Contextual Privacy: the Interplay of Sensitivity & Context

Dr. Rula Sayaf

Disclaimer

I am only a computer scientist.
I have no proper education in any other field.
All the terms in this talk are limited to the
context *of Computer Science*.

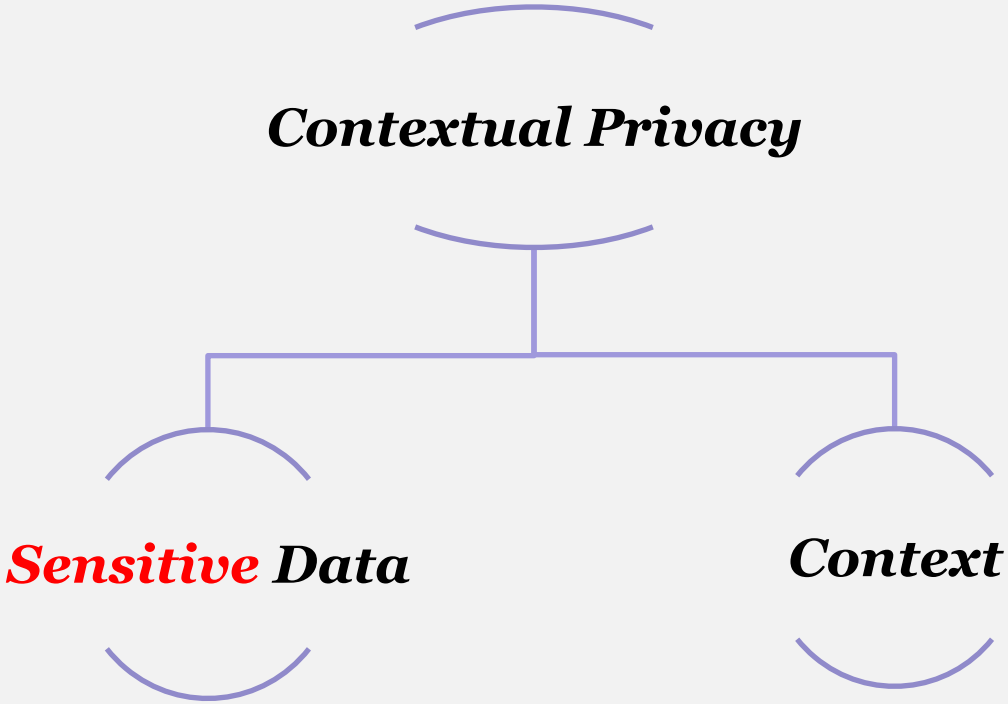
Motivation

Contextual Privacy

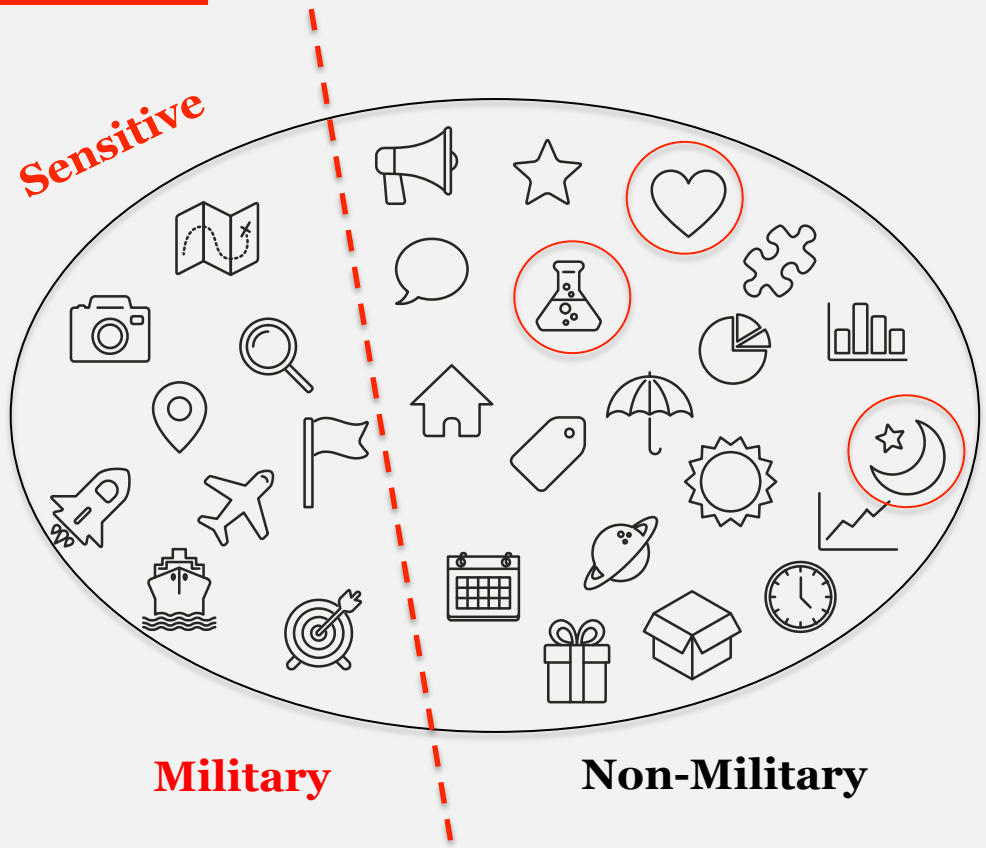
Contextual Privacy ≈ Control(*Sensitive Data, Context*)

