1ˢᵗ Lecture

- "AI and Machine Learning: Game Playing, Data Analysis and Classification " – course title but maybe mostly I'll abbreviate to "AI" ☺

- Introduction – who am I – where am I from?

- What is AI/ML/CV – what can it do - what is this course

- A little bit of theory/conceptual framework – agents, rational agents, utility.
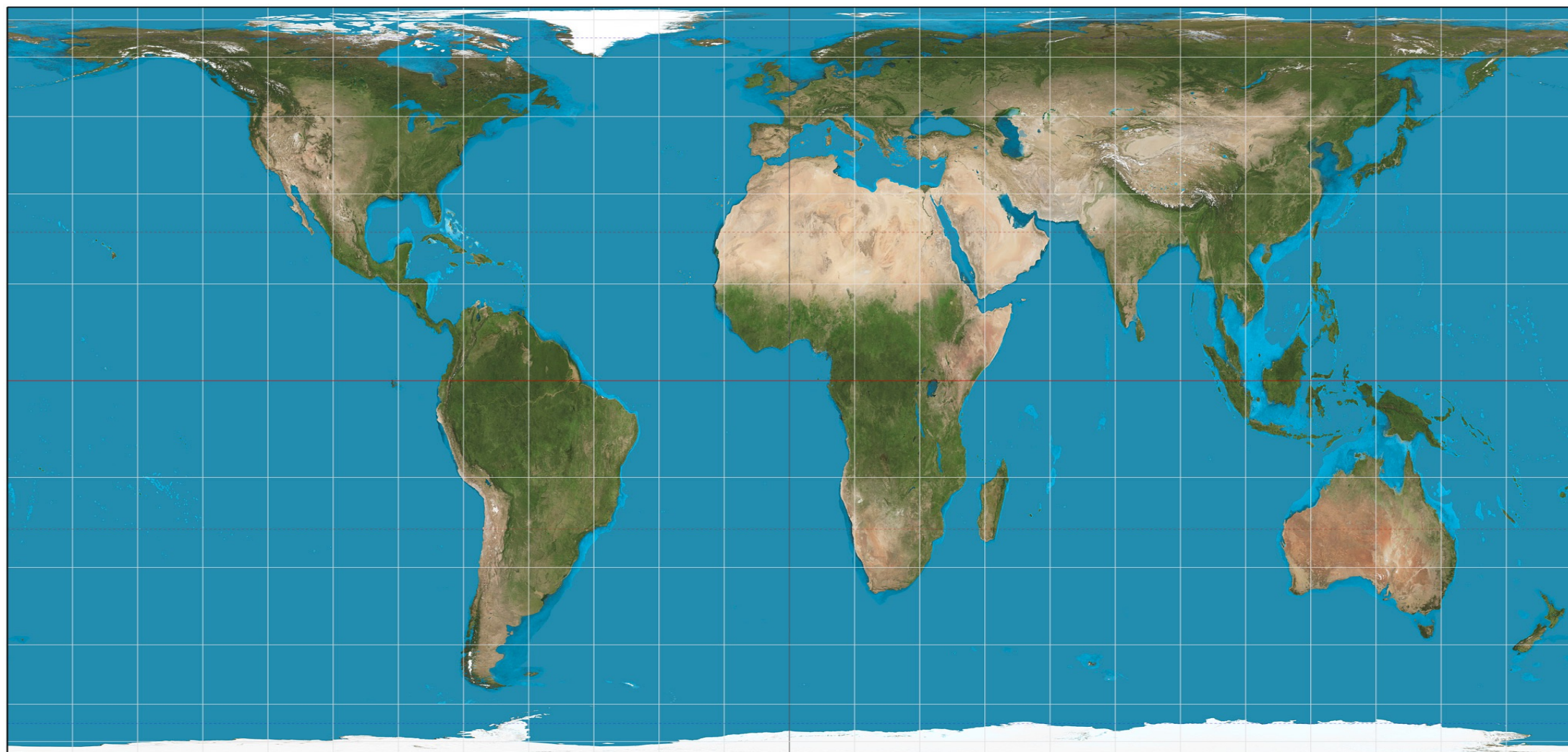
Course web page: https://ai-ecu.github.io/Xidian/

