

Staring Down the Database Reconstruction Theorem

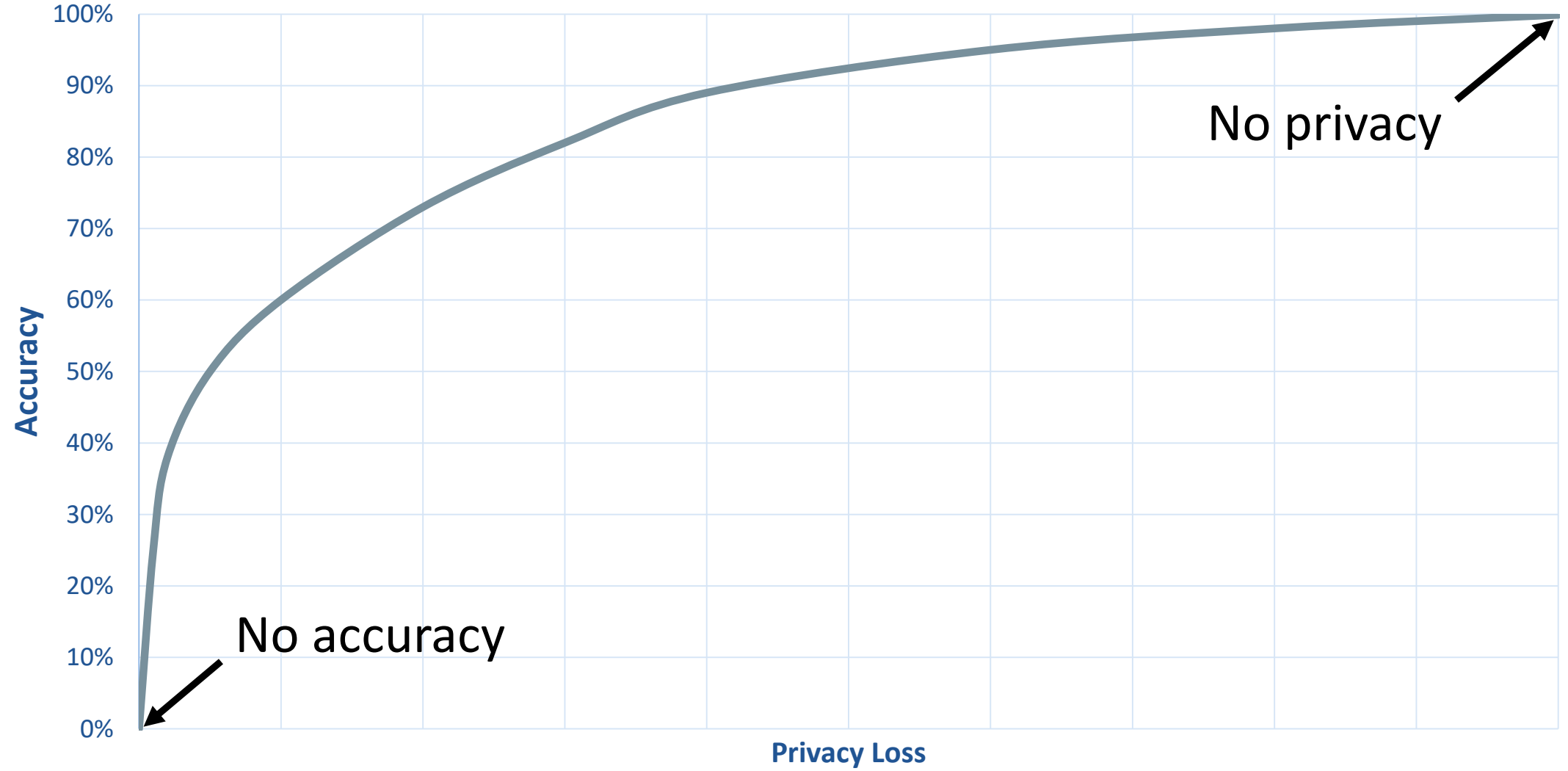
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American Association for the Advancement of Science
Annual Meeting Saturday, February 16, 2019 3:30-5:00

The challenges of a census:

1. collect all of the data necessary to underpin our democracy;
2. protect the privacy of individual data to ensure trust and prevent abuse.

