Accademia dell'Hardware e del Software Libero "Adriano Olivetti"

23 NOVEMBRE 2024

POLO FORMATIVO
OFFICINA H
VIA MONTE NAVALE
IVREA

INTELLIGENZA ARTIFICIOSA

PUÒ ESISTERE UNA IA "FATTA IN CASA"?

09:30 NON CHIAMIAMOLA "INTELLIGENZA ARTIFICIALE"
Macchine calibrate con (tanti) dati
Norberto Patrignani

10:00 INTRODUZIONE ALLA DATA SCIENCE UTILIZZANDO OLS
Manipolazione di dati open source in javascript
Luigi Capra

10:30 QUATTRO CHIACCHIERE CON IL PROPRIO PC
Gianpaolo Perego & Jacopo Battaglia

11:00 MACHINE LEARNING PER OPENSTREETMAP
Andrea Musuruane

11:30 PAUSA CAFFÈ

12:00 AI LAB - LABORATORIO INTELLIGENTE
Usiamo l'IA per riconoscere le cifre
I tutor del Fablab

12:30 CONCLUSIONI E DIBATTITO

Non chiamiamola "intelligenza artificiale"
macchine calibrate con (tanti) dati

Norberto Patrignani
Ivrea, 23 Novembre 02024

Source: Zeno of Elea shows Youths the Doors of Truth and False (Veritas et Falsitas), Pellegrino Tibaldi (1527-1596) ("Il Pellegrini"), Fresco in the Library of El Escorial, Madrid, Source: Wikimedia Commons

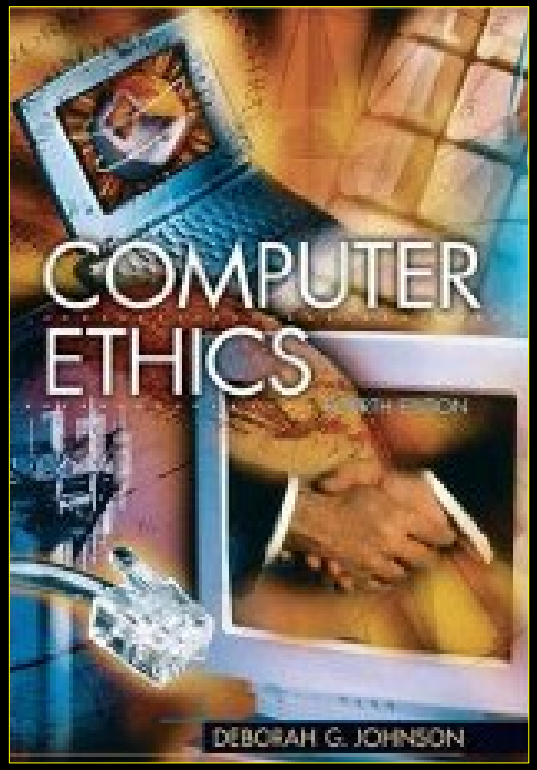
non tutto ciò che è
tecnicamente possibile... è
socialmente desiderabile,
ambientalmente sostenibile,
eticamente accettabile

le tecnologie dell'informazione
sono arrivate a plasmare la società e il pianeta
in modo inquietante,
sono parte integrante delle sfide dell'Antropocene

What is the relationship between technology and society?

Deborah Johnson

1985: Computers as *Socio-Technical Systems*



"technology is not neutral,
technology and society co-shape each other"

Deborah Johnson, 1985

Source: Johnson, D. (1985), *Computer Ethics*, First Edition, Englewood Cliffs, NJ: Prentice-Hall;

1824: Leopardi

Giacomo Leopardi
(1798-1837)

ed accomodando a tanti e cosí vari esercizi, che oramai non gli uomini ma le macchine, si può dire, trattano le cose umane e fanno le opere della vita. Del che la detta accademia prende sommo piacere, non tanto per le comoditá manifeste che ne risultano, quanto per due considerazioni che ella giudica essere importantissime, quantunque comunemente non avvertite. L'una si è che ella confida dovere in successo di tempo gli uffici e gli usi delle macchine venire a comprendere oltre le cose materiali, anche le spirituali; onde nella guisa che, per virtú di esse

grandini. L'altra cagione e la principale si è che, disperando la miglior parte dei filosofi di potersi mai curare i difetti del genere umano, i quali, come si crede, sono assai maggiori e in piú numero che le virtú; e tenendosi per certo che sia piuttosto possibile di rifarlo del tutto in una nuova stampa, o di sostituire in suo luogo un altro, che di emendarlo; perciò l'Accademia dei Sillografi reputa essere espedientissimo che gli uomini si rimuovano dai negozi della vita il piú che si possa, e che a poco a poco dieno luogo, sottentrando le macchine in loro scambio. E deliberata di concorrere con ogni suo potere al progresso di questo nuovo ordine delle cose, propone per ora tre premi a quelli che troveranno le tre macchine infrascritte.

piú d'una macchina si è veduta che giocava agli scacchi per se medesima. Ora, a giudizio di molti savi, la vita umana è un giuoco; ed alcuni affermano che ella è cosa ancora piú lieve, e che tra le altre, la forma del giuoco degli scacchi è piú secondo ragione, e i casi piú prudentemente ordinati che non sono quelli di essa vita. La quale oltre a ciò, per detto di Pindaro, non essendo cosa di piú sostanza che un sogno di un'ombra, ben debbe esserne capace la veglia di un automato. Quanto alla favella, pare non si possa volgere in dubbio che gli uomini abbiano facoltá di comunicarla alle macchine che essi formano, conoscendosi questa cosa da vari esempi, e in particolare da ciò che si legge della statua di Mennone e della testa fabbricata da Alberto magno, la quale era sí loquace, che perciò san Tommaso di Aquino, venutagli in odio, la ruppe. E se il pappagallo di Nevers, con tutto che fosse una bestiolina, sapeva rispondere e favellare a proposito, quanto maggiormente è da credere che possa fare questi medesimi effetti una macchina immaginata dalla mente dell'uomo e construtta dalle sue mani; la quale giá non debbe essere cosí linguacciuta come il pappagallo di Nevers ed altri simili che si veggono e odono tutto giorno, né come la testa fatta da Alberto magno, non le convenendo infastidire l'amico e muoverlo a fracassarla. L'inventore di questa macchina riporterá in premio una medaglia d'oro di quattrocento zecchini di peso, la quale da una banda rappresenterá le immagini di Pilade e di Oreste, dall'altra il nome del premiato col titolo: PRIMO VERIFICATORE DELLE FAVOLE ANTICHE.

Leopardi, G. (1824). *Proposta di premi fatta dall'accademia dei sillografi*, Operette Morali.

"Non è affatto negativo, dunque,
l'atteggiamento di Leopardi verso le scienze e il progresso,
ma ***il suo criticismo corrosivo investe***
l'entusiasmo ingenuo per un potere illimitato,
l'illusione antropocentrica del dominio sul mondo e sull'universo, soprattutto su ciò che è ovviamente umano e non tecnico*."*

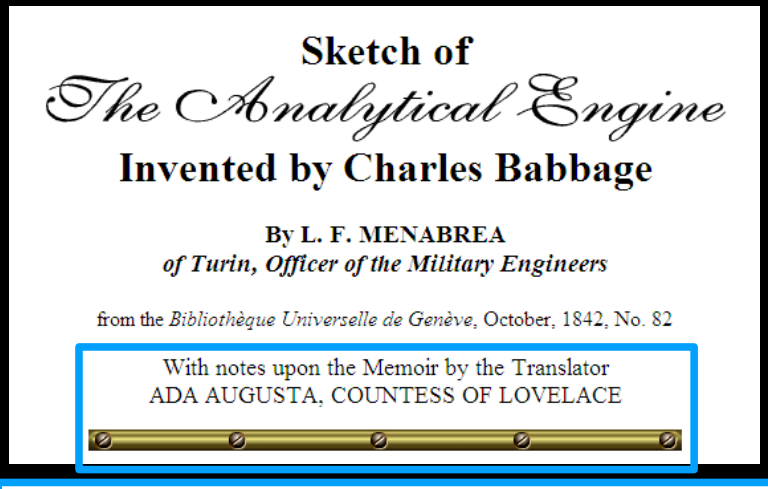
Laura Neri, 2017

Fonte: Neri, L. (2017). *Macchine per giuoco nella Proposta di Leopardi*, Enthymema XVII 2017, Università degli Studi di Milano.

1842: Ada Byron, the 1st Programmer in History

"*La macchina è capace, in certe circostanze, di scoprire quale di due o più contingenze possibili si è verificata e* ***modificare il comportamento futuro in accordo con tale evenienza***"
Ada Byron, Nota A
cit. in Henin, S. (2015). Augusta Ada Lovelace (1815-1852), *Mondo Digitale*, Aprile.

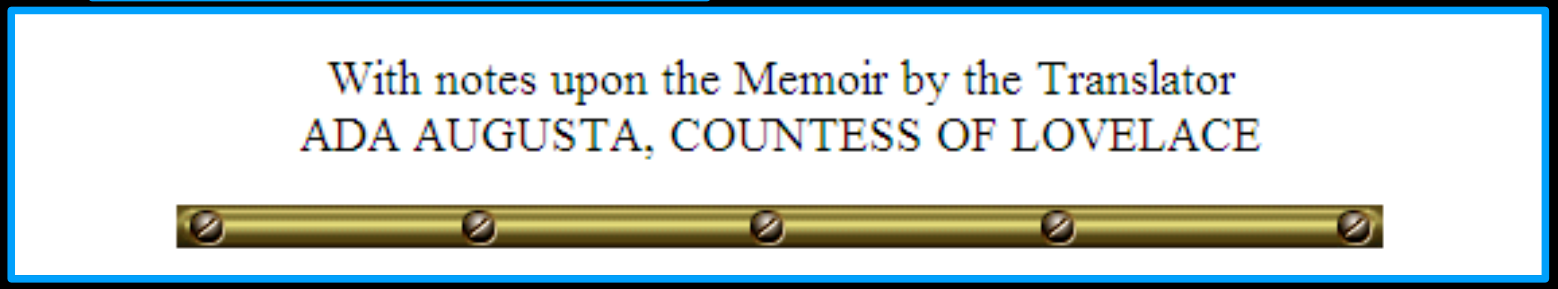
Ada Byron
(1815-1852)


Sketch of
The Analytical Engine
Invented by Charles Babbage

By L. F. MENABREA
of Turin, Officer of the Military Engineers

from the *Bibliothèque Universelle de Genève*, October, 1842, No. 82

With notes upon the Memoir by the Translator
ADA AUGUSTA, COUNTESS OF LOVELACE


With notes upon the Memoir by the Translator
ADA AUGUSTA, COUNTESS OF LOVELACE

- daughter of Anne Isabella Milbanke - George Gordon Byron
- *distinction between operations (Instructions) and objects operated upon (Data)*
- *the objects may not only be numbers, but anything that may be represented by numbers*
- *Babbage was focused on* ***number crunching****, Ada Byron developed a*

vision of the capability of computers to go beyond mere calculating

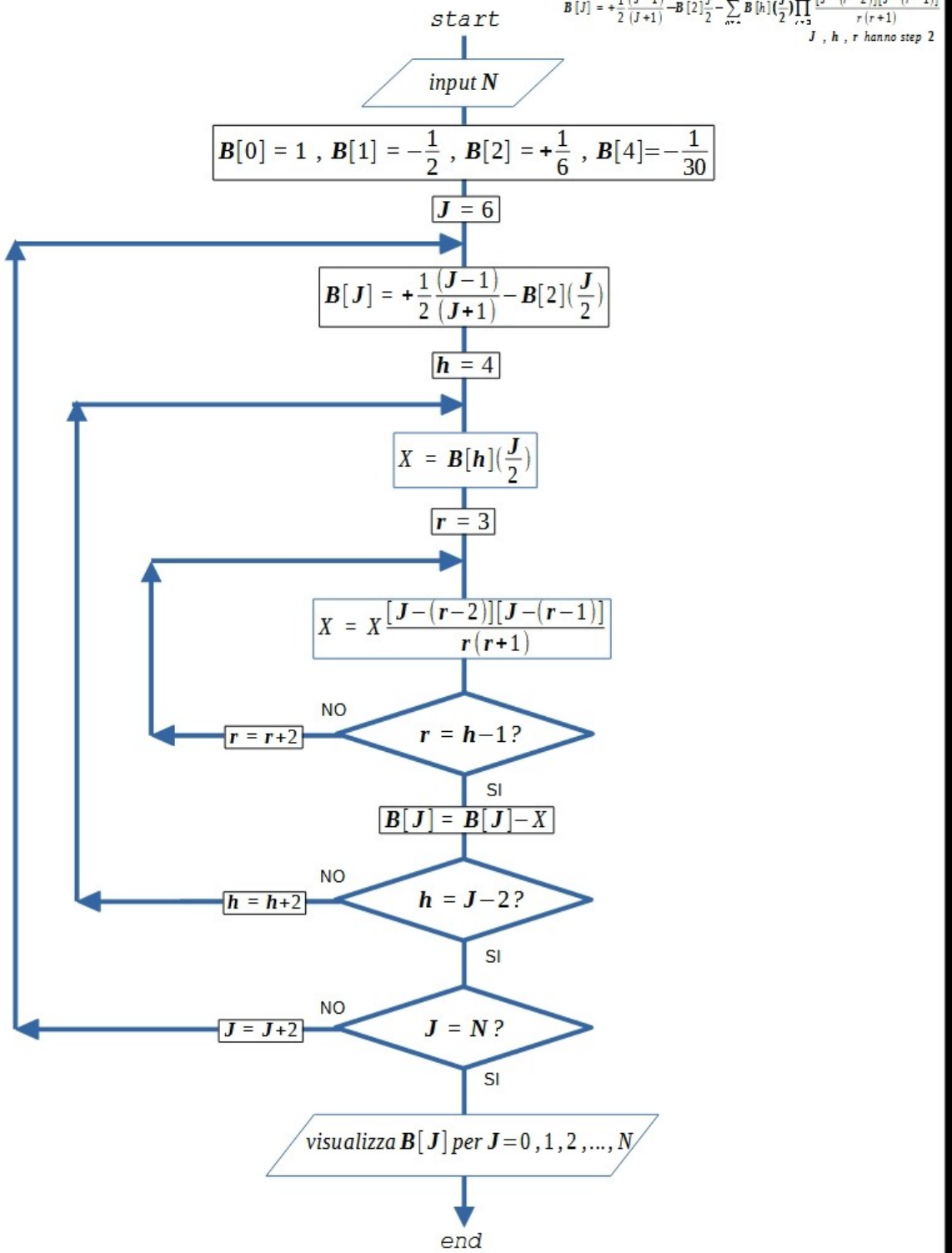
- *Poetical Science: ability by using imagination and metaphor*
to evaluate accurately a concept or an idea

