# Auditing algorithms

Shuning Lu (Ph.D.)
Assistant Professor
Department of Communication
North Dakota State University

Email: shuning.lu@ndsu.edu
Twitter: @shuning_lu

# Today's agenda

**Morning:**

- Logistics
- Overview of algorithms auditing
- Algorithms auditing  tutorial

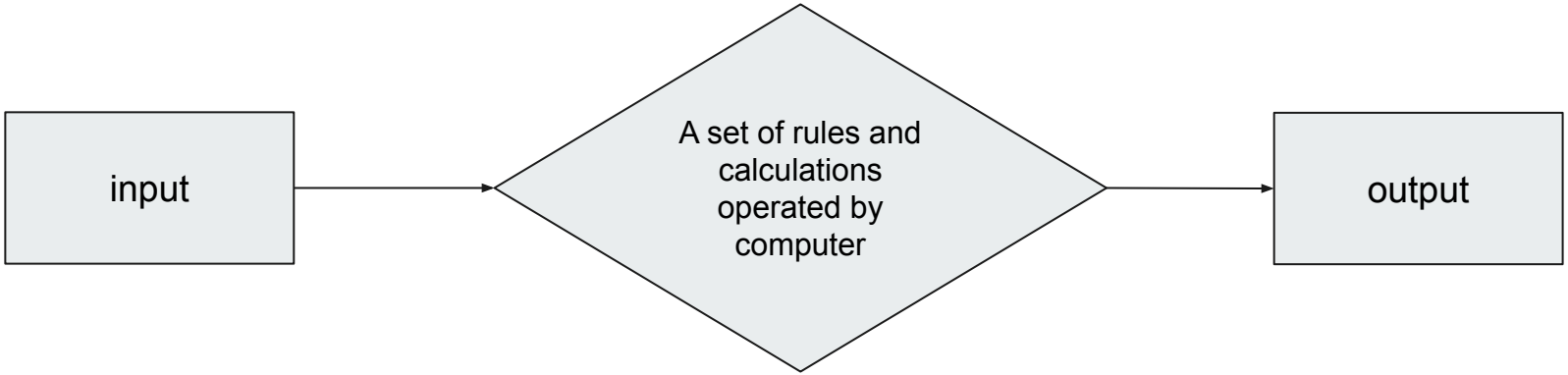
**Lunch break**

**Afternoon:**

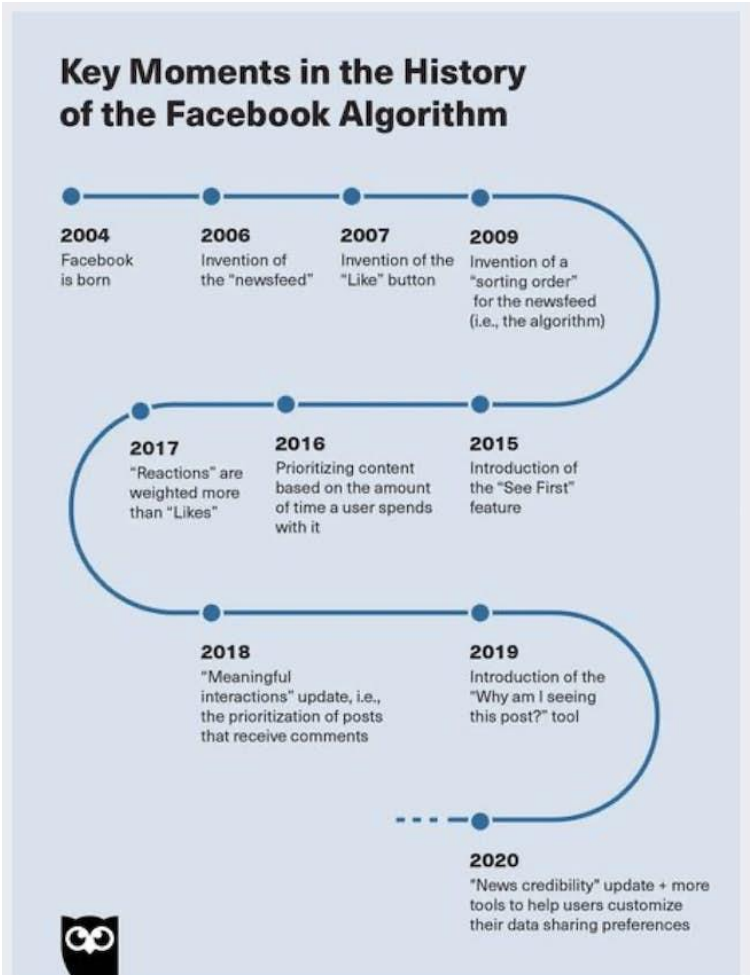
- Group activity & report

# What is algorithm?

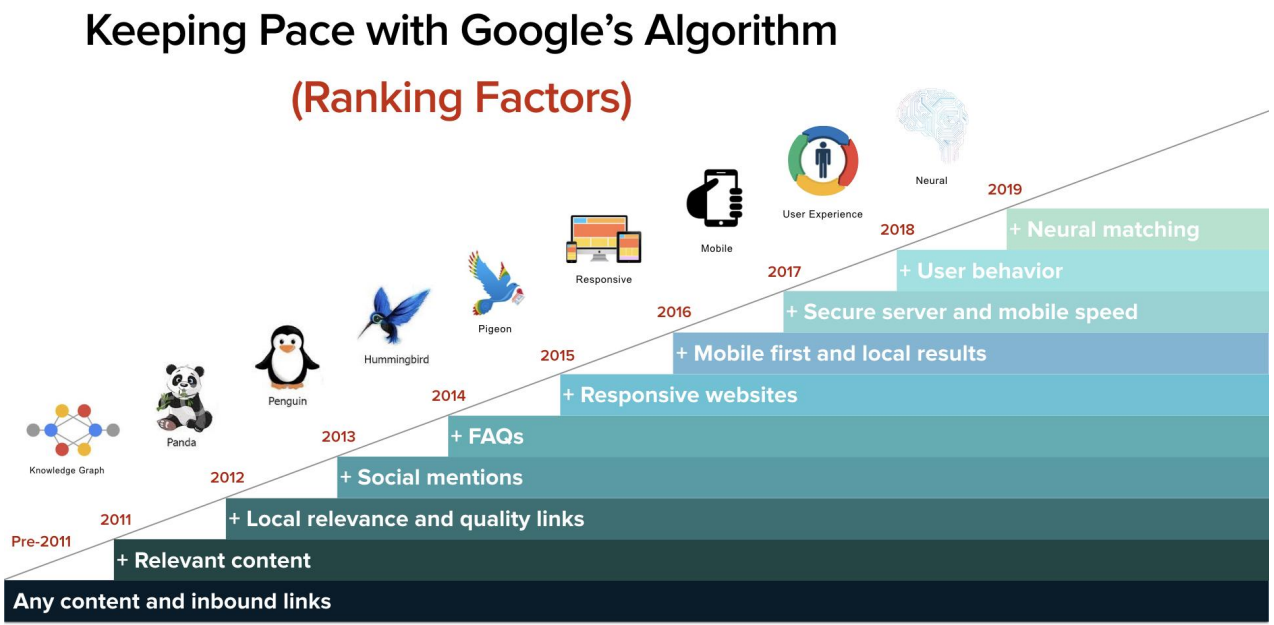
# What is algorithm?



# Meta (Facebook) algorithm



# Google algorithm



# Why auditing algorithms?

Public interest scrutiny

Hold (bad) algorithms accountable

# Why auditing algorithms?

make this technology more explainable, transparent, predictable and controllable

- by citizens, public institutions and also companies,
- either before the development of the system, during its development or a posteriori.

# Goals

The purpose of an audit is to

- Identify or anticipate errors, risks or threats (actual or potential).
- Outline a strategy for improving the algorithmic processes.

# What is algorithm auditing?

Broadly defined: a range of approaches to review algorithmic processing systems.

Narrowly defined: a method of repeatedly querying an algorithm and observing its output in order to draw conclusions about the algorithm's opaque inner workings and possible external impact

# Algorithm auditing as field experiment

| Field experiment | Algorithm auditing |
| --- | --- |
| Treatment | Query |
| Outcome | Results |

In natural, real-world settings.

