Old Title: Data and AI and Society

Resources and Dangers and Opportunities

Kenneth W. Regan

(Includes some material from Kenny A. Joseph and some other past CSE199 units.)

CSE199, Fall 2025

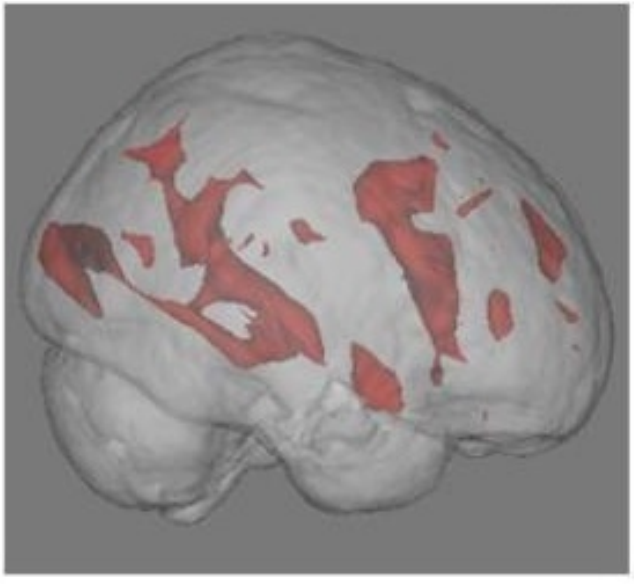
New Title: Data and AI and Society
Resources and Dangers and Opportunities

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(Includes new material about how LLMs work)

CSE199, Fall 2026

Main Problem...



THIS IS YOUR BRAIN



THIS IS YOUR BRAIN ON THE INTERNET

Any Questions?

(Brain scan source, 1987 PSA source)

...And Problems

1. How has the advent of the Internet altered—
   - —our ecology of personhood?
   - —our communal relationships?
   - —opportunity and equity in society?
   - —our cognitive functions?
   - —our organization of life experiences?
2. In an Ocean of Data, will we develop "gills"?
3. How much Greater than Gutenberg?
   - The *Time–Life Top 100 Events of the Last Millennium* placed Gutenberg's circa-1450 invention of the printing press at #1.
4. What ingredients and tools have enabled erecting all of this in only the past 30+ years?
5. **What tools enable us to understand it?** We'll cover some.
6. Will **AGI** (Artificial/Automated General Intelligence) have even greater millennial impact? AGI is arguably already here in coding and mathematics...

Picking Up the Gutenberg Theme

- **Books** existed long before the printing press.
- The scroll form dominated until the codex was invented around the time of Julius Caesar.
- The Herculaneum scrolls were the private library of the Roman poet/philosopher Philodemus and heirs before Mt. Vesuvius carbonized them in 79 CE.
- In what senses were those books "Brain Extenders"?
- As opposed to **Cognition Extenders** as we have today...
- Midway: **Imagination Extenders**. (The writing of *Don Quixote* circa 1605 is #96 on the Time–Life list.)
- One major impact of Gutenberg's mass democritization of affordable books was spreading political and cultural ideas in waves.
- AI will mass-democritize intelligence—for how much good and how much ill?

Brain Extenders (next 2.8 slides unchanged from 2024!)

- Not just Facts and Ideas and Data but also **Computation**.
- Compare using GPS to using a physical map...
- **[Discuss "8 Hours Without Internet" essays.]**
- I [KWR] deal with a special kind of "brain extension": catching those cheat at human chess games by illicitly accessing computer input on which next move to make.
- Since Deep Blue defeated Garry Kasparov in 1997, computers have grown to be far better than us at finding the *best next moves*.
- Large Language Models such as **ChatGPT** operate by finding the *best next words*.
- Do we already invest them with **personhood**?
- Will they—and other forms of **AI** in general—soon supersede us?
- Now: Elon Musk's **Neuralink** brain implant as used to play chess.

The Global Brain

- E.M. Forster, 1909 short story "The Machine Stops."
- Arguably a critique of H.G. Wells's 1905 novel *A Modern Utopia*.
- **Dystopian sci-fi**: humanity forced to rely on a giant machine regulating an underground biosphere and all aspects of life.
- **Actual reality**: the July 19, 2024 CrowdStrike Crash.



Low-Level Foundations

- The root cause of the Crowdstrike crash was **an attempted read from a null pointer** in C++ code.
- We will see other low-level bugs that caused famous breaches.
- "No Code" Software Development is not-here-yet and limited.
- Our existing code base is code-based anyway.
- Analogy: Venice was founded on about 10 million tree logs that were pile-driven into Adriatic Sea shallows.
  - Engineers of 1,100 years ago knew logs wouldn't rot in that water.
  - But Venice has other vulnerabilities that the tides make inroads on.
- Does Code Rot? Does it slowly sink?
- Your CS education will show how to build systems from the ground up...but we will evermore need to protect them from the ground up.
- A spring tide of AI is coming, able to do **zero-day exploits**.