Algoritmo di Ada Byron per i Numeri di Bernouilli (0, N)

per J pari ≥ 6

$$B[J] = +\frac{1}{2}\frac{(J-1)}{(J+1)} - B[2]\frac{J}{2} - \sum_{r=3}^{J-2} B[h]\binom{J}{2}\prod_{r=3}^{h-1}\frac{[J-(r-2)][J-(r-1)]}{r(r+1)}$$

J , h , r hanno step 2



1842

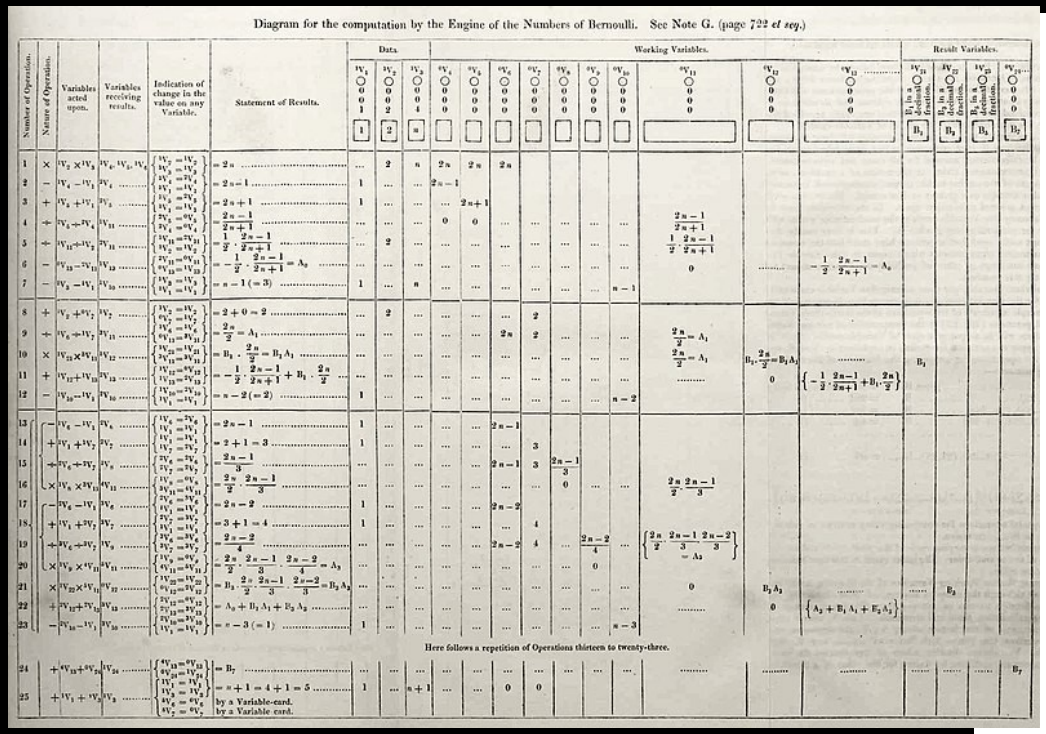


Diagram for the computation by the Engine of the Numbers of Bernoulli. See Note G. (page 722 *et seq.*)

Number of Operation.	Nature of Operation.	Variables acted upon.	Variables receiving results.	Indication of change in the value on any Variable.	Statement of Results.	Data.			Working Variables.									Result Variables.			
						$^{1}V_1$ 1	$^{1}V_2$ 2	$^{1}V_3$ n	$^{1}V_4$	$^{1}V_5$	$^{1}V_6$	$^{1}V_7$	$^{1}V_8$	$^{1}V_9$	$^{1}V_{10}$	$^{n}V_{11}$	$^{n}V_{12}$	$^{n}V_{13}$	$^{1}V_{21}$ B_1	$^{1}V_{22}$ B_2	$^{1}V_{23}$ B_3	$^{1}V_{24}$ ...
1	×	$^{1}V_2 \times {}^{1}V_3$	$^{1}V_4, {}^{1}V_5, {}^{1}V_6$	$\left\{\begin{matrix}{}^{1}V_2 = {}^{1}V_2 \\ {}^{1}V_3 = {}^{1}V_3\end{matrix}\right.$	$= 2n$	...	2	n	2n	2n	2n											
2	−	$^{1}V_4 - {}^{1}V_1$	$^{1}V_4$	$\left\{\begin{matrix}{}^{1}V_4 = {}^{1}V_4 \\ {}^{1}V_1 = {}^{1}V_1\end{matrix}\right.$	$= 2n - 1$	1	...	...	2n − 1														
3	+	$^{1}V_3 + {}^{1}V_1$	$^{1}V_5$	$\left\{\begin{matrix}{}^{1}V_3 = {}^{1}V_3 \\ {}^{1}V_1 = {}^{1}V_1\end{matrix}\right.$	$= 2n + 1$	1	...	...	...	2n+1													
4	÷	$^{1}V_5 \div {}^{1}V_4$	$^{n}V_{11}$	$\left\{\begin{matrix}{}^{1}V_5 = {}^{1}V_5 \\ {}^{1}V_4 = {}^{1}V_4\end{matrix}\right.$	$= \frac{2n-1}{2n+1}$	...	...	...	0	0	...	...	...	...	...	$\frac{2n-1}{2n+1}$ $\frac{1}{2} \cdot \frac{2n-1}{2n+1}$							
5	+	$^{1}V_{11} + {}^{1}V_2$	$^{n}V_{11}$	$\left\{\begin{matrix}{}^{1}V_{11} = {}^{1}V_{11} \\ {}^{1}V_2 = {}^{1}V_2\end{matrix}\right.$	$= \frac{1}{2} \cdot \frac{2n-1}{2n+1}$	...	2	...	...	...	...	...	...	...	...								
6	−	$^{n}V_{13} - {}^{n}V_{12}$	$^{n}V_{13}$	$\left\{\begin{matrix}{}^{n}V_{11} = {}^{n}V_{11} \\ {}^{n}V_{12} = {}^{n}V_{12}\end{matrix}\right.$	$= -\frac{1}{2} \cdot \frac{2n-1}{2n+1} = A_0$	...	...	...	...	...	...	...	...	...	...	0	.....	$-\frac{1}{2} \cdot \frac{2n-1}{2n+1} = A_0$					
7	−	$^{1}V_3 - {}^{1}V_1$	$^{1}V_{10}$	$\left\{\begin{matrix}{}^{1}V_3 = {}^{1}V_3 \\ {}^{1}V_1 = {}^{1}V_1\end{matrix}\right.$	$= n - 1 \ (= 3)$	1	...	n	...	...	...	...	...	...	n − 1								
8	+	$^{1}V_2 + {}^{0}V_2$	$^{1}V_2$	$\left\{\begin{matrix}{}^{1}V_2 = {}^{1}V_2 \\ {}^{0}V_2 = {}^{0}V_2\end{matrix}\right.$	$= 2 + 0 = 2$	...	2	...	...	...	...	2											
9	+	$^{0}V_6 + {}^{1}V_2$	$^{n}V_{13}$	$\left\{\begin{matrix}{}^{0}V_6 = {}^{0}V_6 \\ {}^{1}V_{13} = {}^{1}V_{13}\end{matrix}\right.$	$= \frac{2n}{2} = A_1$	...	...	...	...	...	2n	2	...	...	...	$\frac{2n}{2} = A_1$ $\frac{2n}{2} = A_1$	$B_1 \cdot \frac{2n}{2} = B_1 A_1$	.....	B_1			
10	×	$^{n}V_{13} \times {}^{1}V_{11}$	$^{n}V_{12}$	$\left\{\begin{matrix}{}^{n}V_{13} = {}^{n}V_{13} \\ {}^{1}V_{11} = {}^{1}V_{11}\end{matrix}\right.$	$= B_1 \cdot \frac{2n}{2} = B_1 A_1$	...	...	...	...	...	...	...	...	...	...								
11	+	$^{n}V_{12} + {}^{n}V_{13}$	$^{n}V_{13}$	$\left\{\begin{matrix}{}^{n}V_{12} = {}^{n}V_{12} \\ {}^{n}V_{13} = {}^{n}V_{13}\end{matrix}\right.$	$= -\frac{1}{2} \cdot \frac{2n-1}{2n+1} + B_1 \cdot \frac{2n}{2}$	...	...	...	...	...	...	...	...	...	...	0		$\left\{-\frac{1}{2} \cdot \frac{2n-1}{2n+1} + B_1 \cdot \frac{2n}{2}\right\}$					
12	−	$^{1}V_{10} - {}^{1}V_1$	$^{1}V_{10}$	$\left\{\begin{matrix}{}^{1}V_{10} = {}^{1}V_{10} \\ {}^{1}V_1 = {}^{1}V_1\end{matrix}\right.$	$= n - 2 \ (= 2)$	1	...	...	...	...	...	...	...	...	n − 2								
13	−	$^{1}V_4 - {}^{1}V_1$	$^{2}V_4$	$\left\{\begin{matrix}{}^{1}V_4 = {}^{1}V_4 \\ {}^{1}V_1 = {}^{1}V_1\end{matrix}\right.$	$= 2n - 1$	1	...	...	...	...	2n − 1												
14	+	$^{1}V_1 + {}^{2}V_7$	$^{2}V_7$	$\left\{\begin{matrix}{}^{1}V_1 = {}^{1}V_1 \\ {}^{2}V_7 = {}^{2}V_7\end{matrix}\right.$	$= 2 + 1 = 3$	1	...	...	...	...	...	3											
15	→	$^{2}V_6 \div {}^{2}V_7$	$^{2}V_8$	$\left\{\begin{matrix}{}^{2}V_6 = {}^{2}V_6 \\ {}^{2}V_7 = {}^{2}V_7\end{matrix}\right.$	$= \frac{2n-1}{3}$	...	...	...	...	...	2n − 1	3	$\frac{2n-1}{3}$										
16	×	$^{2}V_8 \times {}^{2}V_{11}$	$^{2}V_{11}$	$\left\{\begin{matrix}{}^{2}V_8 = {}^{2}V_8 \\ {}^{2}V_{11} = {}^{2}V_{11}\end{matrix}\right.$	$= \frac{2n}{2} \cdot \frac{2n-1}{3}$	...	...	...	...	...	...	...	0	...	...	$\frac{2n}{2} \cdot \frac{2n-1}{3}$							
17	[	$^{2}V_6 - {}^{1}V_1$	$^{2}V_6$	$\left\{\begin{matrix}{}^{2}V_6 = {}^{2}V_6 \\ {}^{1}V_1 = {}^{1}V_1\end{matrix}\right.$	$= 2n - 2$	1	...	...	...	...	...	...	...	...	2n − 2								
18	+	$^{1}V_1 + {}^{2}V_7$	$^{2}V_7$	$\left\{\begin{matrix}{}^{1}V_1 = {}^{1}V_1 \\ {}^{2}V_7 = {}^{2}V_7\end{matrix}\right.$	$= 3 + 1 = 4$	1	...	...	...	...	...	4											
19	→	$^{2}V_6 \div {}^{2}V_7$	$^{2}V_9$	$\left\{\begin{matrix}{}^{2}V_6 = {}^{2}V_6 \\ {}^{2}V_7 = {}^{2}V_7\end{matrix}\right.$	$= \frac{2n-2}{4}$	...	...	...	...	...	2n − 2	4	...	$\frac{2n-2}{4}$	...	$\left\{\frac{2n}{2} \cdot \frac{2n-1}{3} \cdot \frac{2n-2}{3}\right\}$ $= A_2$					
20	×	$^{2}V_9 \times {}^{2}V_{11}$	$^{2}V_{11}$	$\left\{\begin{matrix}{}^{2}V_9 = {}^{2}V_9 \\ {}^{2}V_{11} = {}^{2}V_{11}\end{matrix}\right.$	$= \frac{2n}{2} \cdot \frac{2n-1}{3} \cdot \frac{2n-2}{4} = A_2$	...	...	...	...	...	...	...	...	...	0								
21	×	$^{n}V_{12} \times {}^{2}V_{11}$	$^{n}V_{12}$	$\left\{\begin{matrix}{}^{n}V_{12} = {}^{n}V_{12} \\ {}^{2}V_{11} = {}^{2}V_{11}\end{matrix}\right.$	$= B_2 \cdot \frac{2n}{2} \cdot \frac{2n-1}{3} \cdot \frac{2n-2}{3} = B_2 A_2$	...	...	...	...	...	...	...	...	...	...	0	$B_2 A_2$	.....	.....	B_2			
22	+	$^{n}V_{12} + {}^{n}V_{13}$	$^{n}V_{13}$	$\left\{\begin{matrix}{}^{n}V_{12} = {}^{n}V_{12} \\ {}^{n}V_{13} = {}^{n}V_{13}\end{matrix}\right.$	$= A_0 + B_2 A_2 + B_2 A_2$	...	...	...	...	...	...	...	...	...	...	0		$\left\{A_0 + B_1 A_1 + B_2 A_2\right\}$					
23	−	$^{n}V_{13} - {}^{1}V_1$	$^{n}V_{13}$	$\left\{\begin{matrix}{}^{n}V_{13} = {}^{n}V_{13} \\ {}^{1}V_1 = {}^{1}V_1\end{matrix}\right.$	$= n - 3 \ (= 1)$	1	...	...	...	...	...	...	...	...	n − 3								
					Here follows a repetition of Operations thirteen to twenty-three.																		
24	+	$^{n}V_{13} + {}^{n}V_{24}$	$^{n}V_{24}$	$\left\{\begin{matrix}{}^{n}V_{13} = {}^{n}V_{24} \\ {}^{n}V_{24} = {}^{n}V_{24}\end{matrix}\right.$	$= B_7$	...	...	...	...	...	...	...	...	...	...	.....	.....	.....	.....	.....	.....	.....	B_7
25	+	$^{1}V_1 + {}^{n}V_3$	$^{n}V_3$	$\left\{\begin{matrix}{}^{1}V_1 = {}^{1}V_1 \\ {}^{n}V_3 = {}^{n}V_3\end{matrix}\right.$	$= n + 1 = 4 + 1 = 5$	1	...	n + 1	...	...	0	0	...	...	...	.....	.....	.....	.....	.....	.....	.....	...
				$\left\{\begin{matrix}{}^{1}V_1 = {}^{1}V_1 \\ {}^{n}V_3 = {}^{n}V_3\end{matrix}\right.$	by a Variable-card. by a Variable-card.																			

