

User Association Analysis of Locales on Location Based Social Networks

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Outline

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 - **Locale Assortability Coefficient**
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Motivation

- Online Location-based Social Network

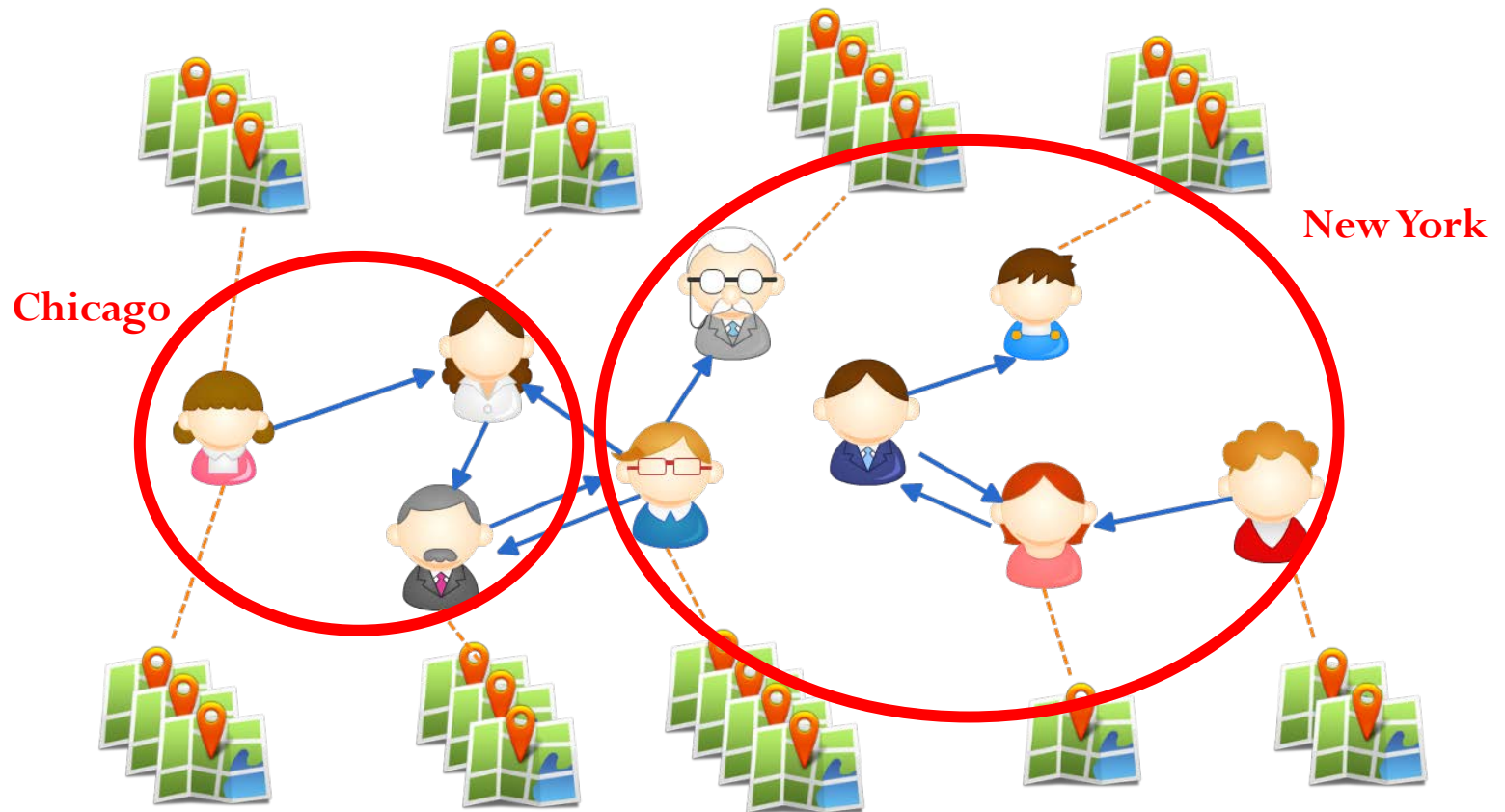


- GPS Logger, smart phones and navigation devices




Motivation

- Clustering Coefficient
- Assortativity Coefficient



EveryTrail Dataset

**Joost Schreve**
About Me
Trying to make EveryTrail a little better everyday.

Location
Palo Alto, California, United States

Member Since
September 21, 2006

Favorite Activities
Alpine skiing, Back-country skiing, Cross-country skiing, Hiking, Mountain biking, Mountaineering, Road biking, Running, Sailing, Trail running, Walking, Other, Driving, Flying, Motorcycling, Sightseeing, Train, Snowshoeing, Boating, Relaxation

