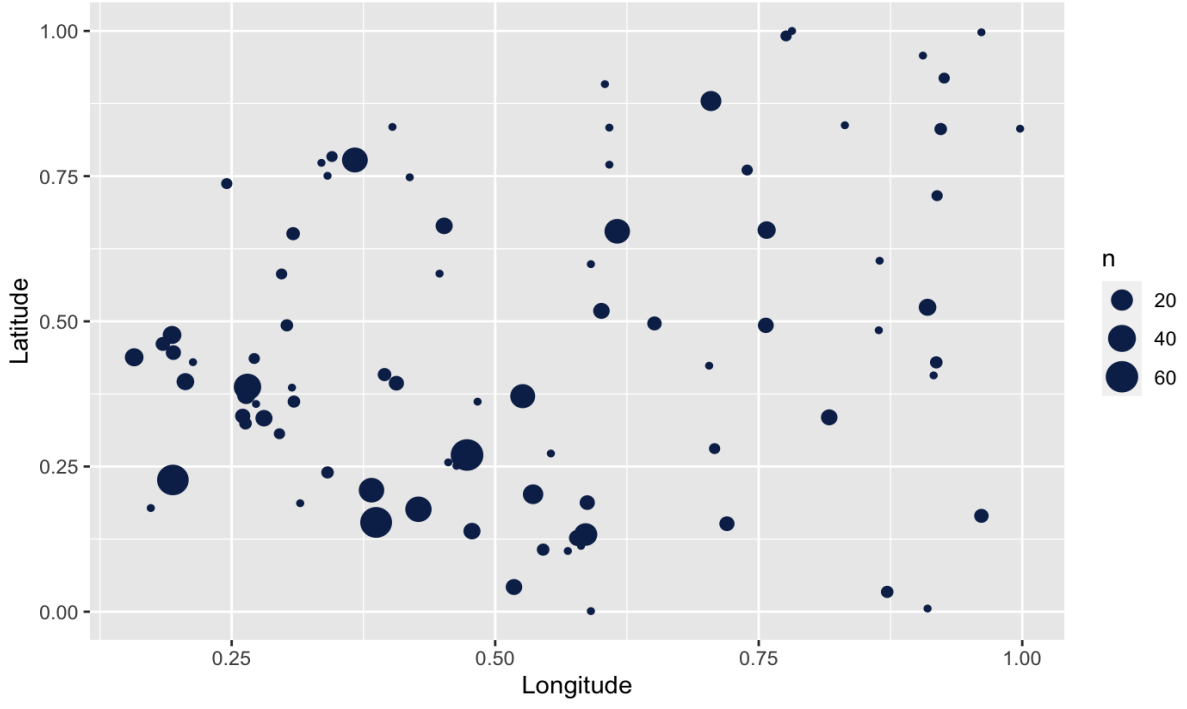


Figure: Scatter Plot

Kernel Smoothing/ KL Function

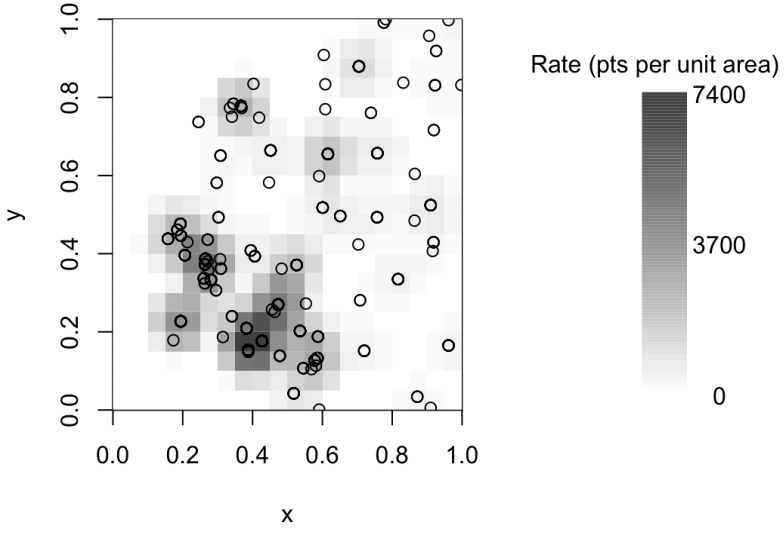


Figure: Kernel Smoothing

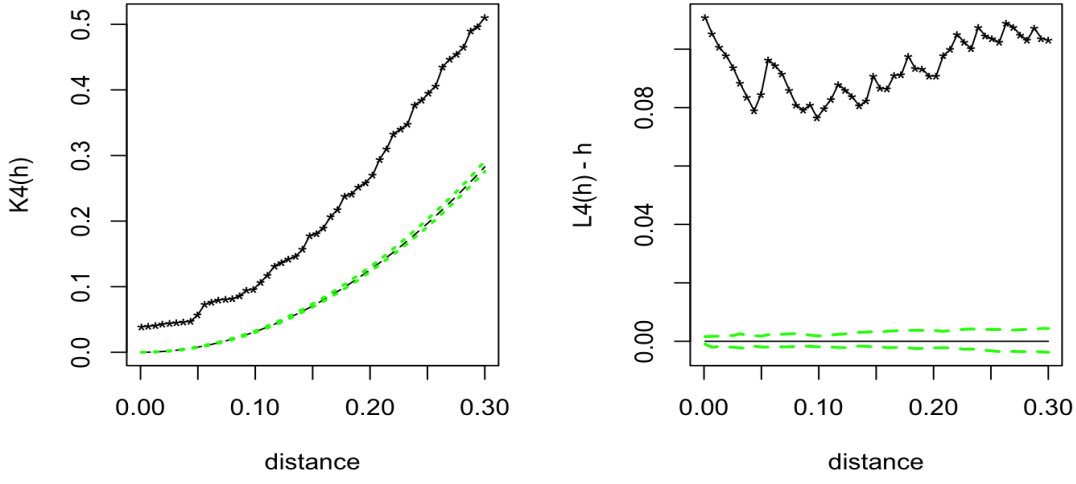


Figure: K, L function

Marked G, J functions

