SEIS 764 Artificial Intelligence

Introduction to Artificial Intelligence

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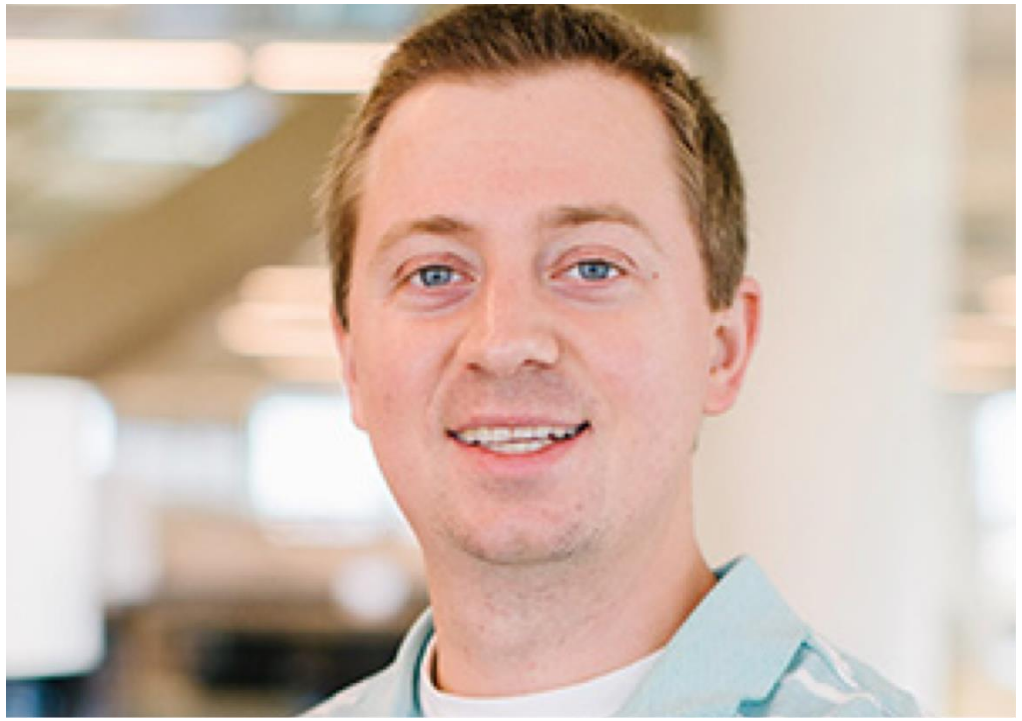
Introduction



- Adjunct Professor of AI @ University of St Thomas & University of San Diego
- Director of Advanced Analytics & Insights @ WinField United
- B.S @ MIT *(Biology)*,Ph.D @ UCSF *(Biophysics)*
- *I've spent the bulk of my career building data science/AI teams & tying technical work to business value*

Syllabus

Grade Evaluation:

- Assignments: **30%**
- Quizzes**: 30%**
- Exam1: **20%**
- Exam2: **20%**

Grading Scale:

In accordance with departmental grading policies, there is no "**D**"

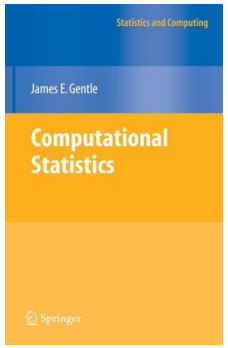
A: 94% or higher
A-: >= 90% and < 94%
B+: >= 85% and < 90%
B: >= 83% and < 85%
B-: >= 80% and < 83%
C+: >= 75% and < 80%
C: >= 70% and < 75%
C-: >= 65% and < 70%
F: < 65%

Course Outline (subject to change)

Lecture	**Date**	**Topic**
Lecture 1	February 3	Introduction to artificial Intelligence
Lecture 2	February 10	Neural networks from scratch
Lecture 3	February 17	Convolutional Neural Networks **(Quiz 1 due)**
Lecture 4	February 24	Overfitting & transfer learning **(Hw 1 due)**
Lecture 5	March 3	Recurrent Neural Networks **(Quiz 2 due)**
Lecture 6	March 10	Natural Language Processing: Part I (**Hw 2 due)**
Lecture 7	March 17	**Exam One**
No Class	March 24	
Lecture 8	March 31	Natural Language Processing: Part II
Lecture 9	April 7	Transformers **(Hw 3 due)**
Lecture 10	April 14	Large Language Models: Part I **(Quiz 3 due)**
Lecture 11	April 21	Large Language Models: Part II **(Hw 4 due)**
Lecture 12	April 28	AI Agents **(Quiz 4 due)**
Lecture 13	May 5	*Introduction to AI careers* **(Hw 5 due)**
Lecture 14	May 12	**Exam Two**

So about ChatGPT…

- Always follow policy, UST or otherwise
- In practice, ChatGPT is a helpful "idea starter"…that's it
- Think of Generative AI like a calculator
  - At first: *you need to learn how to do things manually*
  - Later: *you can (and should!) use ChatGPT as a resource*



What is AI?

Artificial Intelligence is the study and construction of computational agents that act intelligently

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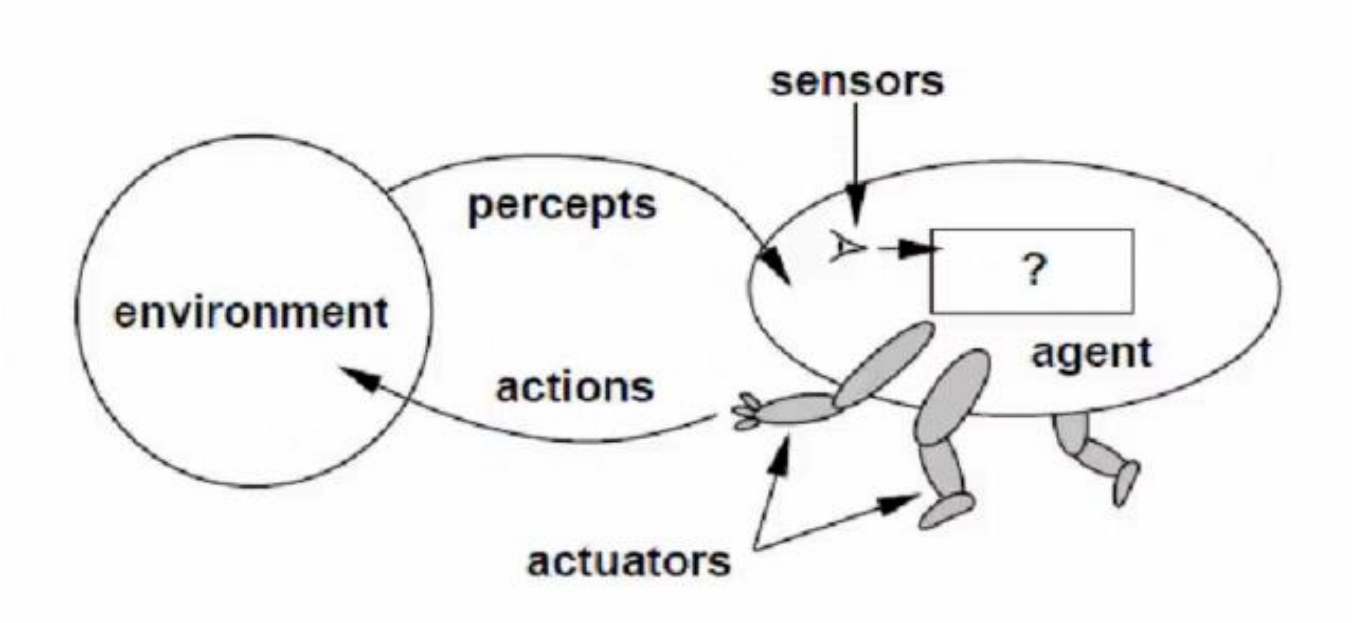
What is an agent?



