Staring Down the Database Reconstruction Theorem

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The views expressed in this talk are my own and not those of the U.S. Census Bureau.

The challenges of a census:

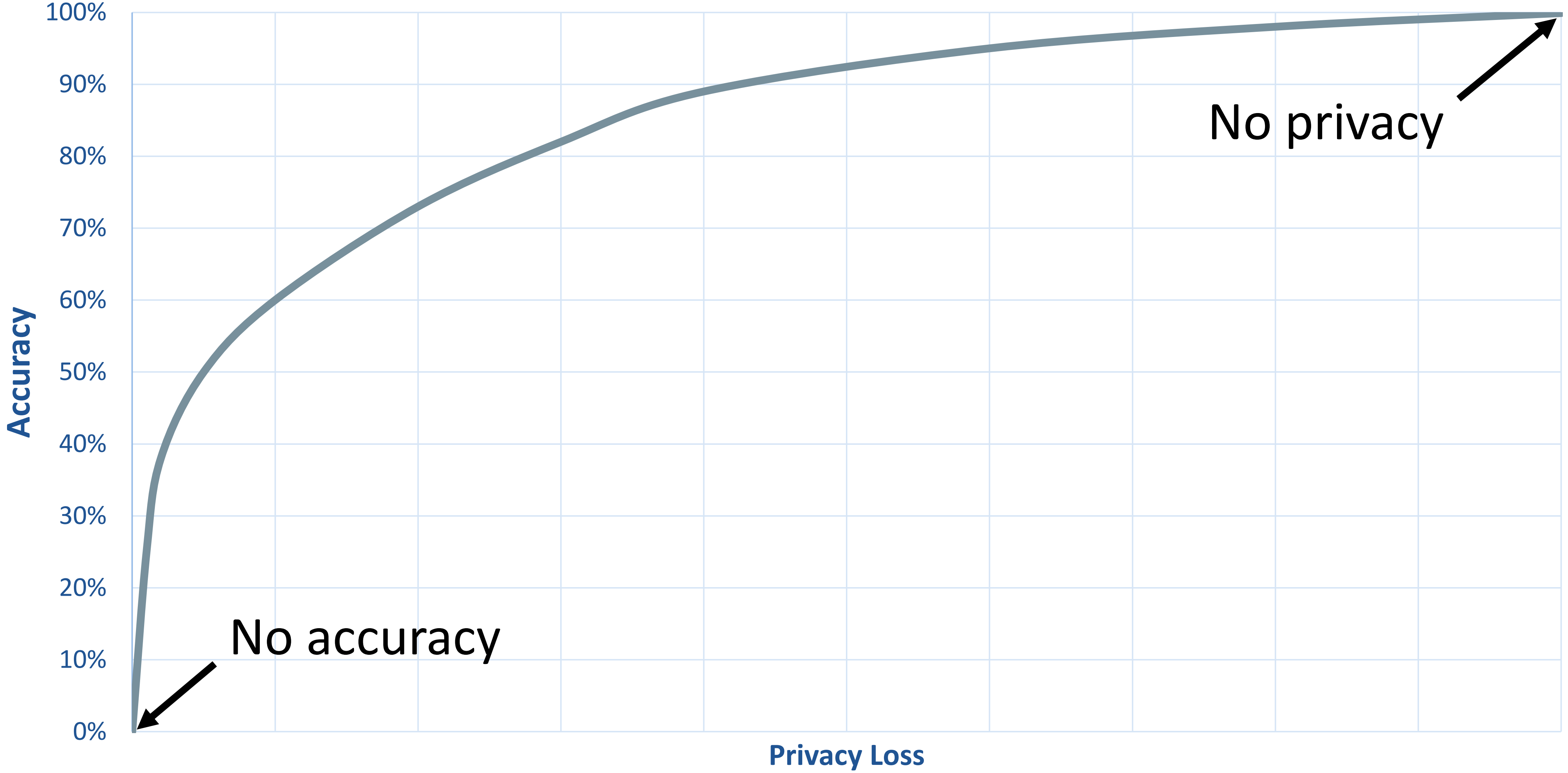
1. collect all of the data necessary to underpin our democracy;
2. protect the privacy of individual data to ensure trust and prevent abuse.

