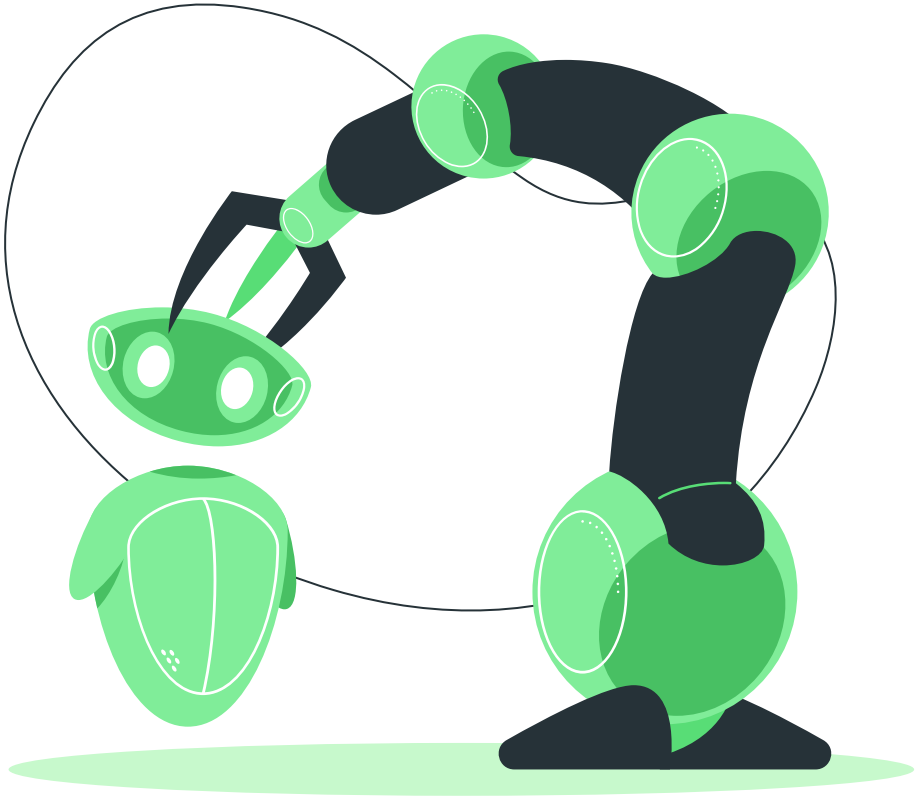
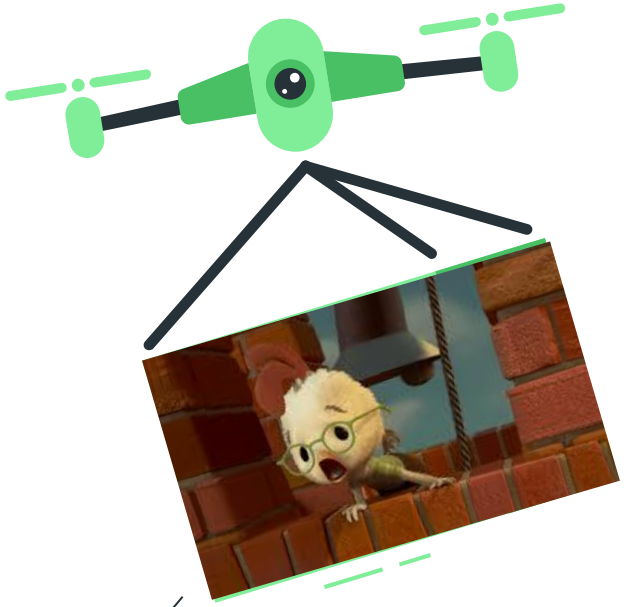
Tesla, AI, & Automation

Ian Wilhite



What is AI?

Can someone give a functional definition for Artificial Intelligence?



Menti!

AI is an Agent that...

Processes input

Either from sensors, input, or training data

Applies models to analyze data

Provides Output

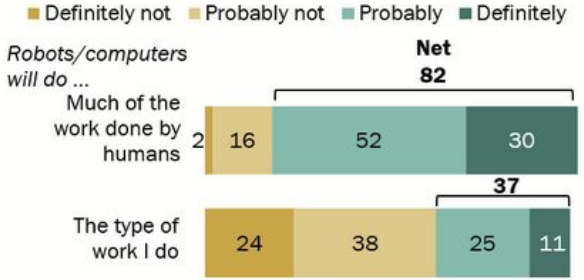
Makes decisions, predictions, or actions


Who cares?

Pew Research Center

Public says robots will take over much of the work done by humans, but most workers don't think it will affect their own type of work

% saying, within the next 30 years, each of the following will ___ happen

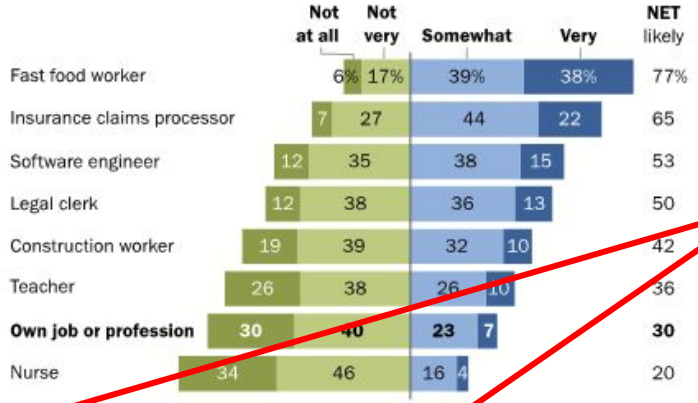


Note: Lower panel based on employed adults. Share of respondents who didn't offer an answer not shown. Figures may not add to subtotals due to rounding.
Source: Survey of U.S. adults conducted Dec. 11-23, 2018.
"Looking to the Future, Public Sees an America in Decline on Many Fronts"

PEW RESEARCH CENTER

Americans view certain professions as being at greater risk of automation than others

% of U.S. adults who say it is ___ likely that the following jobs will be replaced by robots or computers in their lifetimes



