INTERACTION DESIGN

SHARP • ROGERS • PREECE

beyond human-computer interaction

5th Edition

Chapter 10

DATA AT SCALE

Goals

- Provide an overview of some potential impacts of data at scale

- Introduce key methods for collecting data at scale

- Discuss how to make data at scale meaningful

- Review the key methods for visualizing and exploring data at scale

- Introduce design principles for making data at scale ethical

What is data at scale?

- Data at scale is also known as big data
- It describes numbers, images of people, places and things, conversations, video recordings, sensor data, and so on
- Huge potential for solving problems
- But you must know how to collect, analyze, and communicate findings
- Also involves dangers to people's privacy

Collecting data at scale?

- Easy to collect masses of data, but then what do you do with it?

- What are the rules and policies that apply when collecting data about people?

- For example, tracking people's activities as they move through Heathrow and other airports for security reasons may also violate their privacy.

- Also scraping and crowdsourcing data, personal data collection directly and indirectly through devices, and sentiment and social network analysis.

Collecting personal data at Heathrow airport

Source: Mark Zakian / Alamy Stock Photo

Crowdsourcing data

Clicking on this link ([Common Raven](#)) will allow you to see how the abundance of raven changes during each week of the year. (Purple indicates high abundance and yellow indicates low abundance.)

Source: eBird

Citizen science and privacy
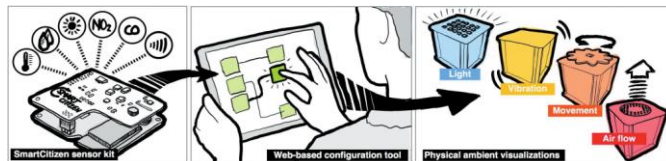

Source: iNaturalist.org

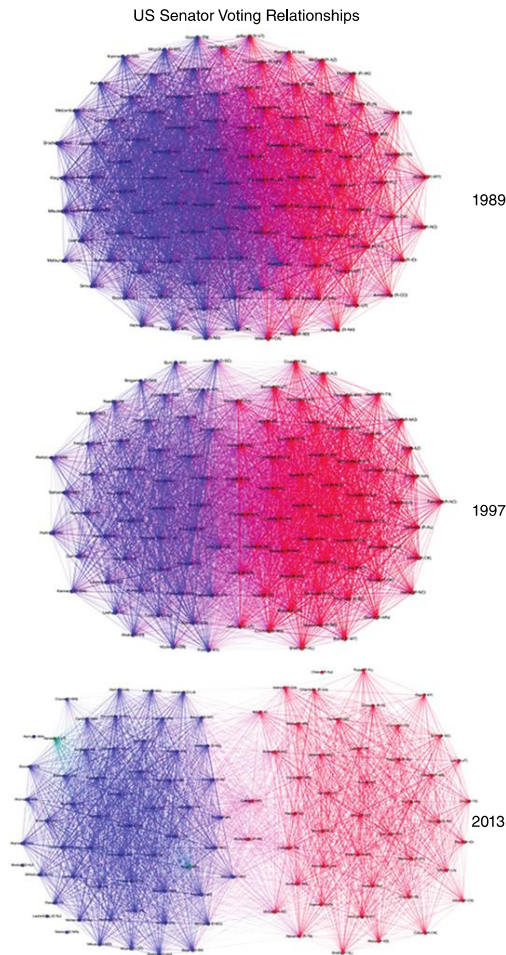# A human data design approach to sensing data

(a)

(b)

(c)

(a) Smart Citizen's dashboard and visualization

(b) A PhysiMove cube set up in a home

(c) The components of a Physikit tool kit

Source: (a) CitizenMe, (b) and (c) Yvonne Rogers

Social network analysis

US Senator Voting Relationships

1989

1997

2013

Source: [Forbes](#)

- US Senators voting relationships in 1989 (top), 1997 (middle), and 2013 (bottom)