An agent is anything that can:

1) Perceive its environment through sensors

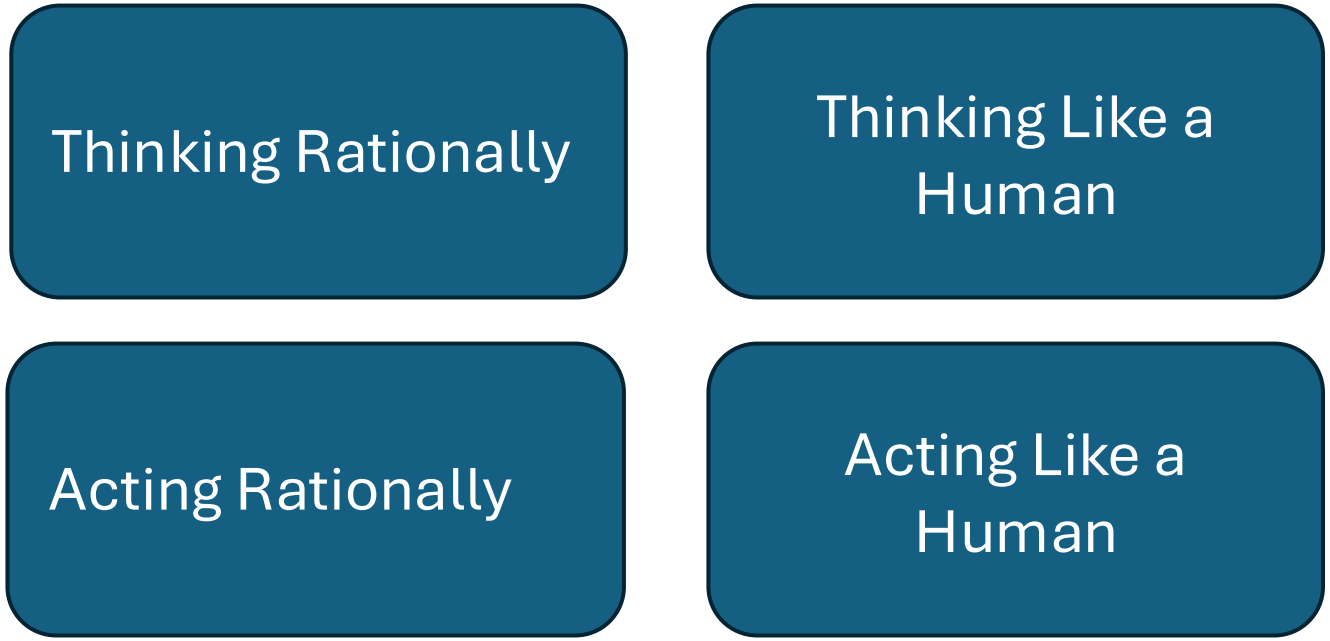
2) Act on that environment via effectors/actuators

How do we define “intelligence”?

Thinking Rationally	Thinking Like a Human
Acting Rationally	Acting Like a Human

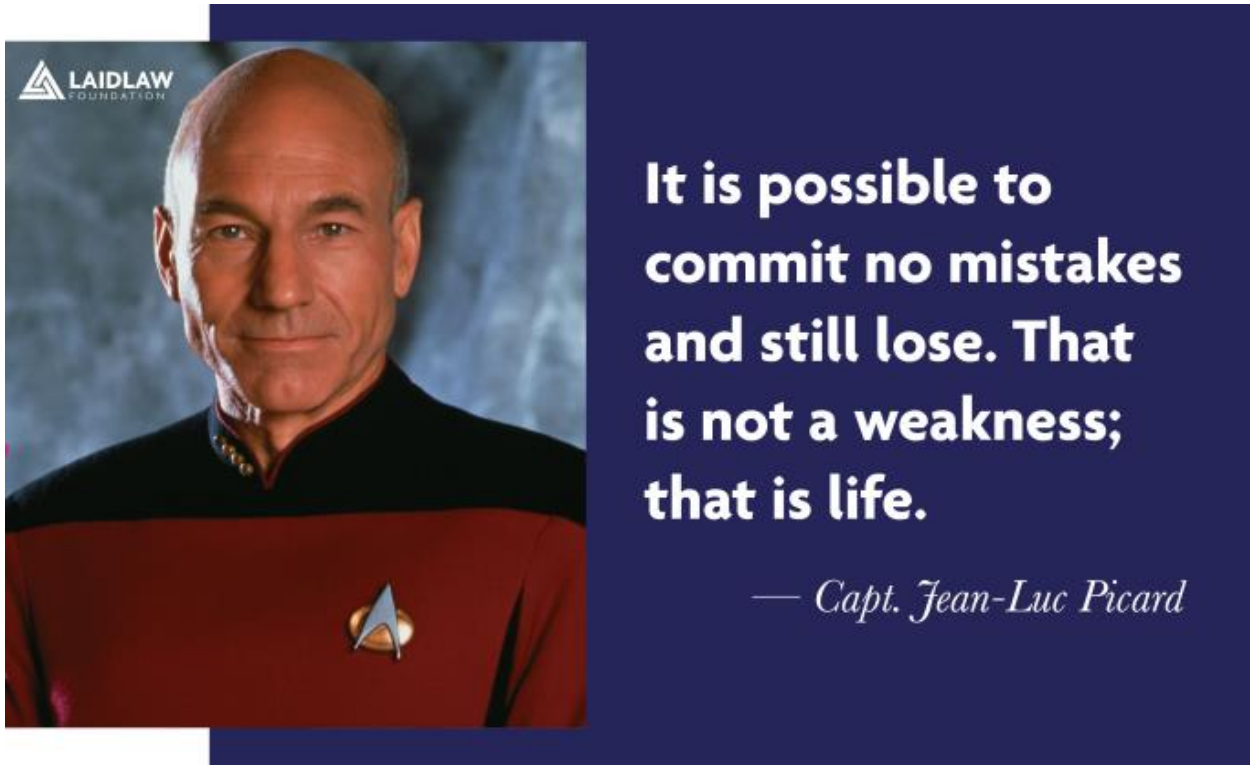
Rationality: doing what maximizes the expected outcome given current information

How do we define “intelligence”?



