Introduction to AI/ML

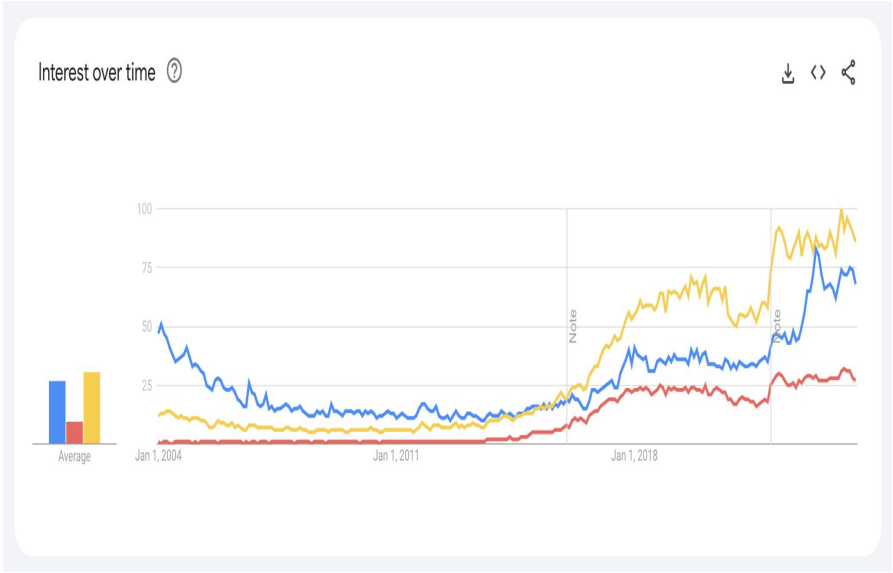
Arun Rajkumar,
Department of Data Science and AI, IIT Madras

Why?

machine learning
Search term

deep learning
Search term

artificial intelligence
Search term



Why?

Top 10 Technology Trends in 2024

1. **Generative AI**
2. **Artificial Intelligence and Machine Learning**
3. Blockchain
4. Cybersecurity
5. Low code/No code
6. Full stack development
7. VR/AR
8. Robotic Process Automation
9. IoT
10. Edge Computing

Where?

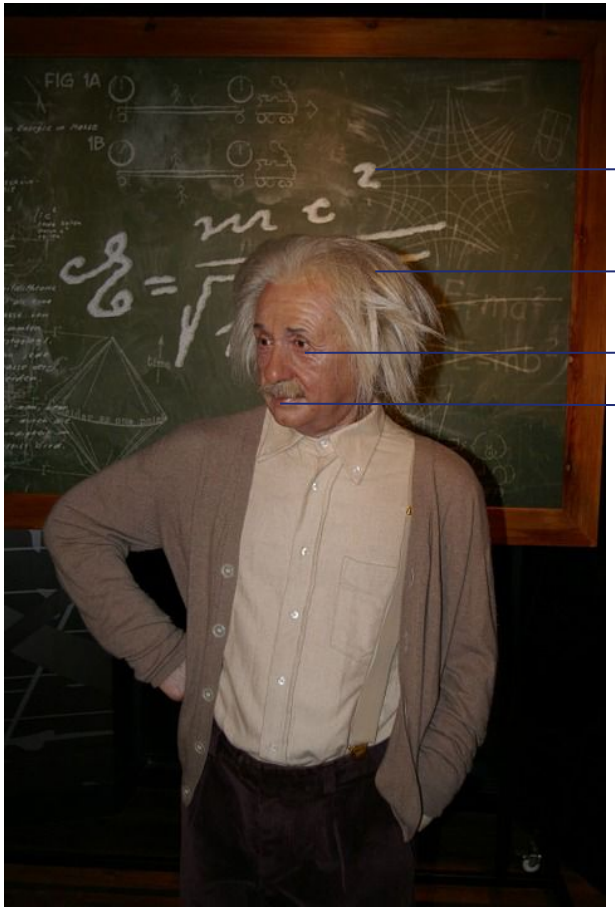


Image: Google

What?

How?