2024

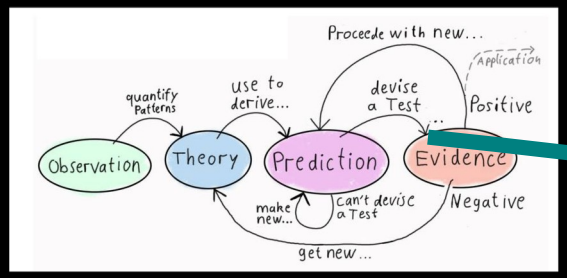
```
// Algoritmo di Ada Byron per il calcolo dei Numeri di Bernouilli
#include <stdio.h>
int main()
{
int N=10;
float B[N], X;
int J, h, r;

// inizializza a 0 tutti i Numeri di Bernouilli da 0 a N
for (J=0; J<=N; J++)
      B[J] = 0.0;

// inizializza i primi Numeri di Bernouilli noti
B[0]=+float(1);
B[1]=-float(1)/float(2);
B[2]=+float(1)/float(6);
B[4]=-float(1)/float(30);

// calcola i numeri di Bernouilli da B[6] a B[N]
for (J=6; J<=N; J=J+2) {
      B[J]=(float(1)/float(2))*(float(J-1)/float(J+1)) - B[2]*float(J)/float(2);

      // sommatoria
      for (h=4; h<=(J-2); h=h+2) {
            // produttoria
            X=B[h]*float(J)/float(2);
            for (r=3; r <= (h-1); r=r+2) {
                  X=X*float( (J-r+2)*(J-r+1) ) / float( (r)*(r+1) );
                  }
            B[J]=B[J]-X;
            }
      }

// visualizza i Numeri di Bernouilli da 0 a N
for (J=0; J<=N; J++) {
      printf("B[ %d ] = ", J); printf("%f\n", B[J]); }

return 0;
}
```

L'esecuzione del programma visualizza:

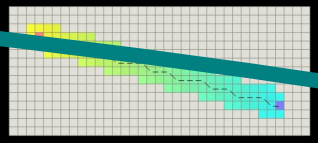
```
B[ 0 ] = 1.000000
B[ 1 ] = -0.500000
B[ 2 ] = 0.166667
B[ 3 ] = 0.000000
B[ 4 ] = -0.033333
B[ 5 ] = 0.000000
B[ 6 ] = 0.023810
B[ 7 ] = 0.000000
B[ 8 ] = -0.033334
B[ 9 ] = 0.000000
B[ 10 ] = 0.075760
```

computer: a machine for executing algorithms

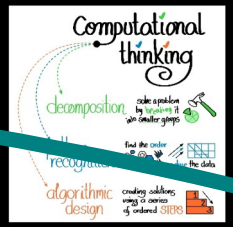
Scientific Method



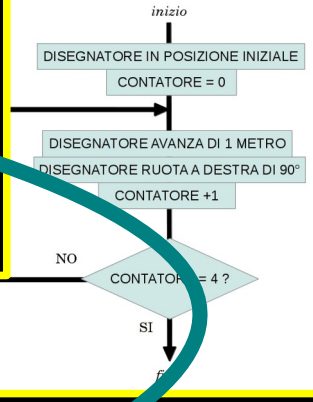
Problem Solving
(& Critical Thinking)



Computational Thinking

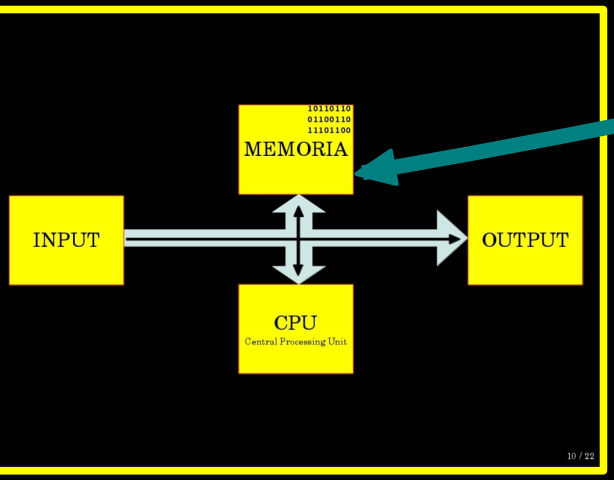


Progetto "Quadrato"
DIAGRAMMA DI FLUSSO

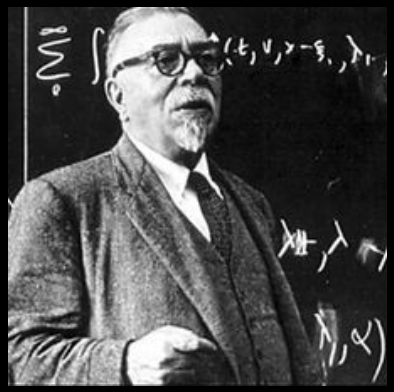


Coding

```
begin
read (X)
if ( X < = 0)
   then goto begin
   else Y = SQRT (X)
write (Y)
end
```

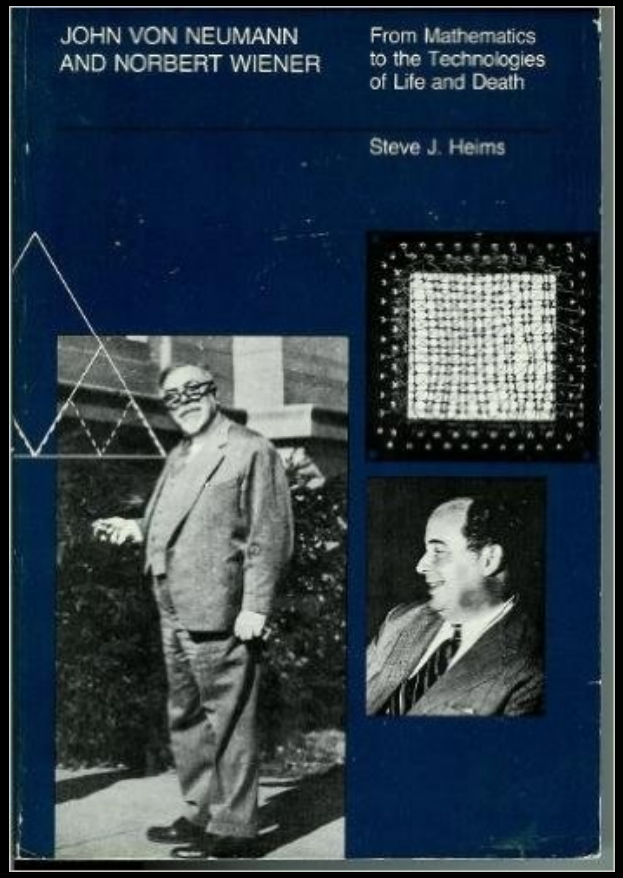


Norbert Wiener & John Von Neumann



Norbert Wiener
(1894-1964)

"*I do not expect to publish any future work of mine which may do damage in the hands of* ***irresponsible militarists****...*"
"A Scientist Rebels",
Atlantic Monthly, January, 1947



John Von Neumann
(1903-1957)

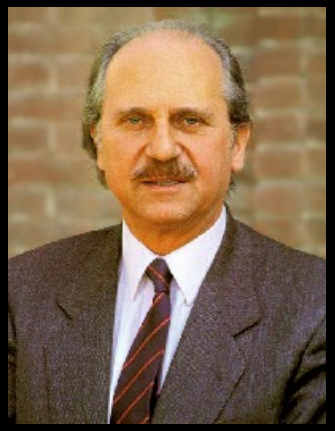
"*... I would prefer not to join the Board (of Bulletin of Atomic Scientists), since I have ... avoided all participation in public activities, which are not of a* ***purely technical nature***"

John Von Neumann to
Norman Cousins
(Library of Congress archives)
May 22, 1946

Source: Heims, S.J. - "John Von Neumann and Norbert Wiener, from mathematics to the technologies of life and death", MIT Press, Cambridge, MA, 1980

1965: Olivetti P101

olivetti



Piergiorgio Perotto
(1930-2002)

Engineering - 1955
Politecnico di Torino

WALL STREET JOURNAL
DALLAS, TEXAS

OCT 15 1965

Desk-Top Size Computer Is Being Sold by Olivetti For First Time in U.S.

By a WALL STREET JOURNAL *Staff Reporter*

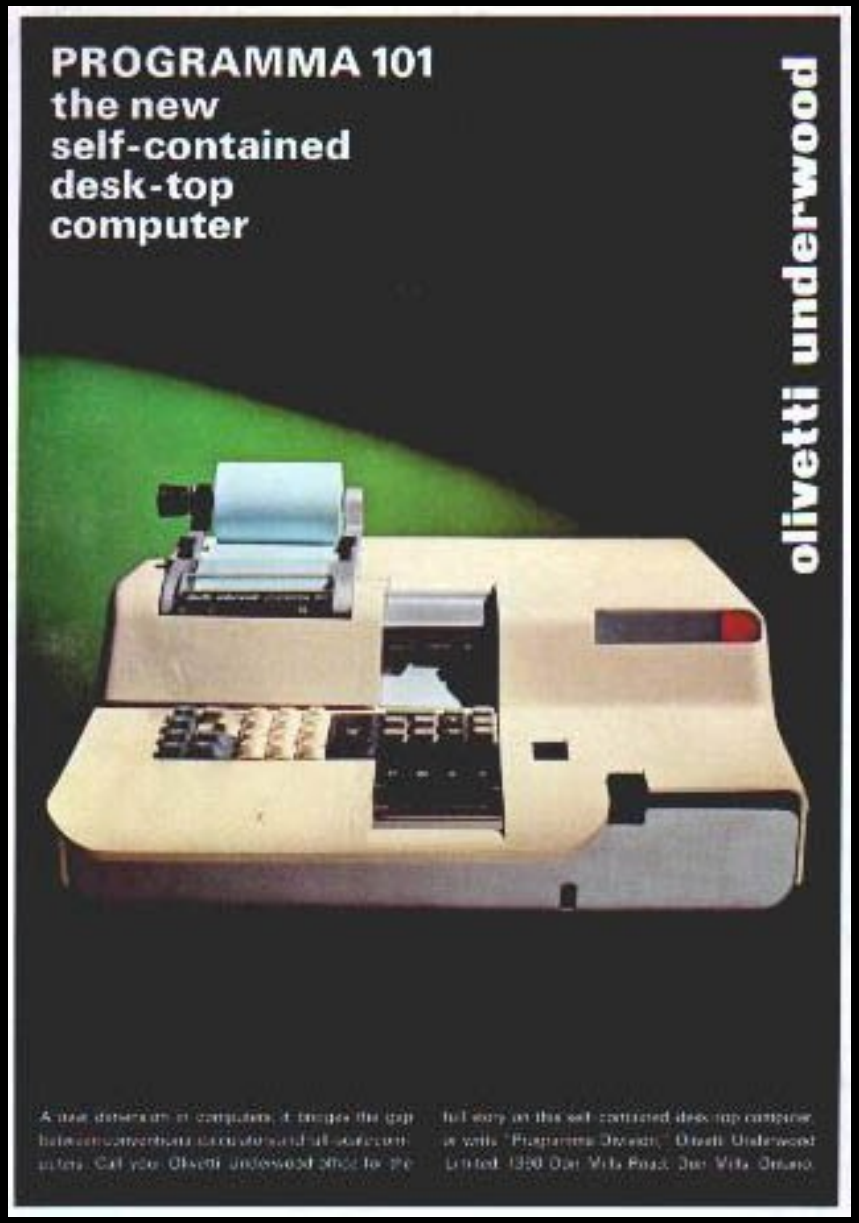
NEW YORK—Olivetti Underwood Corp. is offering its first computer for sale in the U.S.

A small desk-top computer for business and engineering use with sale price of $3,200 was introduced by the company at a press conference.

Olivetti Underwood, a U.S. subsidiary of Ing. C. Olivetti & Co., S.p.A., of Italy, said the computer has the power to make logical decisions. It uses a program card for insertion into the machine to perform operations.

The company said it expects the new computer to fill a gap in the market between desk calculators and large computers.

A calculating machine and an electric typewriter were also introduced.