PETs ≈ Control(*? Data, ?*)

Contextual Privacy

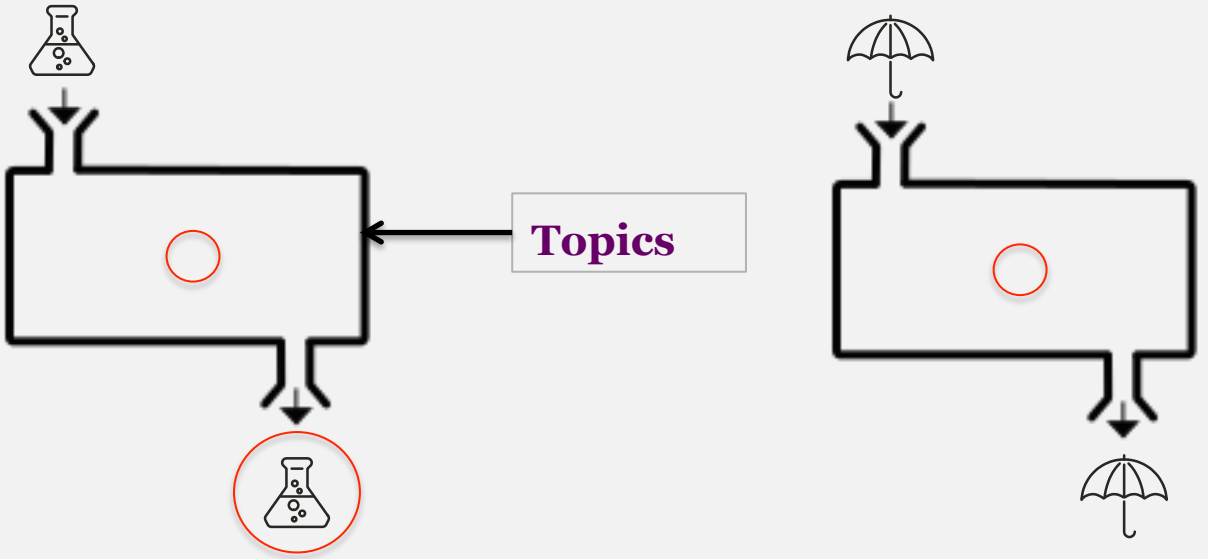


Challenges:
Define Sensitivity

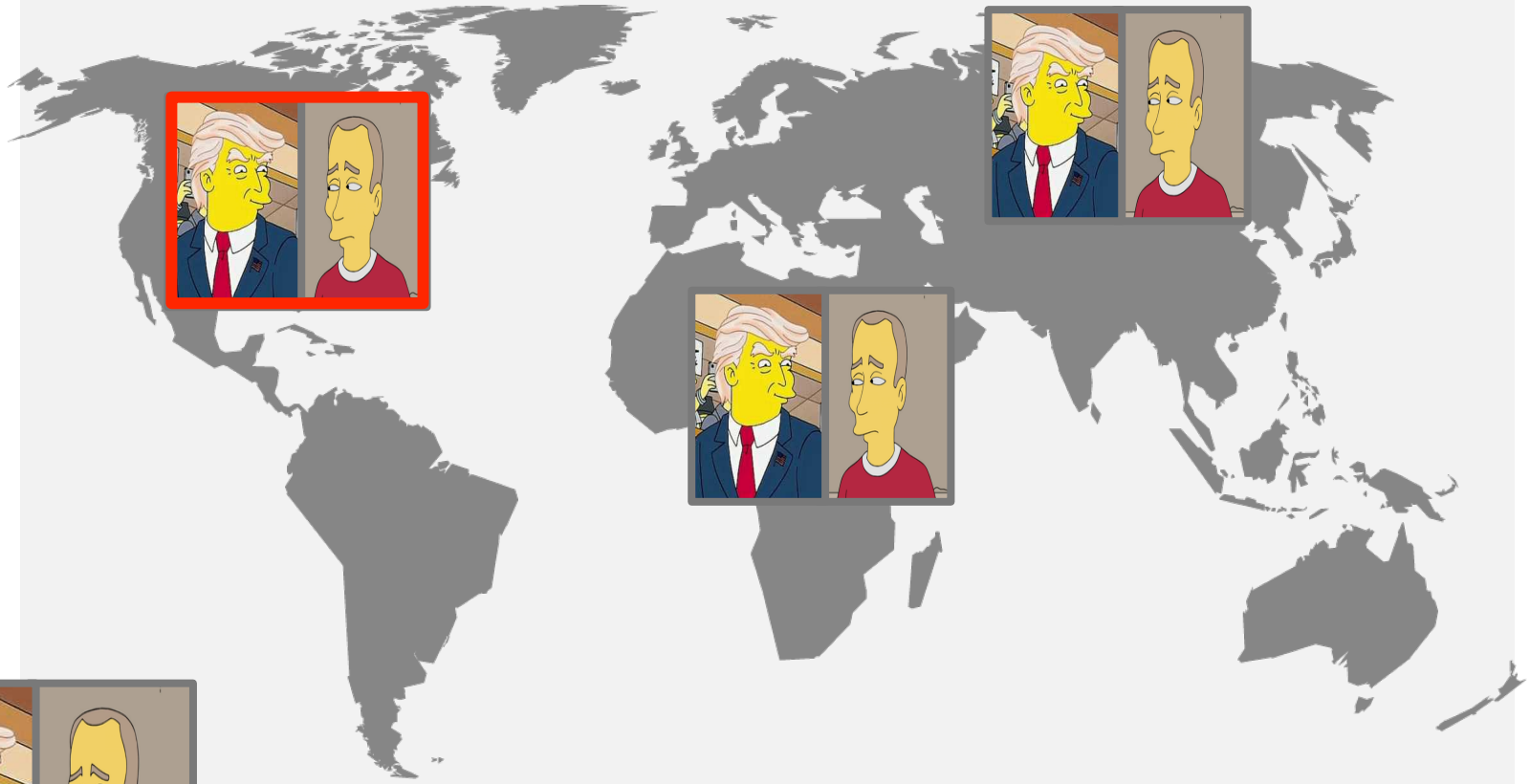


Challenges: Defining Sensitivity

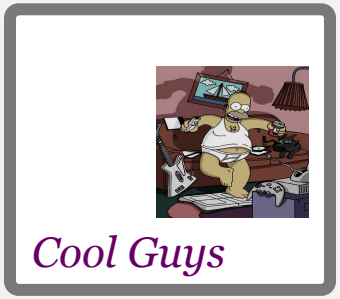
Sensitivity Function $f(x)$