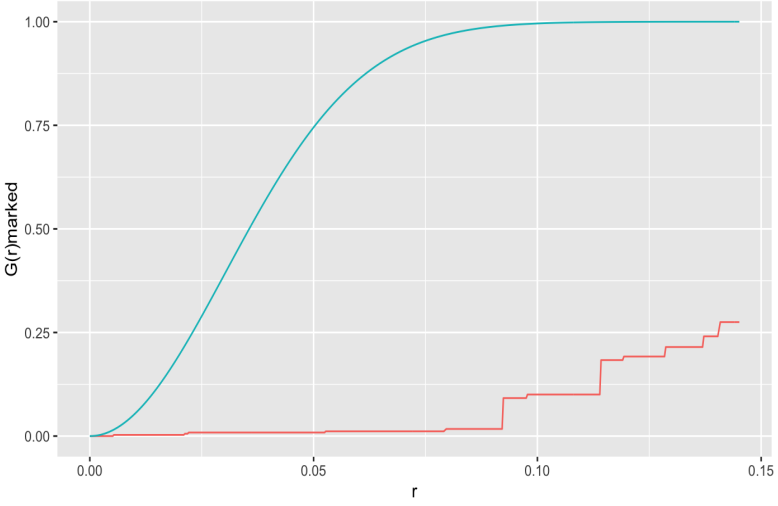


Figure: Marked G

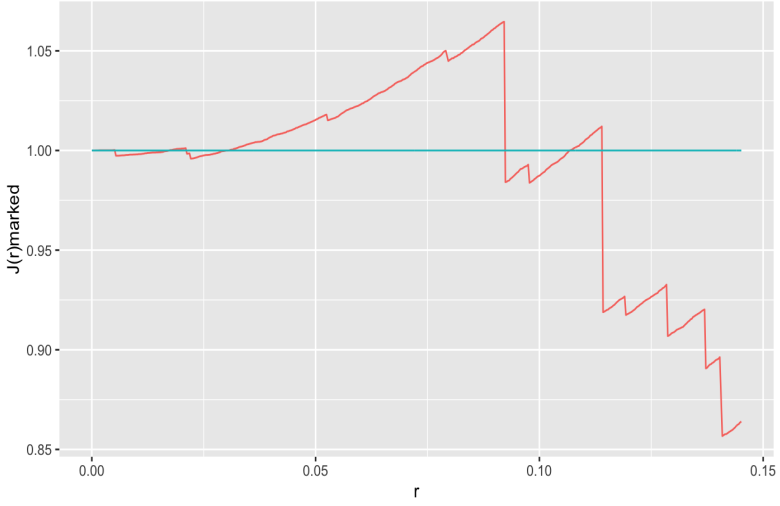


Figure: Marked J

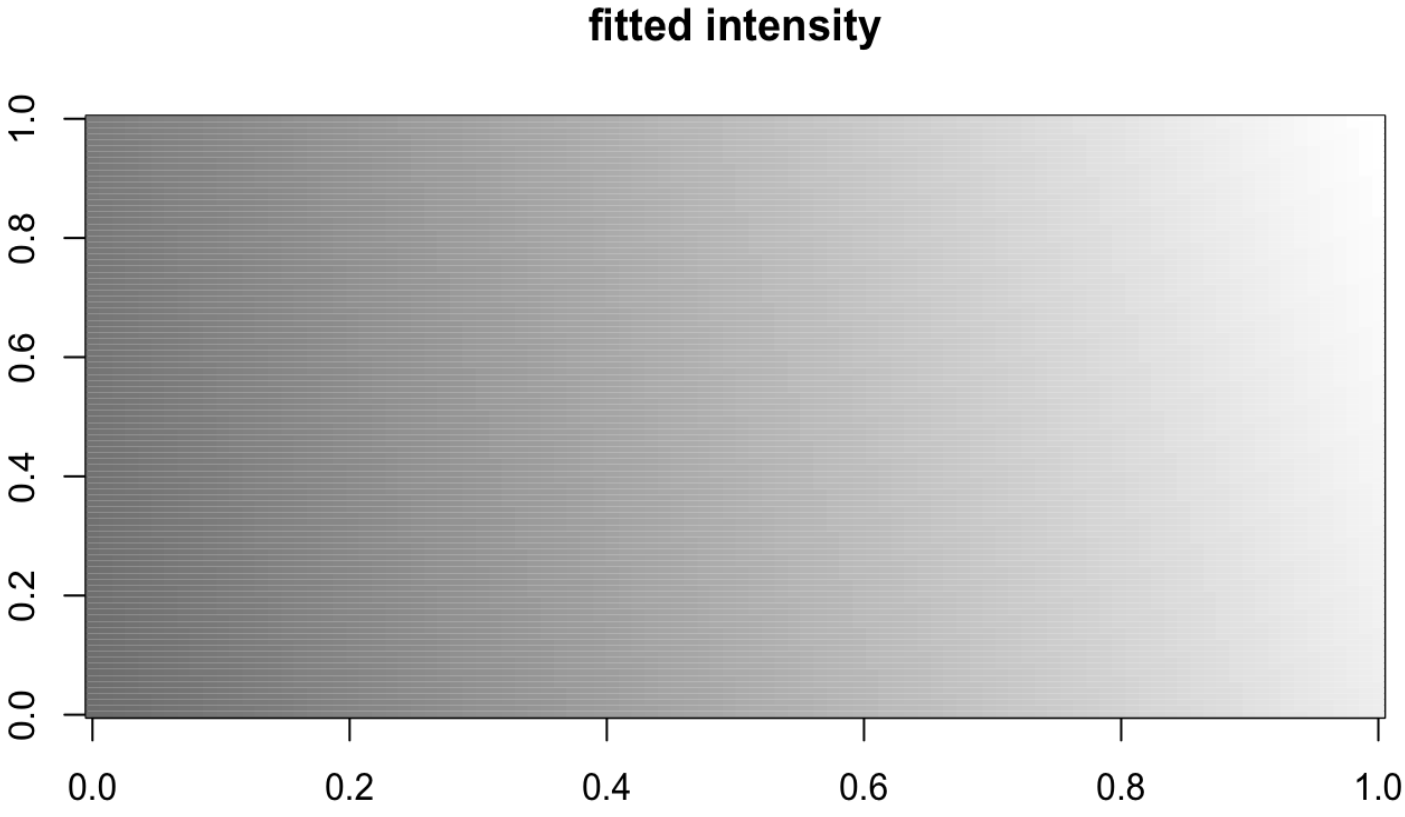
Closer Look

Figure: Top 3 locations Observed

Inhomogeneous Poisson Process

Try several fitting