Dartmouth Summer Research Project on Artificial Intelligence - 1956

*We propose that a 2-month .. study ito proceed on the basis of the conjecture that every aspect of learning or any other feature of **intelligence** can in principle be so precisely described that a machine can be made to **simulate** it. An attempt will be made to find how to make machines use **language**, form abstractions and concepts, **solve kinds of problems now reserved for humans**, and **improve** themselves. We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.*

source:wikipedia

Program

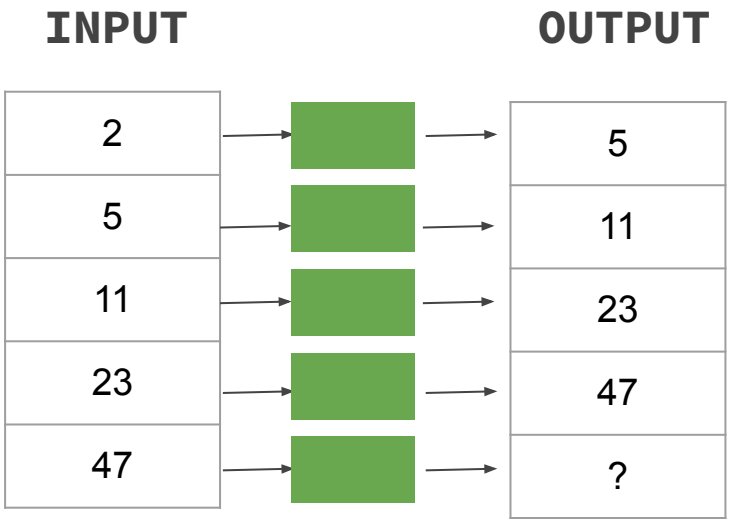
```
function something(n):
    if n <= 1:
        return false
    for i from 2 to n - 1:
        if n % i == 0:
            return false
    return true
```

Input: 10
Output: **False**

Input: 23
Output: **True**

Guess the next number

2, 5, 11, 23, 47, ?




```
function something(n)
        return 2n + 1
```

Two different Paradigms

```
function something(n):
    if n <= 1:
        return false
    for i from 2 to n - 1:
        if n % i == 0:
            return false
    return true
```

INPUT

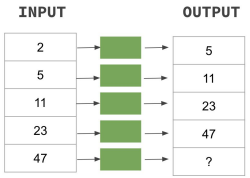
+

PROGRAM

produces

OUTPUT

NOT LEARNING



INPUT

+

OUTPUT

produces

PROGRAM

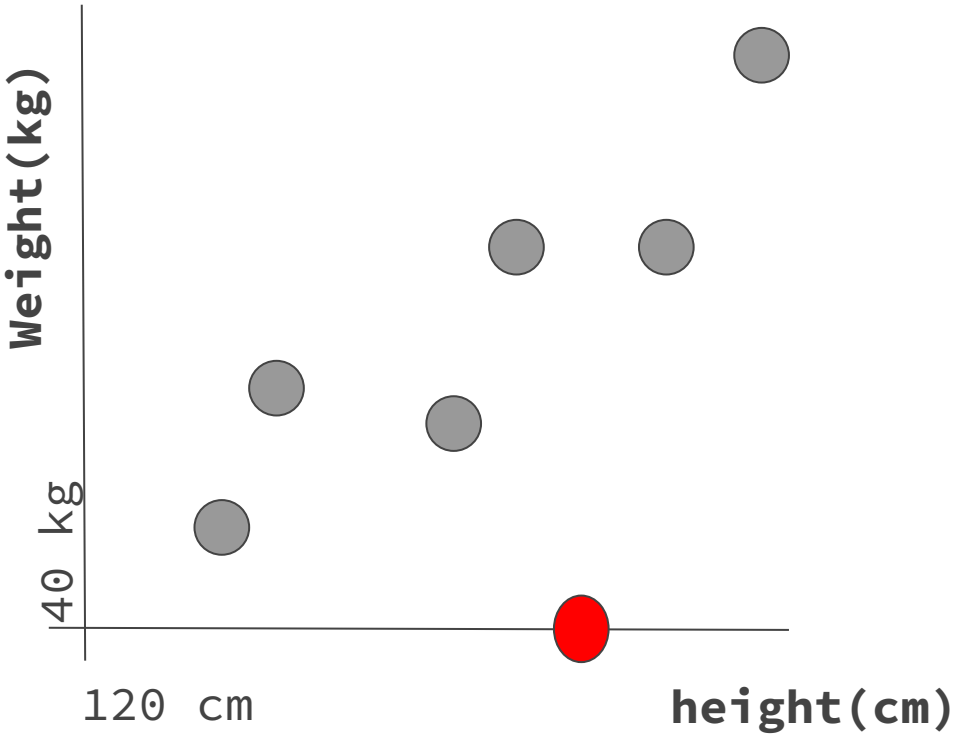
LEARNING

Why should we care to learn - aren’t programs enough?

