Adding Social Constraints to Location Based Services

Grant McKenzie & Martin Raubal
Institute of Cartography & Geoinformation
ETH Zürich

Adding Social Constraints to Location Based Services

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

- Facebook: 800 million users
- Twitter: 200 million tweets a day
- Foursquare: 10 million users

*Statistics from official OSN websites

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

- Facebook: 800 million users
- Twitter: 200 million tweets a day
- Foursquare: 10 million users
- Dramatic increase in mobile device usage for social interactions.

*Statistics from official OSN websites

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

- Facebook: 800 million users
- Twitter: 200 million tweets a day
- Foursquare: 10 million users
- Dramatic increase in mobile device usage for social interactions.

- Shift from *Location-static* to *Location-dynamic* social interactions.

*Statistics from official OSN websites

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

- Facebook: 800 million users
- Twitter: 200 million tweets a day
- Foursquare: 10 million users
- Dramatic increase in mobile device usage for social interactions.

- Shift from *Location-static* to *Location-dynamic* social interactions.
- Analysis of this online content, may provide social details ranging from gender and age to shopping trends or common modes of transportation.

*Statistics from official OSN websites

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

- Facebook: 800 million users
- Twitter: 200 million tweets a day
- Foursquare: 10 million users

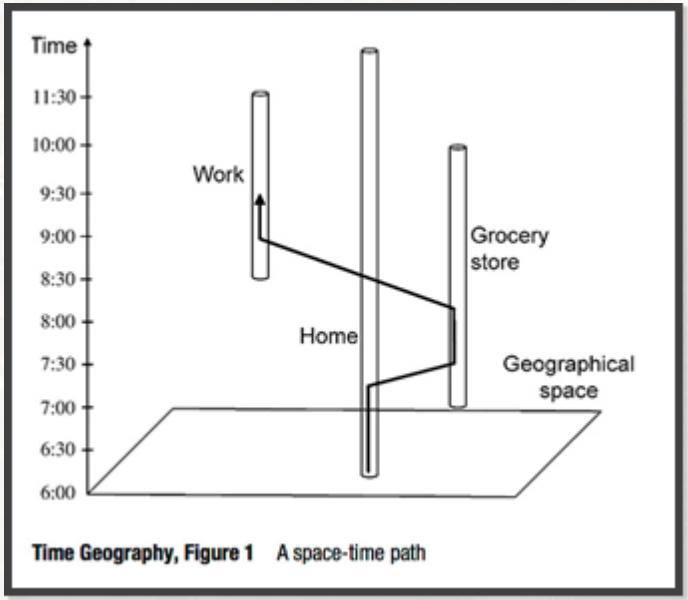
- Dramatic increase in mobile device usage for social interactions.
- Shift from *Location-static* to *Location-dynamic* social interactions.
- Analysis of this online content, may provide social details ranging from gender and age to shopping trends or common modes of transportation.
- Further analysis may also offer insight into socially driven activities and travel behavior.

*Statistics from official OSN websites

Grant McKenzie
[grantm@ethz.ch]

Background

- ***Hägerstrand*** (1970)
- *"What about people in Regional Science?"*



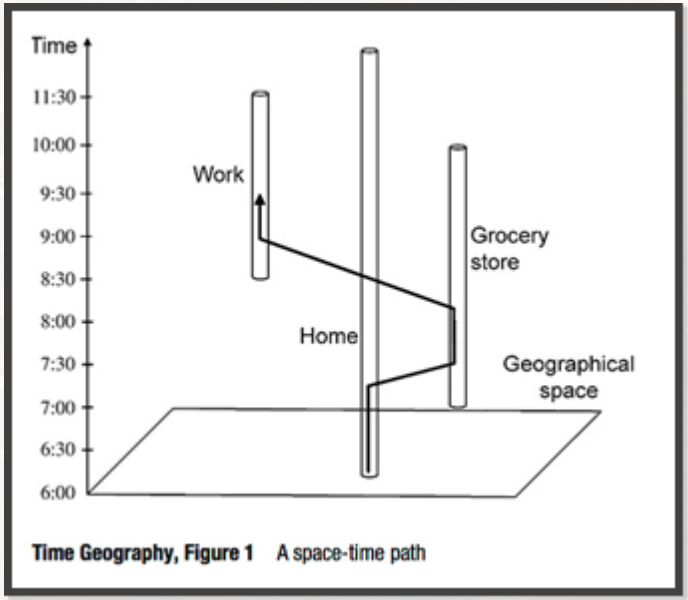
Time Geography, Figure 1 A space-time path