# Legal and ethical compliance

A platform's Term of Services

Computer Fraud and Abuse Act

Researcher's own professional organizations' stances (e.g., IRB)

# Common domains of algorithm auditing

Employment (e.g., ads, ranking of candidates)

Media consumption (e.g., news recommendation & ranking, music streaming sites)

Sharing economy  (e.g., Airbnb rental platform, Uber matching)

Healthcare (e.g., information seeking, diagnose and care for patients)

Online market price and product pricing

# Auditing search engines: The case of Google

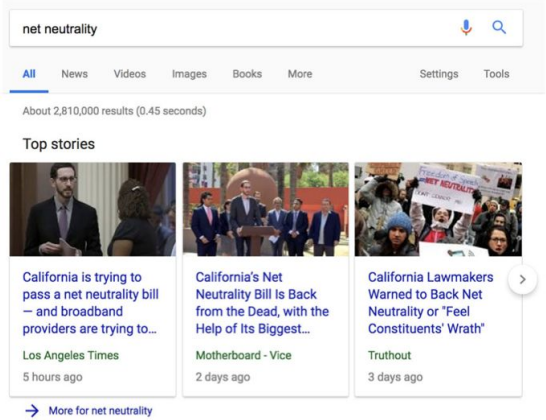



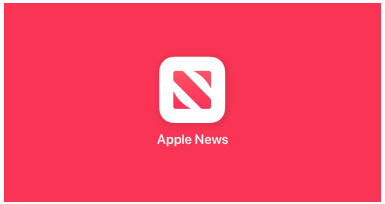

**Figure 1: The Google Top Stories Component shown for a query of "net neutrality".**

What they found:

- A high concentration of certain news sources
- a slight exaggeration in the ideological skew

Trielli, D., & Diakopoulos, N. (2019, May). Search as news curator: The role of Google in shaping attention to news information. In *Proceedings of the 2019 CHI Conference on human factors in computing systems* (pp. 1-15).

# Auditing news recommendation systems: The case of Apple News




Trending story section on the app

Crowdsourced audit: minimal content personalization

Sock-puppet audit: no location-based personalization

Comparison between human-curated Top Stories section and the algorithmically-curated Trending Stories section.

- human performed algorithm in source diversity and evenness.
- Algorithm featured more “soft news”, while editorial curation featured more hard news

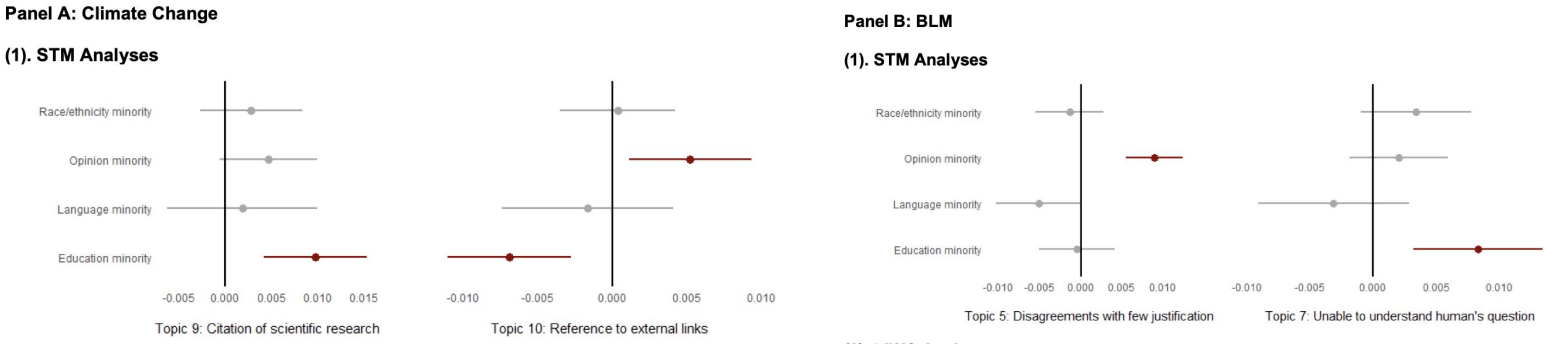
Bandy, J., & Diakopoulos, N. (2020, May). Auditing news curation systems: A case study examining algorithmic and editorial logic in Apple News. In *Proceedings of the International AAAI Conference on Web and Social Media* (Vol. 14, pp. 36-47).