Website
joost-stanford.blogspot.com

276 Trips □ 11 Guides □ 2,157 Pictures □ 2,110 Points □ 542 Followers

Trips Recent Activity | Trips | Guides | Destinations | Info

Palo Alto - Small Dish

by joost on Aug 12, 2011
follow joost
0.0 miles

Family hike from savolere down to le marmot

by joost on Aug 04, 2011
follow joost
Verbier, Valais, Switzerland
1.6 miles



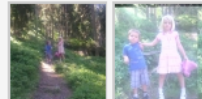
Run From Verbier To Chapelle St Christophe

by joost on Aug 03, 2011
follow joost
Médières, Valais, Switzerland
4.1 miles



Family Hike To Clambin

by joost on Aug 01, 2011
follow joost
Médières, Valais, Switzerland
1.2 miles



Social information

People I'm Following (480)



See all

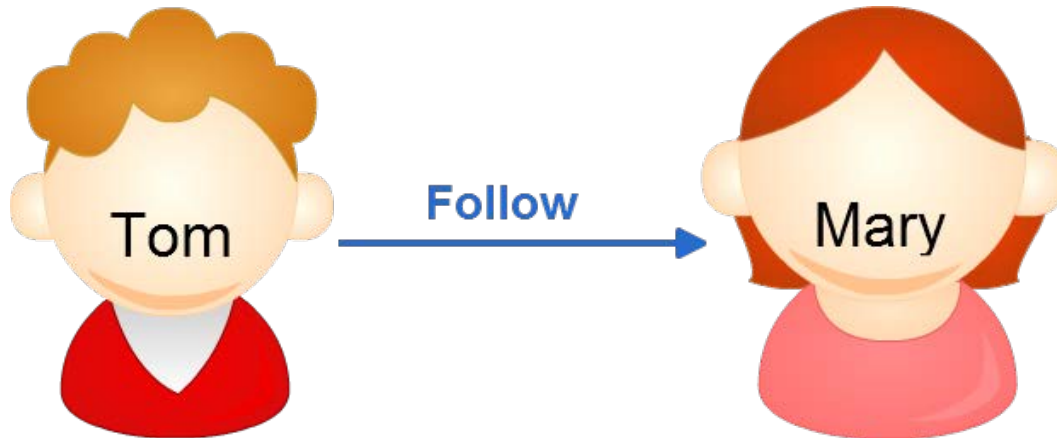
People Following Me (542)