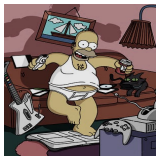
Challenges:
Context & Sensitivity



Challenges:
Context & Sensitivity



Cool Guys



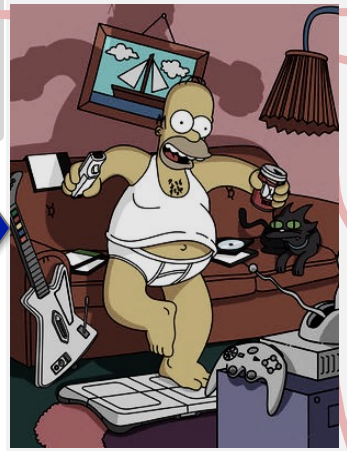
Fun at home

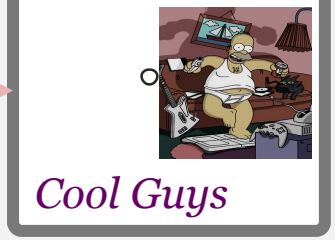
Family

Inappropriate

Work Colleagues

Contextual Privacy





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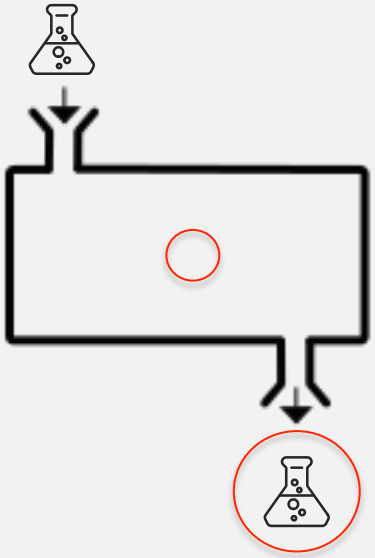
Contextual Privacy

Sensitivity Function $f(x)$



Inappropriate

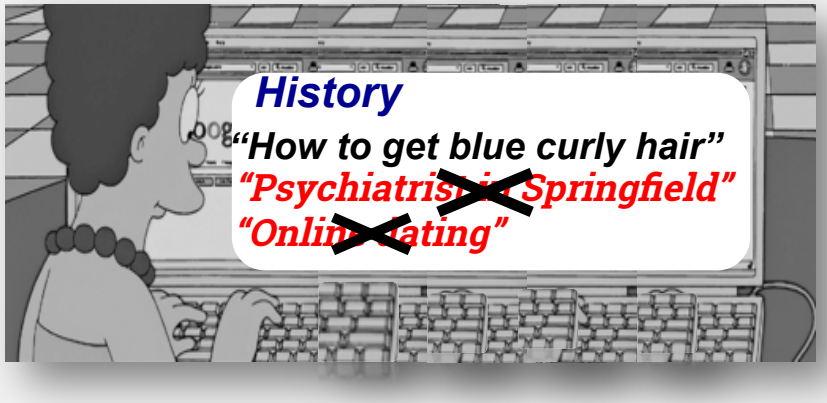
Work Colleagues

Contextual Privacy Analysis

Search Data

Search Query: "How to get blue curly hair"