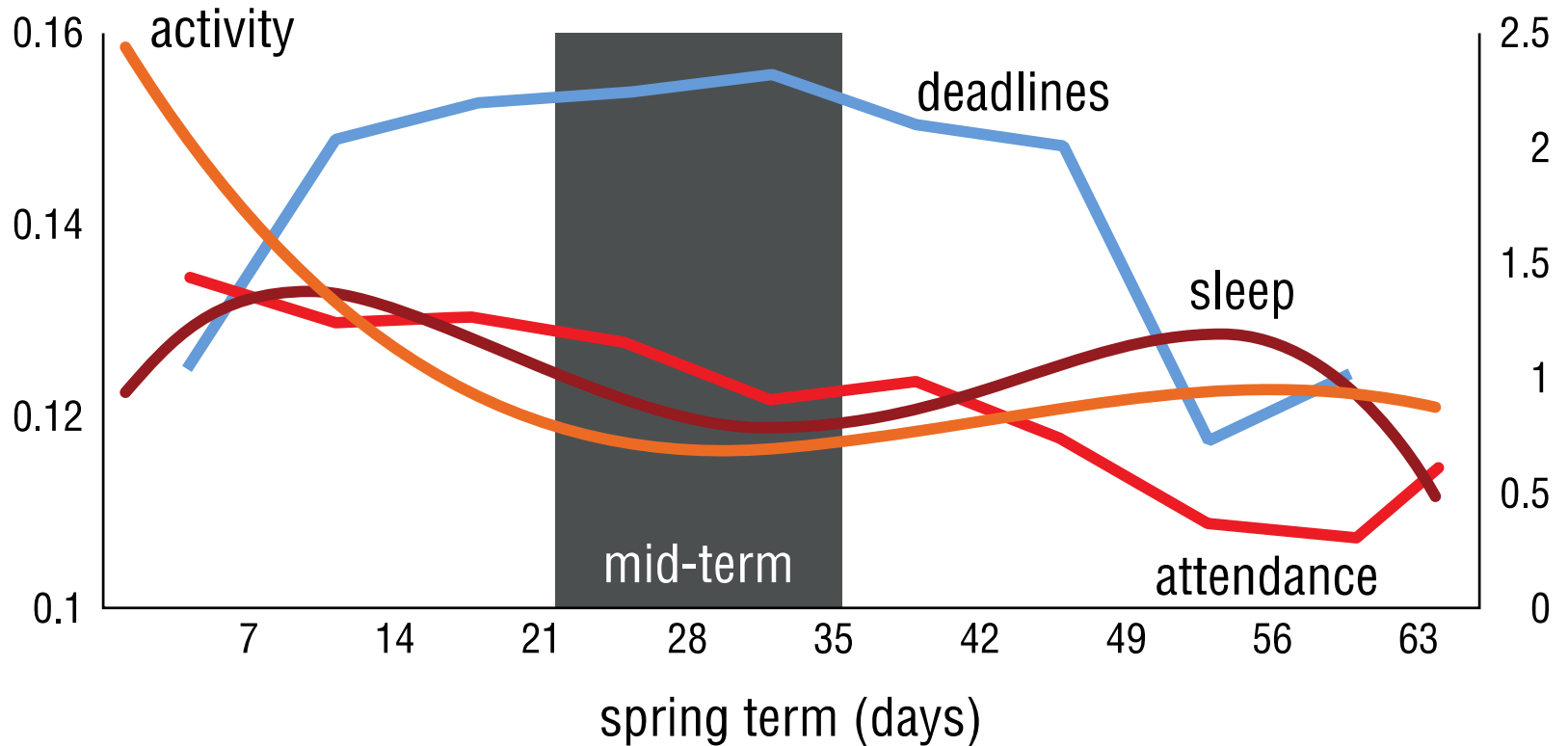- Red represents Republicans and blue represents Democrats