Who am I? - Basic Info

- David Suter – d.suter@ecu.edu.au
- Professor Monash University, Melbourne (previous)
- Professor Adelaide University (previous)
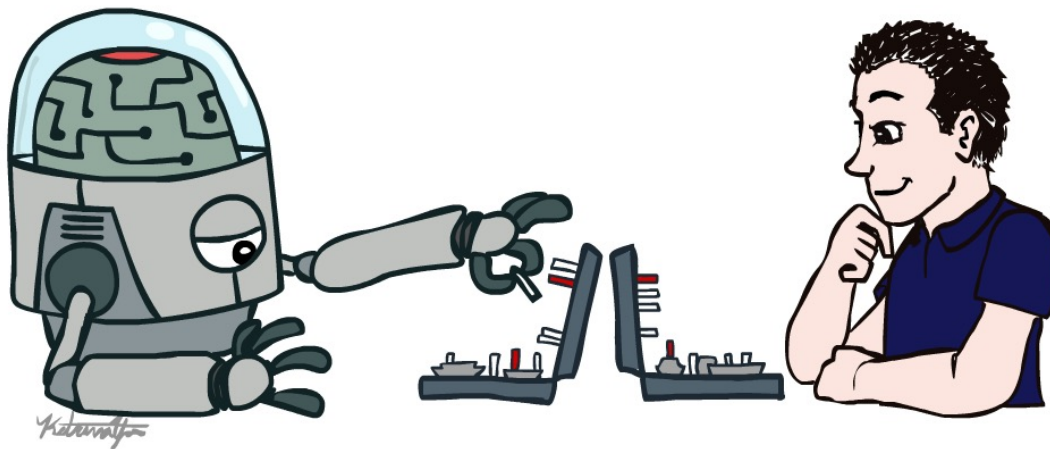- Research Professor Edith Cowan University, Perth (current)

Basic elements: Search, classification, model fitting, decision making

- **These are all topics somewhat covered elsewhere:**
  - Search (particularly tree search) in algorithms and data structure courses
  - Classification – in statistics, and of course in machine learning and data mining
  - Regression/Model Fitting – ditto
  - Optimal decision making – Economics, control, etc.

  This course brings an AI/ML perspective

AI and Machine Learning: Game Playing, Data Analysis and Classification
Introduction

Instructor: David Suter

Course Delivered for Xidian University

Textbook

Russell & Norvig, AI: A Modern Approach, 3rd Ed.

Product details

Paperback: 1152 pages
Publisher: Pearson; 4 edition (October 31, 2019)
Language: English
ISBN-10: 0134610997
ISBN-13: 978-0134610993
Product Dimensions: 0.4 x 0.4 x 0.4 inches
Shipping Weight: 0.2 ounces (View shipping rates and policies)
Average Customer Review: ★★★★☆ ⌄ 223 customer reviews
Amazon Best Sellers Rank: #2,318,672 in Books (See Top 100 in Books)
   #790 in Artificial Intelligence (Books)
   #2319 in Artificial Intelligence & Semantics

Some Parts also from

- Analysis of Boolean Functions (e.g., Chapters 1 and 4 relevant)
  Ryan O'Donnell http://analysisofbooleanfunctions.net

- The Maximum Consensus Problem: Recent Algorithmic Advances

Tat-Jun Chin, David Suter

Resources

The "current Stanford Course" (like this one, highly influenced by the Berkeley Course and textbook).

https://web.stanford.edu/class/cs221/

Big Data Analystics (EdX – free to enroll and basic materials) https://www.edx.org/course/big-data-analytics-2

Section 1: Simple linear regression: Fit a simple linear regression between two variables in R; Interpret output from R; Use models to predict a response variable; Validate the assumptions of the model.

Section 2: Modelling data: Adapt the simple linear regression model in R to deal with multiple variables; Incorporate continuous and categorical variables in their models; Select the best-fitting model by inspecting the R output.

Section 3: Many models: Manipulate nested dataframes in R; Use R to apply simultaneous linear models to large data frames by stratifying the data; Interpret the output of learner models.

Section 4: Classification: Adapt linear models to take into account when the response is a categorical variable; Implement Logistic regression (LR) in R; Implement Generalised linear models (GLMs) in R; Implement Linear discriminant analysis (LDA) in R.