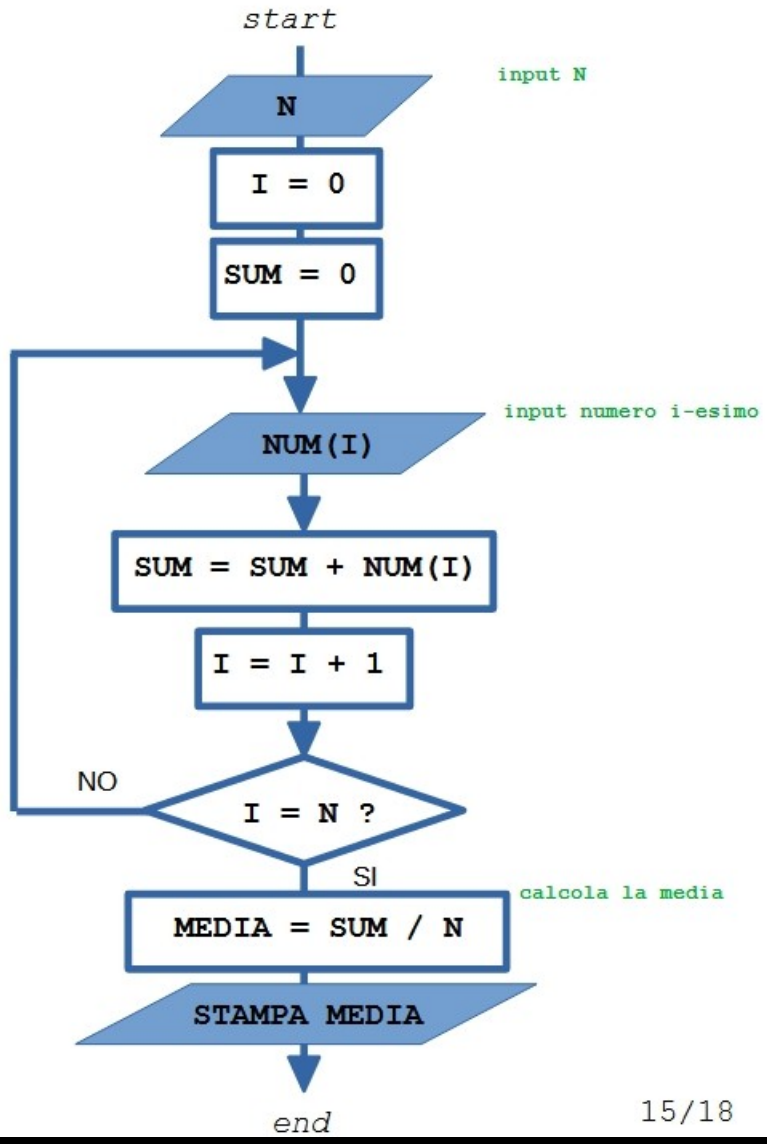
The 1st Personal Computer

Thinking the unthinkable

1965: Olivetti P101's conditional jump

Calcolo (PROGRAMMA!) della media di N numeri

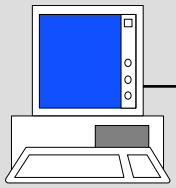
```
A V     /* start, destin. del salto incondiz. "V" */
  S     /* attendi input "N", M = "N"             */
M ↓     /* A = M = "N"                            */
C ↑     /* registro C = M = "N"                   */
C :     /* A = A : C = "N" : "N" = 1              */
D ↕     /* registro D = A = "1", per incr. +1     */
C/*     /* registro C/ = "I" = 0                  */
B *     /* registro B = "SUM" = 0                 */
B/V     /* destin. del salto condiz. C/V          */

S       /* attendi NUM(I), M = NUM(I)             */
M ↓     /* A = M = NUM(I)                         */

B +     /* A = A + B = A + SUM                    */
B ↕     /* B = A, SUM = SUM + NUM(I)              */

D ↓     /* A = D = 1                              */
C/+     /* A = 1 + C/ = 1 + I                     */
C/↕     /* C/ = A, I = I + 1                      */

C ↓     /* A = C, A = N                           */
C/-     /* A = N - C/ = N - I, se I = N, A = 0    */
C/V     /* se A > 0 vai a B/V, se I = N prosegui  */

B ↓     /* A = B = SUM                            */
C :     /* A = SUM : C = SUM : N = MEDIA          */
A ◊     /* stampa A = MEDIA                       */
V       /* salto incondizionato a A V, end        */
```



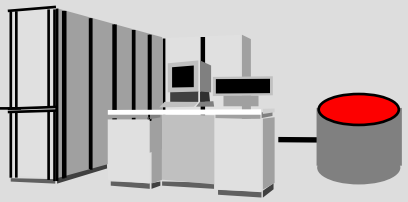
2001: Cloud Computing: Back to the Future

1950

Input
Output
Network



Terminals



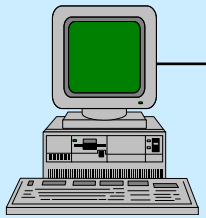
Host

Storage
Processing

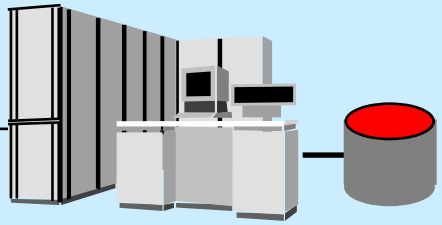
Host-Centric Computing

1965

Input
Storage
Processing
Output
Network



PCs



Host

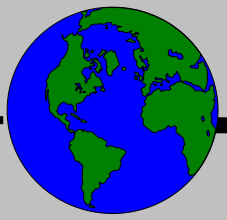
Distributed, Client/Server Computing

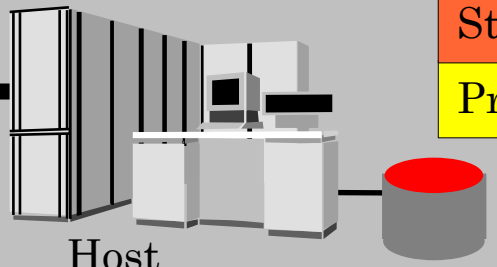
2000

"all IP addresses are equal" but some IP addresses are more equal than others...

Input
Output
Network

TouchScreens

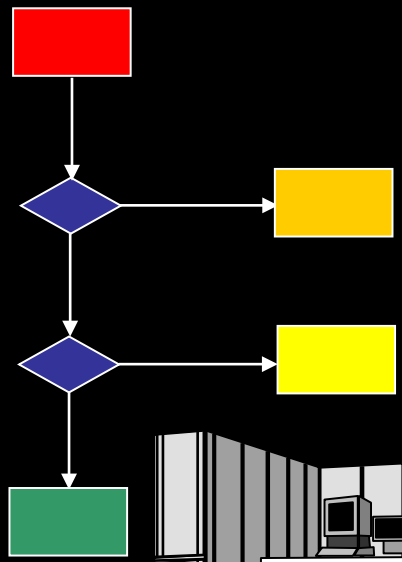




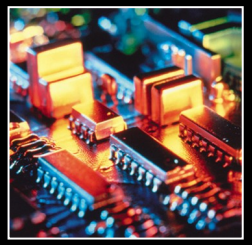
Host

Storage
Processing

Cloud Computing



Technology



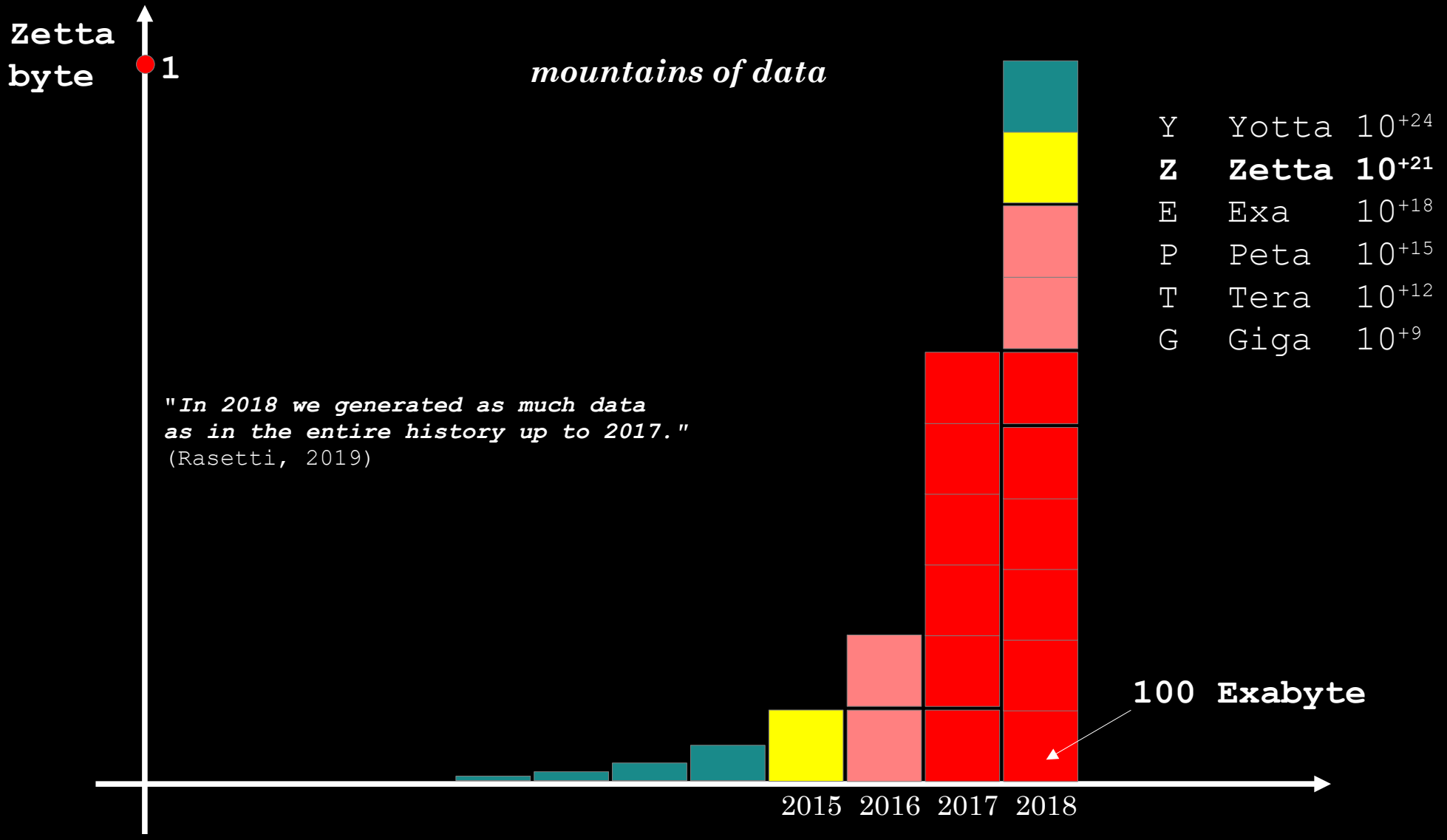
Market

Law

Education

Source: Lessig, L. (1999), *Code and other laws of cyberspace*, Basic Books

2018: Zettabyte era: big data, but how much data?

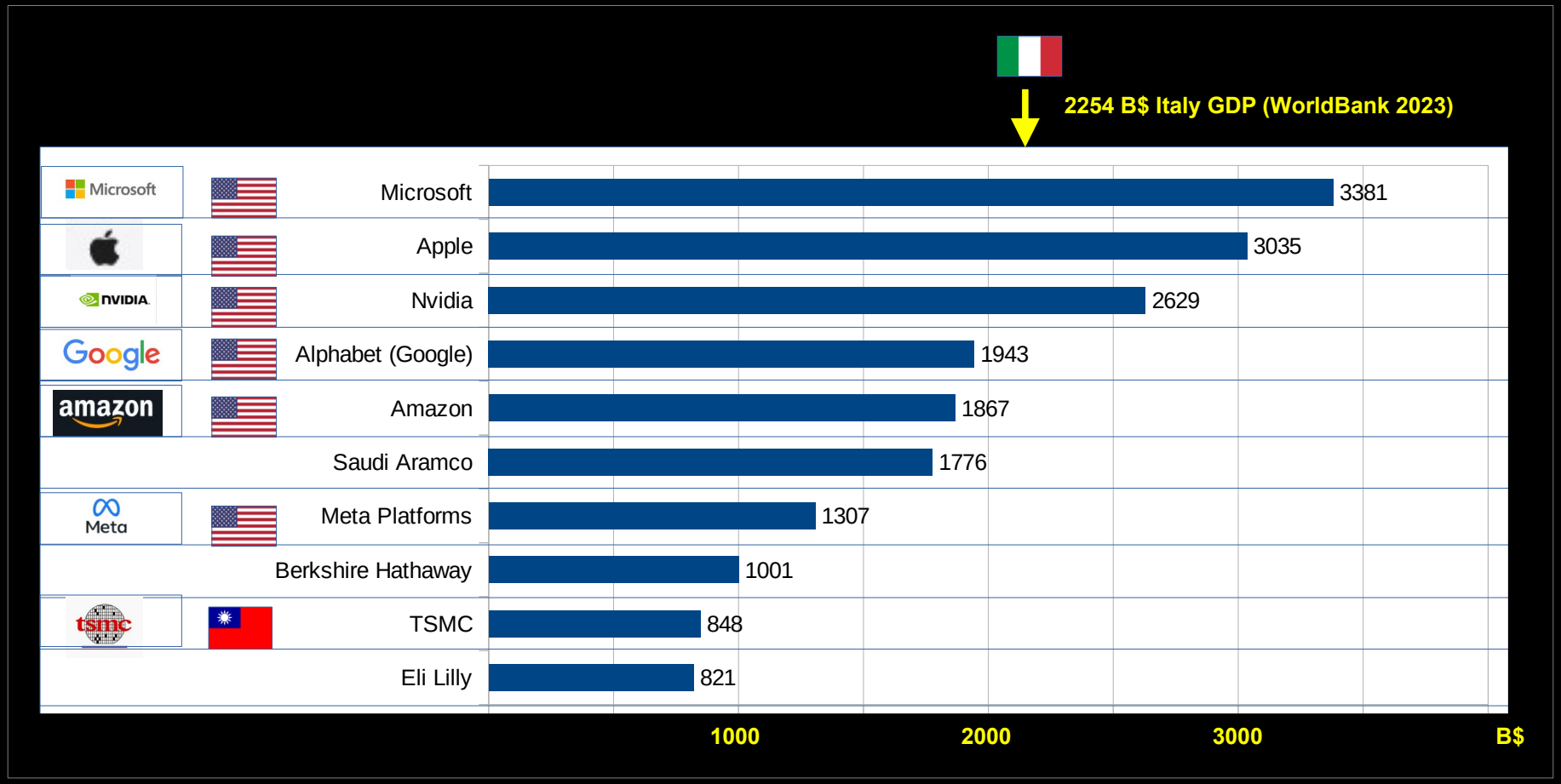


Source: Rasetti M. (2019), *Passare dalla "scienza dei dati" a un vero sapere, per salvare l'umanità: la sfida del secolo*, AgendaDigitale.eu, 4 Mar 2019

Habeas Data?