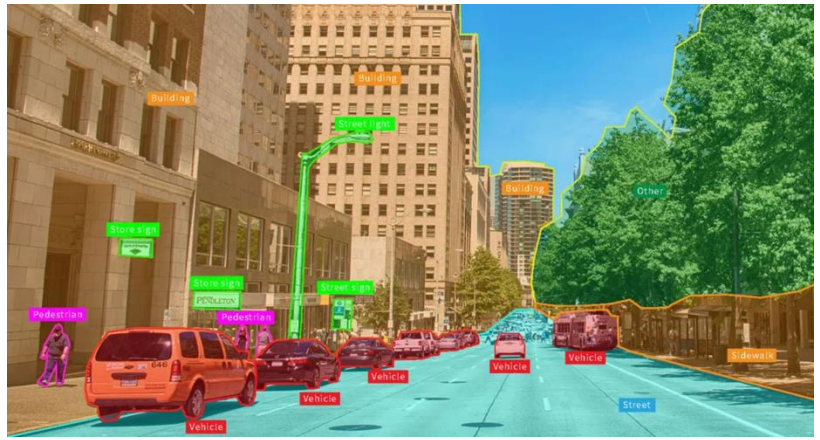
Rationality: doing what maximizes the expected outcome given current information

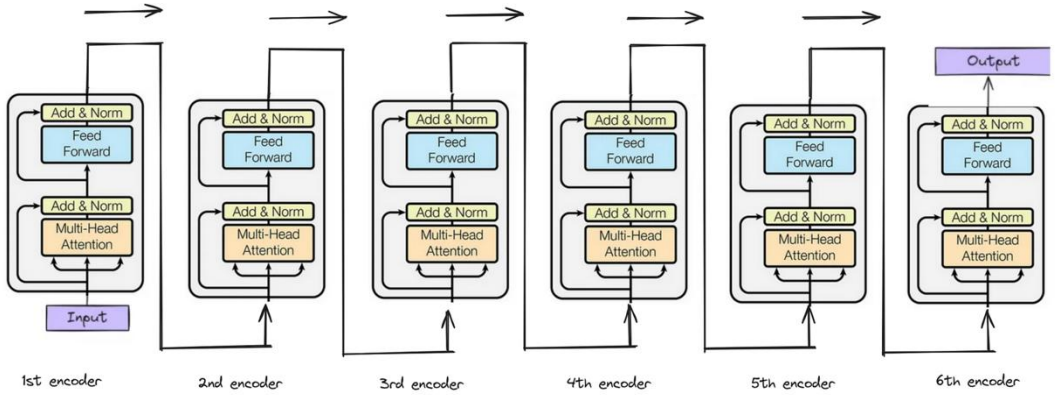
How do we define “intelligence”?