Major Outages Since 2024

- Amazon Web Services Outage 10/20/25: Affected TopHat for this course, but recovered within the class period.
- Nov. 2025 Cloudflare Outage. Affected ChatGPT too.
- Partial recurrence on 12/5/2025.
- Verizon Outage 1/14/26. Google Maps/Directions stopped working mid-drive on my Verizon phone.
- Lesser-scale outages are not rare: see this for July 2026.
- August 2026 scorecard.

2023 movie Leave the World Behind: show clip 1, clip 2.

Caused by cyberattack in film, can same be caused by rogue AI agents?

Closest occurrence: 2026 OpenAI–HuggingFace Attack.

Other Big News—In Mathematics

- Sept. 2024: AI cannot count the number of r's in "strawberry."
- Elementary mistakes in simple CSE439 quantum circuit problems.
- Sept. 2025: Better, but still not able to do HWs.
- Dec. 2025: Passed hallucination test in this lecture. Gave me **proof of impossibility** of a quantum circuit challenge problem using Gaussian number fields.
- Feb. 2026: Gemini able to do my CSE396 TopHat questions in one click.
- May 2026: Able to do not only my quantum HW problems but also John Preskill's.
- Aug. 2026: OpenAI Astra solved ten open problems.
- Then new Aeon model solved a Millennium Prize Problem.
- Quite the opposite of this Musk and Coding Meme.

AI and Machine Learning

Alan Turing: Besides his WWII work on the Enigma machine (featured in the movie *The Imitation Game*) and **Turing Machine** theory of computation in his 1936-38 PhD thesis under Alonzo Church, he is considered the **founder** of Artificial Intelligence.

The **Church-Turing Thesis** is primarily stated in terms of the class of *computable functions*, but here is Turing's angle:

> **Anything that human beings can consistently deduce or classify can also be achieved by computers acting alone.**

The **Turing Test** involves computers trying to be indistinguishable from humans in ordinary life communications and transactions.

Turing All the Possibilities

> TP: If it is easy for humans then it will soon be easy for computers.

Defied by a CAPTCHA: "**C**ompletely **A**utomated **P**ublic **T**uring test to tell **C**omputers and **H**umans **A**part"

- Vision tasks hard for computers but easy for us. Fortmeyer Tweet
- Too breakable? RECAPTCHA uses a different principle.

Also defies the logical **contrapositive** of Turing's Principle:

> If it is really hard for computers then it should be hard for humans.

What we fear when worrying that AI will take away our jobs is:

> Stuff that is hard for humans but easy for computers.

The logical **converse** of Turing's Principle acts as a brake, however:

> If X is hard for humans—insofar as we can't consistently agree on answers—then X is hard for computers too.

Machine Learning (ML)

> The act of modifying a system or algorithm A via interactions with examples and other data so that A can emulate (and/or predict) the interactions without any more data.

Your Brain is Included—then this is just called "learning." **Some examples:**

- Building a **classifier**: able to distinguish pictures of cats, for instance.
- **Clustering analysis:** infer associations from nearness in "parameter space."
- These and similar learning tasks can be automated using **neural nets**.
- Using multiple **layers** of neural nets gives **deep learning**.

Will Extinction Be Academic? (old slide)

- https://rjlipton.wpcomstaging.com/2023/06/08/human-extinction/
- **More present danger, IMHO, is uncritically accepting answers from AI.**
- Besides human demise, will AI cheating make academia extinct?
- Scott Aaronson article including his work on **watermark** cheating detection. Quote: "[ChatGPT's] only goal or intention in the world: to predict the next word."
- Two good articles by Stephen Wolfram on how ChatGPT works.
- Tag line at the top: "It's Just Adding One Word at a Time."
- Analogy to "find the best next move" in chess.
- Indeed, the architecture has affinity to AlphaZero.
- This *may* foster adapting my chess model for a "simple frequentist" kind of cheating detection.

Extra: How Much Data Is There?

- That is, How Big Is the Internet?
- World Wide Web Size.
  - One **terabyte** = 1,000 **gigabytes**.
  - One **petabyte** = 1,000 **terabytes**. "**Big Data**"
  - One **exabyte** = 1,000 **petabytes**.
  - One **zettabyte** = 1,000 **exabytes**.
  - Next level is called **yottabyte**.
- Google now holds about 15 exabytes. Oops—10? OOPS—just 5??