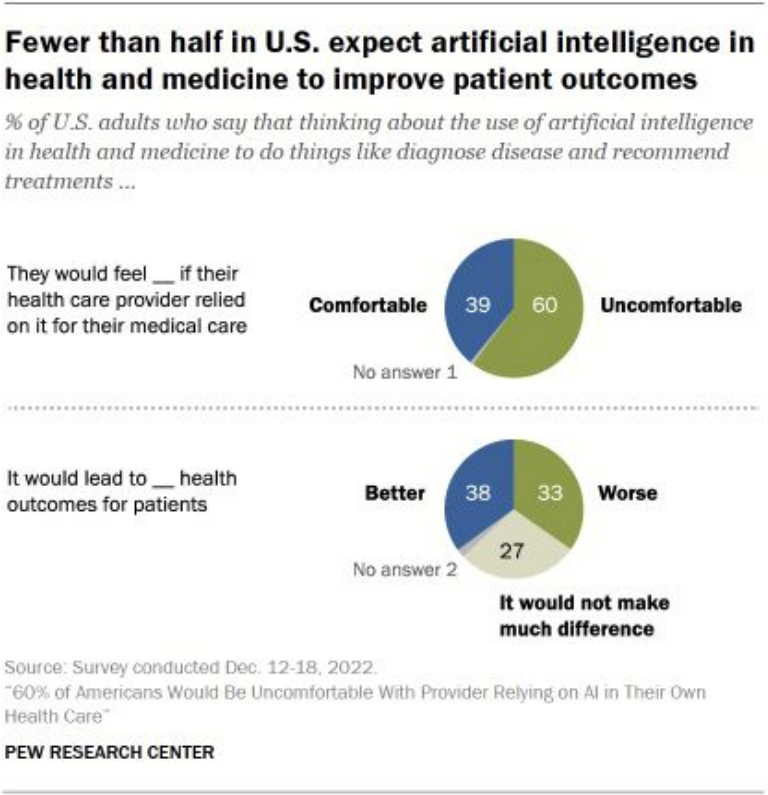
Note: Data for "own job or profession" is based on those who are currently employed. Respondents who did not give an answer are not shown.
Source: Survey conducted May 1-15, 2017.
"Automation in Everyday Life"

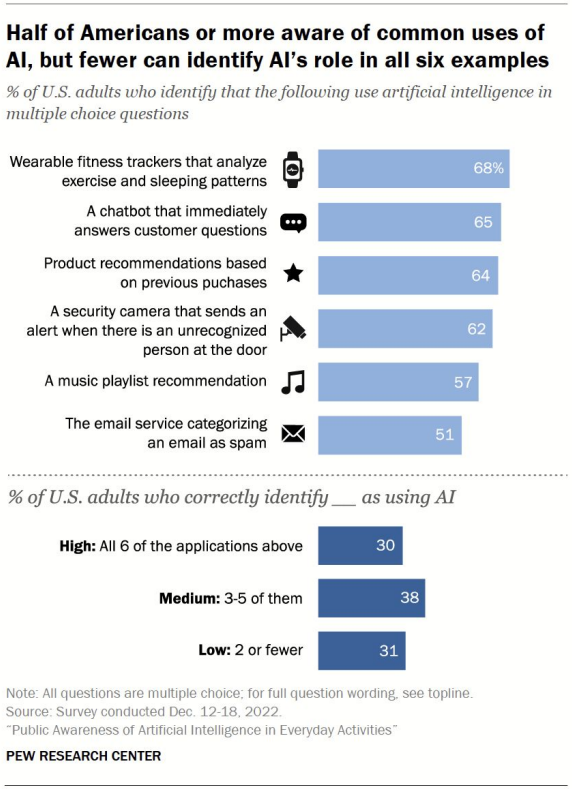
PEW RESEARCH CENTER

In 2017 & 2018!

What has happened since 2018?

Pew Research Center – *newer!*





Vocab!

Neural Network

Layered network that processes data

Natural Language Processor (NLP)

The step that encodes words into vectors

Machine Learning (ML)

trains algorithms to recognize patterns *(stats!)*

Convolutional Neural Network (CNN)

A Neural Network for image processing

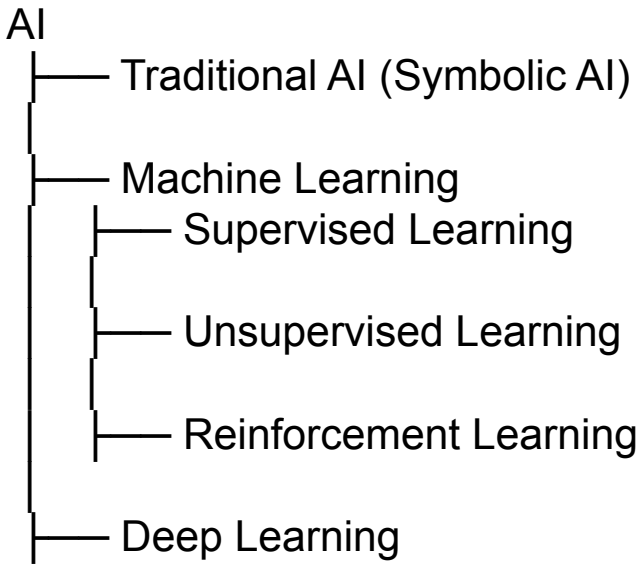
Recurrent Neural Network (RNN)

A Neural Network for serial data input

Training Data

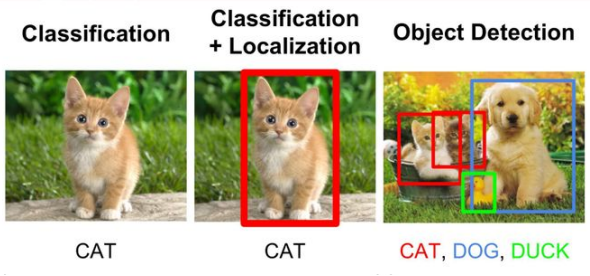
Content libraries used to develop relationships

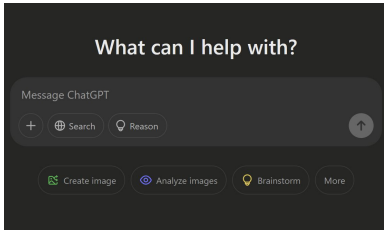
AI Overview


AI
Traditional AI (Symbolic AI)
Machine Learning
Supervised Learning
Unsupervised Learning
Reinforcement Learning
Deep Learning

- AI
  - GOFAI (Good Old-Fashioned AI *or* Symbolic AI)
    - Rule-Based Systems
    - **Control Algorithms**
    - Search Algorithms
    - Knowledge Representation
    - Planning & Reasoning
  - Deep Learning
    - Convolutional Neural Networks (CNNs) – Image Processing
    - Recurrent Neural Networks (RNNs) – Sequence Modeling
    - Transformer Models – Natural Language Processing (e.g., GPT)
    - Generative Models – Data Synthesis (e.g., GANs, VAEs)
    - Deep Reinforcement Learning – AlphaGo, Robotics