Rationality: doing what maximizes the expected outcome given current information

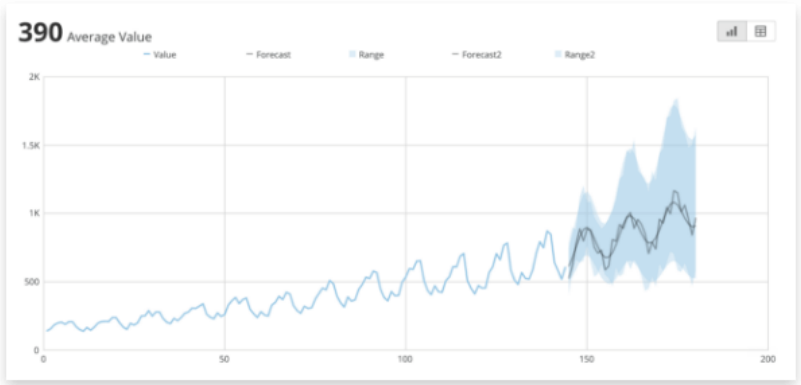
AI is both digital and physical



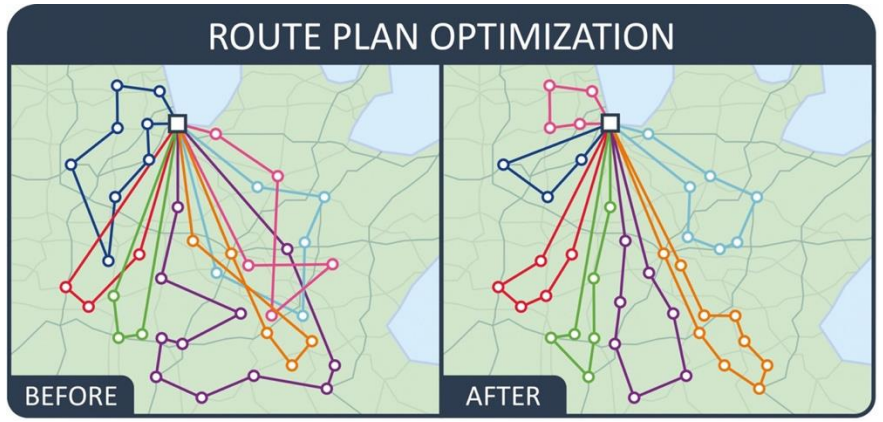


Applications of AI: Decision-Making

Diagnosis

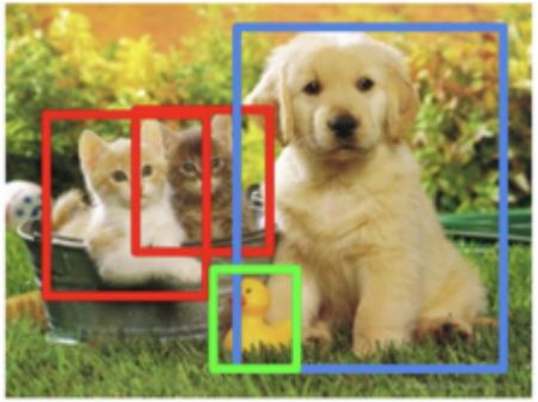


Forecasting

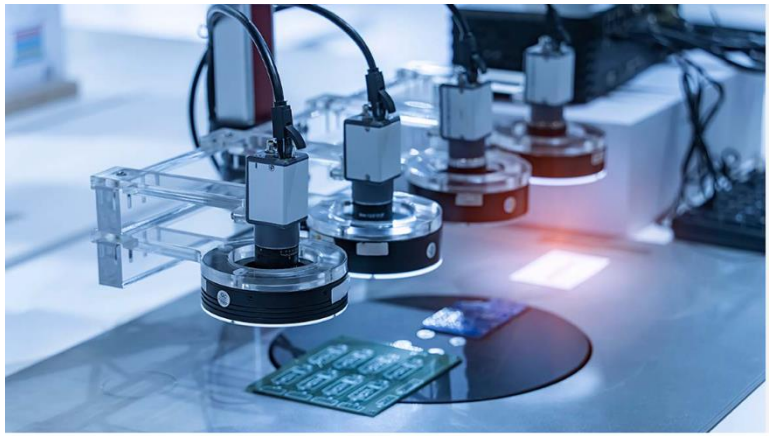


Travel Planning

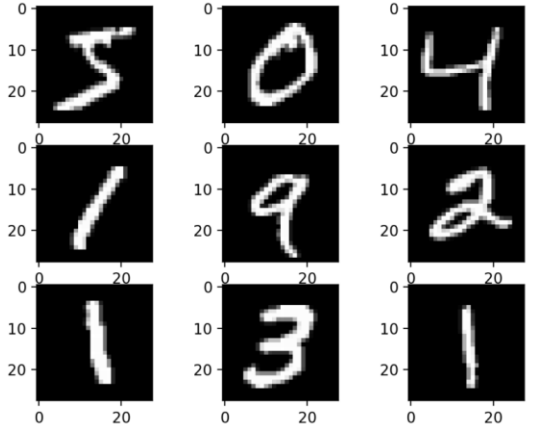
Applications of AI: Computer Vision



Object Detection



Quality Control

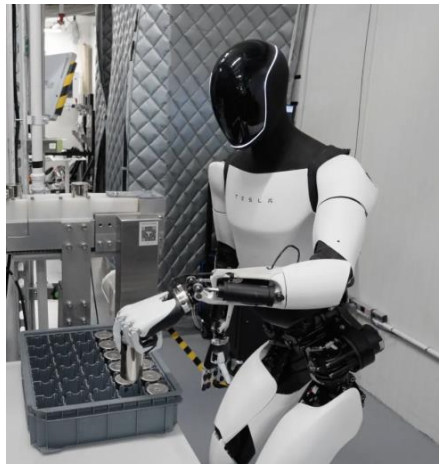


Handwriting Recognition

Applications of AI: Robotics

Self-driving cars

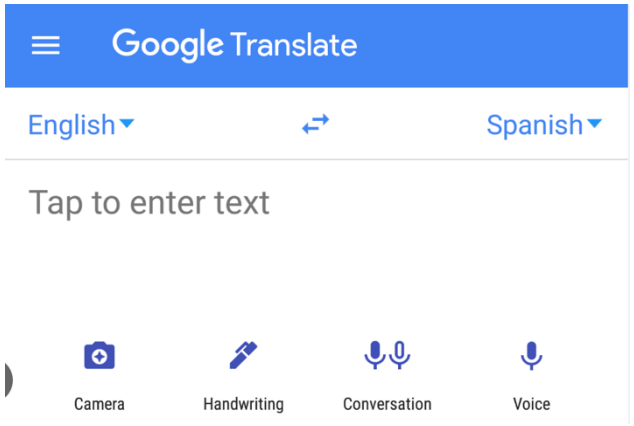
Manufacturing



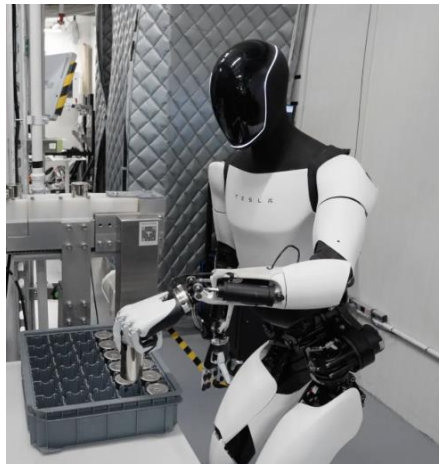
Humanoids?

Applications of AI: NLP

ChatGPT



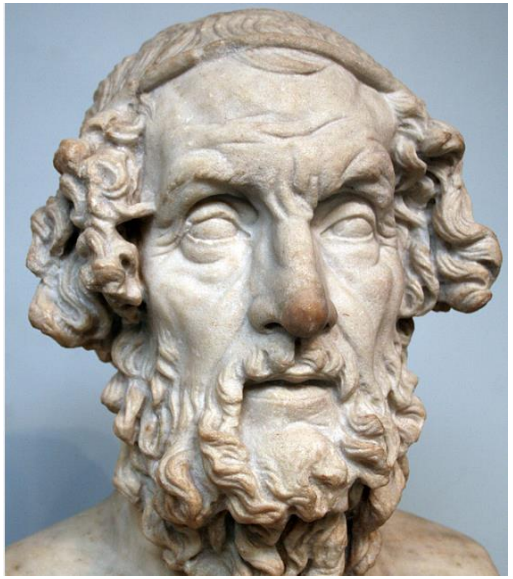
Translation



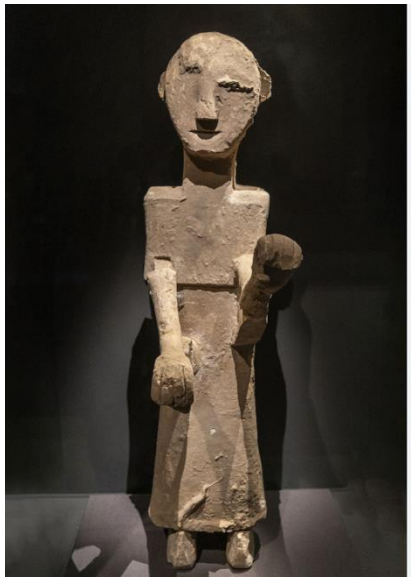
Humanoids?

AI through history

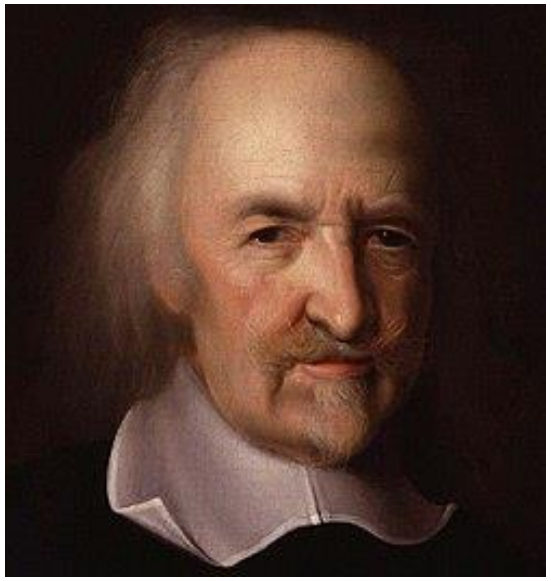
Humans have been fascinated with AI for centuries!