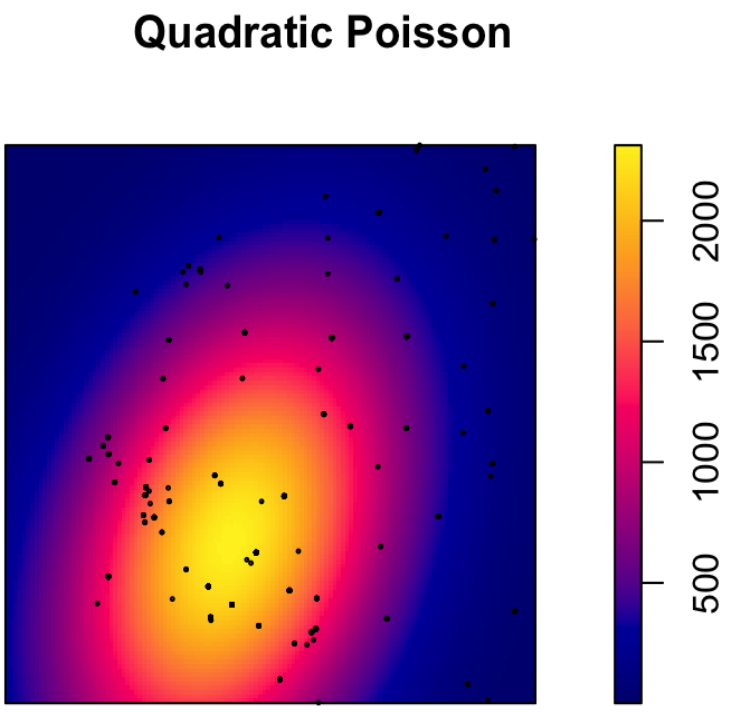
$$\lambda(x, y) = 186.691 - 113.745x - 47.848y$$



Inhomogeneous Poisson Process (Continued)

Try several fitting

$$\lambda(x, y) = 16.36 + 43.74x + 31.80y - 18.51x^2 + 5.12xy - 7.16y^2$$



ETAS Model

$$\lambda(x, y, t) = \mu(x, y, t) + \sum_{t' < t} g^*(x, y) g(t - t') h(m')$$

where $\mu(x, y, t)$ is modeled by $ax + by + c$, $g(t - t')$ is modeled by $\alpha(t - t')$, $h(m')$ is modeled by $Ke^{\beta \times m}$

a	b	c	α	β
-90.64	-130.0	159.26	75.23	0.12

ETAS Model(Continued)