- AI
  - Machine Learning
    - Supervised Learning
      - Regression (e.g., Stock Prediction)
      - **Classification** (e.g., Spam Detection, Medical Diagnosis)
      - **Natural Language Processing** (ChatGPT)
      - Computer Vision (e.g., Facial Recognition, Object Detection)
    - Unsupervised Learning *(just statistics!)*
      - Clustering (e.g., Customer Segmentation)
      - Dimensionality Reduction (e.g., Data Compression)
      - Generative Models (e.g., GANs for Image & Data Generation)
    - Reinforcement Learning
      - Model-Free (e.g., Q-Learning, Policy Gradient)
      - Model-Based (e.g., Monte Carlo Tree Search)
      - **Deep Reinforcement Learning** (e.g., Self-driving cars)
      - Robotics (e.g., Path Planning, Control Systems)






MIT CSAIL

History

Statistics was invented in **1662** by John Graunt working for the London census

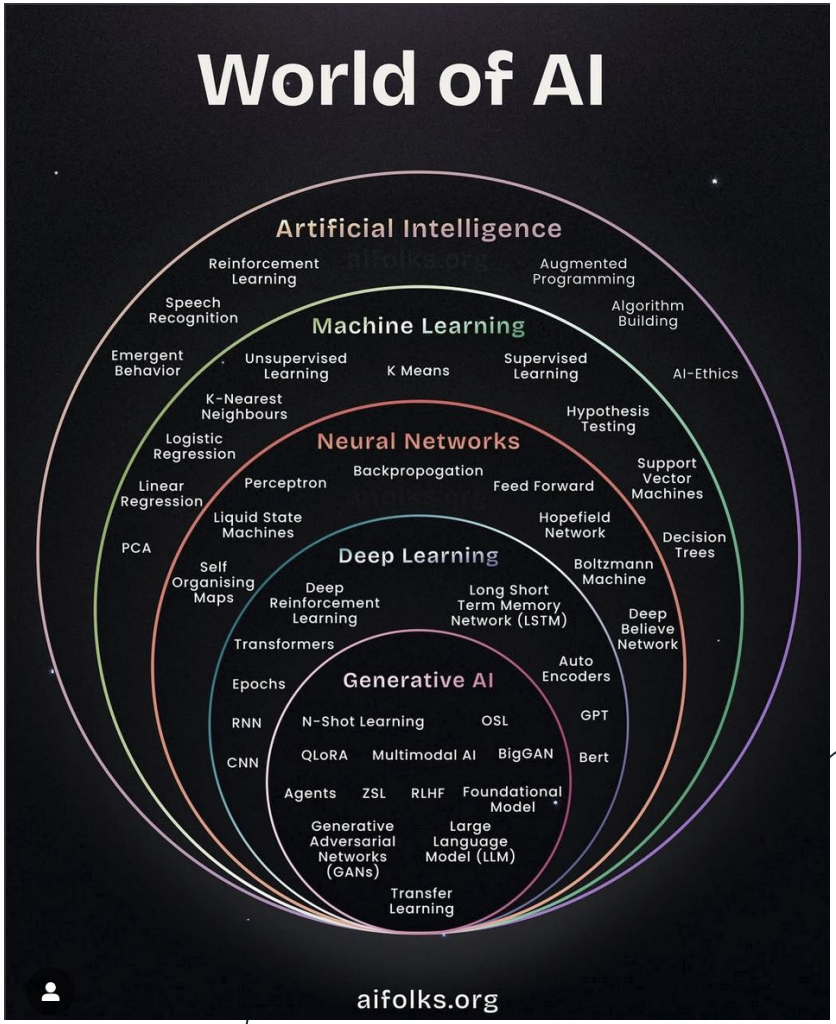
Alan Turing laid the foundation for **search** algorithms through logical agents in **1948**

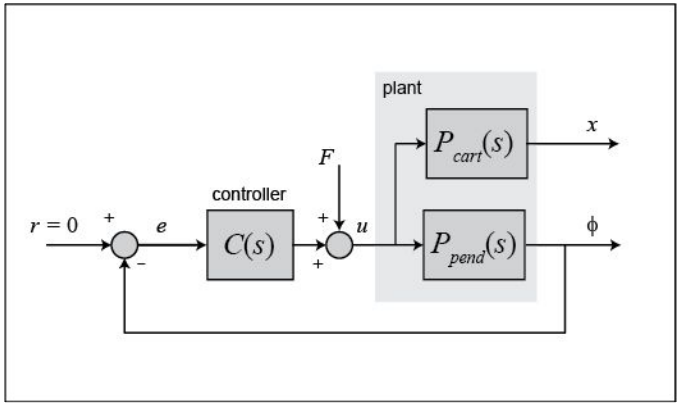
Machine Learning was invented in **1952** at IBM by Arthur Samuel using checkers

John McCarthy holds the Dartmouth Conference to discuss “thinking machines”

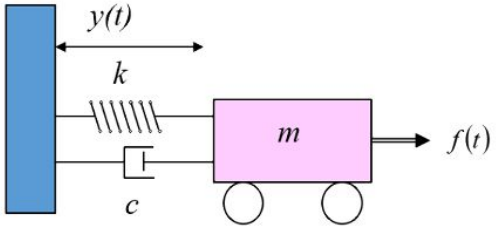
MIT **chatbot** ELIZA in **1966** used for therapy passes Turing test

OpenAI (non-profit) develops the first Large Language Model (**LLM**) GPT-1 in **2018**





Spring-mass-damper response theory



Sum of forces acting on suspension

$$F_m + F_d + F_k = f(t)$$

$$\frac{m}{g_c}\frac{d^2y}{dt^2} + c\frac{dy}{dt} + ky = f(t)$$

Mass acceleration

$$F_m = ma;\ \ a = \frac{dv}{dt};\ \ v = \frac{dy}{dt} \implies a = \frac{d^2y}{dt^2}$$

$$F_m = \frac{m}{g_c}\frac{d^2y}{dt^2}$$

Damping force

$$F_d = c\frac{dy}{dt};\ \ c[=]damping\ coefficient\ \frac{lb_f}{ft/sec}$$

Spring force

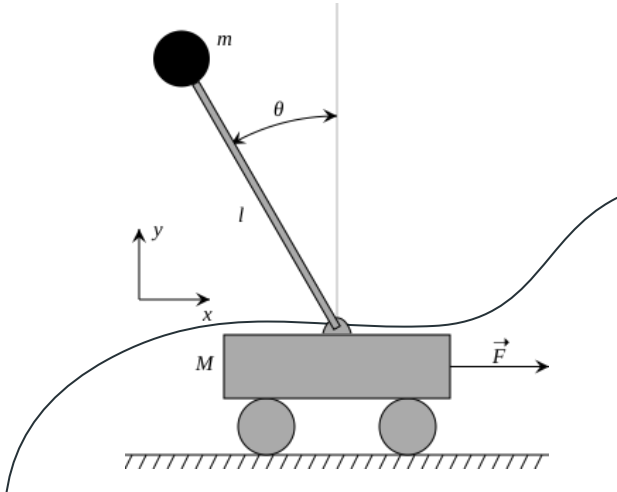
$$F_k = ky;\ \ k[=]spring\ constant\ \frac{lb_f}{ft}$$

Driving bump force

$$f(t)[=]bump\ force\quad lb_f$$

Controls Engineering allows us to **solve** for closed-form solutions to problems

This is what I do!