- Too many statistics
- Noise infusion is necessary
- Transparency about methods helps rather than harms

Fundamental Tradeoff between Accuracy and Privacy Loss



Good science and privacy protection are partners

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Distance/Direction Analysis

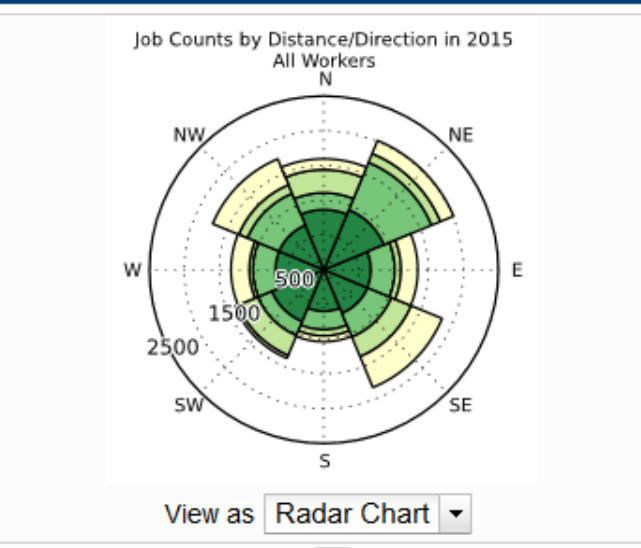
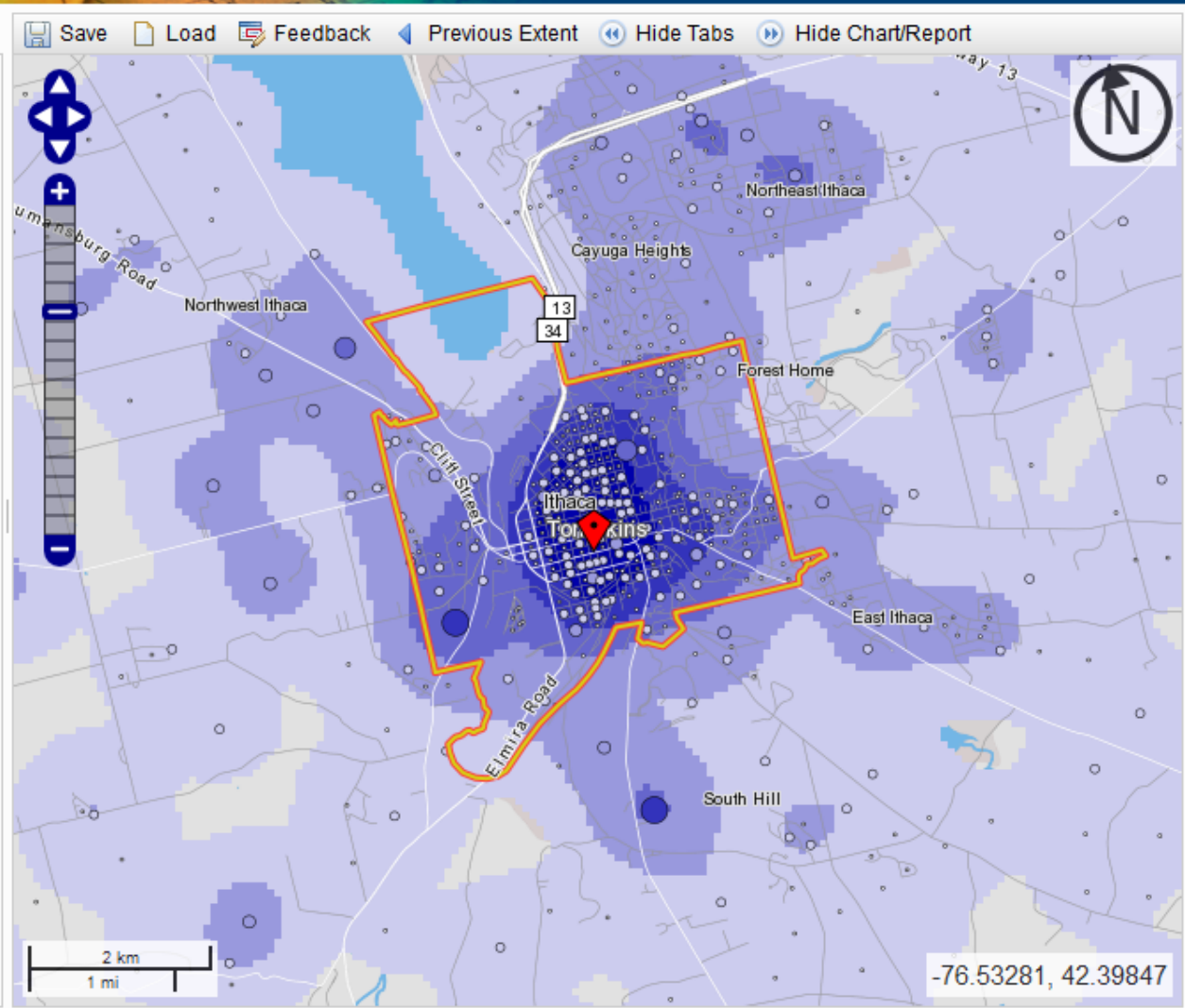
Work to Home