See all

Traveling information

EveryTrail Dataset

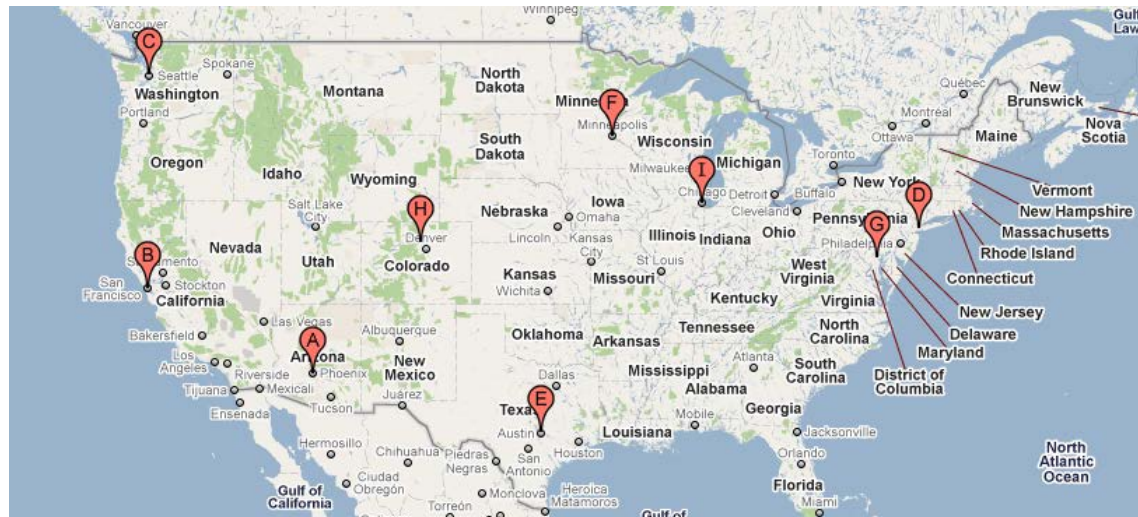


Follower

Followee

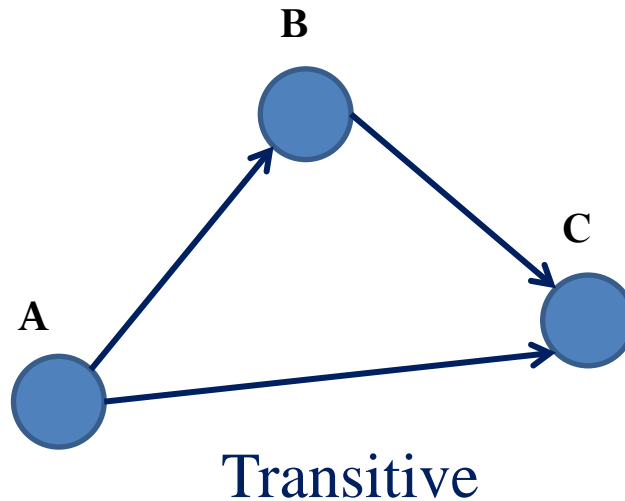
EveryTrail Dataset

	<i>cities</i>	<i># of trips</i>	<i># of users</i>	<i>Avg. # of trips per user</i>	<i>Max # of trips per user</i>
A	Phoenix	389	102	3.81	36
B	San Francisco	355	207	1.71	16
C	Seattle	340	145	2.34	23
D	New York	333	146	2.28	29
E	Austin	293	133	2.2	15
F	Minneapolis	277	70	3.96	100
G	Baltimore	266	18	14.78	241
H	Boulder	180	93	1.94	10
I	Chicago	153	94	1.63	7