Because SCIENCE works that way!

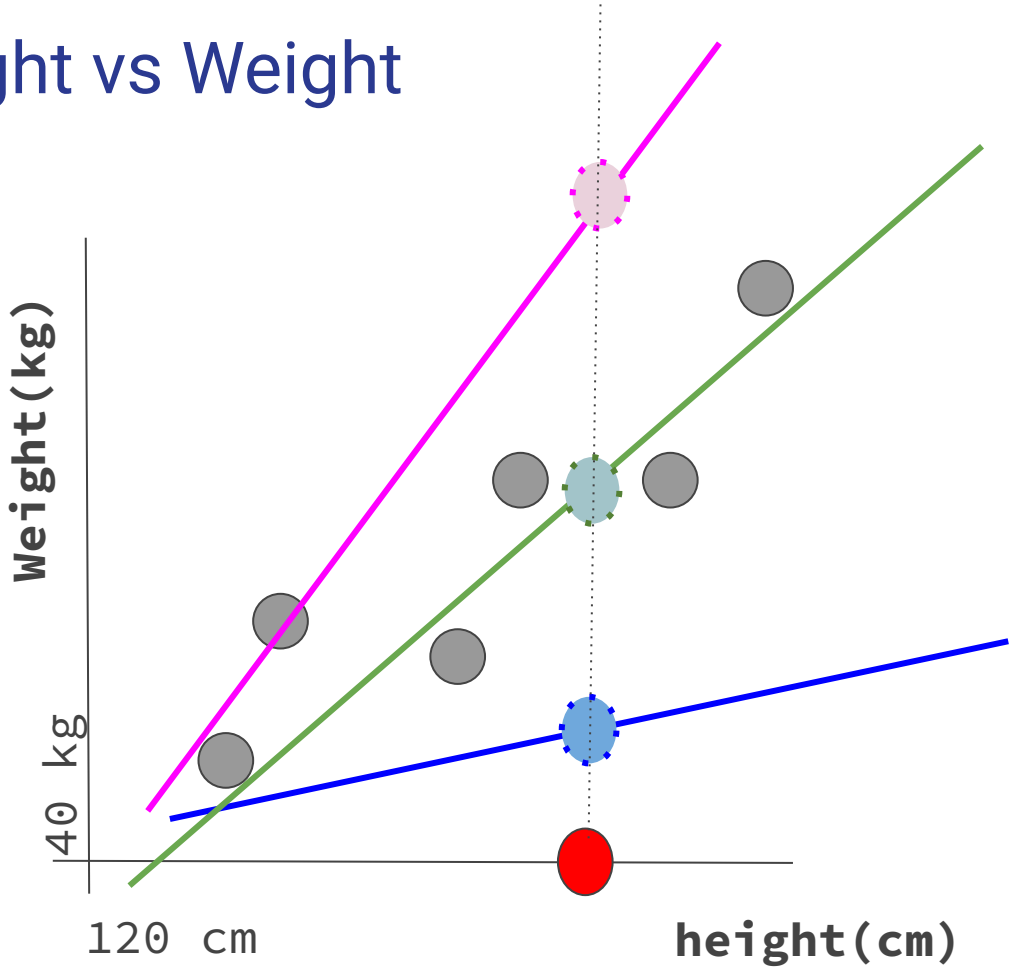
- **Observe** *2,5,11,23,47*
- **Hypothesize** *f(n) = an+b*
- ***Learn*** *a = 2, b = 1*
- **Generalize** *2*(103) + 1 = 207*

Height vs Weight



Given your friend's height,
can we guess their weight?