Homer (700 BC)



China (500 BC)



Thomas Hobbes (1600s)

Alan Turing: the godfather of AI

Hobbes introduced symbolic reasoning … but Turing took it to a new level

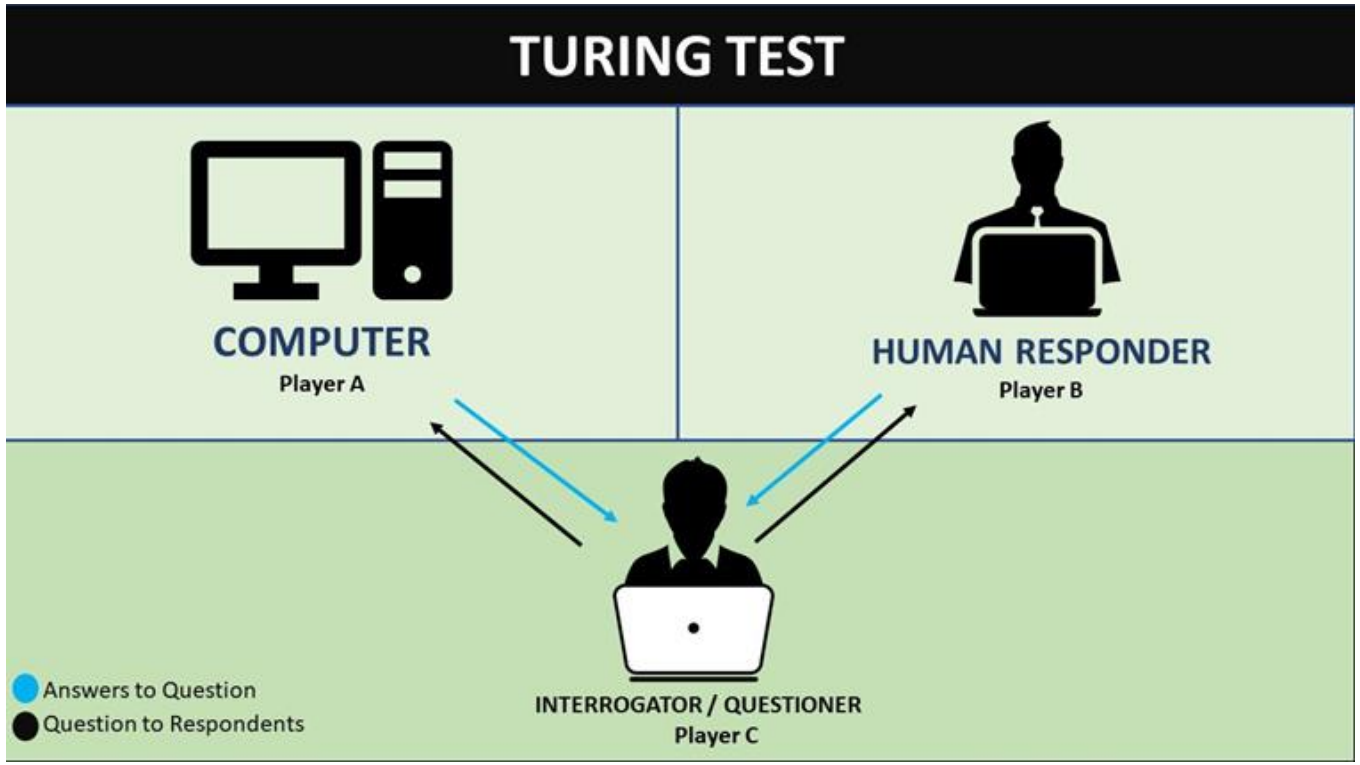
1. Church-Turing thesis

2. Turing test

3. First digital computers

The Turing Test

Intelligence test that judges *external* behavior



The Turing Test

Intelligence test that judges *external* behavior

Large Language Models Pass the Turing Test

Cameron R. Jones
Department of Cognitive Science
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San Diego, CA 92119
cameron@ucsd.edu

Benjamin K. Bergen
Department of Cognitive Science
UC San Diego
San Diego, CA 92119
bkbergen@ucsd.edu

"… GPT-4.5 was judged to be the human 73% of the time…"

The Turing Test

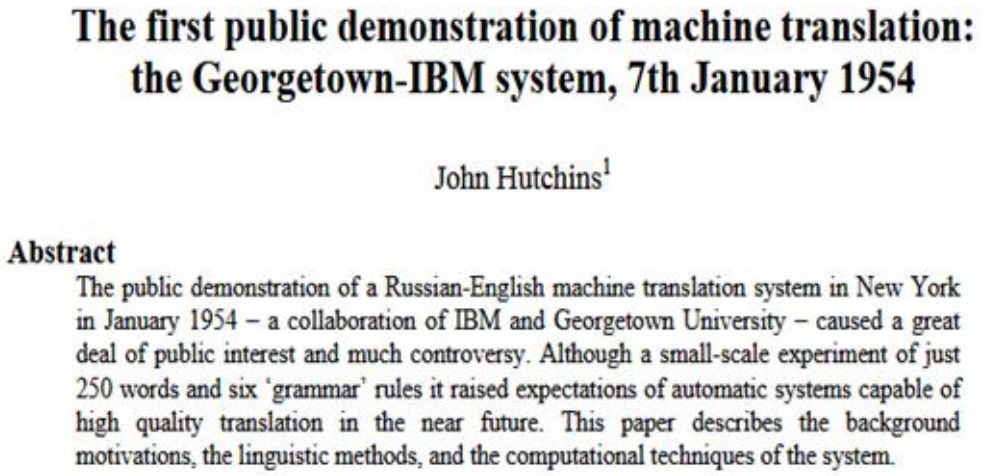
...now what?