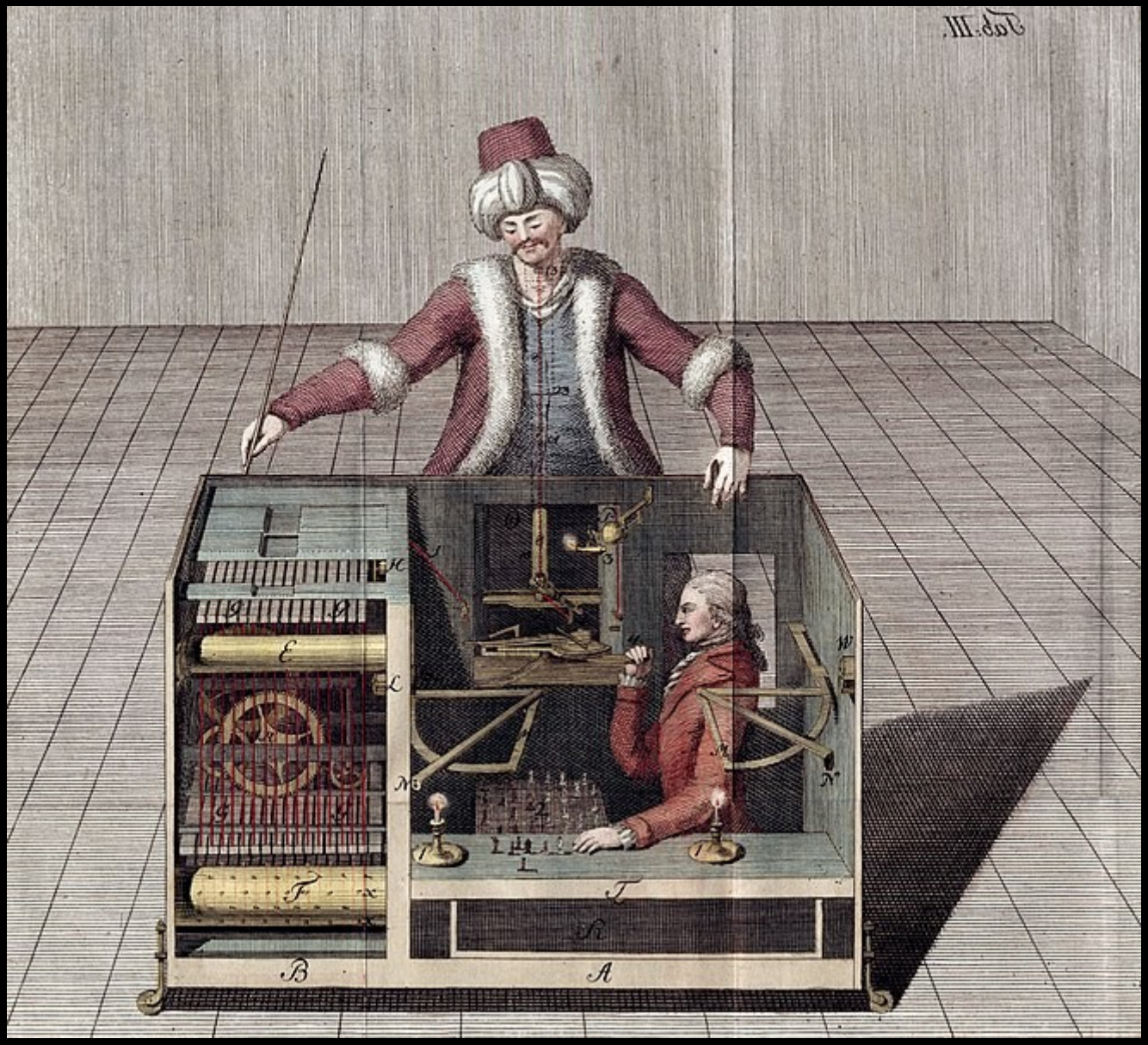
Bansky, *Mobile Lovers*, 2014

2024: the 10 largest companies in the world by market capitalization (in billion U.S. dollars)



Source: Forbes, September 2024

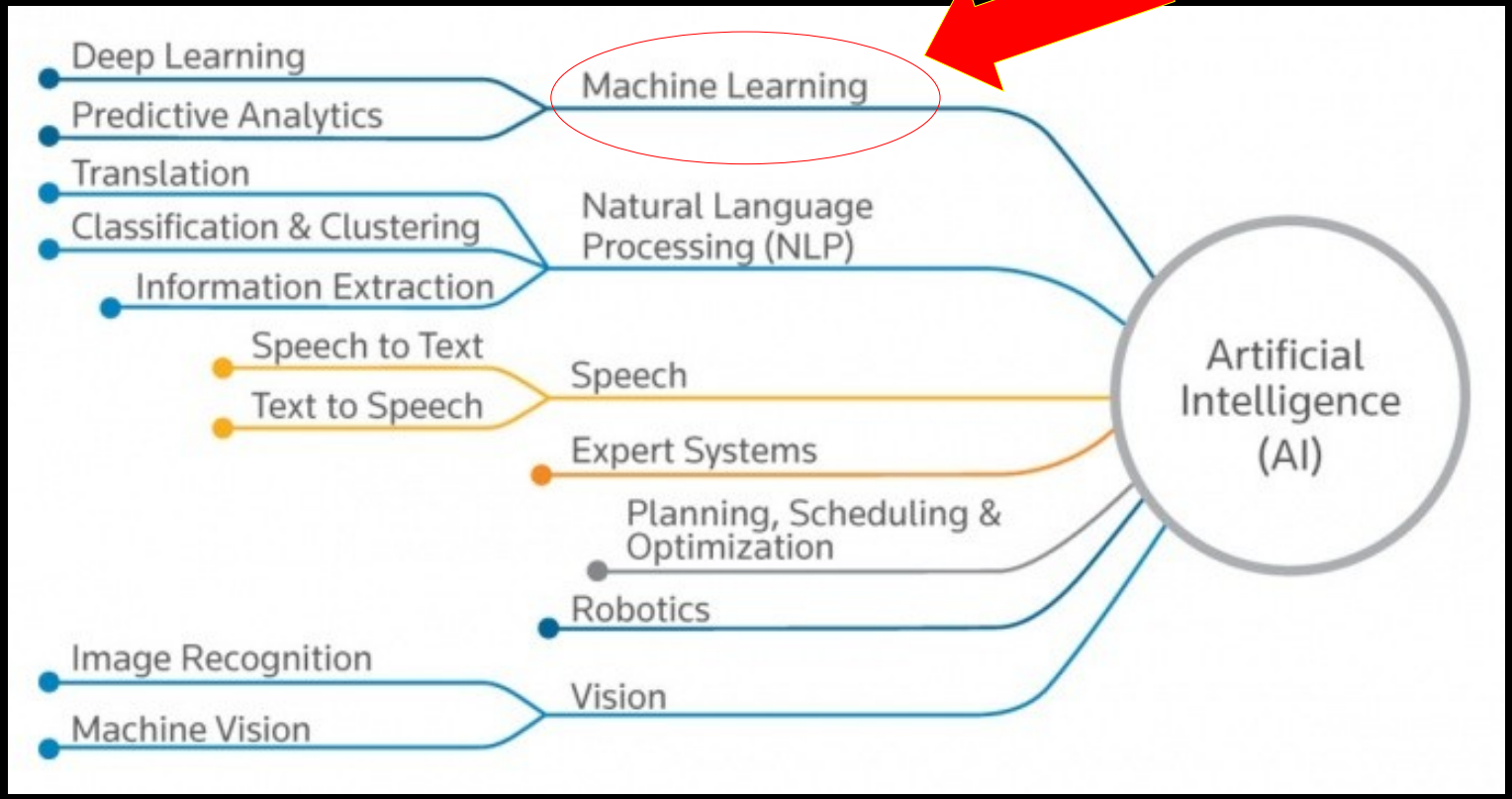
1769: "The Turk", Wolfgang von Kempelen



Edgar Allan Poe (1836). *Il giocatore di scacchi di Maelzel*, Southern Literary Messenger.

Source: Humboldt University Library, Author Joseph Racknitz

"artificial intelligence" undefined



"an engineered or machine-based system that can,
for a given set of objectives,
generate outputs such as <u>predictions, recommendations, or decisions</u>
influencing real or virtual environments.
AI systems are designed to operate with varying levels of autonomy."

National Institute of Standards and Technology - www.nist.gov

Source: Neota Logic

1955: Dartmouth

A PROPOSAL FOR THE
DARTMOUTH SUMMER RESEARCH PROJECT
ON ARTIFICIAL INTELLIGENCE

J. McCarthy, Dartmouth College
M. L. Minsky, Harvard University
N. Rochester, I.B.M. Corporation
C.E. Shannon, Bell Telephone Laboratories

August 31, 1955

Oliver Selfridge, Nathaniel Rochester, Marvin Minsky, John McCarthy
Ray Solomonoff, Peter M. Milner, Claude Shannon

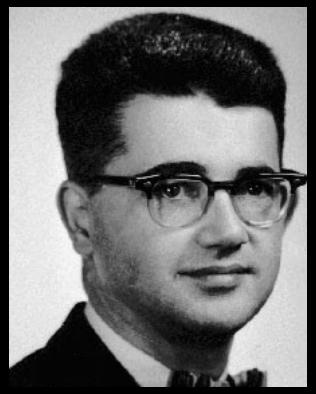
1955: the "AI schism"

Alan Turing (1912-1954) was died,
John Von Neumann (1903-1957) was already ill (1955),
Norbert Wiener (1894-1964) was not invited...

"... possible alternatives:
- '***cybernetics***'
its concentration on analog feedback seemed misguided and
I wished to avoid having either to accept Norbert Wiener as a guru or having to argue with him"
- '***automata theory***'
largely concerned the esoteric and rather narrow mathematical subject
- '***artificial intelligence***'

John McCarthy

Source:
- Nilsson, H.J. (2009). *The Quest for Artificial Intelligence*, Stanford University, pag.78.
- Bloomfieldm B.P. (1987). *The question of artificial intelligence*, Routledge.



John McCarthy
(1927-2011)

*"... 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"*
John McCarthy, 1955

1958: perceptron

Psychological Review
Vol. 65, No. 6, 1958

THE PERCEPTRON: A PROBABILISTIC MODEL FOR INFORMATION STORAGE AND ORGANIZATION IN THE BRAIN[1]

F. ROSENBLATT

Cornell Aeronautical Laboratory

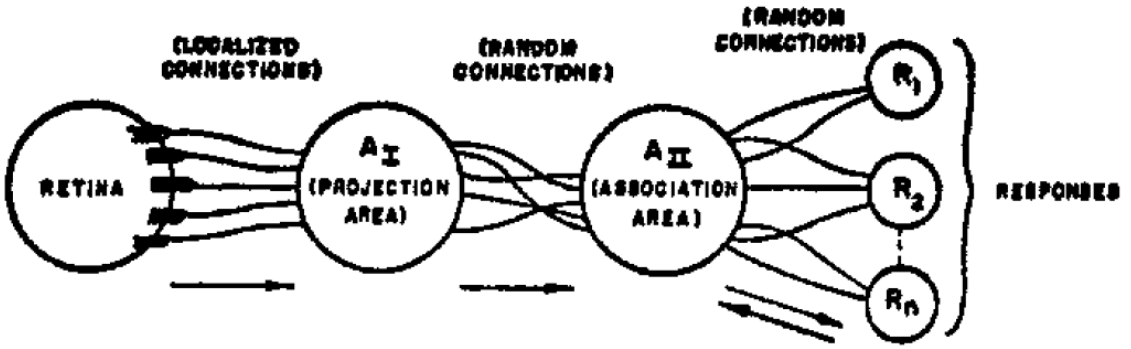
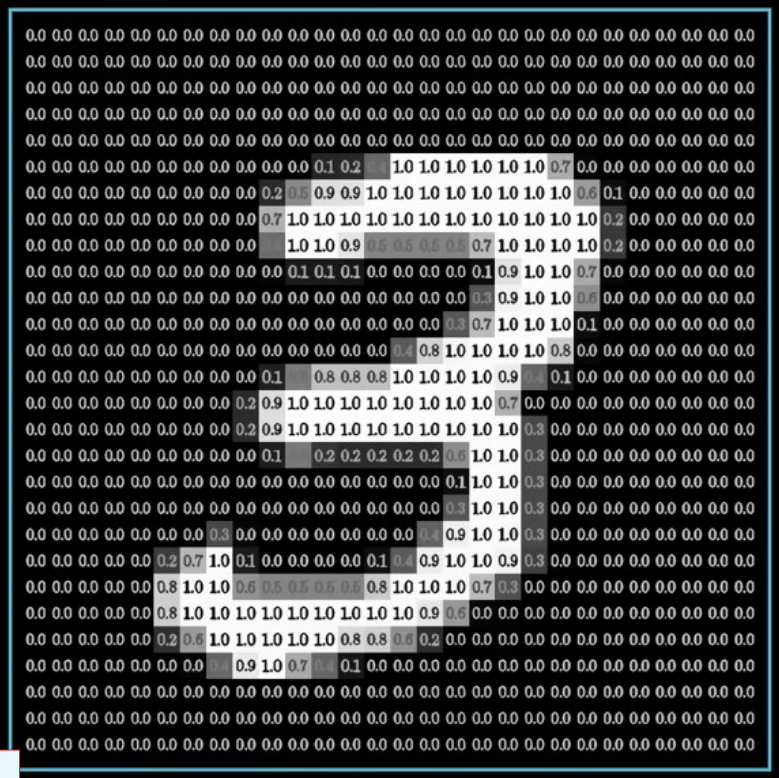


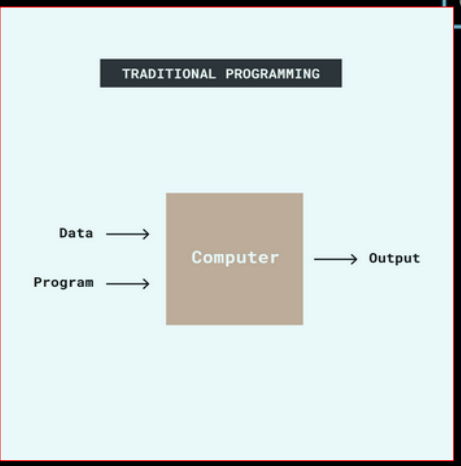
FIG. 1. Organization of a perceptron.

can you write a (traditional) program for this task?