Manage Search History



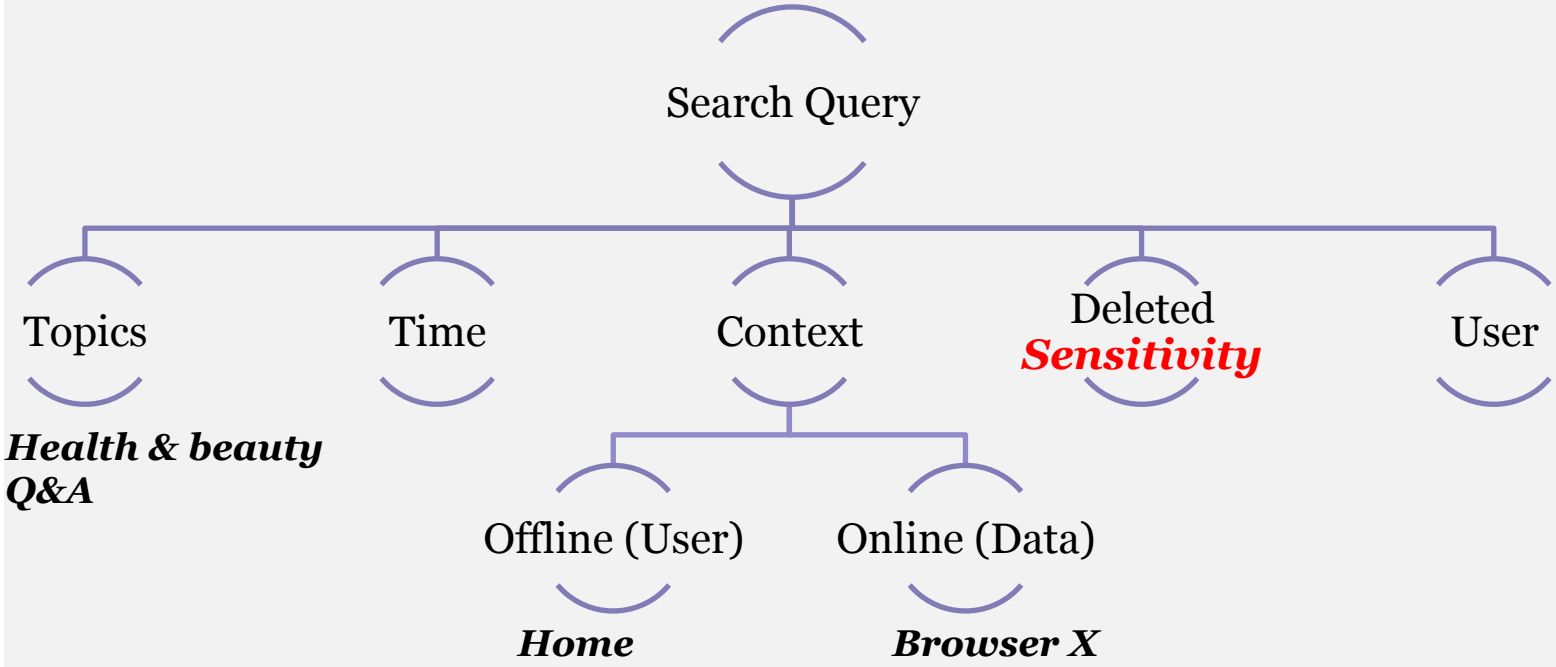
Big Search Data

226,000,000

400,000 US users

Big Search Data

Search Query: "How to get blue curly hair"



Sensitivity Analysis

Questions

- Is there one general pattern?

(Topic=*X)* + (Context=*Y*) + (Time=*Z*) => *Item is Deleted* => *Sensitive*

- What are the factors that affect sensitivity?
    - Topics
    - Context
    - Subjectivity
    - Temporality

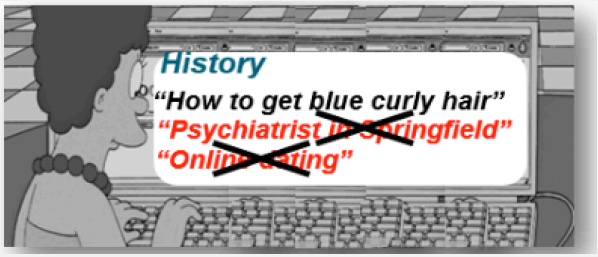
Context Analysis

Questions

- Does context affect disclosure patterns?