Section 5: Prediction using models: Implement the principles of building a model to do prediction using classification; Split data into training and test sets, perform cross validation and model evaluation metrics; Use model selection for explaining data with models; Analyse the overfitting and bias-variance trade-off in prediction problems.

Section 6: Getting bigger: Set up and apply sparklyr; Use logical verbs in R by applying native sparklyr versions of the verbs.

Section 7: Supervised machine learning with sparklyr

Apply sparklyr to machine learning regression and classification models; Use machine learning models for prediction; Illustrate how distributed computing techniques can be used for "bigger" problems.

Section 8: Deep learning: Use massive amounts of data to train multi-layer networks for classification; Understand some of the guiding principles behind training deep networks, including the use of autoencoders, dropout, regularization, and early termination; Use sparklyr and H2O to train deep networks.

Section 9: Deep learning applications and scaling up: Understand some of the ways in which massive amounts of unlabelled data, and partially labelled data, is used to train neural network models; Leverage existing trained networks for targeting new applications; Implement architectures for object classification and object detection and assess their effectiveness.
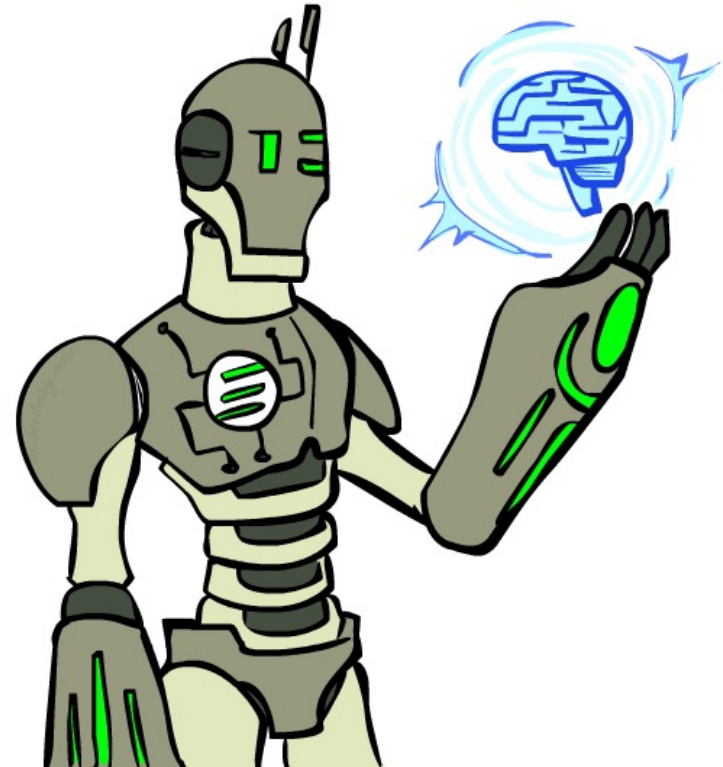
Plenty of online sources…. web search….

First Things

- What is artificial intelligence?

- What can AI do?
- AI is HERE!

- What is this course?

What is AI?

The science of making machines that:

What is AI?

The science of making machines that:

Thinking Humanly	Thinking Rationally
"The exciting new effort to make computers think ... *machines with minds*, in the full and literal sense." (Haugeland, 1985) "[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning ..." (Bellman, 1978)	"The study of mental faculties through the use of computational models." (Charniak and McDermott, 1985) "The study of the computations that make it possible to perceive, reason, and act." (Winston, 1992)
Acting Humanly	**Acting Rationally**
"The art of creating machines that perform functions that require intelligence when performed by people." (Kurzweil, 1990) "The study of how to make computers do things at which, at the moment, people are better." (Rich and Knight, 1991)	"Computational Intelligence is the study of the design of intelligent agents." (Poole *et al.*, 1998) "AI ... is concerned with intelligent behavior in artifacts." (Nilsson, 1998)

Figure 1   Some definitions of artificial intelligence, organized into four categories.