0
1
2
3 ?
4
5
6
7
8
9

28 x 28 = 784 pixels



Source: https://www.3blue1brown.com/

"artificial intelligence" vs history of human thinking

deductive

- top-down
- derives logically-symbolically from some indubitable premises or axioms (Descartes, Leibniz, France, Germany)
to equally certain conclusions (Aristotelian syllogism)
- computing applications:
    logic - symbolic
    algorithmic software, expert systems, ...

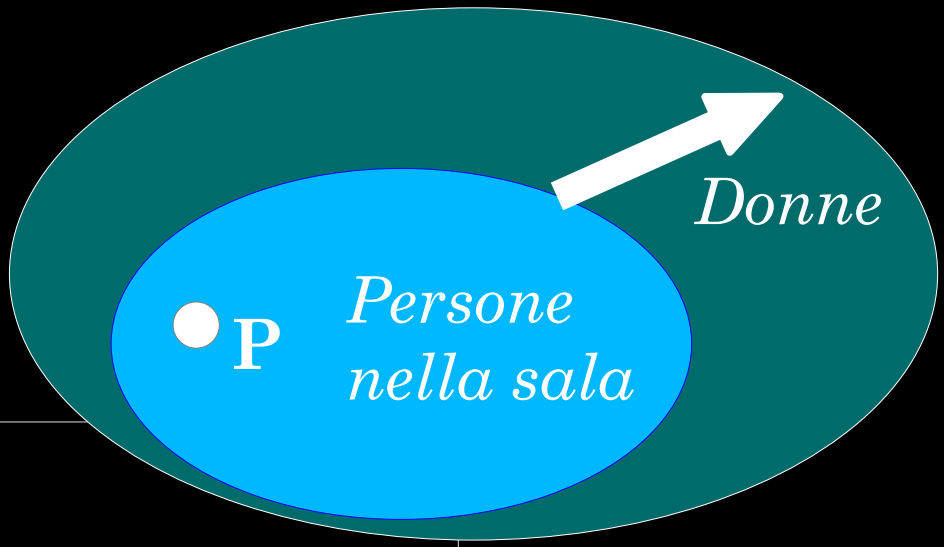
inductive

- bottom-up
- goes back from the observation of particular cases to the formulation of a general law (Bacon, Locke, Hume, empiricism, UK, US, ...)
- computing applications:
    statistical - mathematics
    "statistical" software, neural networks, machine learning, ...

la prospettiva ermeneutica induttiva e probabilistica ...
suggerisce che il passato si ripeterà ...
ma questa prospettiva è discutibile dal punto di vista epistemico e politicamente molto impegnativa ...
Non viviamo in un mondo ideale nel quale tutto è perfetto e senza attrito.
La nostra storia è carica di ingiustizie e disparità ...
Il sistema socio-tecnico esternalizza la nostra memoria collettiva,
se ne appropria e ne astrae regolarità per normare il presente e informare il futuro ...
Per questo è necessario e urgente esercitare il peso della nostra capacità critica sulla AI ...

Source: Teresa Numerico, *Prove di memoria artificiale*, ilmanifesto, 7 Settembre 2024

deduzione / induzione



Deduzione

REGOLA	1.	Tutte le persone in questa sala sono donne
CASO	2.	Questa persona viene da questa sala
RISULTATO	3.	Questa persona è una donna

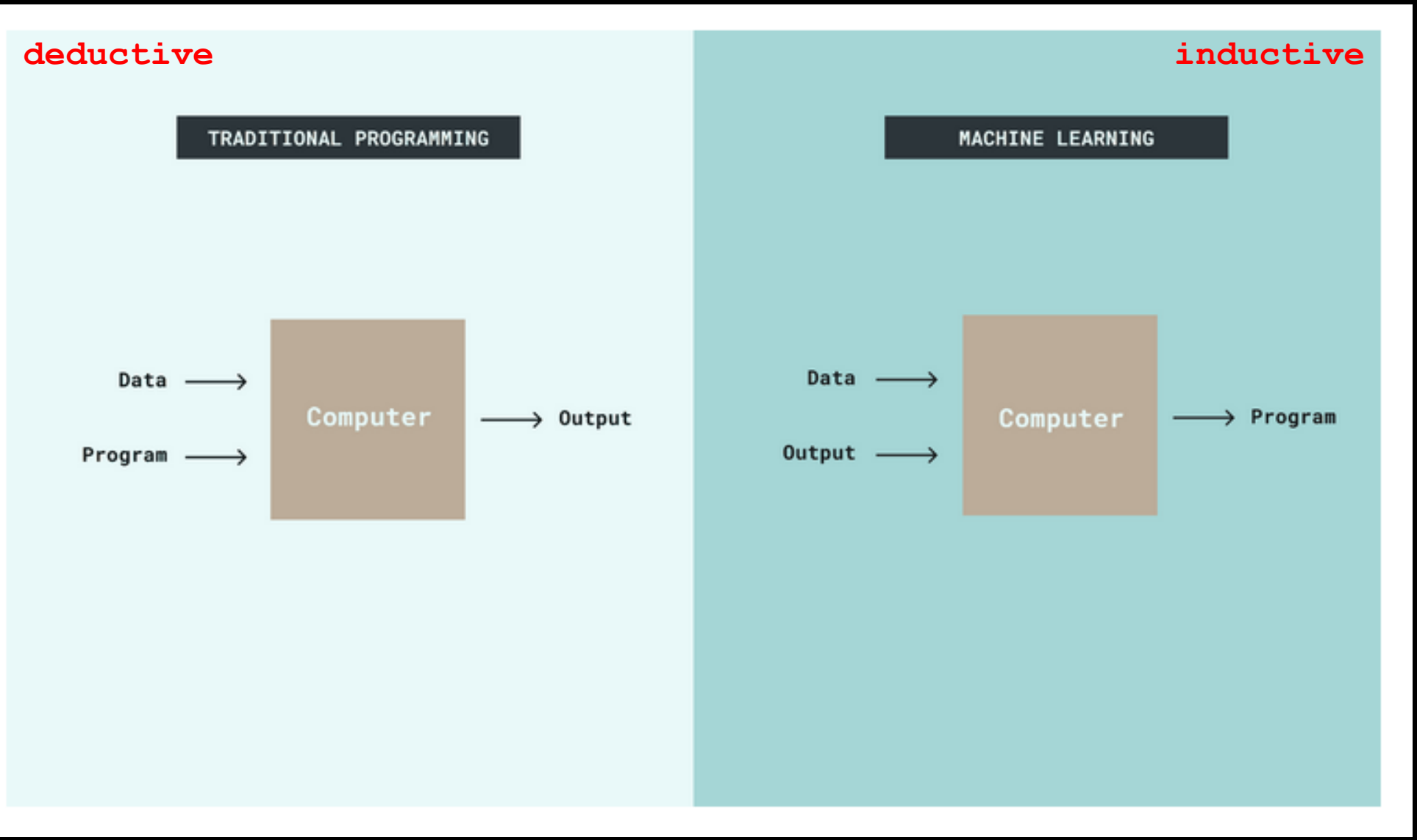
P -> D

Induzione

CASO	2.	Questa persona viene da questa sala
RISULATO	3.	Questa persona è una donna
REGOLA	1.	Tutte le persone in questa sala sono donne

nel machine (deep)-learning
le macchine le calibriamo
con (tanti) dati, esempi, ...

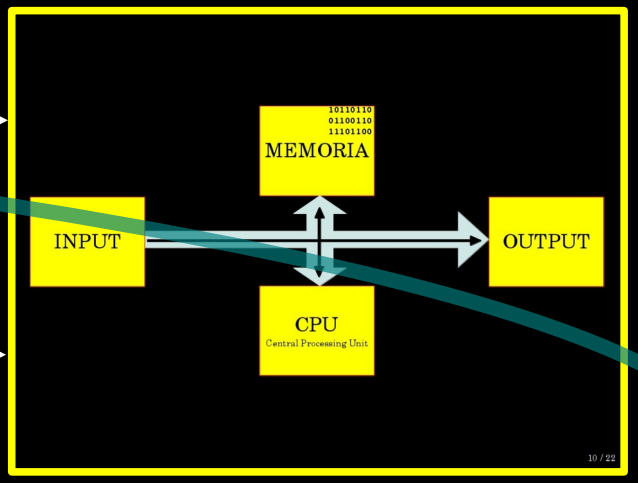
traditional programming (*algorithmic software*) vs machine learning (*statistical software*)



computer: a machine for executing algorithms designed by humans & calibrated with (a lot of data)

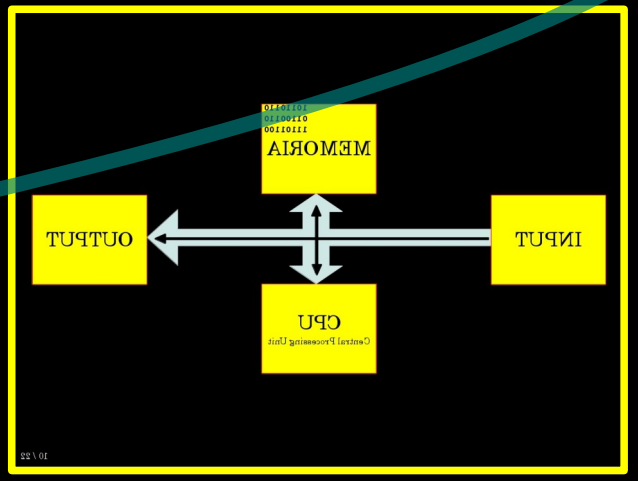
TRAINING DATA!

KNOWN OUTPUT!



"training"
(calibration)

program
(calibrated network)

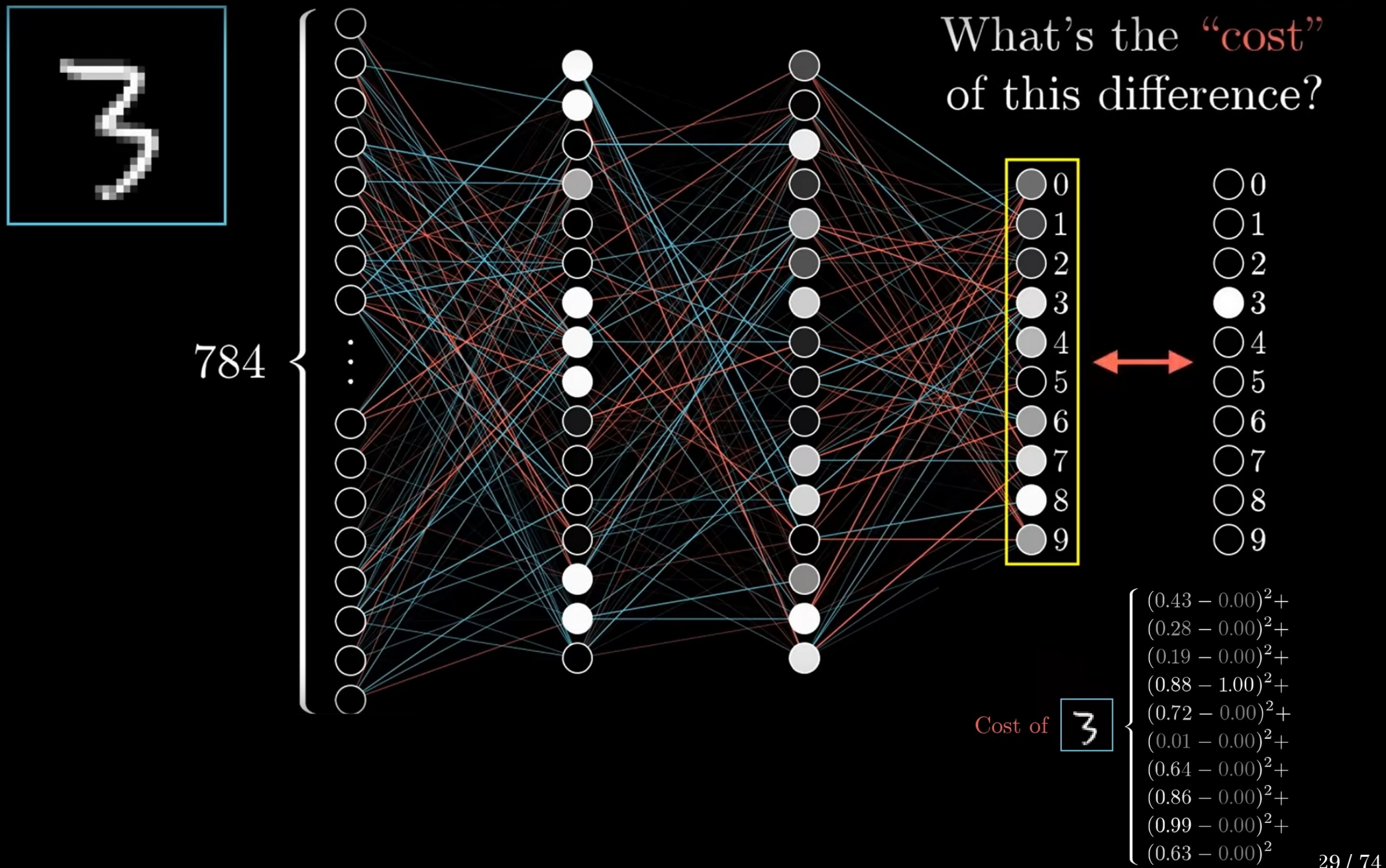


"inference"
(compute)

REAL OUTPUT!