Locale Clustering Coefficient

- Conventional clustering coefficient

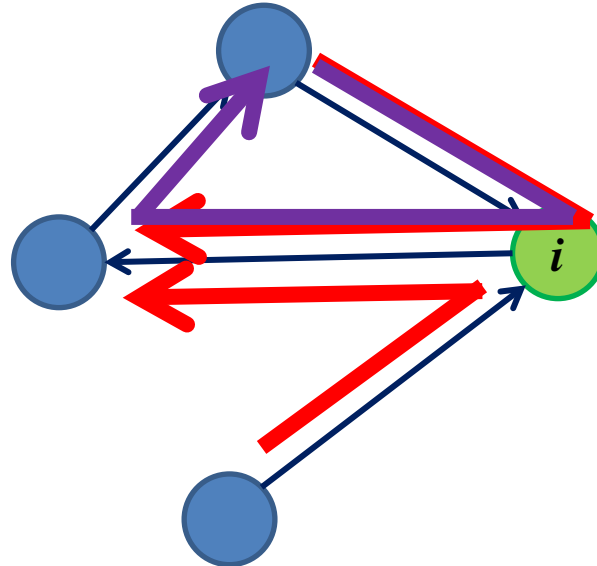


Locale Clustering Coefficient

Number of triples = 2

Number of triangles = 1

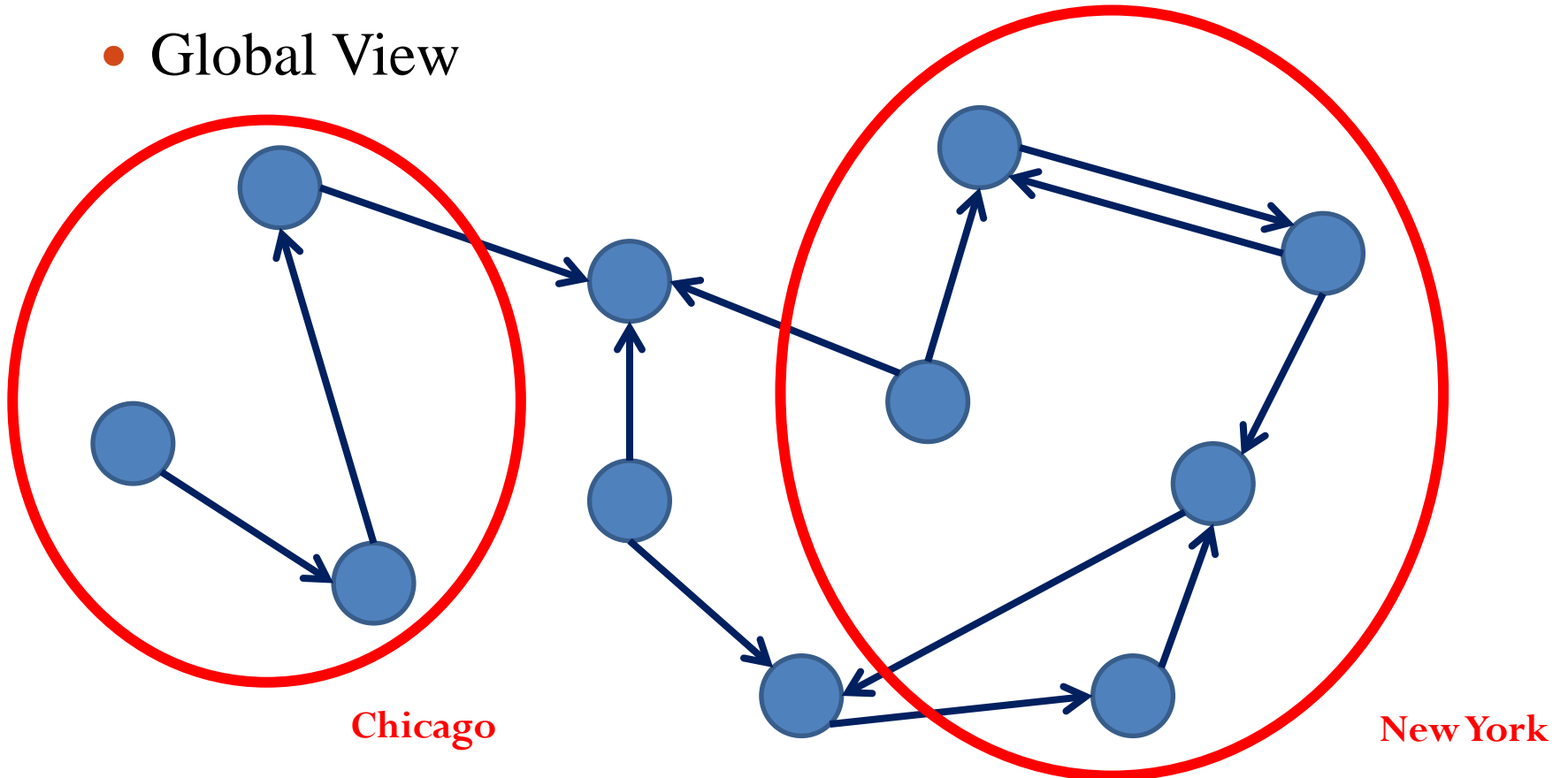
$$C_i = \frac{1}{2} = 0.5$$



$$C_i = \frac{\text{number of triangles connected to node } i}{\text{number of triples centered on node } i}$$