Height vs Weight

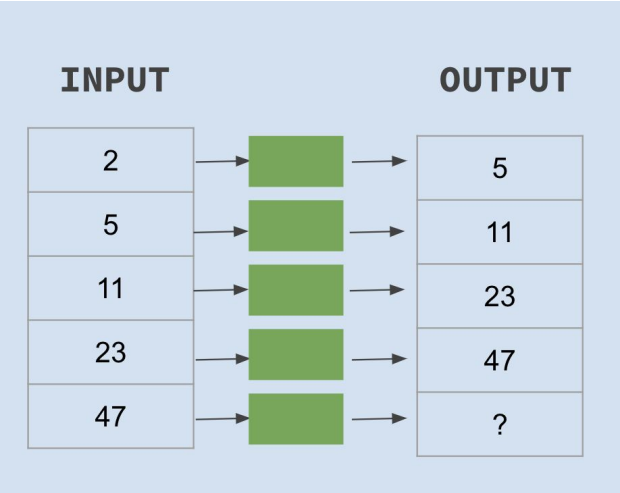


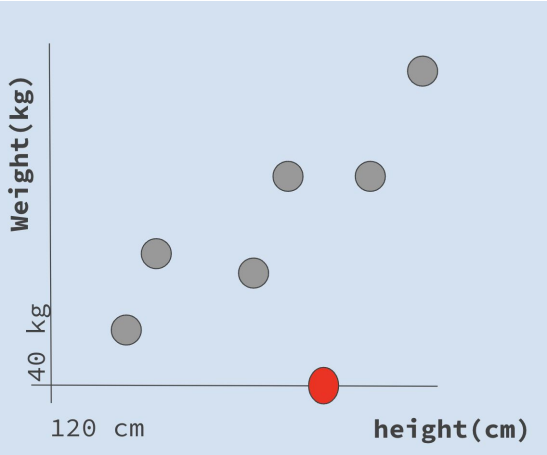
Given your friend's height, can we guess their weight?

Back to OHLG

- **Observe**
  - *Height and weight of students*
- **Hypothesize**
  - *Height and weight are linearly related*
- **Learn**
  - *Find the **‘best’** line according to some measure*
- **Generalize**
  - *Predict weight given height of your friend*

Some points to note





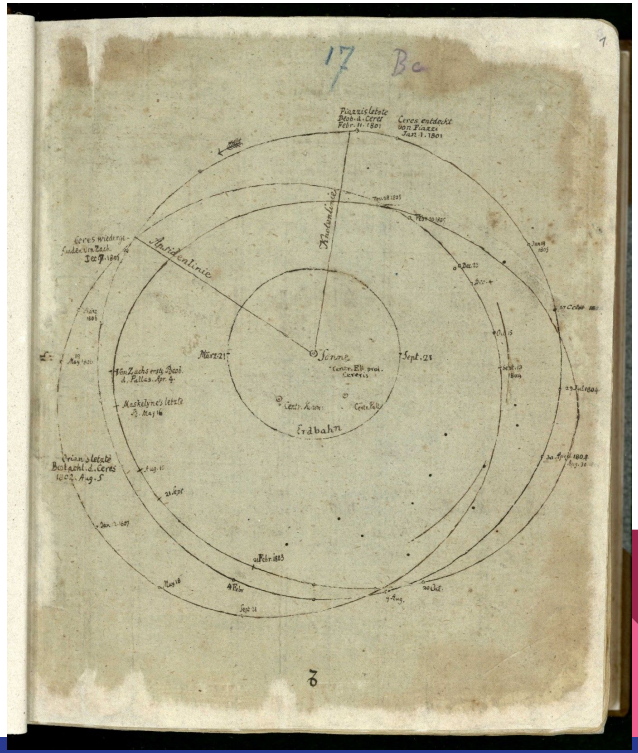
Observed (input,output) is (n,2n+1)

Observed (input,output) is (height, **a***height+**b**+**noise**)

Of astronomical Relevance

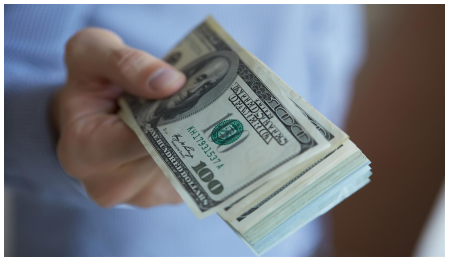
	right ascension	declination	Time
Jan. 2	51° 47′ 49″	15° 41′ 5″	8 h 39 min 4.6 sec
Jan. 22	51° 42′ 21″	17° 3′ 18″	7 h 20 min 21.7 sec
Feb. 11	54° 10′ 23″	18° 47′ 59″	6 h 11 min 58.2 sec