A (Short) History of AI
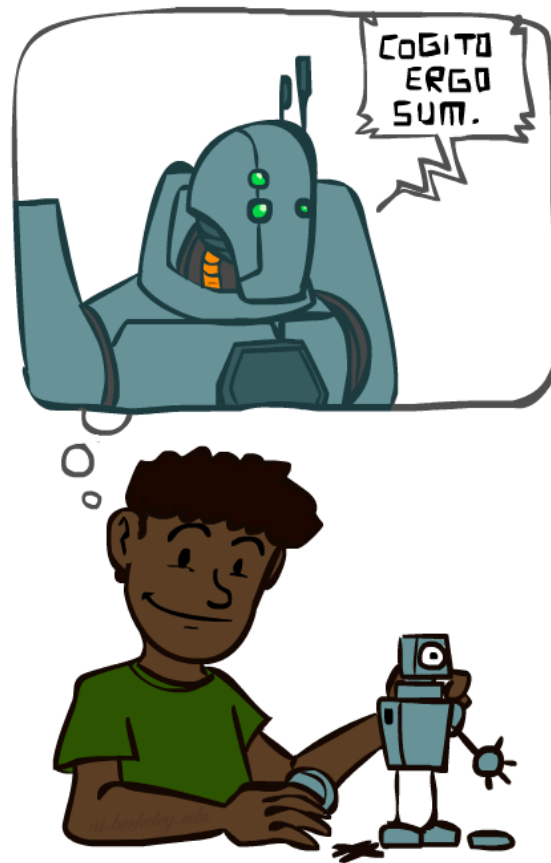
# A (Short) History of AI

- **1940-1950: Early days**
  - 1943: McCulloch & Pitts: Boolean circuit model of brain
  - 1950: Turing's "Computing Machinery and Intelligence"

- **1950—70: Excitement: Look, Ma, no hands!**
  - 1950s: Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's Geometry Engine
  - 1956: Dartmouth meeting: "Artificial Intelligence" adopted
  - 1965: Robinson's complete algorithm for logical reasoning

- **1970—90: Knowledge-based approaches**
  - 1969—79: Early development of knowledge-based systems
  - 1980—88: Expert systems industry booms
  - 1988—93: Expert systems industry busts: "AI Winter"

- **1990—: Statistical approaches**
  - Resurgence of probability, focus on uncertainty
  - General increase in technical depth
  - Agents and learning systems… "AI Spring"?

- **2000—: Where are we now?**
 - Deep Learning is definitely very popular.
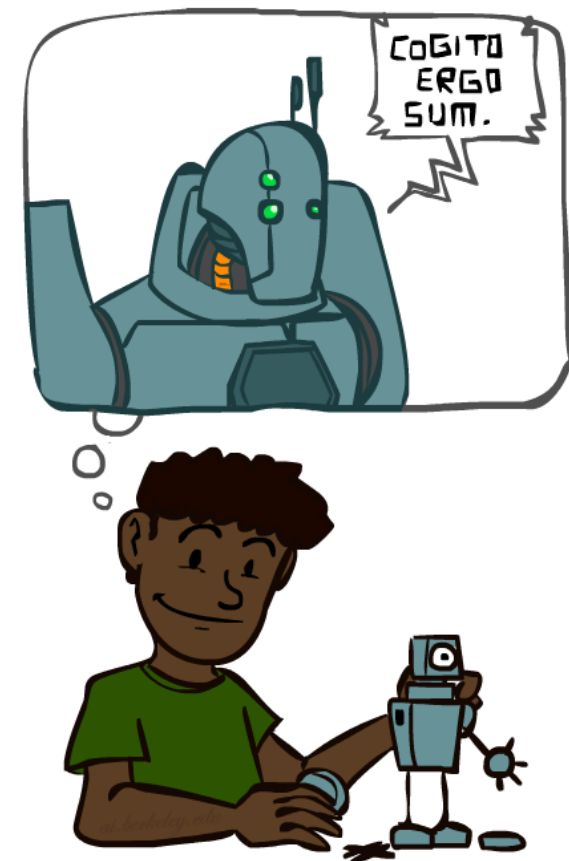
What Can AI Do?

Quiz: Which of the following can be done at present?

