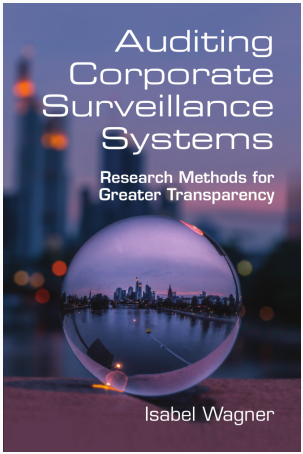
CHALLENGES AND OPEN ISSUES

Isabel Wagner

De Montfort University



OVERVIEW

- Need for more transparency, driven by rapid evolution of connected devices and businesses aiming for opacity
- Experimental audit studies have already increased transparency
- Challenges remain:
  - New methods
  - Open questions for existing systems
  - New systems, especially pervasive and embedded systems: IoT and smart cities

Methodological challenges

EXPERIMENT DESIGN

- Selection of input variable values
  - Varying one variable at a time while keeping others at baseline: insufficient to observe all effects
  - Need to apply fractional factorial or Latin hypercube designs[1]
- Selection of vantage points
  - Increasing regional differentiation, can only be observed via diverse set of vantage points
- Scope: often limited to convenient settings (e.g., Android, English language)
- Replication
  - Reproducibility of experiments is fundamental to scientific method
  - But: system under study is fast-changing black box
  - Publication of code not sufficient
  - How to attribute replication failures?

[1] D. C. Montgomery, *Design and Analysis of Experiments*, 9 edition. Hoboken, NJ: Wiley, Apr. 2019.

DATA COLLECTION

- How to collect data from encrypted traffic?
- How to collect data from closed systems?
- Interaction with websites/apps/devices
  - Needs to be realistic and automated, need to handle logins
  - Desktop: mouse movement, scrolling, keystrokes
  - IoT: unclear how to automate

- Measurement:
  - How to measure “radicalization” and “bias” without resorting to convenient proxy metrics?
  - How to measure functionality and functionality reduction of websites/apps?
- Extraction of response variables
  - Heuristics: need to understand characteristics and biases of existing methods (e.g., domain classification services)
  - Resolving domains to entities: current solutions patchy, lots of manual effort
  - JavaScript: how to deal with obfuscated, embedded JS, JS from multiple sources?
  - Machine learning: best way to collect, clean, label large-scale training data?

Open research questions

Open questions: corporate surveillance methods

- Interdependent privacy (multi-party privacy): actions of one user/information about one user leak information about other users[2]
  - Studied only for location privacy and genomic privacy so far
- Characteristics and prevalence of new tracking methods, e.g., new fingerprinting attributes
- Effect of vendor changes, e.g., Apple's app tracking transparency
- Ad targeting and delivery on other platforms (Twitter, Pinterest, LinkedIn)
- Wealth transfer enabled by privacy-invasive techniques

[2] M. Humbert, B. Trubert, and K. Huguenin, "A Survey on Interdependent Privacy," *ACM Comput. Surv.*, vol. 52, no. 6, 122:1–122:40, Oct. 2019. DOI: 10.1145/3360498.

OPEN QUESTIONS: WEB AND MOBILE SERVICES

- New types of web/mobile services are appearing regularly
- Third-party use by publicly owned services
- Dark patterns: prevalence, effects, countermeasures
- Privacy policies: client-side parsing and matching against user preferences
- Better countermeasures: ad/tracker/fingerprinting blockers

Transparency for smart cities

WHAT MAKES A CITY *SMART*?[3]

- City uses technology to:
  - improve quality/efficiency of services
  - improve citizens' quality of life
  - stimulate sustainable economic growth
- Many applications possible: smart mobility, utilities, buildings, environment, public services, governance, economy, health, and citizens
- Technologies: ubiquitous internet connectivity, smart cards, open data, sensing including participatory sensing, wearable and IoT devices, autonomous systems, intelligent vehicles, cloud computing
- Pervasive use of technology leads to surveillance potential
- Public-private partnerships: third-party surveillance potential
- Citizens cannot *opt out*

[3] D. Eckhoff and I. Wagner, "Privacy in the Smart City – Applications, Technologies, Challenges and Solutions," *IEEE Communications Surveys & Tutorials*, vol. 20, no. 1, pp. 489–516, 2018. DOI: *10.1109/COMST.2017.2748998*.

SMART CITY EXAMPLES (1)

- Hong Kong
  - Octopus card: smart card for public transport, payment, access to buildings
  - Privacy policy permits collection of user data and use for marketing
- Eindhoven
  - Nightlife street Stratumseind
  - Monitoring of noise levels, Wi-Fi tracking to de-escalate street fights
  - “Smart street” can deploy nudges (e.g., change lighting) or dispatch police officers
  - Data is processed on sensors so raw data is not stored
  - But: issues with surveillance in public spaces:[4] surveillance that allows profiling and singling-out restricts social/political participation

[4] M. Galič, “Surveillance, Privacy and Public Space in the Stratumseind Living Lab: The Smart City Debate, beyond Data,” *Ars Aequi*, pp. 570–579, Jul. 2019.

SMART CITY EXAMPLES (2)

- Toronto: planned redevelopment of Quayside neighborhood
- Sidewalk Labs: commercial partner to realize the project
- Alphabet owns Sidewalk Labs, aim to “reimagin[e] cities to improve quality of life”[5]
- Vision: ubiquituos sensing, Google Nest in every home/office, cameras in public spaces to “respond to data”
- Signs of trouble?[6]
  - Ann Cavoukian, former privacy commissioner of Ontario, CA, resigned from privacy consultancy role
  - “citing concerns that a privacy framework she developed is being overlooked”
  - “third parties might have access to identifiable data”
- May 2020: Sidewalk labs withdraws from project, citing Covid-19

[5] *https://www.sidewalklabs.com/*

[6] *https://globalnews.ca/news/4579265/ann-cavoukian-resigns-sidewalk-labs/*

TRANSPARENCY FOR SMART CITIES

- How are risks and rewards split between public and private partners?
- Does private partner claim ownership of collected data?
- City planners may lack awareness of privacy issues, susceptible to claims by private partners
- Challenges when studying smart cities
  - Bound to physical location: unlike IoT devices, cannot set up smart cities in the lab
  - Services may not be world-accessible
  - Difficult to access data flows
- Research partnerships with cities may be needed

Summary

OPEN QUESTIONS AND CHALLENGES

- Many opportunities for future work
- New methods
- Studies of new services
- Transparency for smart cities

ABOUT THIS SLIDE DECK

- These slides are designed to accompany a lecture based on the textbook “Auditing Corporate Surveillance Systems: Research Methods for Greater Transparency” by Isabel Wagner, published in 2022 by Cambridge University Press.
-
-
- Please leave this slide intact, but indicate modifications below.
  - Version 2022-04
  - Improved version for release on book website (Isabel Wagner)
- Updated versions of the original slide deck are available online: corporatesurveillance.org