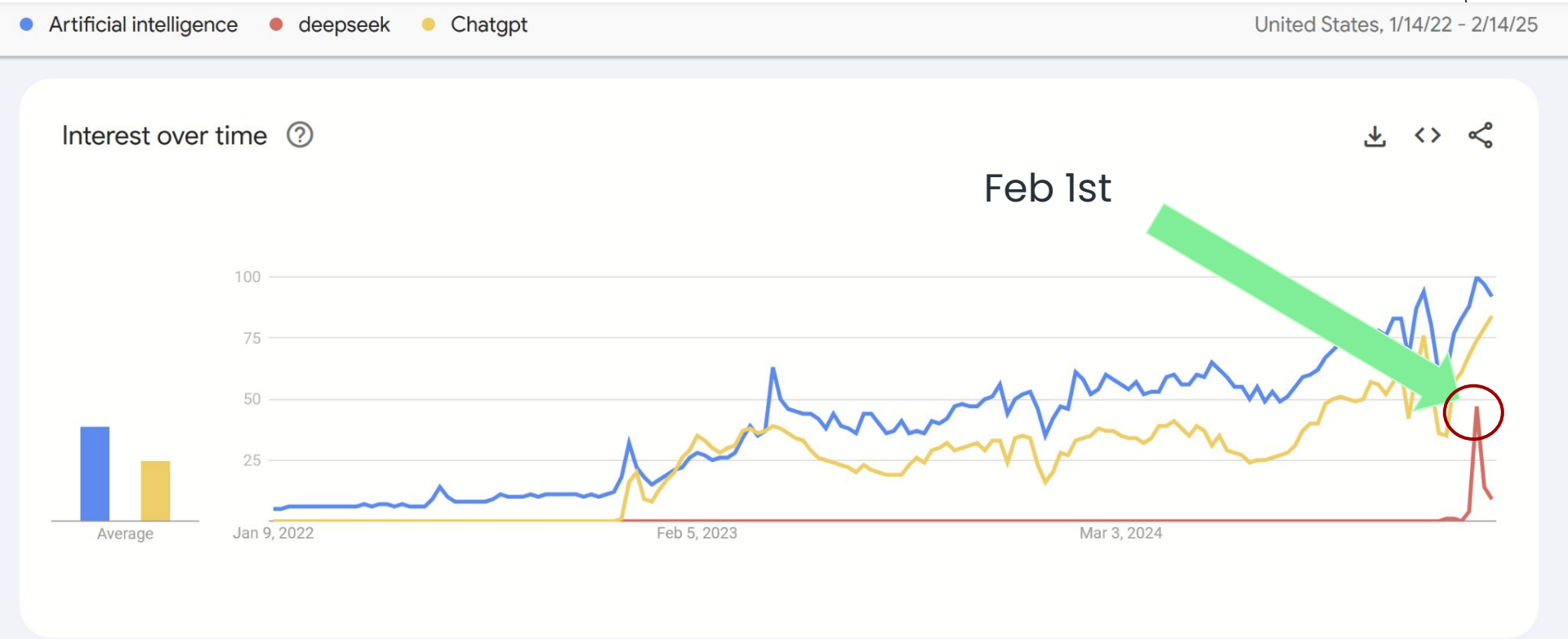
Machine Learning (ML):
- Trained model
- Easier but slower
- Models make ***mistakes***

Eg: a car turns the wrong way

Controls Engineering:
- Closed form solution
- Harder but faster
- Controls has ***uncertainty***

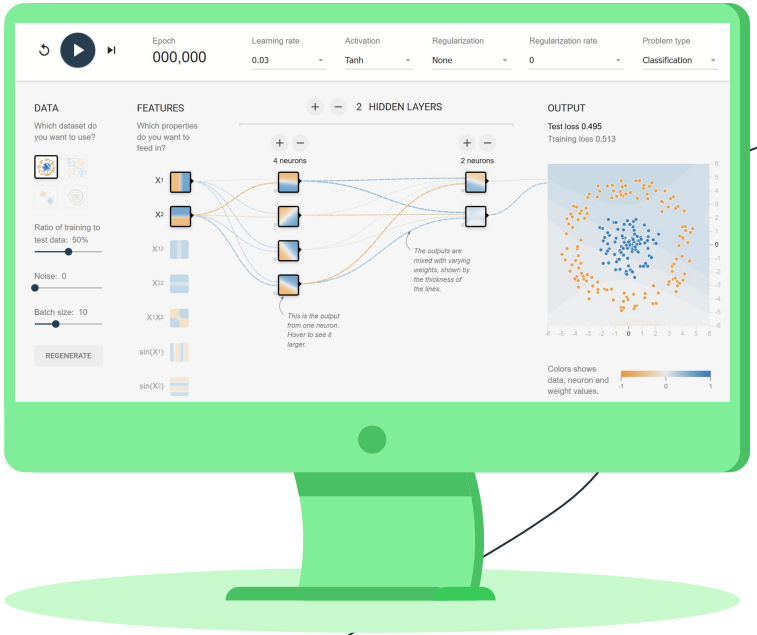
Eg: car will turn left with a radius of 20ft +/- 0.5ft

Google Search Trends



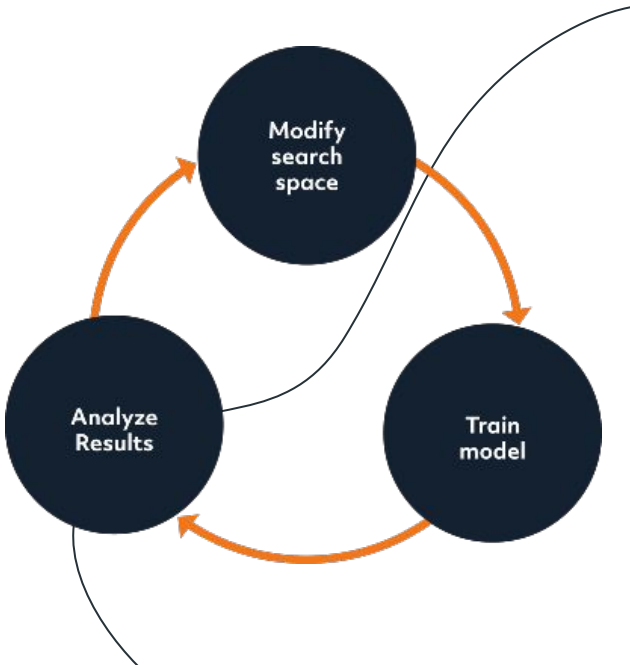
ML Activity!

