Personalized Protection of Identifiers on Public Trajectories

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Overview

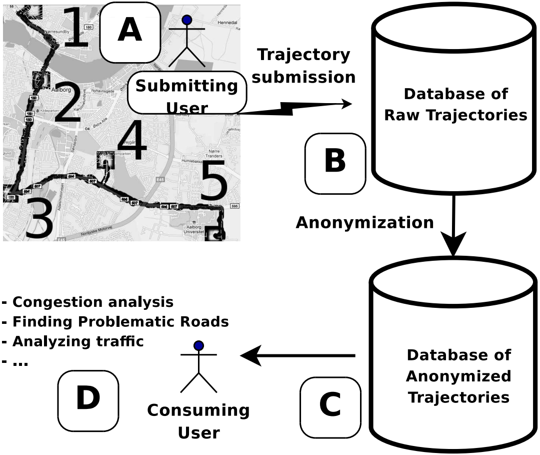
Problem Setting

Privacy Profile

t-anonymity

Conclusion

Problem Setting



- A Privacy Aware User
- B Trusted Server
- C Public Untrusted Server
- D Service Providers

Goals

At the service provider:

- Remove all user identifying information from trajectories.
- Preserve usability to users of public dataset

At the users side:

- Provide **Usability**. specifying privacy should be simple.
- Be **Practical**. No user interaction during normal operation.
- Be **Flexible**. Support several ways of defining privacy.

Related work

Protection of Trajectories

- Collapse trajectories and remove updates
- Only publish edges with k support.

- At each update compute MBR including k-1 updates
- Precompute regions before sending.

- Degrade public dataset so no sub-trajectory can be matched to it.

No work on spatial anonymity with time

Privacy Profile

- Settings
- PSR - Potentially Sensitive Region
- Protection types and schemes
- t-anonymity

Settings

Users Can

- Set both globally and locally
  - Temporal sensitivity
  - Spatial sensitivity
- Define a PSR
- Have multiple profiles.

Definition (Privacy Profile)

$(stime, etime, d_s, d_t, \{PSR\})$

PSR

- A group of edges in a road network considered sensitive
- A value indicating spatial sensitivity
- A value indicating temporal sensitivity
- A general usage class

Definition (PSR)

A PSR p is a tuple $(p_{edges}, d_s, d_t, class)$ where p_{edges} is the set of tuples $\{(e, e_{from}, e_{to} | 0 \leq e_{from} < e_{to} \leq e_{length})\}$ which is sensitive. $e \in \mathbf{E}$ and $e_{from}, e_{to}, e_{length} \in \mathbb{R}$. e_{from}/e_{to} specifies on e the start-/end-location covered by p_{cover}. If e is fully included in p_{cover}, e_{from}/e_{to} is equal to $0/p_{length}$. $d_s, d_t, class \in \mathbb{N}$ is respectively the spatial sensitivity, the temporal sensitivity, and the PSR classification

PSR Classes

Classification	**Scheme**
Public Service Point	AS
House	ASTI,RS
Route w. endpoints	AS, ASTI, RS
Route w/o endpoints	AS, ASTI, RS

Protection Schemes

- AS - Always Sensitive.
- ASTI - Always Sensitive within a time interval.
- RS - Rarely Sensitive.

t-anonymity

Spatial k-anonymity

- Adapted for trajectories
- Argumented with time.

In a PSR:

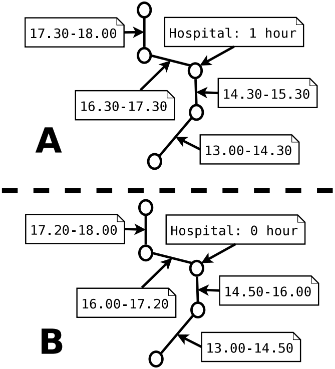
- Spatial sensitivity decides t-1 trajectories to hide between
- Temporal sensitivity defines a time period shared with t-1 other trajectories.

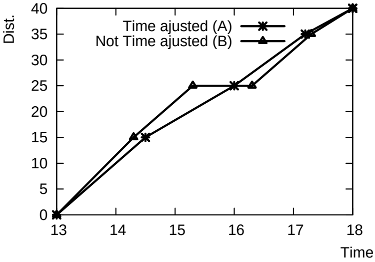
Definition: t-anonymity

Definition (t-anonymity)

Given $\mathbf{T}$, the set of trajectories and p_{edges}, the set of edges covering a sensitive part of trajectory γ.
Let $\Gamma \subseteq \mathbf{T}$ be all trajectories which subtrajectories intersect with p_{edges}. $\Gamma' \subseteq \Gamma$ be all trajectories where, for edges intersecting with p_{edges}, at each timestamp of γ their timestamps lie within a time period TP symmetric around the timestamp of γ.
Γ' is said to satisfy t-anonymity with respect to TP and γ iff Γ' contains at least $t - 1$ other trajectories.

Time Period


17.30-18.00
Hospital: 1 hour
16.30-17.30
14.30-15.30
13.00-14.30
A
17.20-18.00
Hospital: 0 hour
16.00-17.20
14.50-16.00
13.00-14.50
B


Dist.
40
35
30
25
20
15
10
5
0
13
14
15
16
17
18
Time
Time ajusted (A)
Not Time ajusted (B)

Conclusion

- Novel Privacy Profile to specify spatial-temporal sensitivity
- Introduced t-anonymity
- Introduced a way of temporally hiding users movements.

Future Work

- Performance study to determine a threshhold **D** for data integrety, to determine when data is no longer usable by data consumers.

End of Presentation

Thank You For Listening