“Modern” AI followed Turing

- Neural networks first proposed in 1943!
- 1956 Dartmouth conference: *the “birthplace” of AI*
- AI went through 3 boom/bust cycles over the next 70 years…we’re living in the 4th boom

AI Boom #1: language translation (1950s)

- Cold War led to AI-driven English/Russian translation
- Georgetown-IBM experiment translated 60 Russian sentences
- Lots of funding! But it wasn't perfect…language context is off
- 1966: US Govt decides progress is too slow and cuts off funding



The first public demonstration of machine translation: the Georgetown-IBM system, 7th January 1954

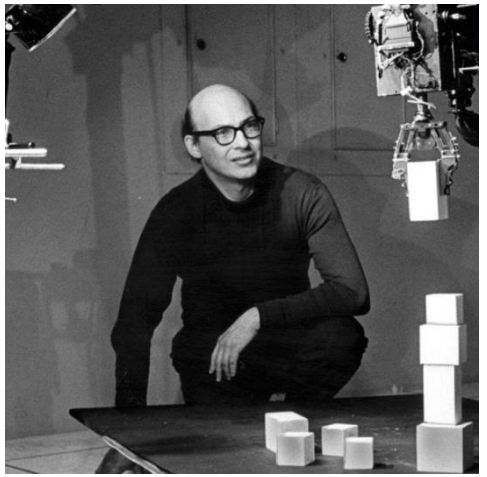
John Hutchins[1]

Abstract

The public demonstration of a Russian-English machine translation system in New York in January 1954 – a collaboration of IBM and Georgetown University – caused a great deal of public interest and much controversy. Although a small-scale experiment of just 250 words and six 'grammar' rules it raised expectations of automatic systems capable of high quality translation in the near future. This paper describes the background motivations, the linguistic methods, and the computational techniques of the system.

AI Boom #2: microworlds (1970s)

- What if we “shrink” the world to something manageable?
- Minsky’s “blocks” that AI could manipulate & ELIZA (first AI chatbot)
- …turns out these smaller worlds don’t generalize usefully
- Lighthill Report (1974) – UK govt declares an “utter failure of AI to achieve its objectives”



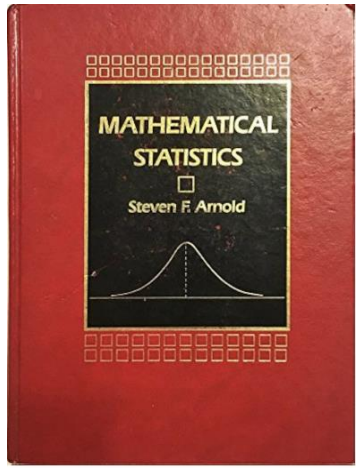
```
Welcome to
                EEEEEE  LL      IIII   ZZZZZZ   AAAAA
                EE      LL       II       ZZ   AA   AA
                EEEEE   LL       II     ZZZ    AAAAAAA
                EE      LL       II    ZZ      AA   AA
                EEEEEE  LLLLLL  IIII ZZZZZZ    AA   AA

  Eliza is a mock Rogerian psychotherapist.
  The original program was described by Joseph Weizenbaum in 1966.
  This implementation by Norbert Landsteiner 2005.


ELIZA: Is something troubling you ?
YOU:   Men are all alike.
ELIZA: What is the connection, do you suppose ?
YOU:   They're always bugging us about something or other.
ELIZA: Can you think of a specific example ?
YOU:   Well, my boyfriend made me come here.
ELIZA: Is it important to you that your boyfriend made you come here ?
YOU:   He says I'm depressed much of the time.
ELIZA: I am sorry to hear that you are depressed.
YOU:   It's true. I am unhappy.
ELIZA: Can you explain what made you unhappy ?
YOU:
```

AI Boom #3: expert systems (1980s)

- What if we encode domain expertise?
- MYCIN: Infection diagnosis
- Systems were brittle & hard to maintain. Needed costly re-training
- High-profile failures like Japan's 5th Generation Computer Systems didn't help…

AI Boom #4: big data & deep learning

- 1990s – early 2000s:
  "statisticians are the original data scientists!"



- 2005+: Hadoop created to begin the Big Data era

- 2006: AWS launches
  (Google/MSFT Azure follow)

AI Boom #4: big data & deep learning

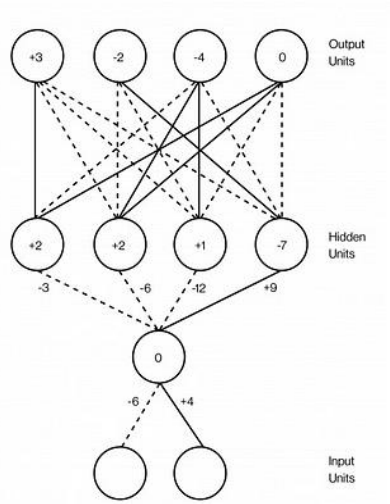
This advance in compute resources and data to train on would set the stage for a deep learning revolution!

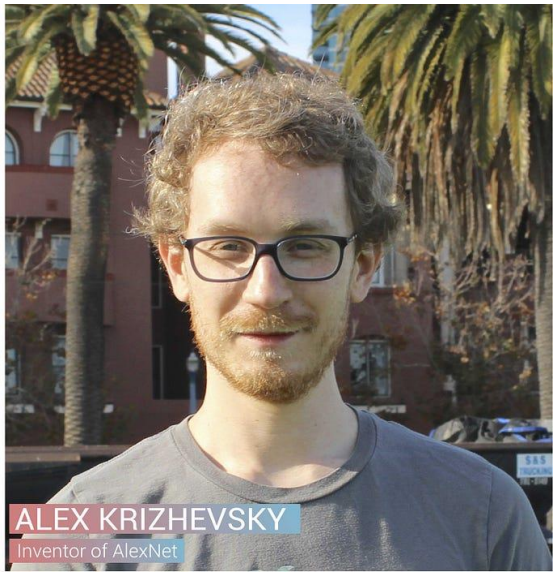
Analytics And Data Science

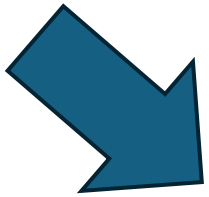
Data Scientist: The Sexiest Job of the 21st Century

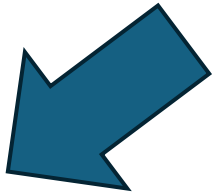
Meet the people who can coax treasure out of messy, unstructured data. by Thomas H. Davenport and DJ Patil

AlexNet: the breakthrough



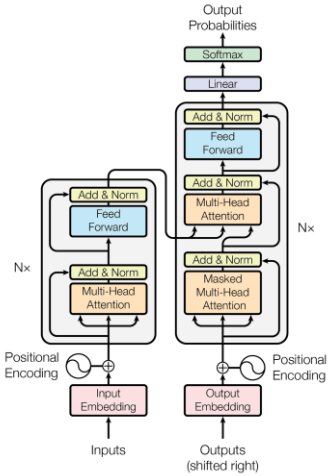






The (re)surgence of deep learning

- 2014: “basically all Computer Vision is NNs”
- 2016: AlphaGo
- 2017: Transformers (BERT)
- 2020: GPT-3
- 2021: DALL-E/GH Copilot
- 2022: ChatGPT



Our course will focus on deep learning

“How do I stay relevant?”