playground.tensorflow.org



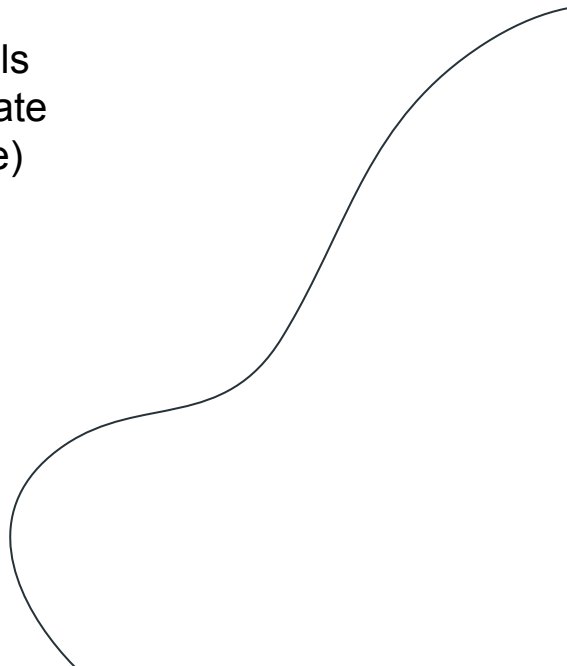
NN Training Speedrun:

Model - the output of the final node in a neural network
Feature - a simple function applied to the input data
Neuron - a weighted combination of previous nodes
Layer - a step of neurons to tune
Training - automatically tuning the parameters neurons based on model *test loss*
Training loss - % error model makes on training data
Test loss - % error model makes on unseen data

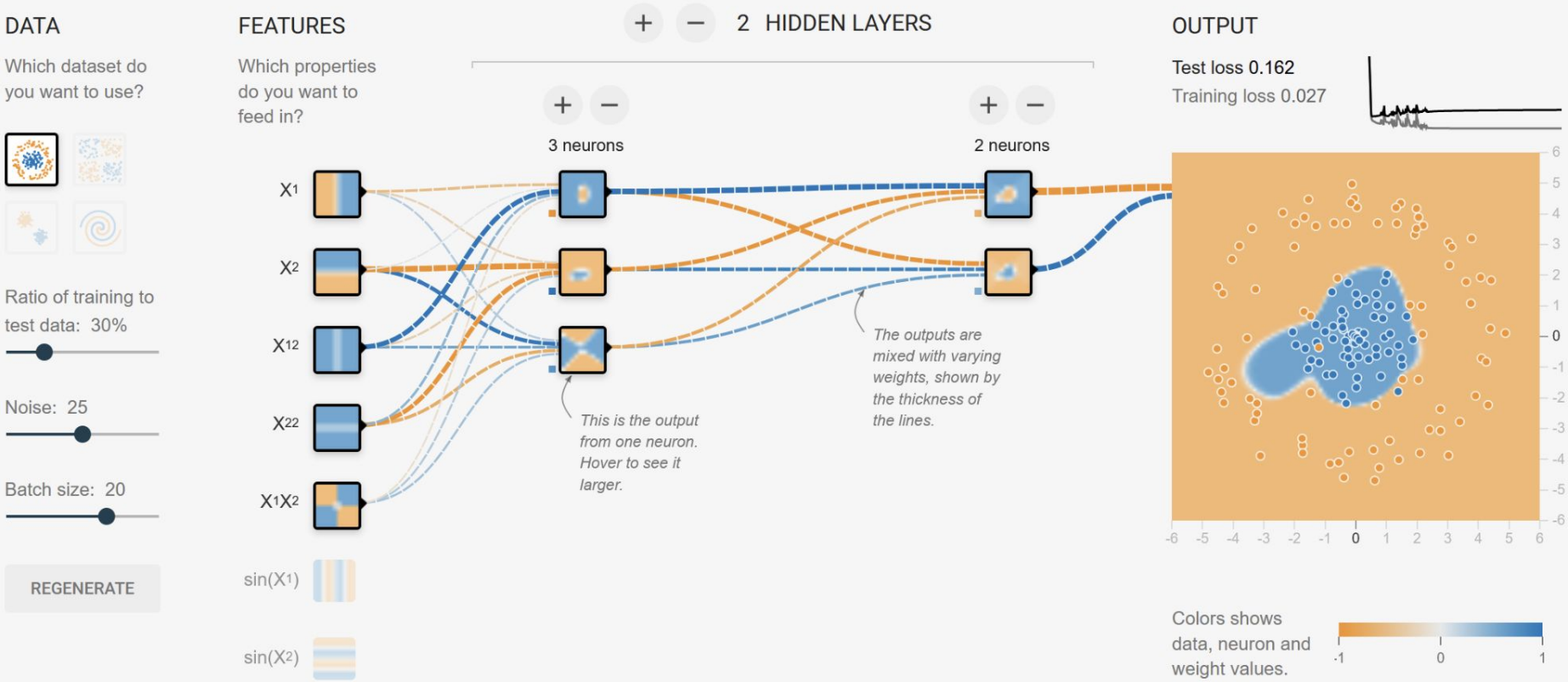


Tips:

- Simpler models will converge faster
- Larger models can approximate more complex systems
- You should enable input features that resemble the systems
- Larger number of layers will allow for more complicated models
- More features will allow more tools for your model to incorporate
- Common testing ratio of 20-30% (testing is an entire discipline)