Display Settings
 Labor Market Segment: [All Workers](#)
 Filter: [All Workers](#)
 Year: [2015](#)

Map Controls
 Color Key: ☒ [Thermal Overlay](#)
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Legends
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Jobs by Distance - Work Census Block to Home Census Block

	2015	
	Count	Share
Total Primary Jobs	12,260	100.0%
Less than 10 miles	5,949	48.5%
10 to 24 miles	2,987	24.4%
25 to 50 miles	1,451	11.8%
Greater than 50 miles	1,873	15.3%

What we did

- Database reconstruction for all 308,745,538 people in 2010 Census
- Link reconstructed records to commercial databases: acquire PII
- Successful linkage to commercial data: putative re-identification
- Compare putative re-identifications to confidential data
- Successful linkage to confidential data: confirmed re-identification
- Harm: attacker can learn self-response race and ethnicity

What we found

- Census block correctly reconstructed in all 6,207,027 inhabited blocks
- Block, sex, age, race, ethnicity reconstructed
 - Exactly: 46% of population (142 million of 308,745,538)
 - Allowing age +/- one year: 71% of population (219 million of 308,745,538)
- Block, sex, age linked to commercial data to acquire PII
 - Putative re-identifications: 45% of population (138 million of 308,745,538)
- Name, block, sex, age, race, ethnicity compared to confidential data
 - Confirmed re-identifications: 38% of putative (52 million; 17% of population)
- For the confirmed re-identifications, race and ethnicity are learned exactly, not statistically

We fixed this for the 2020 Census by implementing differential privacy

Acknowledgments

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Thank you.

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More Background on the 2020 Census Disclosure Avoidance System

- September 14, 2017 CSAC (overall design)
<https://www2.census.gov/cac/sac/meetings/2017-09/garfinkel-modernizing-disclosure-avoidance.pdf?#>
- August, 2018 KDD'18 (top-down v. block-by-block)
<https://digitalcommons.ilr.cornell.edu/ldi/49/>
- October, 2018 WPES (implementation issues)
<https://arxiv.org/abs/1809.02201>
- October, 2018 [ACMQueue](https://arxiv.org/abs/1809.02201) (understanding database reconstruction)
<https://digitalcommons.ilr.cornell.edu/ldi/50/> or
<https://queue.acm.org/detail.cfm?id=3295691>
- December 6, 2010 CSAC (detailed discussion of algorithms and choices)
<https://www2.census.gov/cac/sac/meetings/2018-12/abowd-disclosure-avoidance.pdf?#>

Selected References

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