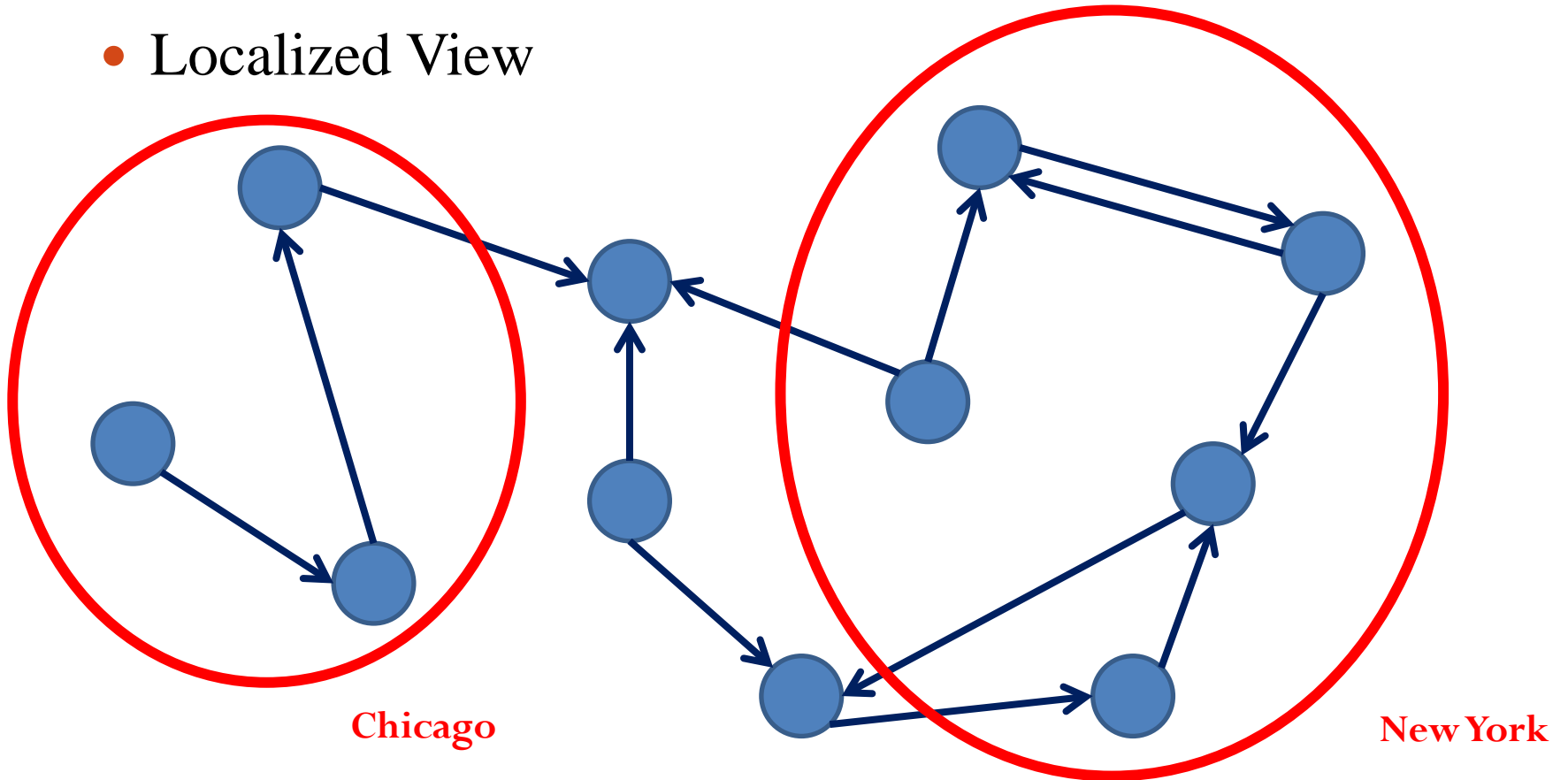
Locale Clustering Coefficient

- Global View



Locale Clustering Coefficient

- Localized View



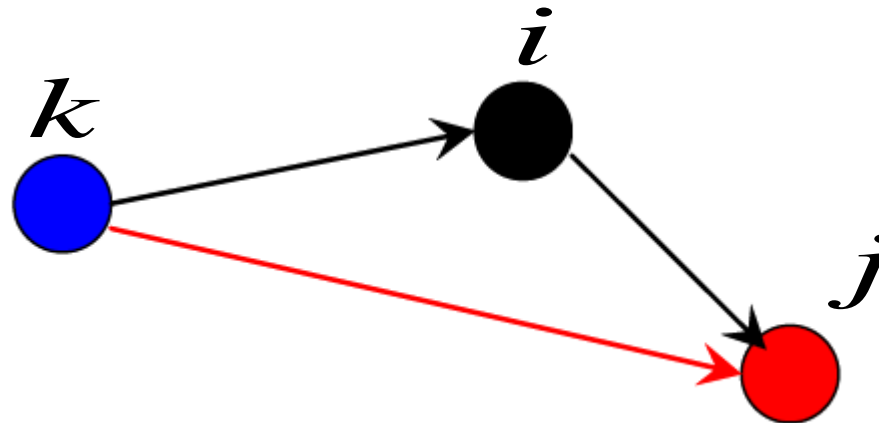
Locale Clustering Coefficient

Cities	LCC (Global)	LCC (Localized)
Austin	0.07	0.005
Seattle	0.056	0.025
Phoenix	0.094	0.018
New York	0.032	0.225
San Francisco	0.107	0.284
Chicago	0.002	0
Boulder	0.017	0
Baltimore	0.069	0
Minneapolis	0	0

All Users: 0.058

Inward Locale Transitivity

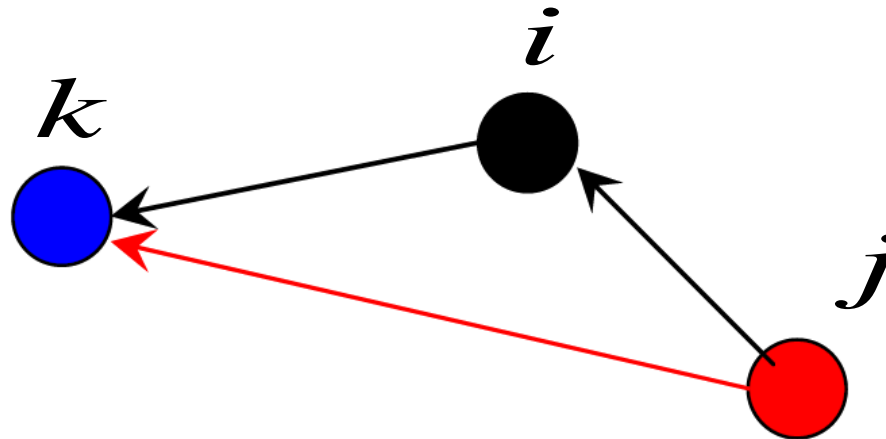
●: outside user ●: arbitrary user ●: inside user



$$T_{\text{inward}}(i) = \frac{\text{\# of In - Pair from node } k \text{ to node } j}{\text{\# of triples from node } k \text{ to node } j \text{ centered on node } i}$$