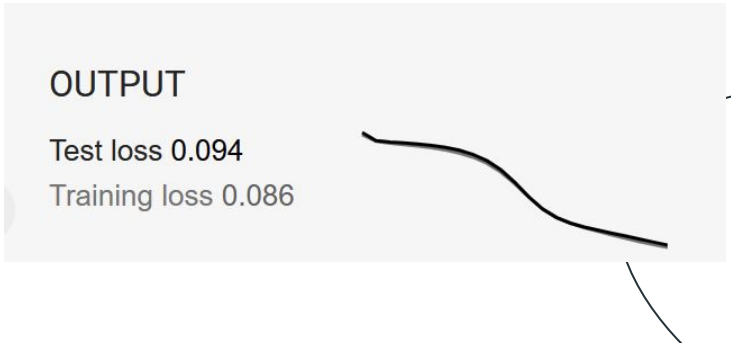


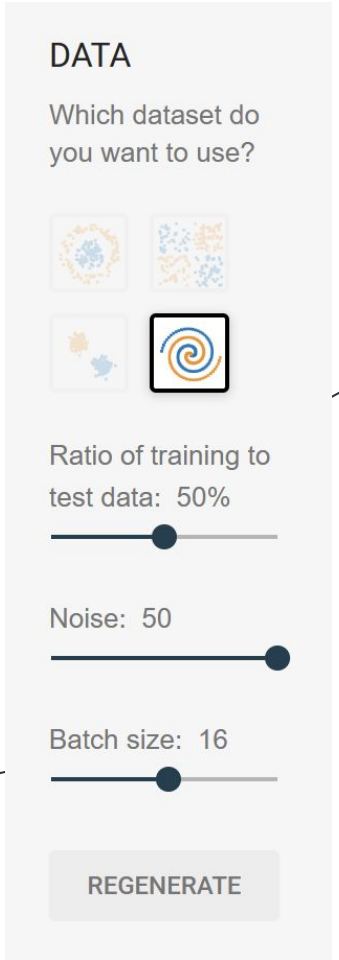
Overview


DATA
Which dataset do you want to use?
Ratio of training to test data: 30%
Noise: 25
Batch size: 20
REGENERATE
FEATURES
Which properties do you want to feed in?
2 HIDDEN LAYERS
3 neurons
2 neurons
X1
X2
X12
X22
X1X2
sin(X1)
sin(X2)
This is the output from one neuron. Hover to see it larger.
The outputs are mixed with varying weights, shown by the thickness of the lines.
OUTPUT
Test loss 0.162
Training loss 0.027
Colors shows data, neuron and weight values.
-1
0
1

CHALLENGE 1

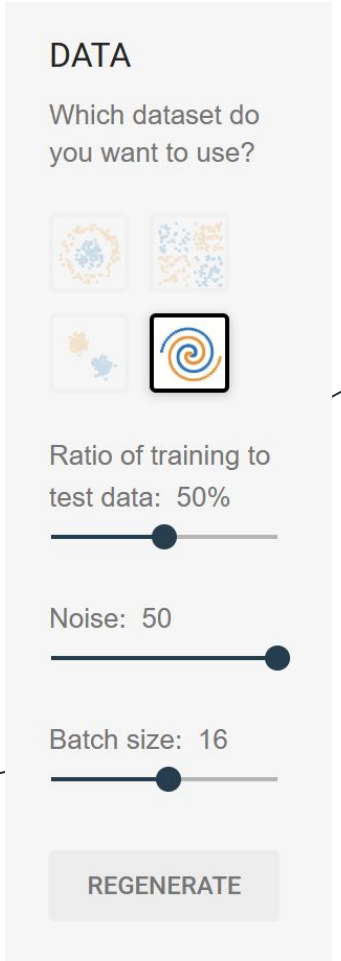
- **GOAL:**
  - **Test Loss < 0.200**
- **Requirements:**
  - **Exclusive or dataset**
  - **Noise: 25**





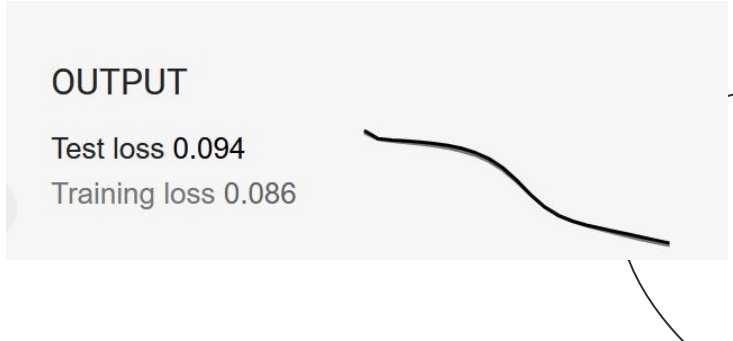
CHALLENGE 2

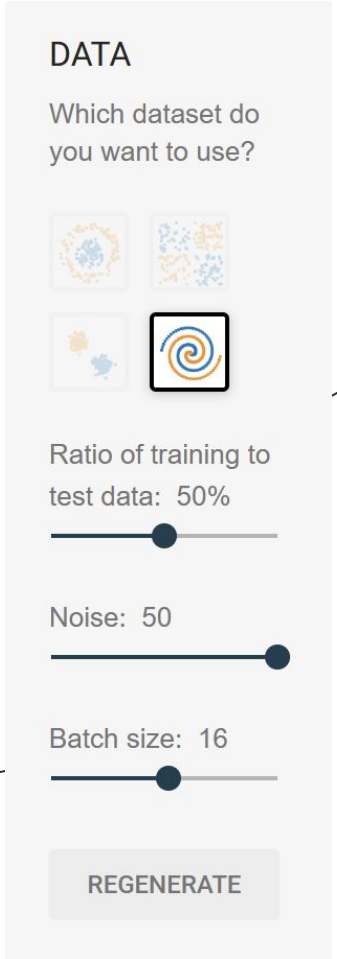
- **GOAL:**
  - **Test Loss < 0.250**
- **Requirements:**
  - **Spiral dataset**
  - **Noise: 50**



CHALLENGE 3

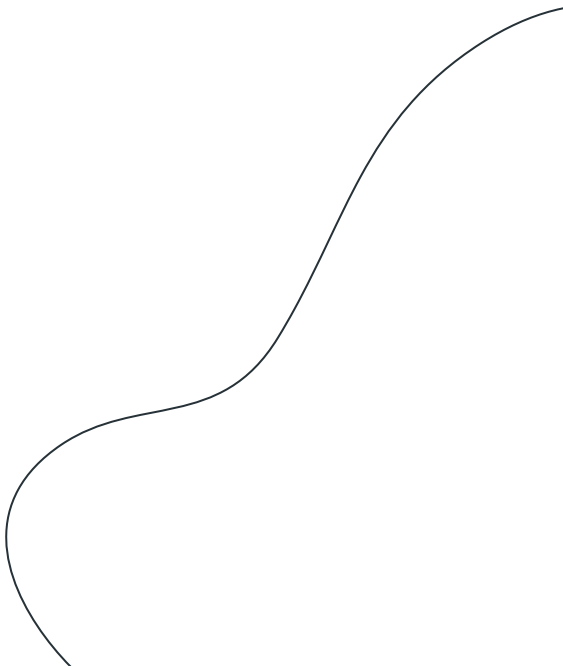
- **GOAL:**
  - **Test Loss < 0.150**
- **Requirements:**
  - **Circle dataset**
  - **Noise: 25**
  - **<5 neuron**





Tying it back in

- Models are never 100% accurate
- Small errors in a model can mean major changes
- Nearly *impossible* to back-validate (understand)



What about Tesla?