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

Background

- ***Hägerstrand*** (1970)
- *"What about people in Regional Science?"*
- Activities made up of Space and Time



Time Geography, Figure 1 A space-time path

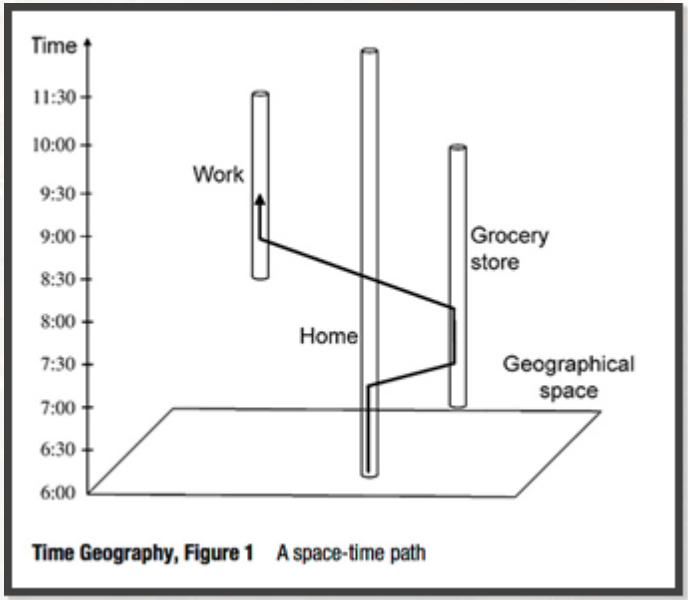
ETH zürich UCSB

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

Background

- ***Hägerstrand*** (1970)
- *"What about people in Regional Science?"*
- Activities made up of Space and Time
- Constraints on activities:
  - Authority / Capability / Coupling



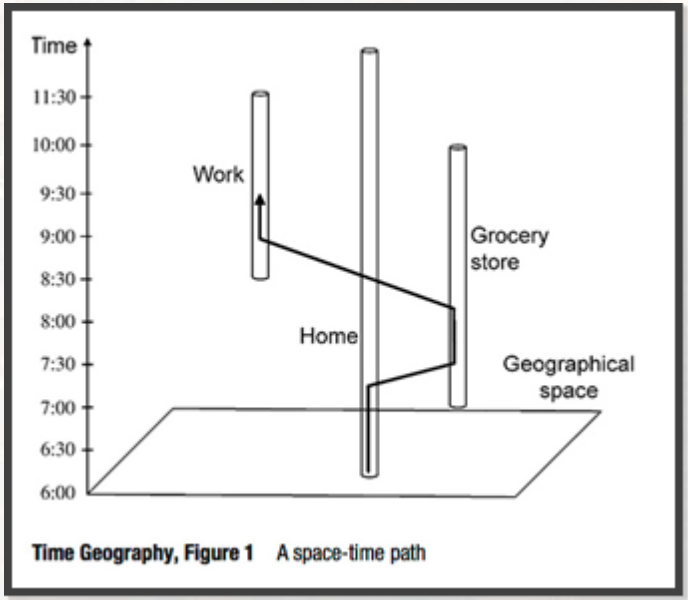
Time Geography, Figure 1 A space-time path

ETH Zürich UCSB
Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

Background

- ***Hägerstrand*** (1970)
- *"What about people in Regional Science?"*
- Activities made up of Space and Time
- Constraints on activities:
  - Authority / Capability / Coupling
- ***Miller, Raubal & Winter***
  - Affordances