- Too many statistics

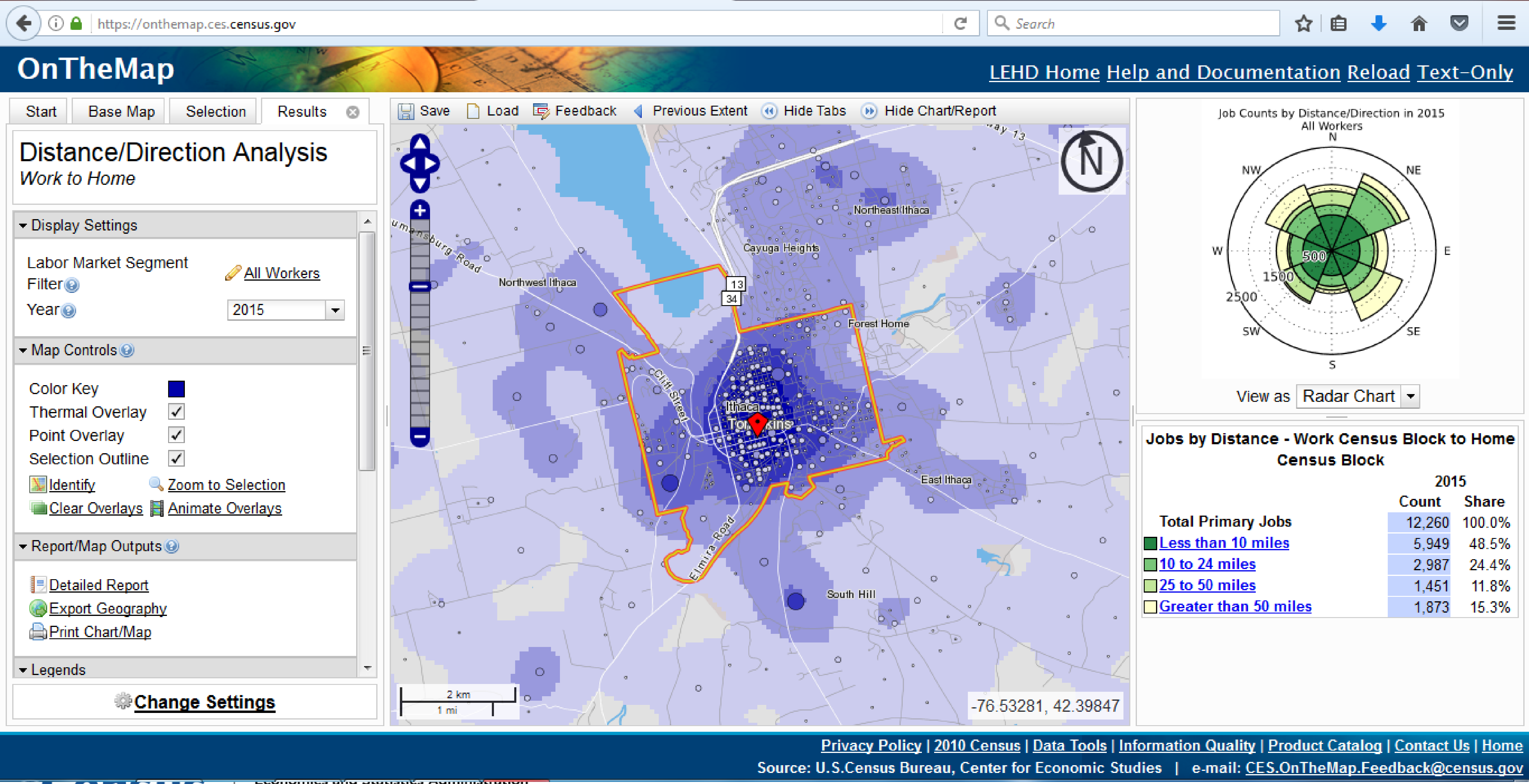
- Noise infusion is necessary

- Transparency about methods helps rather than harms

Fundamental Tradeoff betweeen Accuracy and Privacy Loss



Good science and privacy protection are partners



https://onthemap.ces.census.gov

OnTheMap

LEHD Home Help and Documentation Reload Text-Only

Start | Base Map | Selection | Results

Save | Load | Feedback | Previous Extent | Hide Tabs | Hide Chart/Report

Distance/Direction Analysis

Work to Home

Display Settings

Labor Market Segment Filter: All Workers

Year: 2015

Map Controls

Color Key

Thermal Overlay ☑

Point Overlay ☑

Selection Outline ☑

Identify | Zoom to Selection

Clear Overlays | Animate Overlays

Report/Map Outputs

Detailed Report

Export Geography

Print Chart/Map

Legends

Change Settings

Job Counts by Distance/Direction in 2015
All Workers

View as: Radar Chart

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%

Privacy Policy | 2010 Census | Data Tools | Information Quality | Product Catalog | Contact Us | Home

Source: U.S.Census Bureau, Center for Economic Studies | e-mail: CES.OnTheMap.Feedback@census.gov

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* (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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