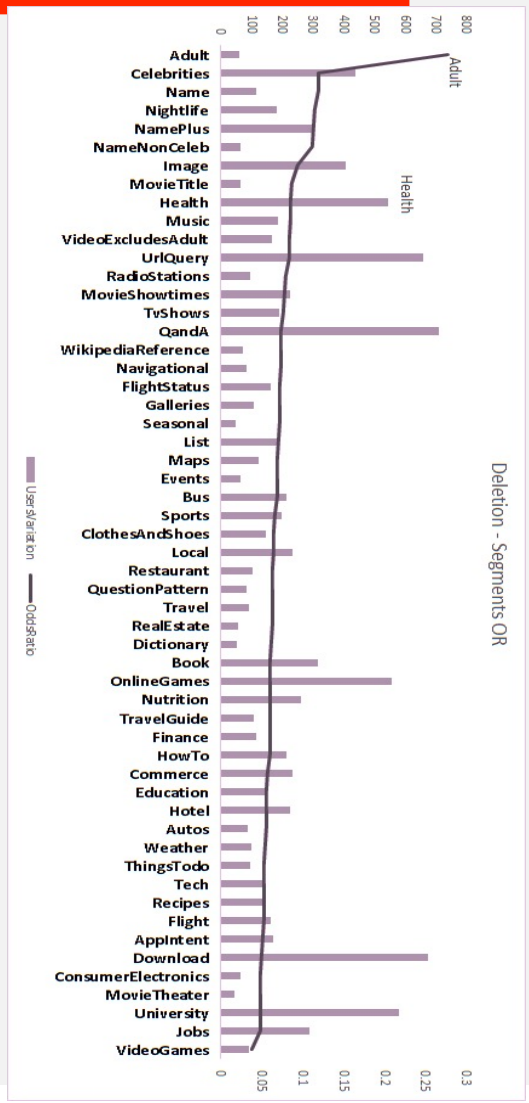
If (Context = Y) => Disclose (Topic=*X*)

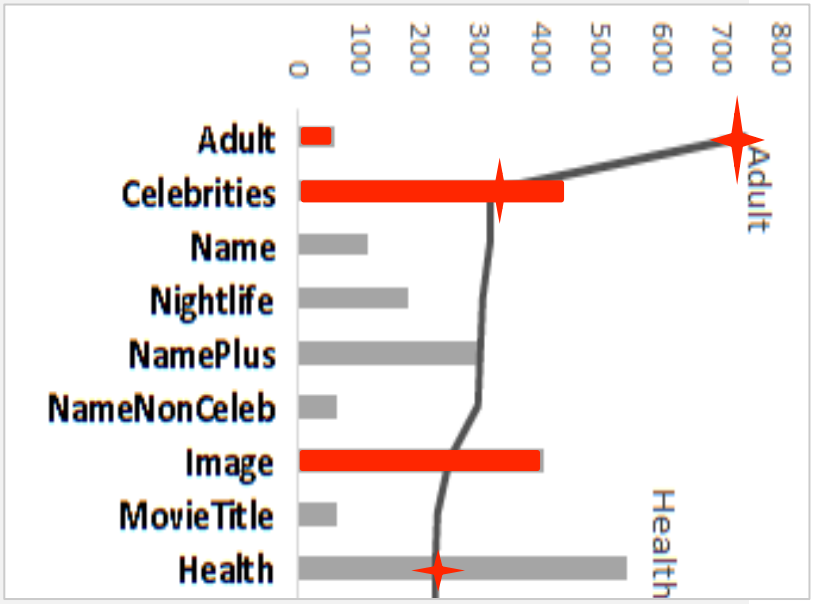
- Does context affect post-disclosure patterns (sensitivity management patterns)? Or does adding more contextual information affect the accuracy of the pattern?



Contextual Sensitivity

Topics Sensitivity





Sensitive topics vary across users!

Sensitivity Pattern

There exists pattern explaining the behaviour of the *400,000* users

(Content=*Health)* + (Context=*Home*) + (Time=*Noon*) => *Item is Sensitive*

Sensitivity could not be predicted with topics only!

Sensitivity Topics

- Adult
- Celebrities
- Night Life
- Health
- Name of Non-celebrities
- Clothes and Shoes
- Flight status

Common world knowledge of sensitivity is insufficient!

Topics that indicate sensitivity vary from what is expected to be sensitive!

Sensitivity Contexts

Online Context:

- Search History
- Vertical Change (Web, Image, Video)
- Safe search setting = Strict

Offline Context:

- Windows Live Users
- Non-Facebook Users
- Time

Sensitivity could be affected by the interest, and the type of services users are exposed to!