Carl Friedrich Gauss



A simple example

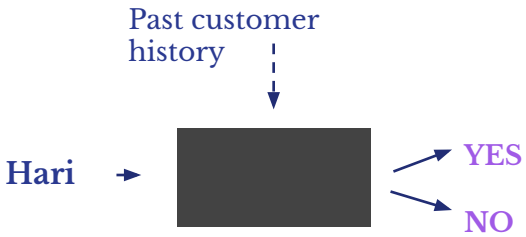
Problem: Given the loan history of customers, predict if a new customer will payback loan or not.

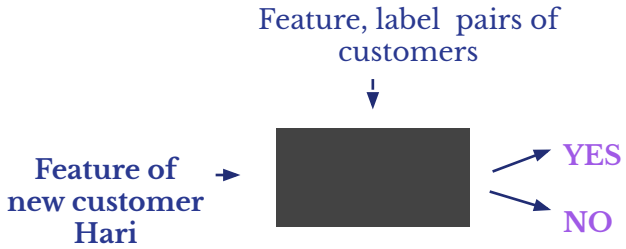


OUTPUT or LABEL

INPUT or FEATURES

Name	Age	Gender	Education	Salary	Married	Location	Decision
John	29	M	M.S	$12500	Yes	Urban	YES
Mary	27	F	Ph.D	$30000	No	Rural	YES
Smith	36	M	B.S	$4500	Yes	Rural	NO
Hari	*28*	*M*	*B.S*	*$16000*	*No*	*Urban*	???





More examples

- Spam vs Non-spam
- Forecasting rainfall
- Recommending movies
- Friend suggestions
- Voice/Instrument separation
- Grouping pictures in phone
- Robot navigation
- Digit recognition

What?

~~Procedural~~
Eg: Tax calculation

~~Memorize~~

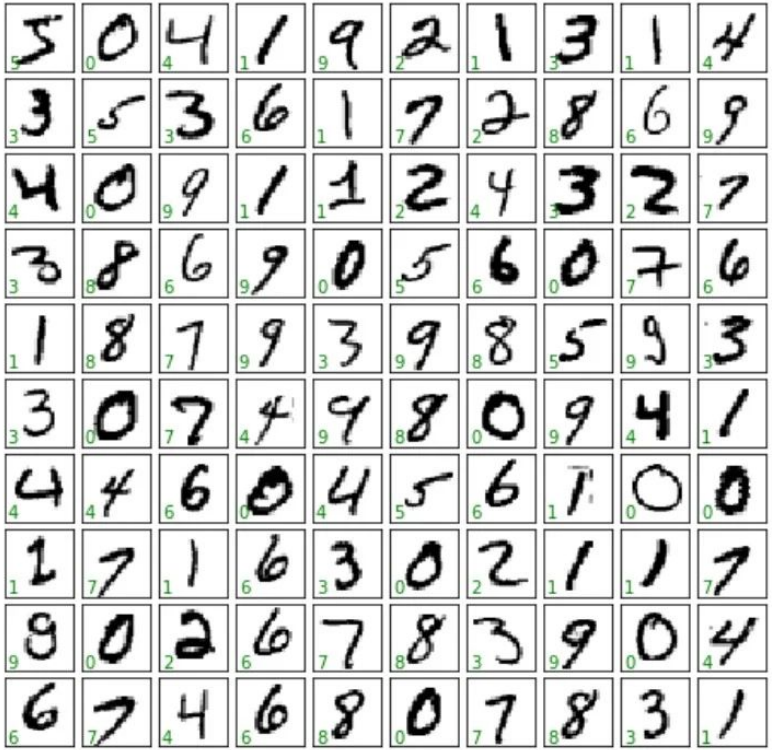
~~Magic~~

Data driven

Generalize

Math!

Guess the features



Guess the features

Hello how are you doing? Please reply to this email when you have some time.	NOT SPAM
You have won $10000000 in lottery	SPAM
Download this software - your system is compromised	SPAM
Can we setup a meeting at 1PM tomorrow?	NOT SPAM