Time Geography, Figure 1 A space-time path

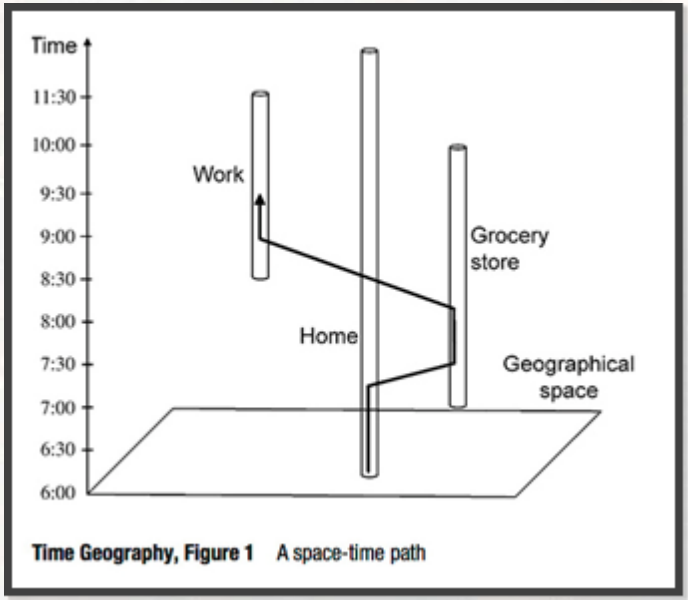
Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

Background

- ***Hägerstrand*** (1970)
- *"What about people in Regional Science?"*
- Activities made up of Space and Time
- Constraints on activities:
  - Authority / Capability / Coupling

- ***Miller, Raubal & Winter***
  - Affordances
  - Physical Affordances
  - Mental Affordances
  - Socio-Institutional Affordances



Time Geography, Figure 1 A space-time path

Grant McKenzie
[grantm@ethz.ch]

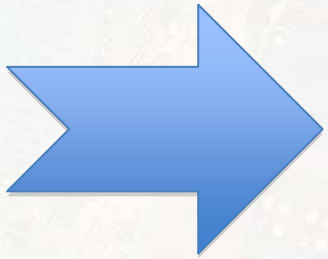
Adding Social Constraints to Location Based Services

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

vimeo
skype
Zimbra
eskobo
Trumba
FireAnt
Renkoo
standpoint
SHOUTWIRE
Social
blogbeat
FeedBurner
Noodly
pegasus
ShoZu
askeet!
Megite
MusicSearch
Spin
ClipShack
jambo
box
Jots
Simpy
pictureCloud
ScoopGO!
ourmedia
Yub.com
looklater
chatsum
Linked in
EchoSign.
ICEROCKET
wink
Squeet
chuquet
wal-mart
Windows Live
IBM
PEPSI
ebay
Google
Gmail
Technorati
feedmarket
messenger
Meet With Approval
Ning
flickr
Findory
PODZINGER
CONGOO
gOFFICE
Bloglines
Gcast
Jumpcut
Yahoo!
AOL
Amazon
Wikipedia
Blogcritics.org
inboxcom
newroo
attensa
blinklist
Xmail
HardDrive
30DAYTAGS
Woobox
Woobi
Woobi Creator
kajeet
Zoho
Zoopo
Qoop
Qoop
Qoop

Adding Social Constraints to Location Based Services



Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

Backstrom et al. 2011, Chang et al. 2011, Cheng et al. 2011, Hecht et al. 2011

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

Backstrom et al. 2011, Chang et al. 2011, Cheng et al. 2011, Hecht et al. 2011

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

Backstrom et al. 2011, Chang et al. 2011, Cheng et al. 2011, Hecht et al. 2011

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

Backstrom et al. 2011, Chang et al. 2011, Cheng et al. 2011, Hecht et al. 2011

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

Backstrom et al. 2011, Chang et al. 2011, Cheng et al. 2011, Hecht et al. 2011

Grant McKenzie
[grantm@ethz.ch]

Research Questions

- Which social factors lead individuals to make the decisions they do?