Sensitivity Temporality

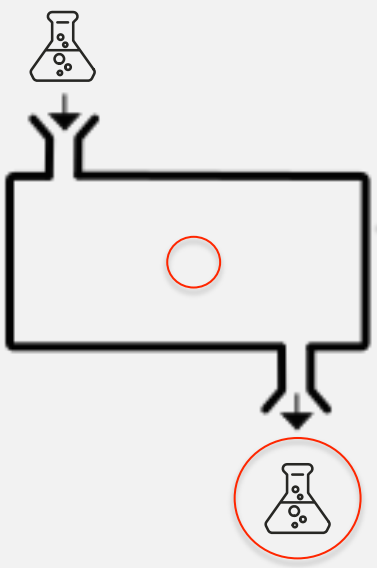
Patterns vary over time – and across users too

Content Determinants	Nov	Dec	Jan	Feb	Mar	Apr
Adult	1	1	1	1	1	1
ClothesAndShoes	1	1	1	1	1	1
Health	1	1	1	1	1	1
MovieTitle	1	1	1	1	1	1
Name	1	1	1	1	1	1
NameNonCeleb	1	1	1	1	1	1
NamePlus	1	1	1	1	1	1
Nightlife	1	1	1	1	1	1
VideoExcludesAdult	1	1	1	1	1	1
QandA	1	1	1	1	1	1
FlightStatus	0	1	0	1	0	0
UrlQuery	0	0	1	1	0	1
MovieShowtimes	0	0	0	1	1	1
RadioStations	0	0	0	1	1	0
Restaurant	0	0	0	1	1	0
Dictionary	0	0	0	0	0	1
Nutrition	0	0	0	0	0	1
TvShows	1	0	0	0	0	0
Bus	0	1	1	0	0	0

Topics and contexts determination of sensitivity is temporal and subjective!

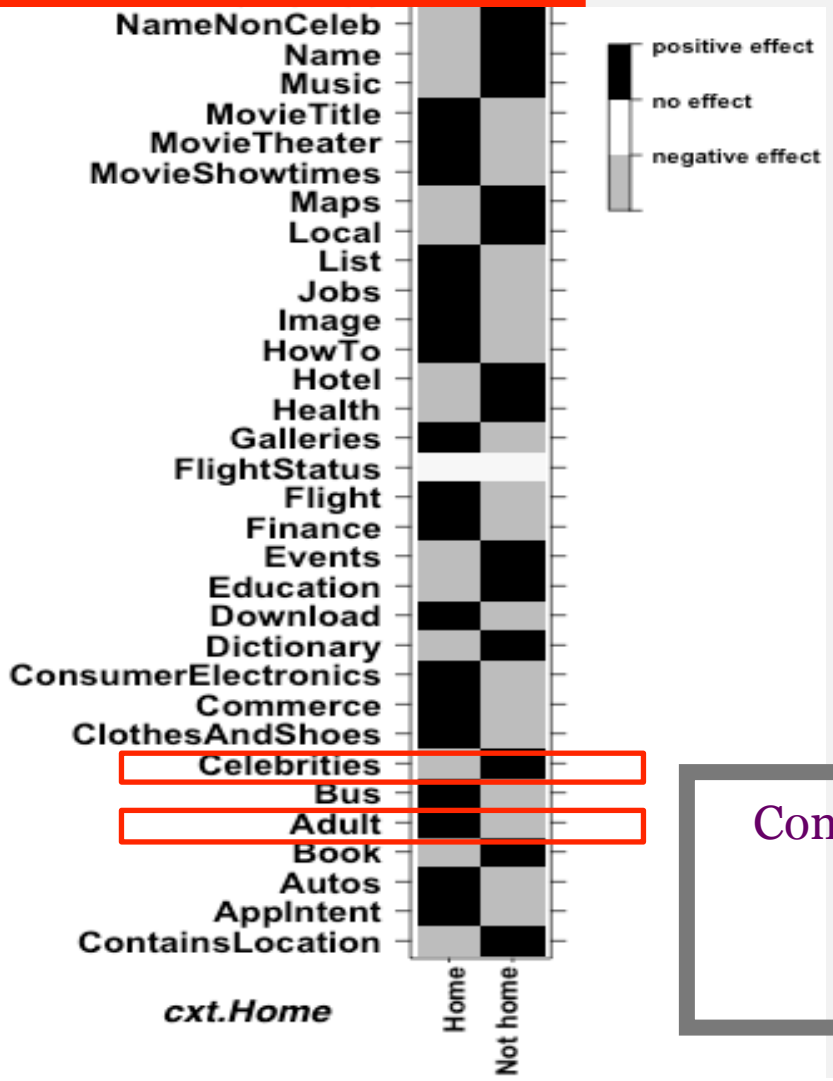
Sensitivity Pattern

Sensitivity Function $f(x)$



- **Context**
- **Content**
- **Subjectivity**
- **Temporality**

Context & Disclosure



Context affects the disclosure of sensitive topics!