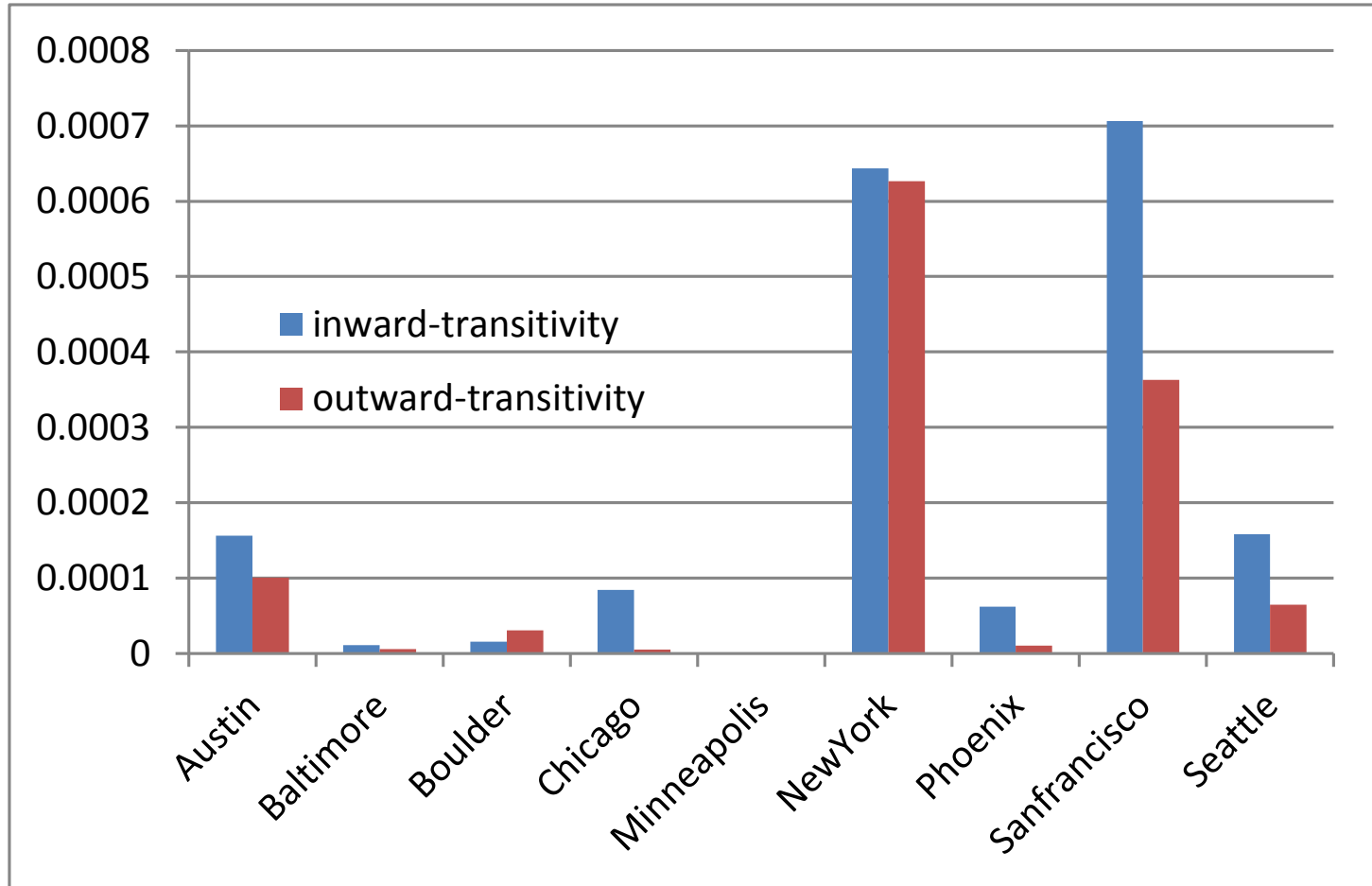
Inward Locale Transitivity

●: outside user ●: arbitrary user ●: inside user



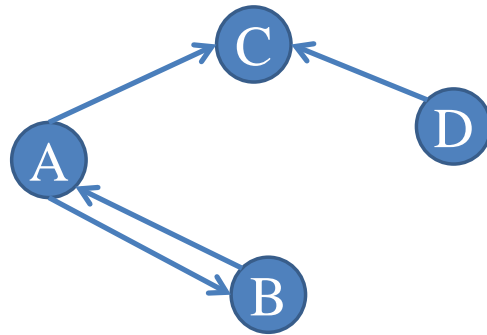
$$T_{\text{outward}}(i) = \frac{\text{\# of Out - Pair from node } j \text{ to node } k}{\text{\# of triples from node } j \text{ to node } k \text{ centered on node } i}$$

Inward Locale Transitivity

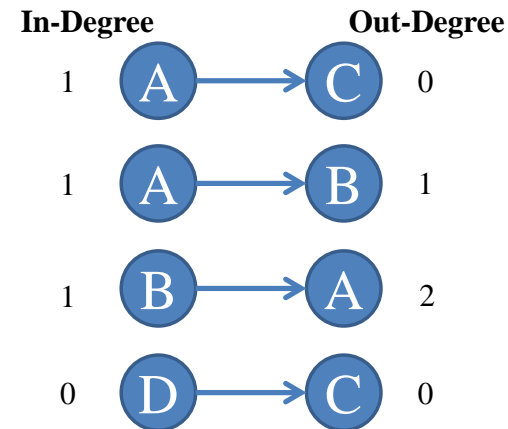


Locale Assortativity Coefficient

- Measure the degree of connectivity association
- Examine the assortativity in terms of node degree



(A)



(B)