Probing people's reactions to personal tracking

This facility is proud to participate in the healthy building initiative.
Behaviour at these toilets is being recorded for analysis.
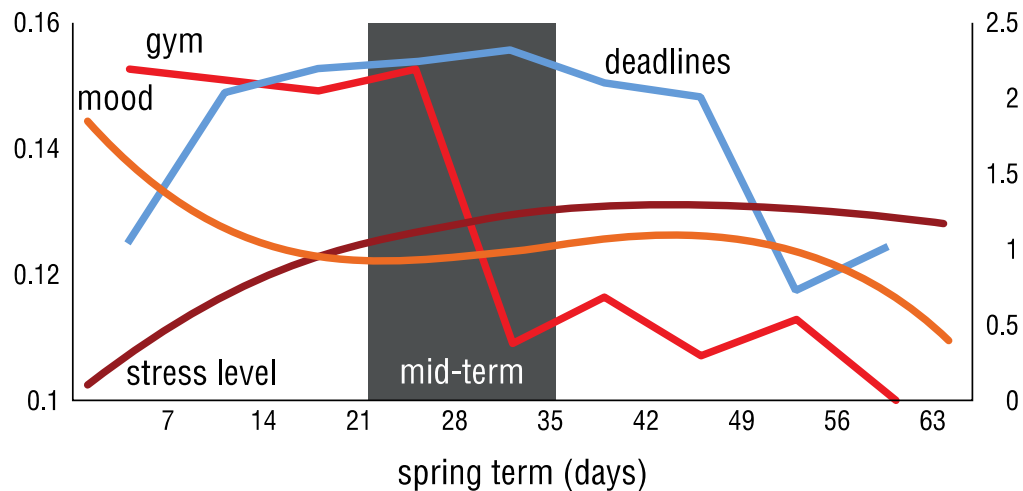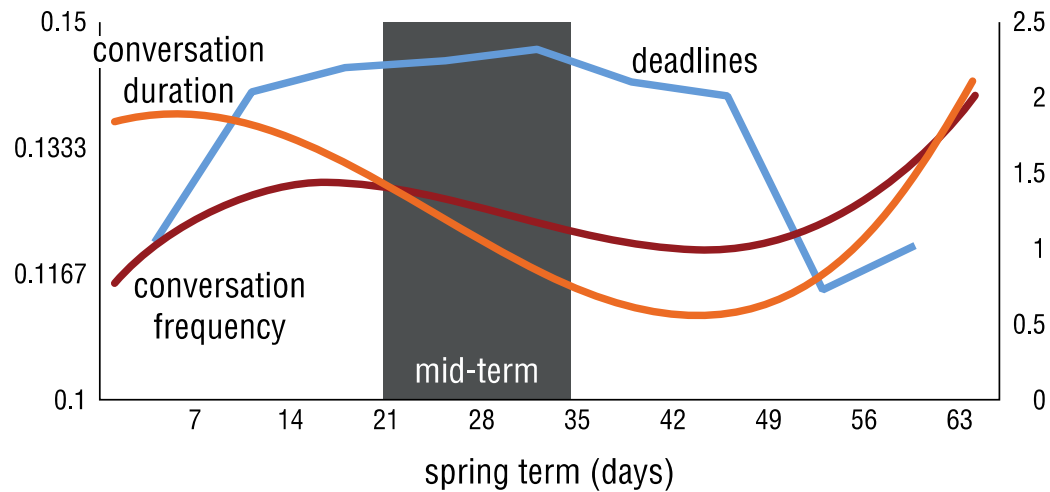Access your live data at **quantifiedtoilets.com**

Quantified Toilets
Every day. Every time.

● Recent anonymized random data feed

Time	Toilet ID	Sex	Deposit	Odor	Blood alcohol	Drugs detected	Pregnancy	Infections
09:39:34 AM	T205	female	205ml	neutral	0.061%	no	no	none
09:33:20 AM	T109	female	175ml	neutral	0.054%	no	no	none
09:23:07 AM	T706	female	185ml	nutty	0.000%	no	no	none
09:19:02 AM	T715	female	75ml	neutral	0.000%	no	no	none
09:18:07 AM	T704	female	100ml	neutral	0.000%	no	no	none
09:11:56 AM	T706	female	80ml	neutral	0.000%	no	no	none
09:07:09 AM	T211	male	150ml	neutral	0.001%	no	no	gonorrhea
09:05:30 AM	T312	male	250ml	neutral	0.001%	no	no	none
09:00:39 AM	T314	female	245ml	neutral	0.002%	no	no	chlamydia
08:57:22 AM	T107	male	160ml	neutral	0.000%	no	no	none