Context & Post-disclosure

More information about context => a higher prediction accuracy

Online Context

- Anonymiser type:
  - Inactive
  - *Active (negative effect)*

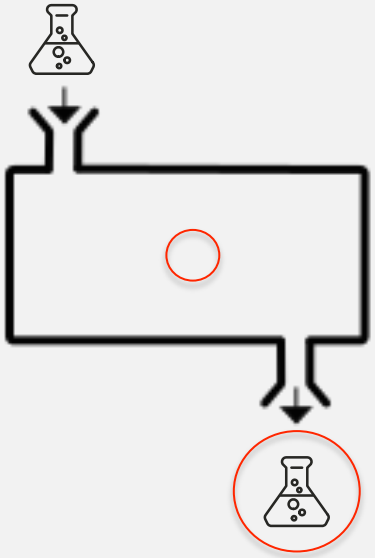
Offline Context

- Organisation type:
  - Government State
  - Medical and Dental Services
  - Finance
  - Religious Organizations

- The more context, the better the understanding of sensitivity!
- Using PETs affects actions to protect sensitive data!

Contextual Privacy

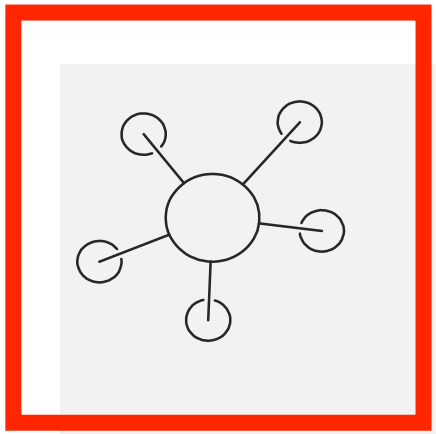
Sensitivity Function $f(x)$



Inappropriate

Work Colleagues

Conclusions

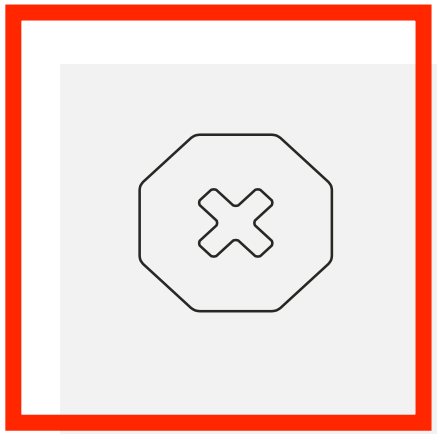


Multiple Ingredients

Topics, contexts, time, subjectivity, and possibly other aspects …

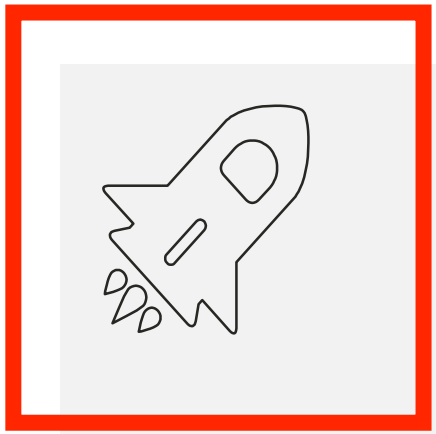
Sensitivity or Inappropriateness

Requires users involvements to decide



Deletions Illusion?

Expect actual deletions with the GDPR?



Sensitivity in Courts?

Report a violation by selling a search

Thanks!
Any questions?

@privacyhole
rula@privacyhole.com

PhD Thesis: *Contextual Privacy: the Interplay of Sensitivity and Context* is available here

The work in this thesis has been completed partially at Microsoft Research, Cambridge.

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