Grant McKenzie
[grantm@ethz.ch]

Research Questions

- Which social factors lead individuals to make the decisions they do?
- How do these factors rank in terms of influence on location and travel behavior?

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

Research Questions

- Which social factors lead individuals to make the decisions they do?
- How do these factors rank in terms of influence on location and travel behavior?
- Which types of activities in space and time are strongly constrained by social interaction?

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

Research Questions

- Which social factors lead individuals to make the decisions they do?
- How do these factors rank in terms of influence on location and travel behavior?
- Which types of activities in space and time are strongly constrained by social interaction?

- Build a probability model with the intention of predicting an individual's activity location.

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

Research Questions

- Which social factors lead individuals to make the decisions they do?
- How do these factors rank in terms of influence on location and travel behavior?
- Which types of activities in space and time are strongly constrained by social interaction?

- Build a probability model with the intention of predicting an individual's activity location.
- Hypothesize that given previous activity history and online social network data, it is possible to predict a user's spatial and temporal movement with significantly greater accuracy than estimates based solely on previous activity history.

Grant McKenzie
[grantm@ethz.ch]

Proposed Methods

- 100 Participants
  - 50 Random sampling
  - 50 Network sampling
  - Active *Facebook* users

Grant McKenzie
[grantm@ethz.ch]

Proposed Methods

- 100 Participants
  - 50 Random sampling
  - 50 Network sampling
  - Active *Facebook* users
- Extract social content
  - Profile information (age, gender…)
  - Wall posts (updates, links, comments…)

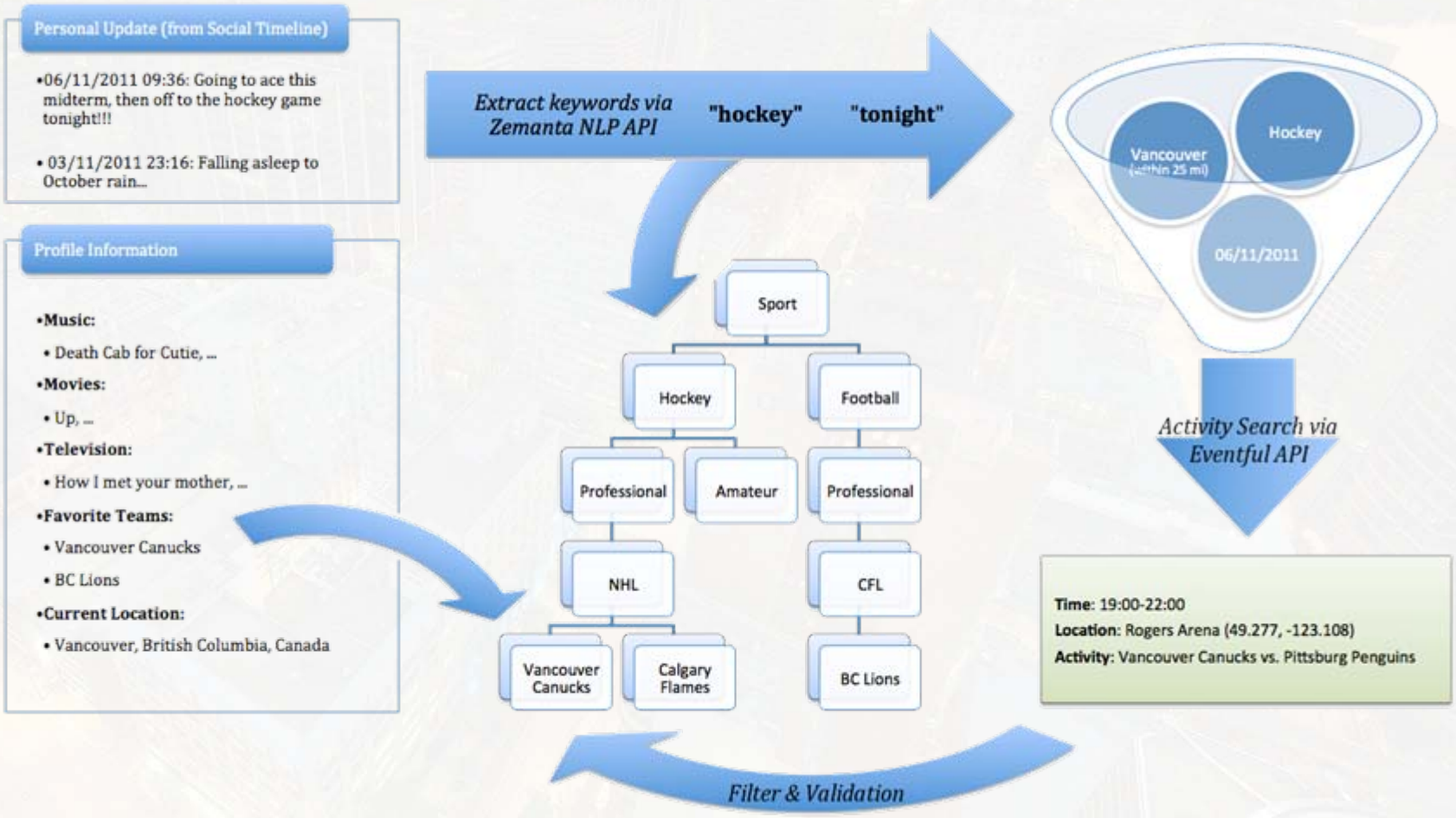
Grant McKenzie
[grantm@ethz.ch]