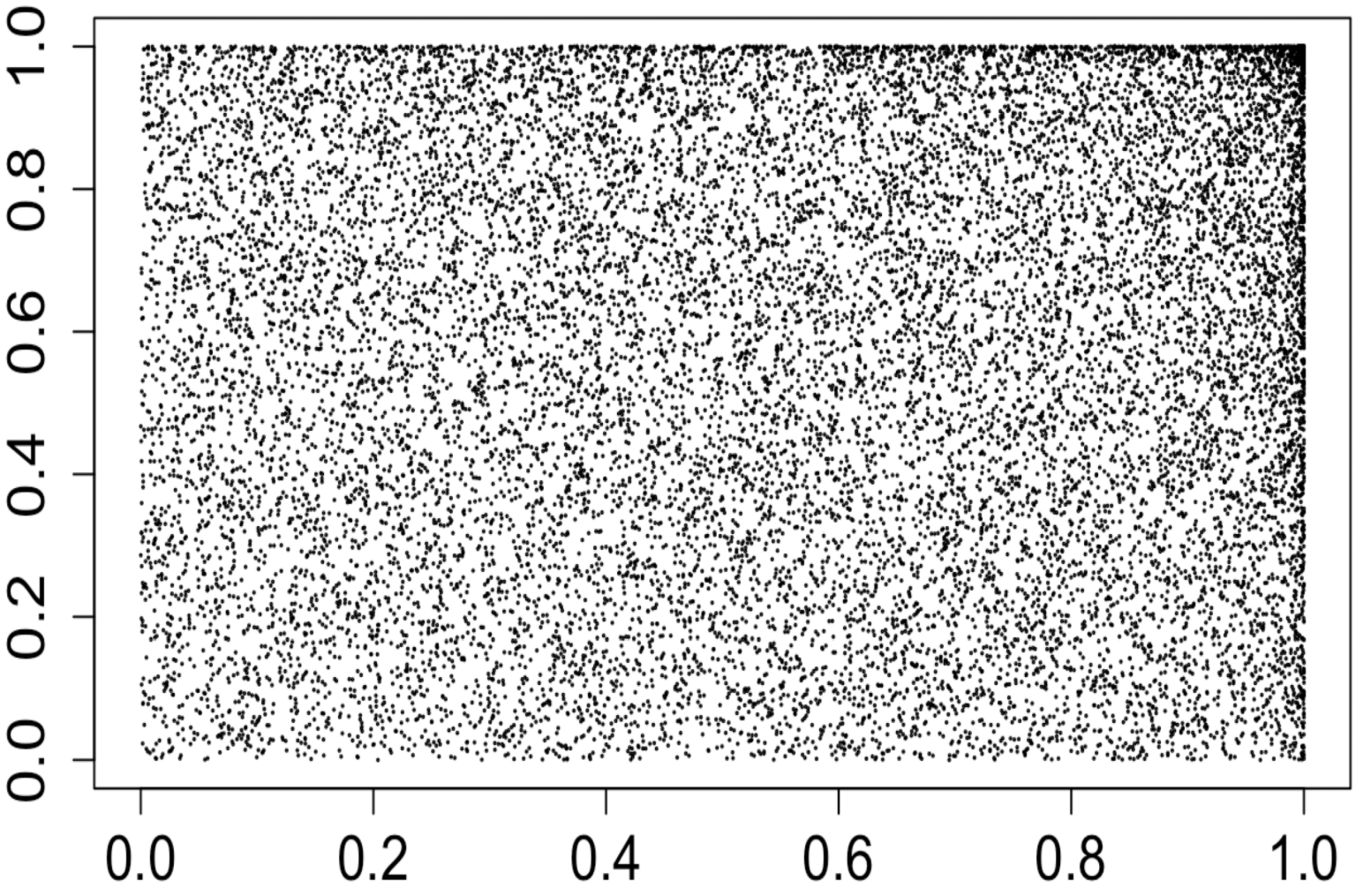


Figure: Superthinned Points

Future Work

Shortcomings

1. Temporal variability
2. Spatial boundary definition
3. Covariates that impact λ
4. User Engagement Metrics

Related Improvement

1. Academic calendars
2. Expand analysis regions
3. Wifi heatmap, Building location, Venue categorization etc.

References

M. N. M. van Lieshout.
Theory of spatial statistics.
Routledge Cavendish, London, England, Mar. 2019.

D. Yang, D. Zhang, L. Chen, and B. Qu.
Nationtelescope: Monitoring and visualizing large-scale collective behavior in lbsns.
Journal of Network and Computer Applications, 55:170–180, Sept. 2015.

D. Yang, D. Zhang, and B. Qu.
Participatory cultural mapping based on collective behavior data in location-based social networks.
ACM Transactions on Intelligent Systems and Technology, 7(3):1–23, Jan. 2016.