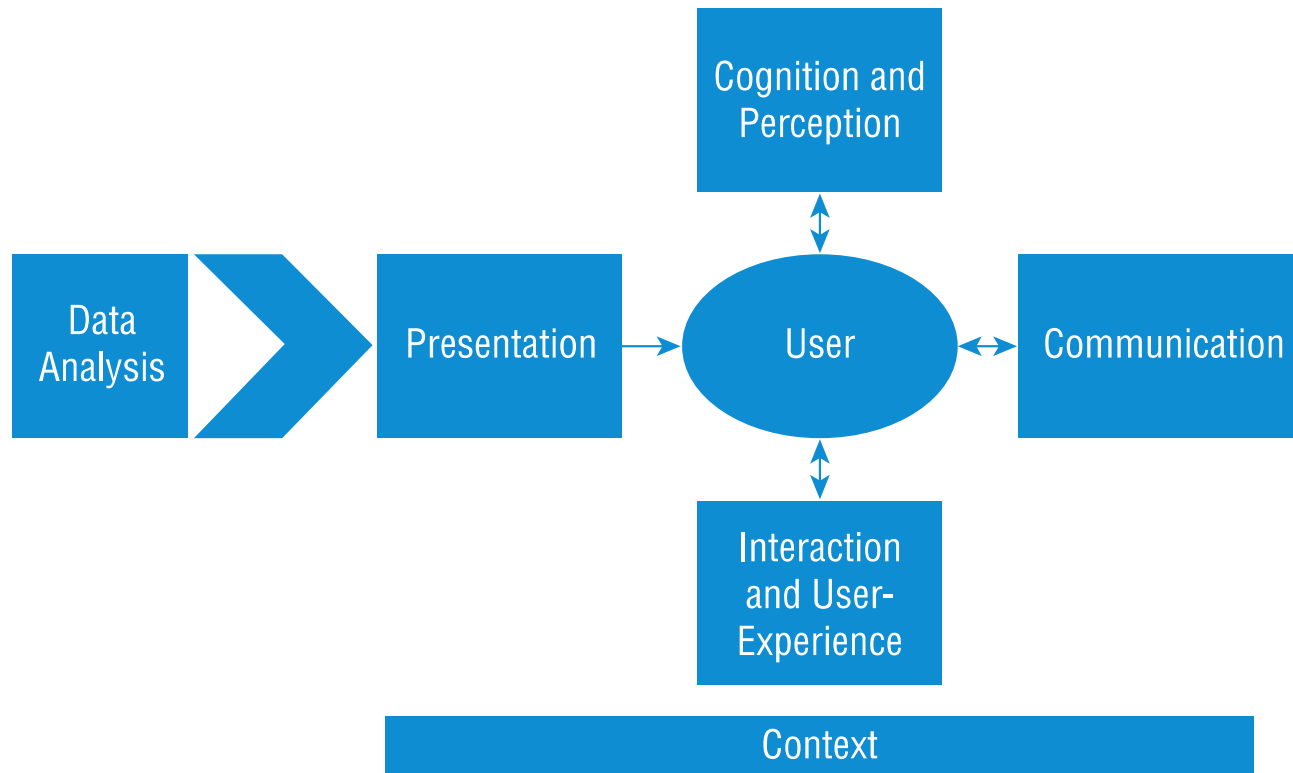Source: Courtesy of Quantified Toilets

www.id-book.com

Students' activity

Activity

Source: StudentLife Study

Visualizing and exploring data

A simplified path for data to be meaningful

Source: Used courtesy of Dr. Artur Lugmyr

Market map of stocks