Proposed Methods

- 100 Participants
  - 50 Random sampling
  - 50 Network sampling
  - Active *Facebook* users
- Extract social content
  - Profile information (age, gender…)
  - Wall posts (updates, links, comments…)
- Ground truth / Validation
  - Activity diary

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services



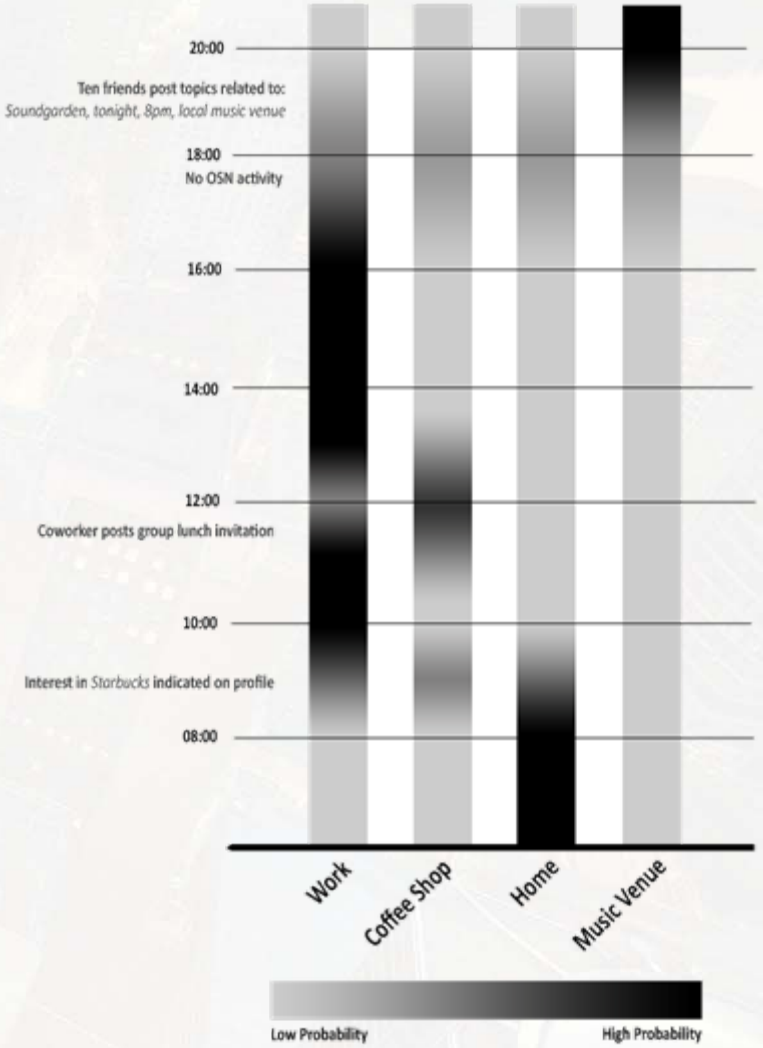
Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