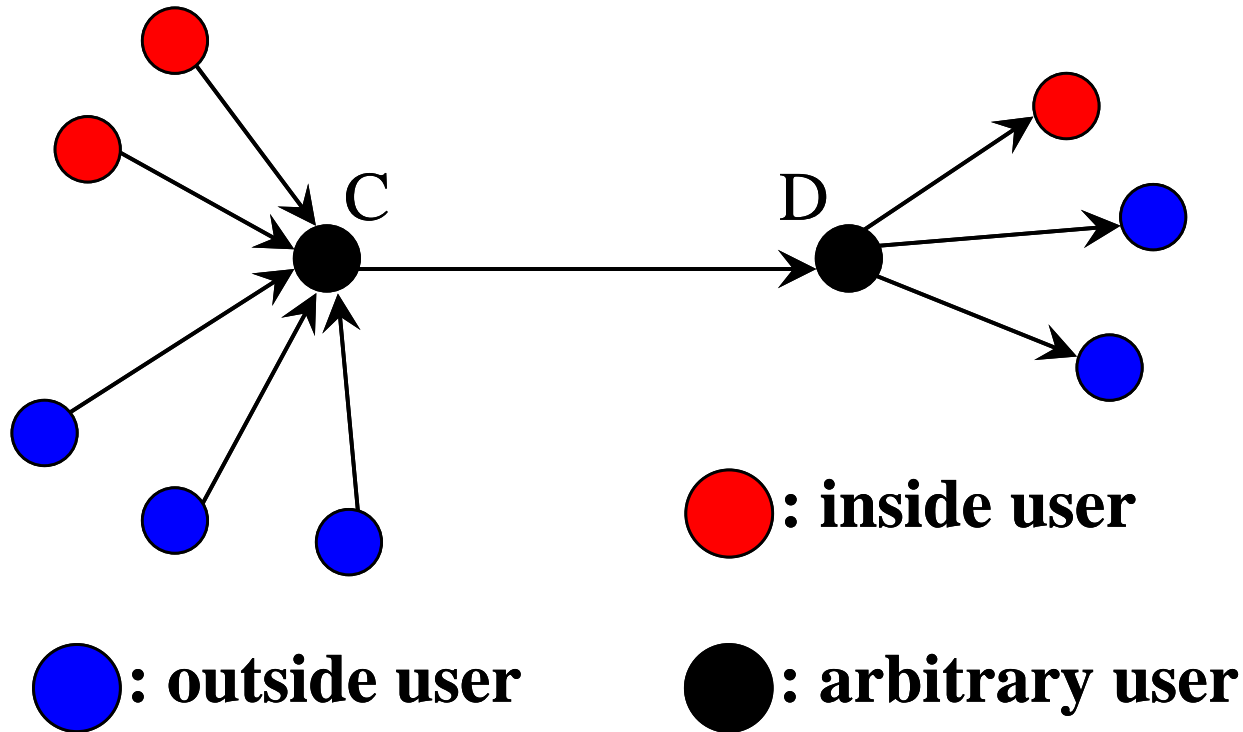
Locale Assortativity Coefficient

Cities	LAC (Global)	LAC (Localized)
Austin	0.941*	1*
SanFrancisco	0.353*	0.524*
Baltimore	no edge	no edge
Boulder	0.612	1*
Chicago	0	0
Minneapolis	no edge	no edge
NewYork	0.376	0.573*
Phoenix	0.238	0.318
Seattle	0.607	0.882*

All Users: 0.159

Locale Assortativity Coefficient

- Inward Assortativity for Locale (IAL)

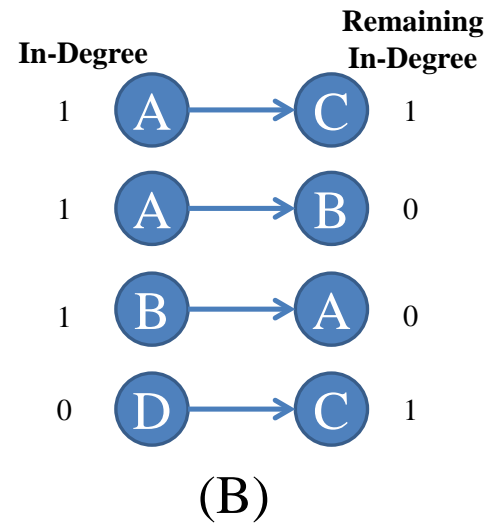
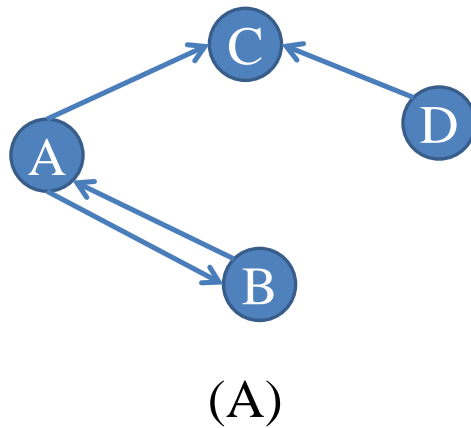