AI Boom #2: microworlds (1970s)

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University of San Diego

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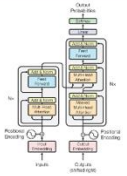


University of San Diego

“How do I stay relevant?”

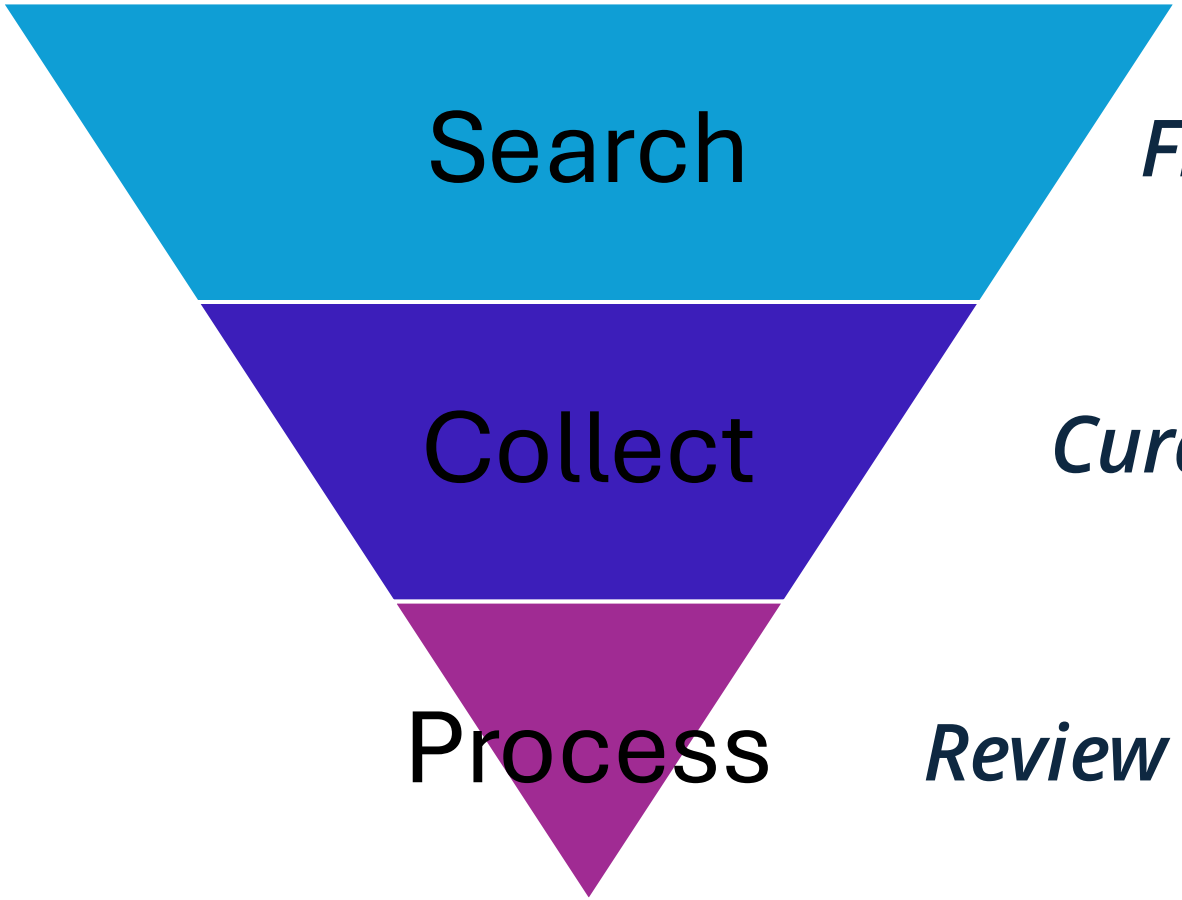
Top AI News : Exploring the Latest Innovations
38K views

🔥 What is Generative AI ? | Generative AI ...
191K views

OpenAI's CEO on What Kids Should Be ...
4.6M views

Staying up to date is essential for career relevance and project success … but we often miss insights, waste time & lose motivation