REAL DATA!

inizialize **randomly**, test and compute the "cost", repeat...
then compute the "average cost" of all training data



Source: https://www.3blue1brown.com/

Machine Learning open issues

training data / testing data availability

features extraction / preprocessing!

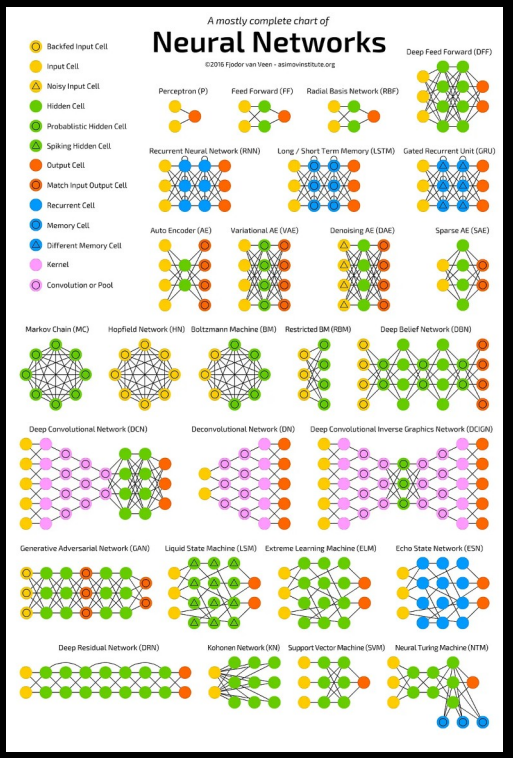
what kind of neural network? (architecture)

how many layers?

how many neurons per layer?

how to find the minimum error?

accuracy?



2009: ImageNet

ImageNet project leader

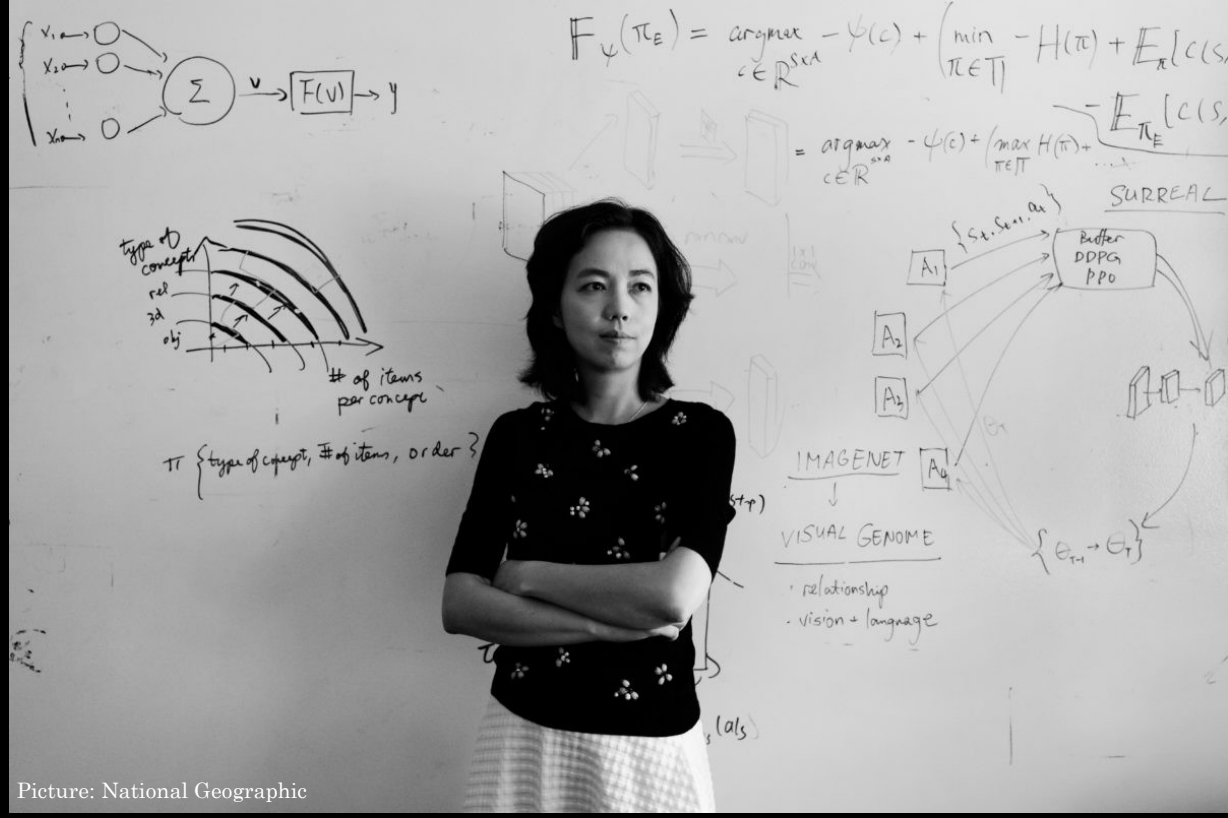
Professor of computer science at
Stanford University

Co-director of the Stanford Institute for
Human-Centered Artificial Intelligence

Co-director of the Stanford Vision and Learning Lab

Director of the
Stanford Artificial Intelligence Laboratory (SAIL)

Co-founder AI4ALL



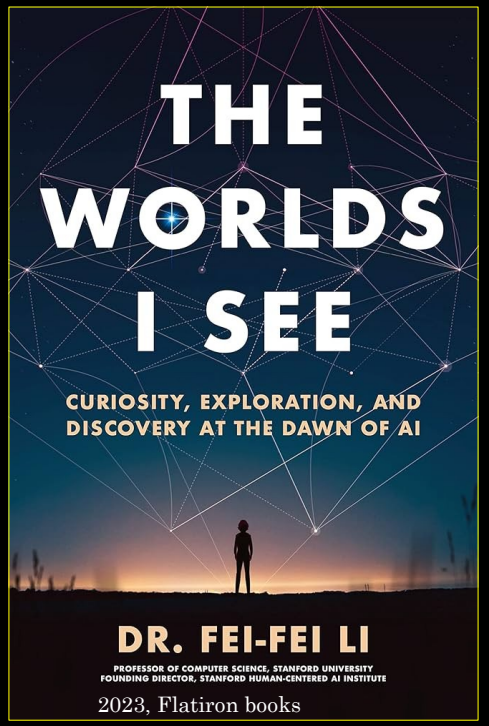
Picture: National Geographic

Fei-Fei Li

14 x 10^6 images
manually (!) annotated
> 20.000 categories

Picture: Andrej Karpathy

Source: IEEE Conference on Computer Vision and Pattern Recognition, Miami, IEEE, 18 agosto 2009,
Jia Deng; Wei Dong; Richard Socher; Li-Jia Li; Kai Li; Li Fei-Fe (2009). IImageNet: A large-scale hierarchical image database, IEEE Explore



2023, Flatiron books

ethics and AI: transparency?

"...quello che questa nuova generazione di IA
era in grado di fare -
buono o cattivo, atteso o meno -
veniva complicato dalla
mancanza di trasparenza intrinseca
nella sua progettazione ..."

Fei Fei Li, 2024

2012: AlexNet

DOI:10.1145/3065386

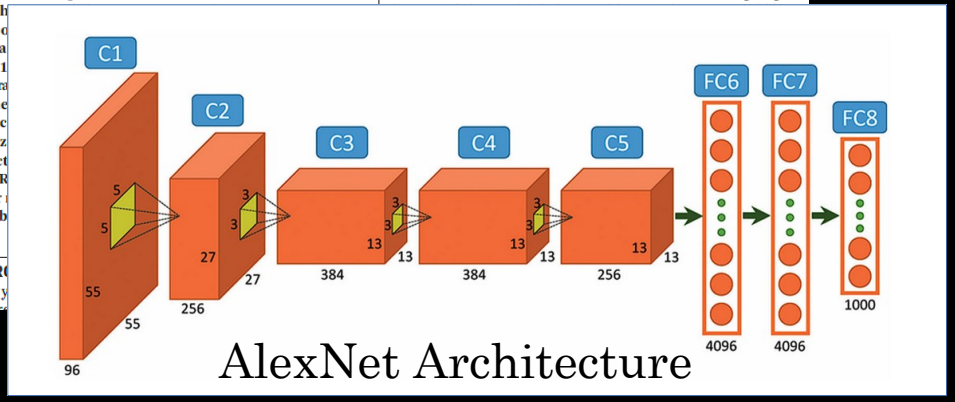
ImageNet Classification with Deep Convolutional Neural Networks

By Alex Krizhevsky, Ilya Sutskever, and Geoffrey E. Hinton

Abstract

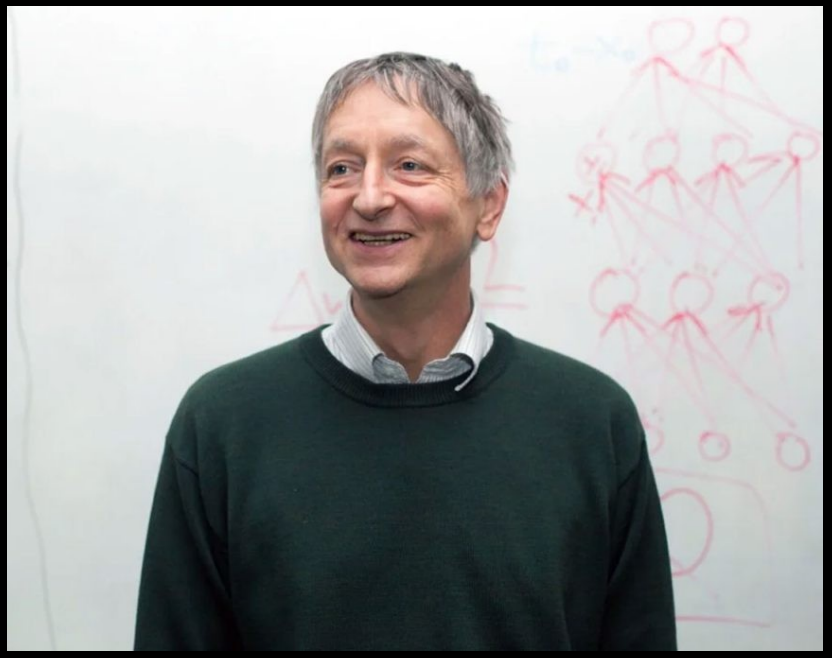
We trained a large, deep convolutional neural network to classify the 1.2 million high-resolution images in the ImageNet LSVRC-2010 contest into the 1000 different classes. On the test data, we achieved top-1 and top-5 error rates of 37.5% and 17.0%, respectively, which is considerably better than the previous state-of-the-art. The neural network, which

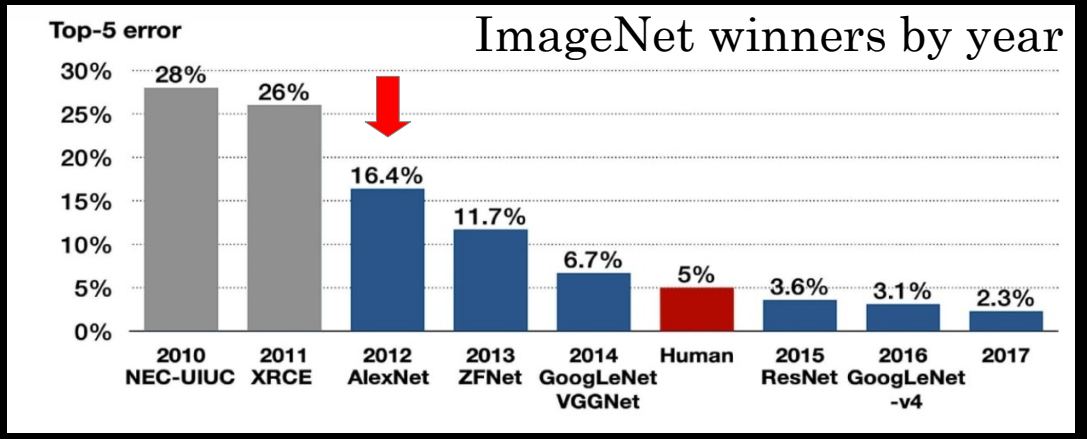
that were widely investigated in the 1980s. These networks used multiple layers of feature detectors that were all learned from the training data. Neuroscientists and psychologists had hypothesized that a hierarchy of such feature detectors would provide a robust way to recognize objects but they had no idea how such a hierarchy could be learned. There was great excitement in the 1980s because several different research groups



AlexNet Architecture

DNN-research (a startup with his two students)
was sold for 44 M$ to Google via an aution!
against Microsoft, Baidu, Deep Mind (acq.by Google in 2014)
at Lake Tahoe, Nevada on December 2012





Zeno of Elea?

"I see that as a huge problem —
not being able to know *what's true anymore"*

Geoffrey Hinton, 2023

"***given the text so far, what should the next word be?***"

The best thing about AI is its ability to

learn	4.5%
predict	3.5%
make	3.2%
understand	3.1%
do	2.9%

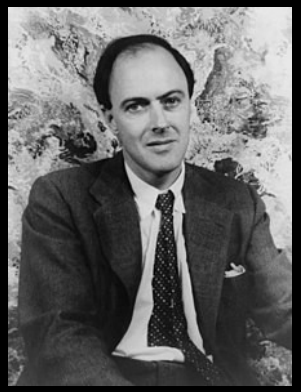
the remarkable thing is that when ChatGPT does something like write an essay
what it's essentially doing is just asking over and over again
"***given the text so far, what should the next word be?***"

"estrusori di stringhe di testo probabili"
Daniela Tafani, 2024

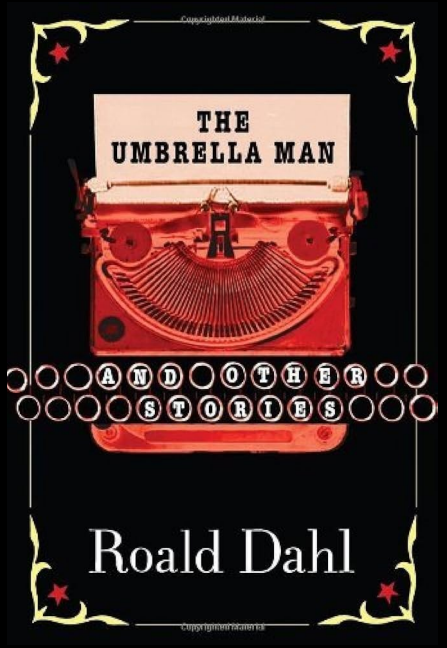
Source: Tafani, D. (2024). Omini di burro. Scuole e università al Paese dei Balocchi dell'IA generativa, Bollettino telematico di filosofia politica.