Self-driving cars

Journalistic media

Reuters

Tesla recalls 1.85 million US vehicles over unlatched hood issue

Jul 30, 2024 • By David Shepardson

NBC NEWS

Tesla recalls more than 375,000 vehicles for power steering issue

1 hour ago • By Matt Lavietes

MotorTrend

2023 Tesla Model Y Yearlong Review: How Does Full Self-Driving Work?

Jan 22 • By Alex Leanse

BUSINESS INSIDER

I drive a Cybertruck, and I'm sick of people flipping me off. I wish they understood how helpful this car is for me.

Jan 26 • By Angela Kenzslowe

yahoo/finance

Elon Musk insists Tesla isn't a car company as sales falter

Apr 24, 2024 • By Hamza Shaban

yahoo/finance

Tesla stock rises after company pledges return to growth after Q4 results disappoint

Jan 30 • By Pras Subramanian

AP

Tesla sales dropped 1.1% in 2024, its first annual decline in a dozen years

Jan 2 • By Tom Krisher & Bernard Condon

AP

Tesla sales fall for second straight quarter despite price cuts, but decline not as bad as expected

Jul 2, 2024 • By Tom Krisher

Social Media (Instagram)

Interactive Digital Media

r/RealTesla · 12d ago

Tesla is Collapsing.

24K votes · 2.3K comments

r/electricvehicles · 22d ago

Finally did it. Out with the Tesla.

3.7K votes · 818 comments

r/Wellthatsucks · 2y ago

Dude left his Tesla in a garage for a month...

57K votes · 4.2K comments

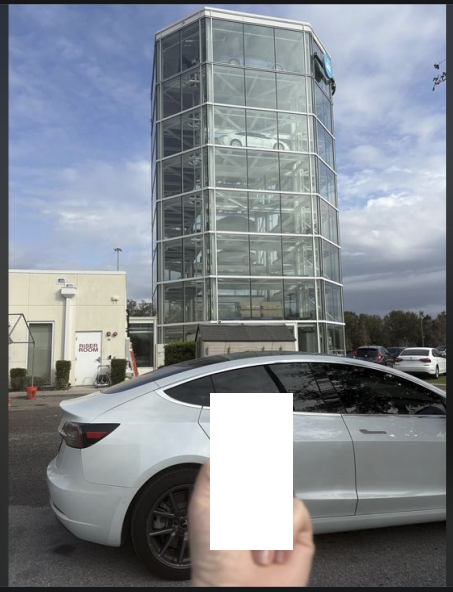
r/europe · 14d ago

Tesla Sales Plunge through Europe

126K votes · 4.8K comments

r/pics • 20 days ago
ThePetiteBaker

My bubbie would be proud that I stood for our values (sold Tesla)



66K · 5.9K · 12 · Share

r/RealTesla • 12 days ago
Zestyclose-Habit-970

Tesla is Collapsing.

For the first time in over a decade, Tesla's sales declined year-over-year.

The company delivered 1.79 million vehicles in 2024, falling short of 2023's 1.81 million—a 1.1% drop. On the surface, this might seem small, but in an industry where growth is everything, this is a disaster. Legacy automakers like BYD, Hyundai, and others are beginning to eat Tesla's lunch.

Germany: Tesla sales crashed by a staggering 60% in January 2025, with just 1,277 registrations in the EU's largest auto market. This isn't a fluke—it's a market-wide rejection.

France: Another 63% sales collapse in the same period.

California: Tesla's home turf, where it once reigned supreme, saw a 11.6% drop in registrations while competitors gained market share.

The cracks in Tesla's foundation are no longer just visible—they're gaping holes. Tesla's brand value dropped by $15 billion in 2024, a massive loss that signals a shift in public perception. The endless delays, price cuts, quality control issues, and Musk's erratic behavior have eroded consumer trust.

Let's not forget the PR nightmare of endless recalls, self-driving crashes, and Musk's alienation of core demographics. This isn't just a temporary dip—this is a full-blown identity crisis.

r/teslainvestorsclub • 1 mo. ago
hairy_quadruped · Top 1% Poster

For the good of Tesla, the company, Musk the CEO has to go.

Musk is the CEO and public face of Tesla. Back in it early days (pre-2018) he was awkward but enthusiastic, progressive and apolitical. You would buy a Tesla-made car because it was different, fun, fast, smart and relatively green. The company as led by Musk kick-started the electric car as a viable option and revolutionised the car industry.

Now, Musk has gone down a very murky rabbit hole. His public face is less about his companies, and more about his politics. He has huge influence, and not in a way the most of the world wants.

A European study has shown that 30% of Tesla owners in the Netherlands are considering selling their car or have already done so. Tesla sales in Q4 2024 are down 40% compared to the previous year. Global sales are down 1.1%, the first ever drop in sales since 2011.

Anecdotally, in Australia, everyone I have talked to has said they would not consider buying a Tesla now. Tesla sales in Australia for 2024 are down 1.5% for the model 3 and 26% for the model Y.

There are many reasons why this decline could be occurring. Interest rates are still up. The Model Y refresh is pending. But I think a huge part is the disenchantment of buyers because of Musk's public face.

I think Musk should go. Musk is damaging Tesla. He should not be CEO. I think as shareholders we should protect our interests and vote for him to be removed as CEO.

1.7K · 965 · 1 · Share

Journalistic media - *self driving*

NBC NEWS

Tesla Autopilot linked to hundreds of collisions, has 'critical safety gap,' Federal regulator says

Apr 26, 2024 • By Lora Kolodny & Rob Wile

BUSINESS INSIDER

A safety group graded 14 driver-assistance systems. Tesla's self-driving option was the worst.