Locale Assortativity Coefficient

Cities	IAL (Absolute)	IAL (Relative)
Austin	0.124 *	0.159*
San Francisco	0.183*	0.275*
Baltimore	0.074*	0.052*
Boulder	0.097*	0.121*
Chicago	0.092*	0.091*
Minneapolis	0.0004	0.011*
New York	0.214*	0.335*
Phoenix	0.052*	0.086*
Seattle	0.124*	0.181*

Locale Assortability Coefficient

- Observe whether popular users in the network follow the users who are also popular



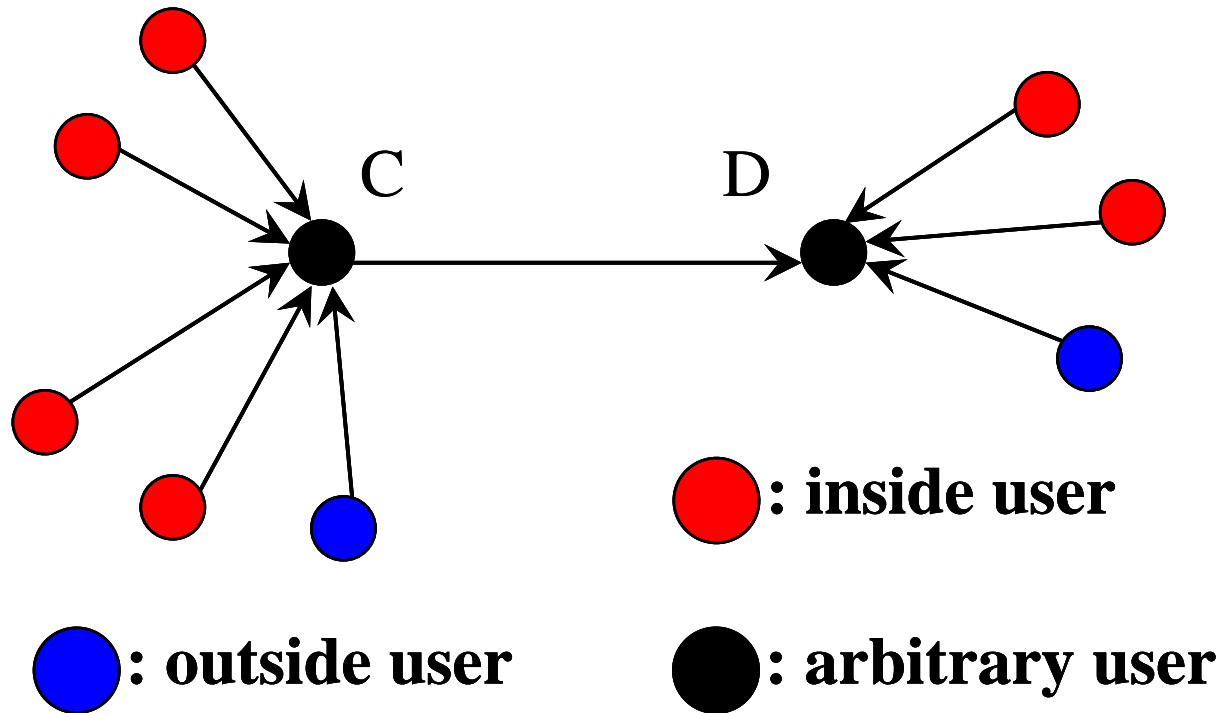
Locale Assortability Coefficient

Cities	LABC (Global)	LABC (Localized)
Austin	0.325	0.961*
San Francisco	0.356*	0.589*
Baltimore	no edge	no edge
Boulder	0.46	0
Chicago	0.707	0
Minneapolis	no edge	no edge
New York	0.562*	0.603*
Phoenix	0.254	0.251
Seattle	0.35	0.236

All Users: 0.158

Locale Assortability Coefficient

- Inward Assortability for Locale (IABL)



Locale Assortability Coefficient

Cities	IABL (Absolute)	IABL (Relative)
Austin	0.133*	0.076*
San Francisco	0.207*	0.207*
Baltimore	0.075*	0.027*
Boulder	0.102*	0.063*
Chicago	0.093*	0.034*
Minneapolis	0.0004	0.016*
New York	0.258*	0.251*
Phoenix	0.053*	0.051*
Seattle	0.130*	0.094*

Conclusion and Future Work

- We propose a series of locale based metrics to support association analysis of users in a location-based social network
- The analysis result indicate that **high clustering effect** among users in **New York City** and **San Francisco**
- Our locale based association analysis shows similar result for users in the locales of **New York City** and **San Francisco** but not for users in other cities
- We plan to further investigate other locale based metrics to enhance the analysis on LBSNs and apply these metrics to real application

Thanks for your attention!