# Auditing chatbots: the case of ChatGPT

ChatGPT

## evaluating equity in human-AI dialogues

examine how GPT-3 responded to different subpopulations on climate change and the Black Lives Matter (BLM) movement.




Chen, K., Shao, A., Burapacheep, J., & Li, Y. (2022). A critical appraisal of equity in conversational AI: Evidence from auditing GPT-3's dialogues with different publics on climate change and Black Lives Matter. *arXiv preprint arXiv:2209.13627*.

# How to conduct algorithm auditing?

Selecting a research topic

Selecting an algorithmic/platform to audit

Data collection

Data analysis

Communicating findings

Metaxa, D., Park, J. S., Robertson, R. E., Karahalios, K., Wilson, C., Hancock, J., & Sandvig, C. (2021). Auditing algorithms: Understanding algorithmic systems from the outside in. *Foundations and Trends® in Human–Computer Interaction*, *14*(4), 272-344.

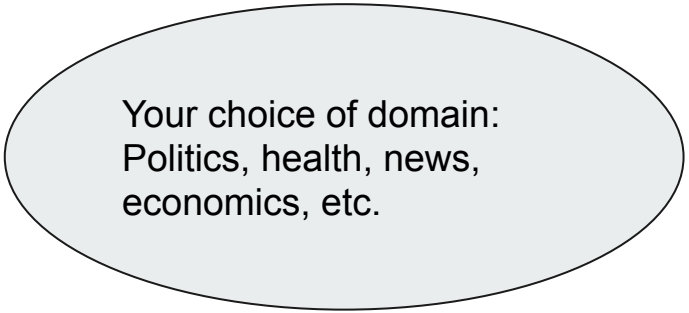
# Selecting a research topic

What do algorithms represent in general?

- the baseline/real world pattern
- the normative standard (diversity)

How do algorithms treat different users?

- output across users
- user experience



# Selecting an algorithm/platform to audit

Search engines

Social media news feed

Conversational AI

Image retouch app

...

# Research design

Cross-platform comparison

International differences

Temporal considerations

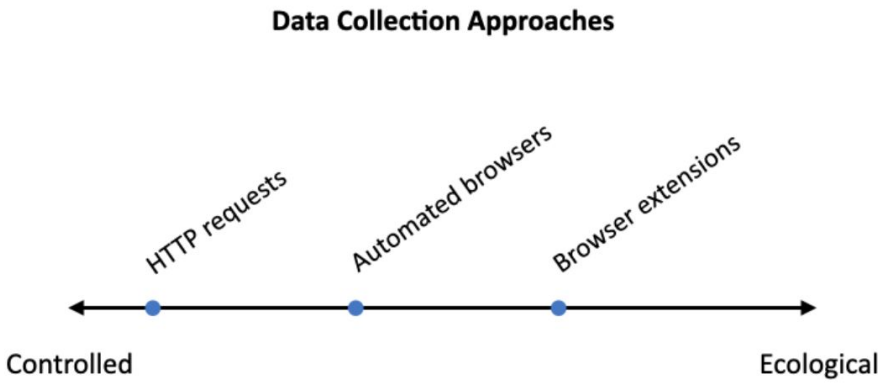
# Data collection

Human-based approach:

- researchers
- volunteers, crowdworkers

Automated approach:

- Automated browsers
- Socket puppet
- Web extension



# Data analysis

Quantitative content analysis

Qualitative thematic analysis

Computational text analysis

Statistical modeling

# Group activity Day 2

## Summary

An open-ended group exercise to propose and pilot an algorithm auditing study. You need to select a topic and platform for auditing, create a plan, report initial findings, and suggest a direction for future research.

## Activity

- Split into small groups and select person(s) to take notes and report group process/results.
- 13:40-13:50: brainstorm potential research ideas and select one to pursue
- 13:50-14:00: discuss data collection strategy (collect by yourself as pilot or use/combine advanced methods)
- 14:00-15:20: collect and analyze initial data to answer 1-2 key research questions
- 15:20-15:30: reflect on the strengths/limitations of what you have completed and ways to address
- 15:30-16:00: come back together as a large group and discuss projects at the end of the day