Expected Outcomes

Produce a model that

- Inputs social data
- Outputs socially constrained probability values used to infer location.



ETH zürich UCSB

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

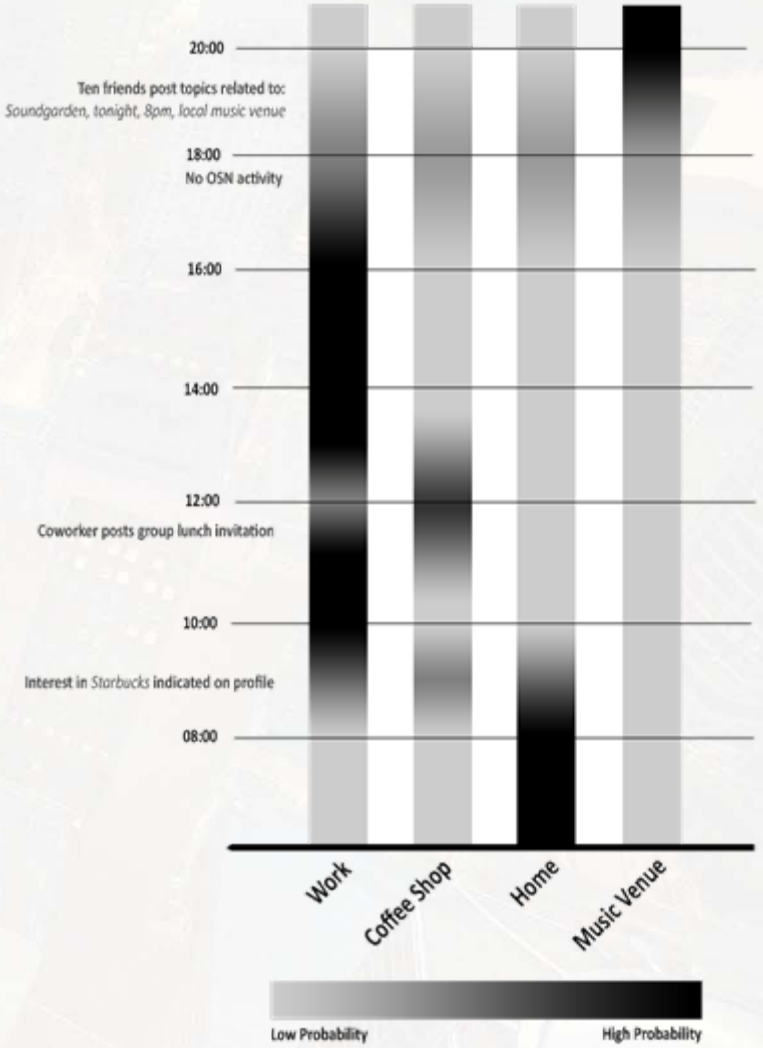
Expected Outcomes

Produce a model that

- Inputs social data
- Outputs socially constrained probability values used to infer location.

Example:

- Interest in *Starbucks*
  - = Increased probability of stopping at *Starbucks* on the way to work.



Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

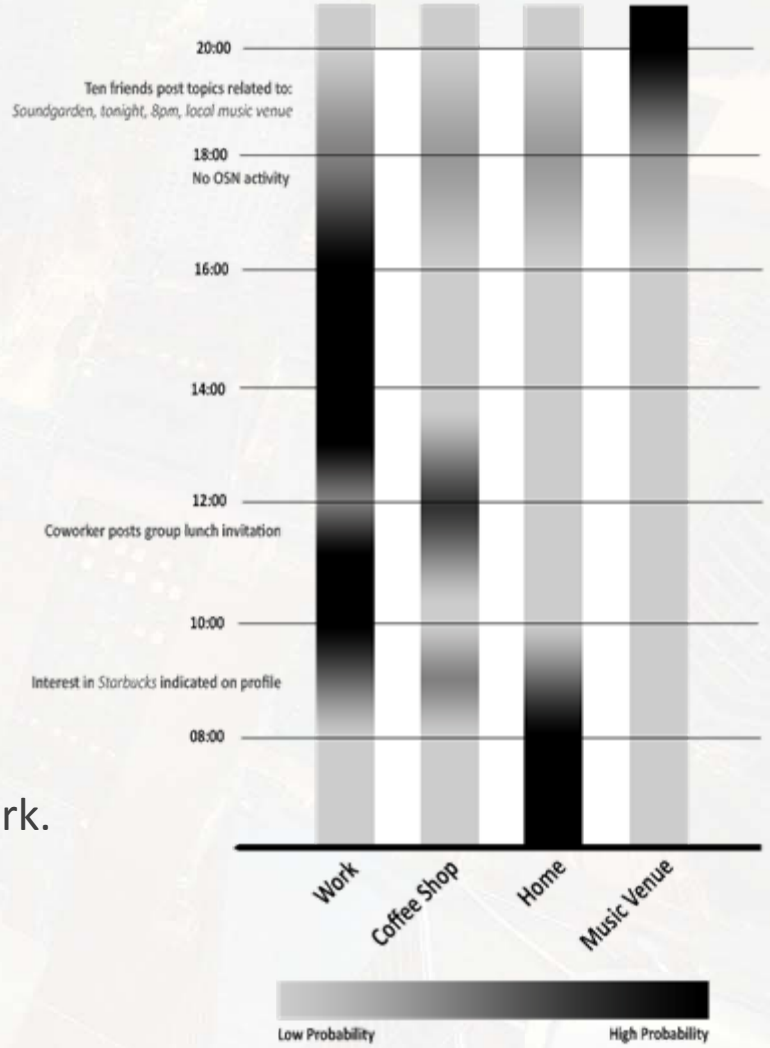
Expected Outcomes

Produce a model that

- Inputs social data
- Outputs socially constrained probability values used to infer location.

Example:

- Interest in *Starbucks*
  - = Increased probability of stopping at *Starbucks* on the way to work.
- Coworker lunch invitation
  - = Increase probability of not being at work.



Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

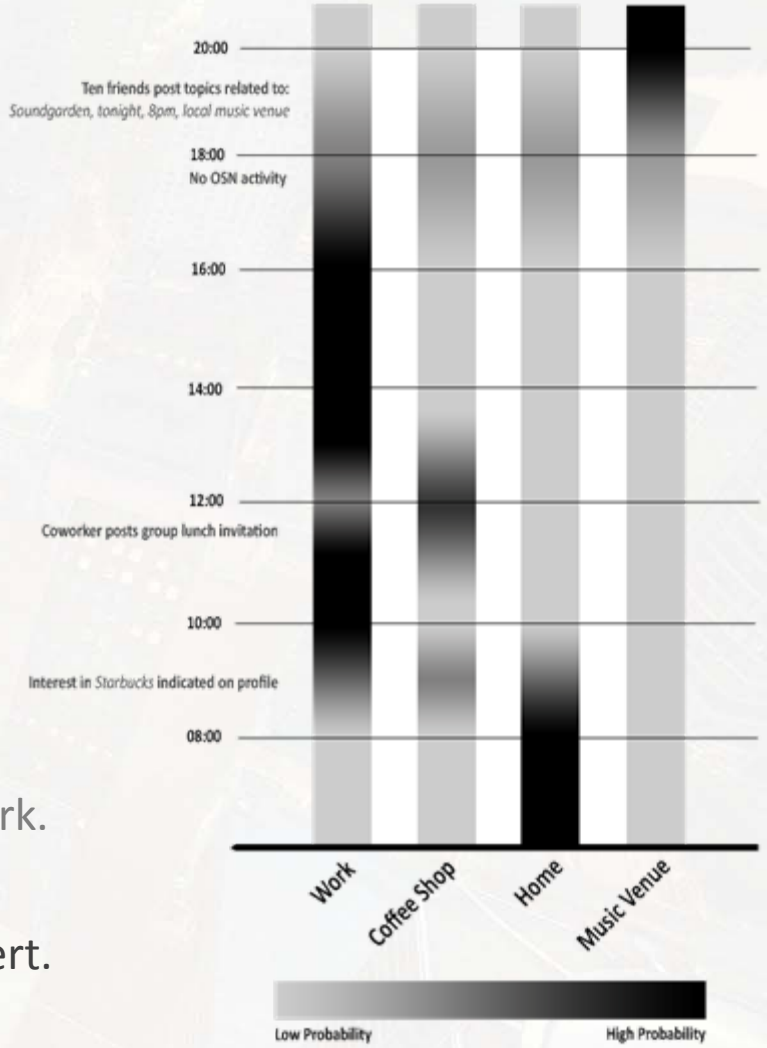
Expected Outcomes

Produce a model that

- Inputs social data
- Outputs socially constrained probability values used to infer location.

Example:

- Interest in *Starbucks*
  - = Increased probability of stopping at *Starbucks* on the way to work.
- Coworker lunch invitation
  - = Increase probability of not being at work.
- Friends post about concert tonight
  - = High probability of attending the concert.



Grant McKenzie
[grantm@ethz.ch]

Validation & Applications

Validation

- Social similarity measures
- Social distance measures
- Link strength (post frequency)
- Ground truth against activity diaries

Grant McKenzie
[grantm@ethz.ch]

Validation & Applications

Validation

- Social similarity measures
- Social distance measures
- Link strength (post frequency)
- Ground truth against activity diaries

Real world applications

- Social Network applications
- Emergency response
- Security intelligence
- Advertising

Grant McKenzie
[grantm@ethz.ch]

Conclusions & Concerns

Concerns & Limitations

- Privacy concerns

Grant McKenzie
[grantm@ethz.ch]

Conclusions & Concerns

Concerns & Limitations

- Privacy concerns
- Privately owned datasets

Grant McKenzie
[grantm@ethz.ch]

Conclusions & Concerns

Concerns & Limitations

- Privacy concerns
- Privately owned datasets
- Data accuracy

Grant McKenzie
[grantm@ethz.ch]

Conclusions & Concerns

Concerns & Limitations

- Privacy concerns
- Privately owned datasets
- Data accuracy

Conclusions

- Unprecedented amount of shared data available

Grant McKenzie
[grantm@ethz.ch]

Conclusions & Concerns

Concerns & Limitations

- Privacy concerns
- Privately owned datasets
- Data accuracy

Conclusions

- Unprecedented amount of shared data available
- Many datasets publically available and in real-time

Grant McKenzie
[grantm@ethz.ch]

Conclusions & Concerns

Concerns & Limitations

- Privacy concerns
- Privately owned datasets
- Data accuracy

Conclusions

- Unprecedented amount of shared data available
- Many datasets publically available and in real-time
- Can be used to enhance a LBS experience

Grant McKenzie
[grantm@ethz.ch]

Adding Social Constraints to Location Based Services

Grant McKenzie & Martin Raubal
Institute of Cartography & Geoinformation
ETH Zürich
grantm@ethz.ch

Paper: http://goo.gl/qaPlj
Image References: http://goo.gl/SFuua