- ✔ Play a decent game of table tennis?
- ✔ Play a decent game of Jeopardy?
- ✔ Drive safely along a curving mountain road?
- ❓ Drive safely along Complex Roads?
- ✔ Buy a week's worth of groceries on the web?
- ✘ Buy a week's worth of groceries at a physical store?
- ❓ Discover and prove a new mathematical theorem?
- ✘ Converse successfully with another person for an hour?
- ❓ Perform a surgical operation?
- ✔ Put away the dishes and fold the laundry?
- ✔ Translate spoken Chinese into spoken English in real time?
- ✘ Write an intentionally funny story?
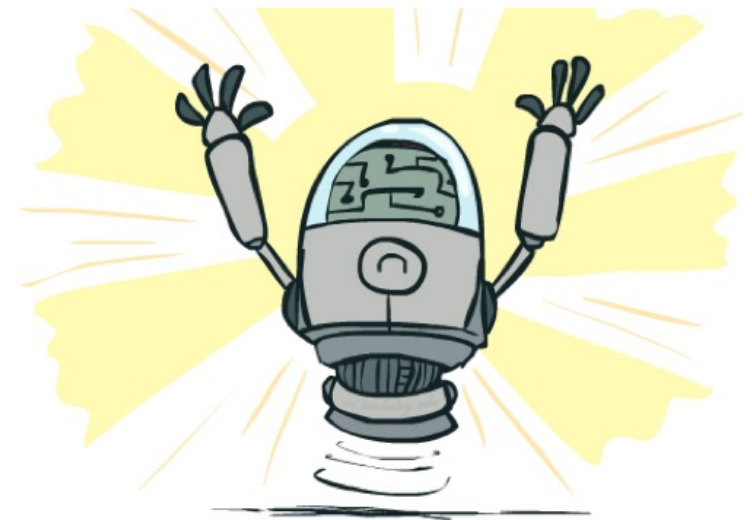
Natural Language

- **Speech technologies (e.g. Siri)**
  - Automatic speech recognition (ASR)
  - Text-to-speech synthesis (TTS)
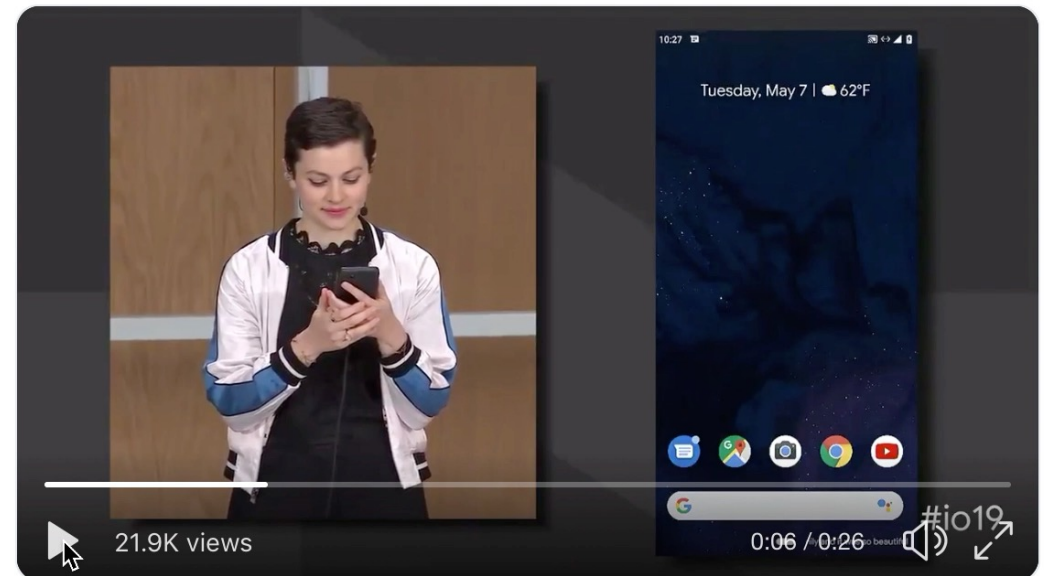 - Dialog systems
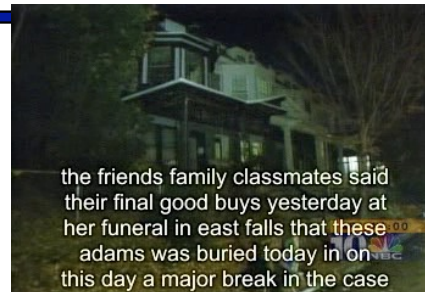
2001: A Space Odyssey - Trailer

Service Robot Xiamen, PRC, Nov 2018

Google Major Announcements, May 7 2019

So fast, you might've missed it. Running on-device, the next generation Google Assistant makes it easier to multitask across apps—so things like looking up answers, and finding and sharing a photo are faster than ever. #io19