Search, Collect, Process



Find high quality sources

Curate relevant articles

Review at the right level

Search: *find high-quality sources*

1) Tech company sites

- *AI @ Meta, Netflix Tech Blog*

2) Aggregator platforms

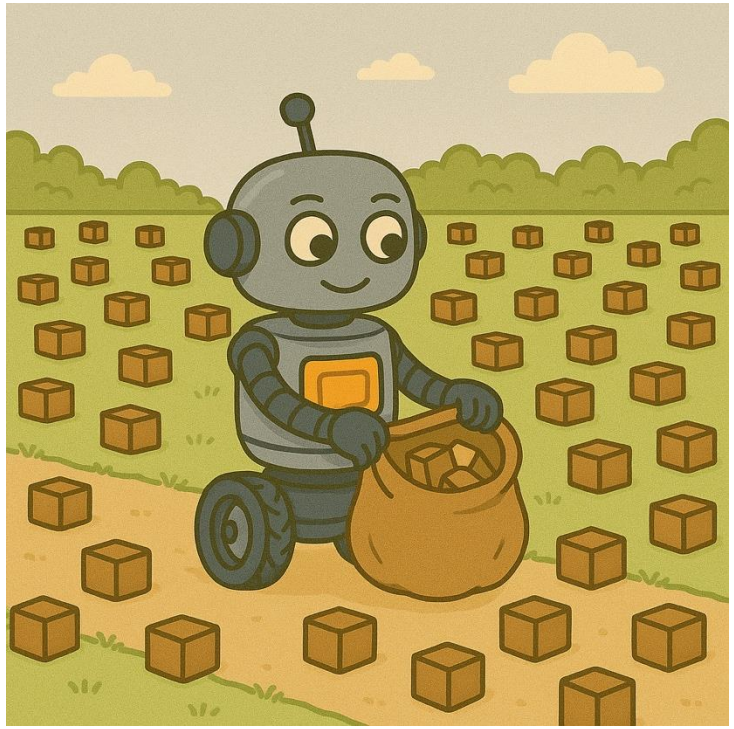
- *Towards Data Science, KDNuggets*

3) Personal experts

- *Andrej Karpathy, Andrew Gelman*

4) YouTube

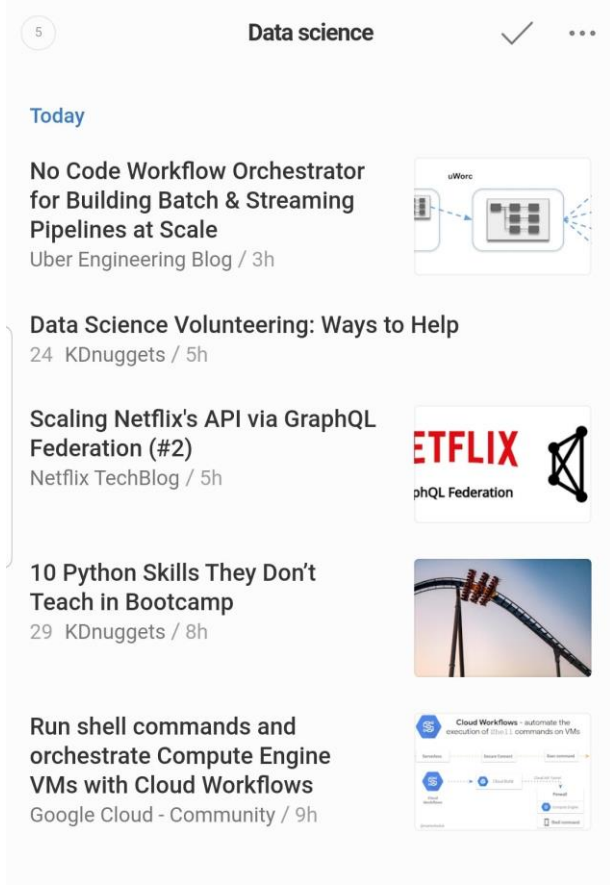
- 3blue1brown, Google Cloud Tech



Collect: *curate relevant articles*

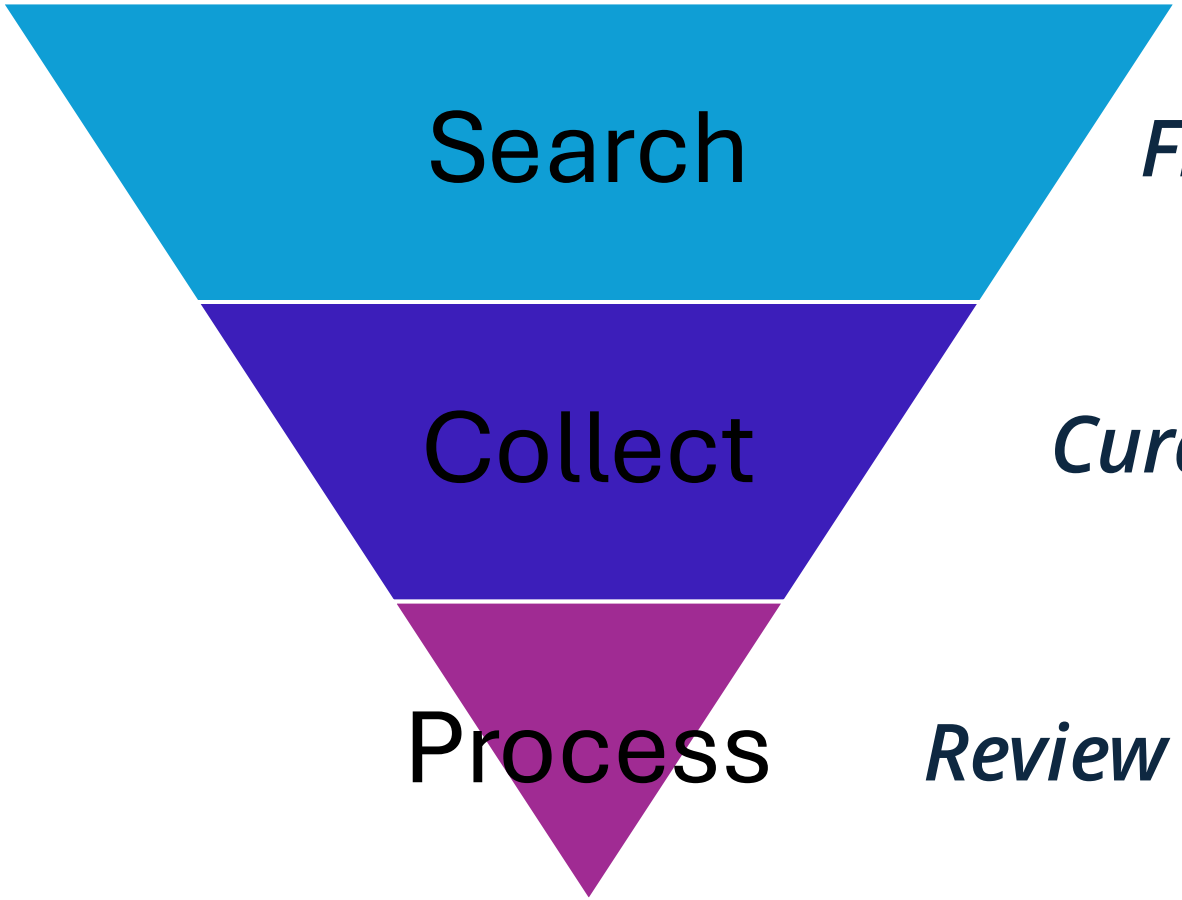
1. Put all your sources into one place

2. Define a “review cadence”



Process: filter for learning

Search, Collect, Process



Find high quality sources

Curate relevant articles

Review at the right level

GenAI: the next frontier

- Wider search net
- Generative AI summaries & tutoring
- NotebookLM: *game changer*

NotebookLM demo

Article summary prompt template

Visit this URL: [PASTE URL]

Summarize the article for a Chief AI Officer. Format the response with:
- 3-sentence summary
- Strategic insight for enterprise AI adoption
- 2 questions to ask your AI/data team
- Notable quotes or data points (if any)

Weekly update prompt template

Search for the top 5 new articles this week related to: "enterprise LLM deployment" OR "AI infrastructure" OR "generative AI use cases"

For each article, summarize with:
- Title and source
- 2-sentence summary
- One strategic insight or trend
- Link to the article

Competitive intel prompt template

Visit this URL: [COMPETITOR PRODUCT RELEASE OR BLOG POST]

Summarize with:
- What is being released or announced?
- How it positions the company strategically
- Any implications for our product/data/infra strategy
- What makes this announcement technically or commercially significant

Weekly Literature Review

Each week, you will be asked to review one technology-related article published in the last 7 days. In order to do so, you will need to have identified and curated a collection of sources to pull from – the “Collect” from the “Search, Collect, Process” reviewed in class.

Identify at least 5 information sources you plan to monitor during this course (tech sites, news aggregators, company blogs, etc), and explain why you chose them.

Set up your “Collect” workflow and document the technical architecture. This could be as simple as a ChatGPT subscription coupled with manual RSS feeds, or an all-in-one automated solution. Include the cadence with which you plan to review this workflow.