Mar 12, 2024 • By Camilo Fonseca

Forbes

Car Automation Programs—Including Tesla's—Get Poor Ratings From Safety Group

Mar 12, 2024 • By James Padraig Farrell

AP

Questions about the safety of Tesla's 'Full Self-Driving' system are growing

Aug 28 • By Tom Krisher

CNN

Feds investigating safety of Tesla's 'Full Self-Driving' feature

Oct 18 • By Chris Isidore

Rolling Stone

I Took a Ride in a 'Self-Driving' Tesla and Never Once Felt Safe

Aug 19, 2024 • By Miles Klee

WIRED

Tesla Autopilot Was Uniquely Risky—and May Still Be

Apr 26, 2024 • By Aarian Marshall

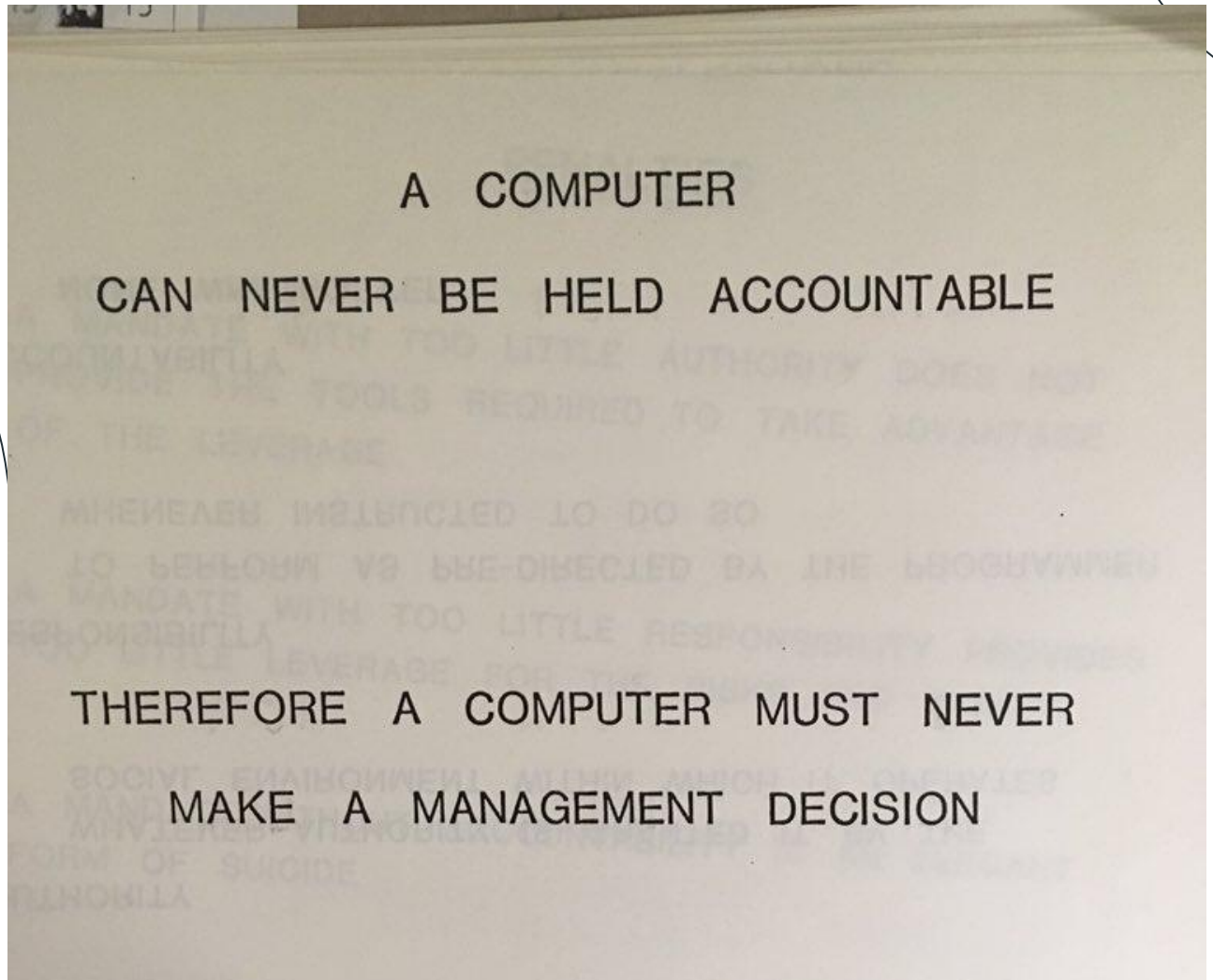
San Antonio Express-News

Tesla is safest in world, says driver whose Cybertruck self-drove into pole

Yesterday • By Annasofia Scheve

Stock price


Tesla Inc
NASDAQ: TSLA
Overview
Compare
Financials
Market Summary > Tesla Inc
281.95 USD
+ Follow
+237.42 (533.17%) ↑ past 5 years
Closed: Feb 27, 7:59 PM EST • Disclaimer
After hours 282.29 +0.34 (0.12%)
1D 5D 1M 6M YTD 1Y 5Y Max
500
400
300
200
100
0
2021
2022
2023
2024
2025
Open 291.16
High 297.23
Low 280.88
Mkt cap 883.48B
P/E ratio 138.33
Div yield -
52-wk high 488.54
52-wk low 138.80

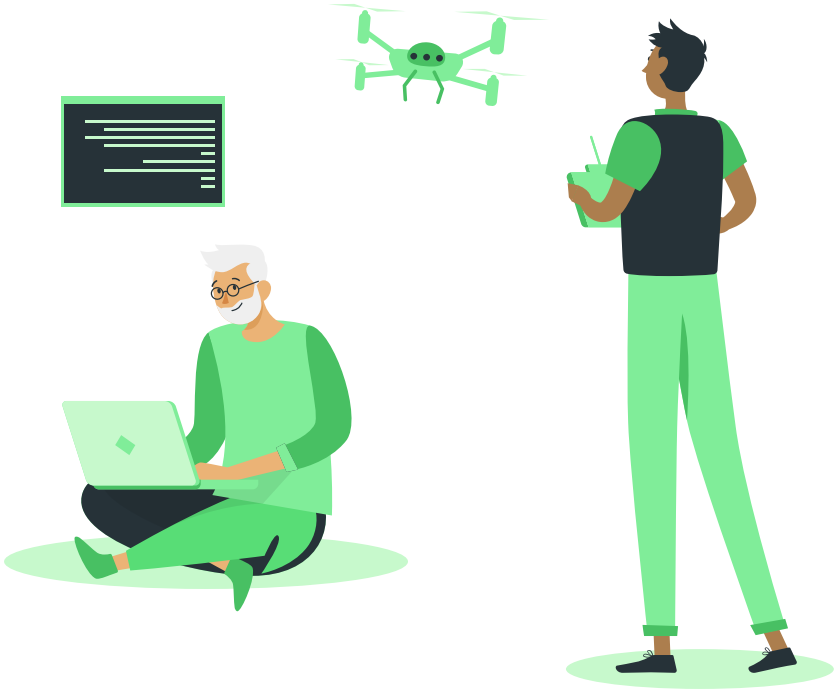


Circa IBM, 1979

Thanks!

Additional Resources

- StatQuest
- MIT OpenCourseware Intro to ML
- Tensorflow (TF) python library



Questions

(talk to your neighbors!, individual submission)

Technical questions:

1) Will test loss ever equal 0? Why?
2) How does Deep Learning improve?
3) Can we *always* understand the models we create?

Journalism questions:

4) Before this presentation, do you think AI was accurately described in mass media?
5) How does the language used in headlines and news stories shape the public's expectations of Tesla's technology?
6) Would you ride in a self-driving car? Why or why not?