Rank ⇵	Name ⇵	Citizenship ⇵	Net worth (USD) ⇵	Age ⇵	Main source of wealth ⇵
1	Jeff Bezos	🇺🇸 United States	$152.0 billion ▲	55	Amazon.com
2	Bill Gates	🇺🇸 United States	$99.7 billion ▲	63	Microsoft
3	Bernard Arnault	🇫🇷 France	$89.1 billion ▲	69	LVMH
4	Warren Buffett	🇺🇸 United States	$88.5 billion ▲	88	Berkshire Hathaway
5	Amancio Ortega	🇪🇸 Spain	$67.5 billion ▲	82	Zara
6	Mark Zuckerberg	🇺🇸 United States	$65.4 billion ▲	34	Facebook
7	Larry Ellison	🇺🇸 United States	$65.4 billion ▲	74	Oracle
8	Carlos Slim	🇲🇽 Mexico	$63.2 billion ▼	78	América Móvil
9	Michael Bloomberg	🇺🇸 United States	$59.4 billion ▲	76	Bloomberg
11	Larry Page	🇺🇸 United States	$55.3 billion ▲	45	Google
10	Mukesh Ambani	🇮🇳 India	$58.7 billion ▲	62	Reliance Industries
12	Sergey Brin	🇺🇸 United States	$54.1 billion ▲	45	Google
13	Françoise Bettencourt Meyers	🇫🇷 France	$53.2 billion ▲	65	L'Oréal
14	Charles Koch	🇺🇸 United States	$52.0 billion ▲	83	Koch Industries
15	David Koch	🇺🇸 United States	$52.0 billion ▲	78	Koch Industries
16	Jim Walton	🇺🇸 United States	$45.9 billion ▲	70	Walmart
17	Alice Walton	🇺🇸 United States	$45.7 billion ▲	69	Walmart
18	S. Robson Walton	🇺🇸 United States	$45.6 billion ▲	74	Walmart
19	Steve Ballmer	🇺🇸 United States	$45.4 billion ▲	62	Microsoft
20	Ma Huateng	🇨🇳 China	$41.9 billion ▲	47	Tencent

Internet/Tech/Comms – invariably investing heavily in AI

Fashion/Retail – and what is a common target of AI startups?

Source Wikepedia 7/4/19

Fortune's Wealthiest Americans (1957) [edit]

In 1957, *Fortune* magazine developed a list of the seventy-six *wealthiest Americans*, which was republished in many American newspapers.

Getty, when asked his reaction on being named *wealthiest American* and whether he was really worth a billion dollars, said "You know, if you can count your money, you don't have a billion dollars" and then famously added, "But remember, a billion dollars isn't worth what it used to be."[2]

$700,000,000 to $1,000,000,000

- Jean Paul Getty, Oil; business headquarters is in Los Angeles, California.

$400,000,000 to $700,000,000

- Mrs Mellon Bruce, the former Ailsa Mellon, New York, New York. Inherited wealth: Mellon Bank, Gulf Oil Company, Alcoa.
- Arthur Vining Davis, Miami, Florida; Alcoa, Florida real estate.,
- H. L. Hunt, Dallas, Texas; independent oil operator.
- Paul Mellon, Upperville, Virginia; inherited wealth.
- Richard King Mellon, Pittsburgh, Pennsylvania; inherited wealth: Alcoa, Gulf Oil, Mellon Bank, etc
- John D. Rockefeller Jr., New York inherited wealth: Standard Oil Trust.
- Mrs. Alan M. Scaife, the former Sarah Mellon, Pittsburgh. Inherited wealth.

$200,000,000 to $400,000,000

- Irénée du Pont, Wilmington, Delaware and Cuba; inherited wealth: E. I du Pont de Nemours & Co.
- William du Pont Jr., Wilmington; inherited wealth: E. I du Pont de Nemours & Co.
- Mrs. Frederick Guest, the former Amy Phipps, Palm Beach, Florida. Inherited wealth.
- Howard Hughes, Los Angeles; inherited wealth: Hughes Tool Company.
- Joseph P. Kennedy, Boston, Massachusetts-New York; real estate.

Oil

Manufacturing/ Metals

Finance

Source Wikepedia