PRIVACY THROUGH SOLIDARITY

Asia J. Biega
Rishiraj Saha Roy   Gerhard Weikum
YOUR PROFILE MEANS ... PERSONALIZATION

SEARCH

python

RECOMMENDATIONS

... NumPy Cookbook

... Python Programming

programming, java, inheritance, nltk

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YOUR PROFILE MEANS ... YOU

SEARCH

- programming
- pottery
- ethno jazz
- mediation
- back exercise
- tokyo in august

RECOMMENDATIONS

- Python Programming
- The Holy Bible
- The Modern Libertarian
- Mein Kampf

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YOU CAN’T HAVE YOUR CAKE AND (HAVE YOUR SERVICE PROVIDER) EAT IT TOO . . .
... OR CAN YOU?

programming

python

pottery

ethno jazz

mediation

back exercise

tokyo in august

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… OR CAN YOU?

programming

mediation
back exercise

privacy: profile fragmentation

pottery

ethno jazz
tokyo in august

user utility: coherent chunks

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FRAGMENTATION: PRACTICALLY

Local user profiles

?
MEDIATOR ACCOUNTS PROXY

Local user profiles

Items

Mediator Accounts

Results

Store

no links

Item: query
rating

Service Provider

Result: ranking
predicted ratings

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PRIVACY VS. UTILITY

This work

PRIVACY
profile scrambled

USER UTILITY
results personalized

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PRIVACY VS. UTILITY

Usual focus

PRIVACY
profile scrambled

USER UTILITY
coherent context preserved

SERVICE PROVIDER UTILITY
minimize analytics loss

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PRIVACY VS. UTILITY – STRATEGIES

 PRIVACY
 Random shuffling

 USER UTILITY
 Results intact

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CONTROLLING THE TRADE-OFF

\[ P(m|o) = \alpha \cdot P_{priv}(m|o) + (1 - \alpha) \cdot P_{util}(m|o) \]

**Profiling-Tradeoff Assignment**

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MEDIATOR ACCOUNTS: SEARCH

QUERY HISTORY
programming
pottery
tokyo in august

Language model-based personalization
query-doc + doc-mediator

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**MEDIATOR ACCOUNTS: RECOMMENDERS**

**RATING HISTORY**
- Umiera piękno: 4
- Koreni: 5
- Artpop: 1

**Aggregation**
- User U
- Mediator M

**Similarity:**
- Categorical

**Collaborative filtering**

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EVALUATION

~900 User profiles
(Queries synthesized from StackExchange)

Profiling-Tradeoff Assignment

Mediator Accounts
Q: HOW DOES THE PRIVACY-UTILITY TRADE-OFF LOOK LIKE?

~900 User profiles
(Queries synthesized from StackExchange)

Profiling-Tradeoff Assignment

Mediator Accounts

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EVALUATION: METRICS

For each object:

```
  Diff* (user u, mediator m)
```

Ranking over StackExchange answers

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<th>MODEL</th>
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<td>object-level</td>
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<td>MSE (recommenders)</td>
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EVALUATION: OBSERVATIONS

TRADE-OFFS (EMPIRICAL)

SEARCH SYSTEMS

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EVALUATION: OBSERVATIONS

TRADE-OFFS (EMPIRICAL)

SEARCH SYSTEMS

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EVALUATION: OBSERVATIONS

TRADE-OFFS (EMPIRICAL)

SEARCH SYSTEMS

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EVALUATION: OBSERVATIONS

TRADE-OFFS (EMPIRICAL)

Utility loss low even for random

SEARCH SYSTEMS

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EVALUATION: OBSERVATIONS

TRADE-OFFS (EMPIRICAL)

Alpha influences the variance

SEARCH SYSTEMS

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EVALUATION: OBSERVATIONS

PROFILE DIVERSITY

SEARCH SYSTEMS

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EVALUATION: OBSERVATIONS

PROFILE DIVERSITY

SEARCH SYSTEMS

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EVALUATION: OBSERVATIONS

PROFILE DIVERSITY

Coherent

Random

high diversity = utility-safe scrambling

SEARCH SYSTEMS

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EVALUATION: OBSERVATIONS

Similar observations hold

RECOMMENDER SYSTEMS

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PRIVACY THROUGH SOLIDARITY

PROFILING PRIVACY

USER UTILITY

MEDIATOR ACCOUNTS

SEARCH

RECOMMENDERS

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