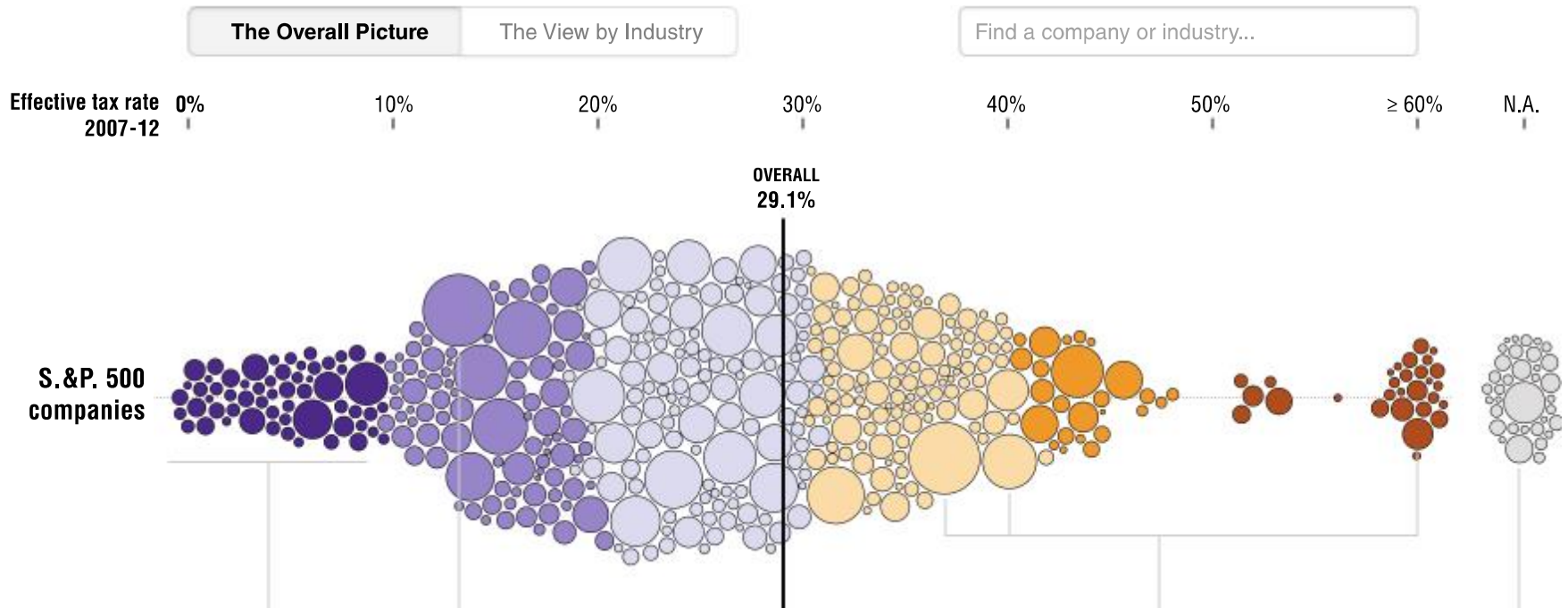# Visualization of different sounds including birds and insects

Source: Used courtesy of Oliver et al., 2018. Permission from ACM Publications.

Dashboard showing changes in sales information

Source: Zoho Analytics

Interactive graphic using D3

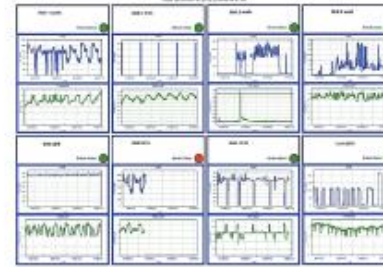*Source*: Reproduced with permission from PARS International

Exemplar dashboards
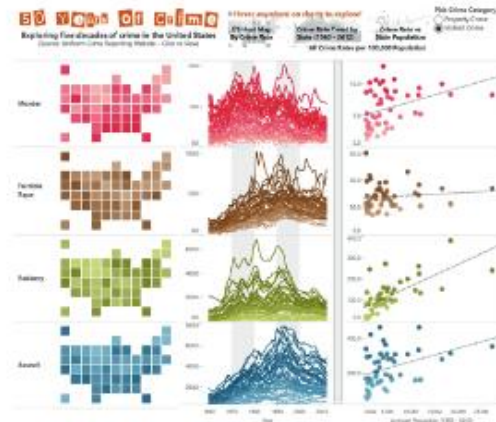

1 Strategic Decision-Making

2 Quantified Self

3 Static Operational
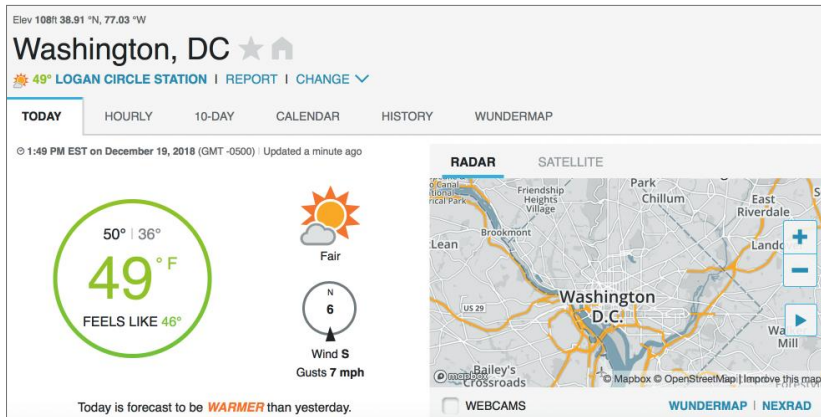
4 Static Organizational
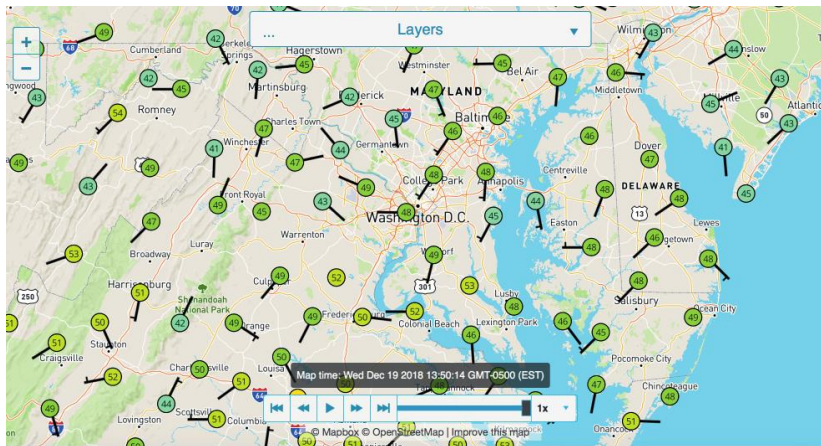
5 Operational Decision-Making

6 Communication

7 Dashboards Evolved

Source: Sarikaya et al., 2018. Graph 1. Reproduced with permission of IEEE.
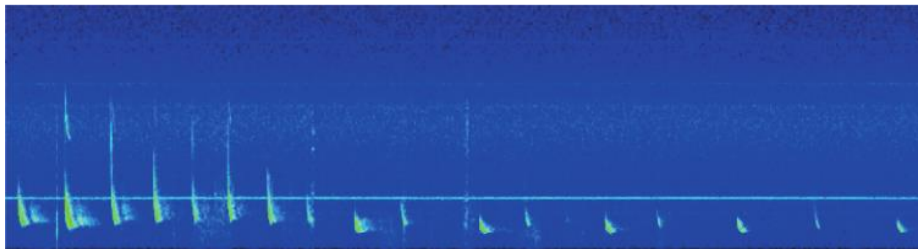
Weather data

(a)

(b)

(a) Actual weather data

(b) Wundermap of data from the same area at the same time

Source: <u>Weather Underground</u>

Two different visualizations of bat call data

(a)

(b)

(a) General visualization for the public
(b) Spectrogram for scientists

Source: (a) Used courtesy of Matej Kaninsky; (b) Used courtesy of Sarah Gallacher

Graphical display of average daily energy consumption for a building

Source: Yvonne Rogers

DeepCam's face-tracking software

Source: DeepCam

Data ethics principles (FATE)

Fairness: Is the treatment just and without favoritism or discrimination?

Accountability: Is the data accurate and correct?

Transparency: Are the decisions being made by a system visible?

Explainability: Can people understand the explanations provided by the system?

The goal of **FATE** is to make decisions made by computer systems just and fair.

Summary

- This chapter discussed how data at scale is collected, analyzed, and communicated.

- The data can be qualitative or qualitative.

- It comes from different sources, for example, sensors, social media, documents, and facial recognition data.

- Privacy is a big concern because data from different sources can be brought together to reveal patterns of behavior.

- The FATE frameworks suggests ethical principles to guide UX design: **F**airness, **A**ccountability, **T**ransparency, and **E**xplainability.