Source: Stephen Wolfram, What Is ChatGPT Doing … and Why Does It Work? February 14, 2023

1954: *The Great Automatic Grammatizator*, R.Dahl



Roald Dahl
(1916-1990)



Lo scrittore automatico, R.Dahl, 1954

un giovane ingegnere,
avendo compreso le "regole matematiche" della grammatica
progetta una "macchina per scrivere storie...

R. Dahl (1996), *Il libraio che imbrogliò l'Inghilterra seguito da Lo scrittore automatico*, Guanda Editore.

1960: *Il versificatore*, P.Levi

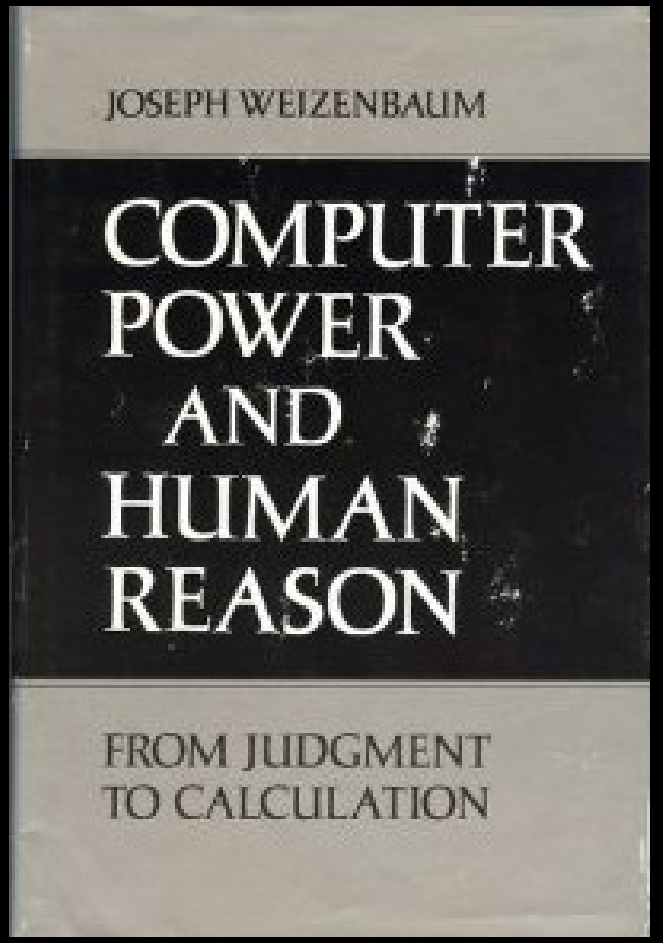
Primo Levi
(1919-1987)

Un poeta deve produrre, per la clientela, fra le altre cose,
"*due carmi conviviali, un poemetto per il matrimonio (...), quattordici inserzioni pubblicitarie, e un cantico per la vittoria del Milan*".
Egli si convince dunque, ... ad acquistare, dal signor Simpson,
rappresentante di una ditta americana di articoli per ufficio, un "*Versificatore*", una macchina che, se opportunamente programmata, può far fronte dignitosamente alle richieste.
Il "*Versificatore*" non è esente da malfunzionamenti ...

P. Levi, Il versificatore, in Idem, Storie naturali, Einaudi, Torino 1966

1966: Eliza, Joseph Weizenbaum

Joseph Weizenbaum
(1923-2008)

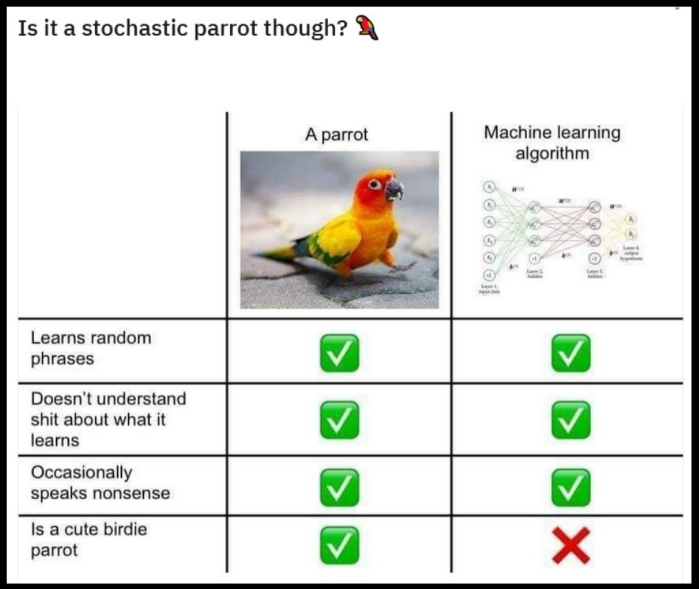


"The key question is the control of the time.
We would need more time to take some decisions.
The rhythm of the computers and of the telecommunication systems
is not the rhythm of time which is needed to take meaningful decisions"
J.Weizenbaum, Namur Award Lecture, Namur, 11 January 1991

Eliza Effect
the problem of a natural anthropomorphization that occurs
when humans interact with a chatbot that engages in dialogue well enough
to trick users into believing there is a conscious, intelligent mind inside the program

Source: Weizenbaum J., "Computer Power and Human Reason: From Judgment To Calculation", Freeman, 1976

2022: ChatGPT: a stochastic parrot?



Emily M. Bender, Timnit Gebru, Angelina McMillan-Major, and Shmargaret Shmitchell. 2021. ***On the Dangers of Stochastic Parrots: Can Language Models Be Too Big?*** . Fairness, Accountability, and Transparency (FAccT '21), March 3–10, 2021, https://doi.org/10.1145/3442188.3445922

In the large models of natural language LLMs,
we have, for the first time,
a ***dissociation of language and thought***

Nei grandi modelli del linguaggio naturale,
si ha, per la prima volta,
una ***dissociazione tra linguaggio e pensiero***

Daniela Tafani (2024, 8 Marzo). *A chi servono i "pappagalli stocastici"* , CRS Centro per la Riforma dello Stato

il computer può pensare?

Edsger W. Dijkstra
(1930-2002)

chiedersi
'se un computer può pensare'
è come chiedersi
'se un sottomarino sa nuotare'

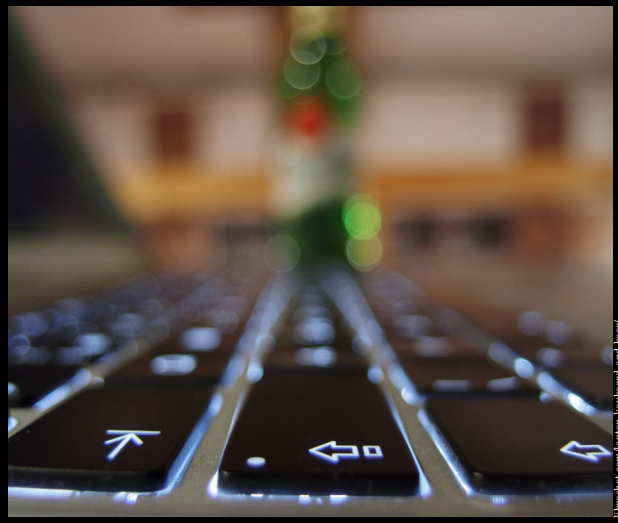
Edsger W. Dijkstra (1984)
Computer Scientist
Winner of Turing Award

Dijkstra Algorithms,
Structured Programming,
Semaphores and ... against GOTO

Source: E.W.Dijkstra, "Notes On Structured Programming", Tech.University of Eindhoven, The Netherlands,1972

ethics

Photo by JNS/Gamma-Rapho via Getty Images



i1.wp.com/laptop-keyboard-and-bear/

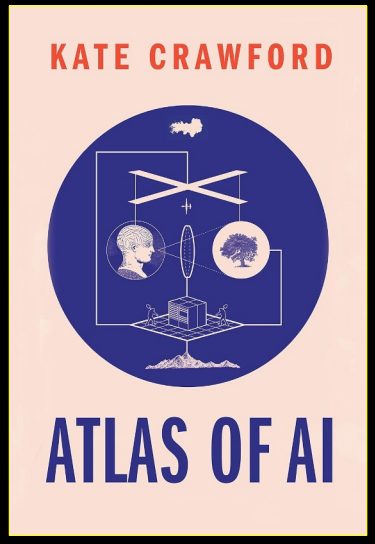
astrazione ed estrazione

"La descrizione dell'IA
come qualcosa di
fondamentalmente ***astratto***
la separa
dall'energia,
dal lavoro e
dal capitale necessari per produrla e
dai molti diversi tipi di ***estrazione***
che la rendono possibile"

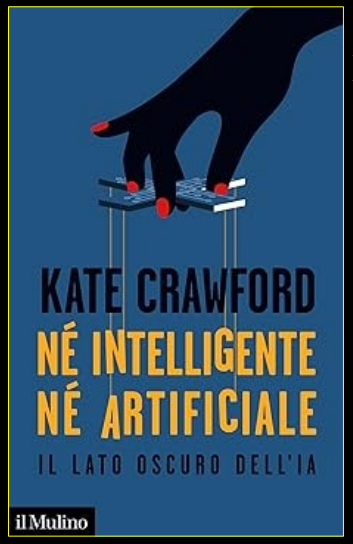
Kate Crawford, 2021

Kate Crawford

Research Professor at University of Southern California
Co-founder AI Now Institute, New York
2024 European Commission's Grand Prize for Science, Technology, and Art



Crawford, K. (2021).
Atlas of AI:
Power, Politics, and the Planetary Costs of Artificial Intelligence,
Yale University Press.



Crawford, K. (2021).
Né intelligente, né artificiale.
Il lato oscuro dell'IA,
IlMulino.

2023: epistemic chaos

bad-information

real, factual information typically **disseminated out of context**

mis-information

false and misleading information created and disseminated
without the explicit intention to deceive,
unfortunately **perceived and retransmitted as being true**

dis-information

false information, spread with the **explicit intention of deceiving people**,
polarizing opinion into incommunicative groups, with no middle ground,
to the extreme consequences

The Washington Post
Democracy Dies in Darkness

Tech Help Desk Future of Transportation Innovations Internet Culture Space Tech Policy Video Gaming

INNOVATIONS

ChatGPT invented a sexual harassment scandal and named a real law prof as the accused

The AI chatbot can misrepresent key facts with great flourish, even citing a fake Washington Post article as evidence

By Pranshu Verma and Will Oremus

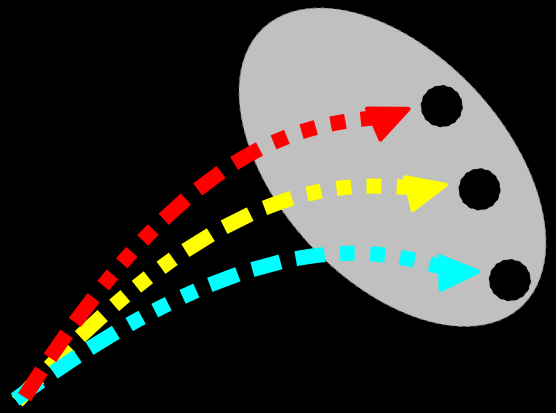
Tech is not your friend. We are. Sign up for The Tech Friend newsletter. →

The chatbot, created by OpenAI, said Turley had made sexually suggestive comments and attempted to touch a student while on a class trip to Alaska, citing a March 2018 article in The Washington Post as the source of the information. The problem: No such article existed. There had never been a class trip to Alaska. And Turley said he'd never been accused of harassing a student.

A regular commentator in the media, Turley had sometimes asked for corrections in news stories. But this time, there was no journalist or

Source: The Washington Post, April 5, 2023

cedimento epistemologico



- forecast, pre-***vedere*** =
  - fore+cast,
    to estimate how something will be in the future
  - *prae* (avanti) *videre* (vedere), vedere prima
    (soprattutto con gli occhi della mente)

- prediction, pre-***dire*** =
  - prophecy, to pronounce solemnly,
    a statement of what will happen in the future
  - *prae* (avanti) *dicere* (dire), annunciare che una cosa futura avverrà

- prescription, pre-***scrivere*** =
  - order, direction, written directions from a doctor
  - *prae* (avanti) *scribere* (scrivere), ordinare, comandare per iscritto,
    ordine del medico

Fonte: Wikimedia Commons - Francisco de Goya (1746–1828), Il sonno della ragione produce mostri

2008: the end of Scientific Method?

"The new availability of huge amounts of data,
along with the statistical tools to crunch these numbers,
offers a whole new way of understanding the world.
Correlation supersedes causation,
and science can advance even without coherent models, unified theories,
or really any mechanistic explanation at all"

Chris Anderson, "*The End of Theory: The Data Deluge Makes the Scientific Method Obsolete*", Wired, 23 June 2008

"... il metodo scientifico, quindi, si basa
sull'osservazione e sulla sperimentazione,
sulla misura, sulla produzione di risultati per
generalizzazione (induzione) e sulla
conferma di tali risultati *attraverso un certo numero di verifiche.*
Per fare un esperimento, tuttavia, è necessario prima
possedere un'ipotesi e degli strumenti per verificarla"

Treccani, 2022

trasparency and science

technique

how does the model work?

causal

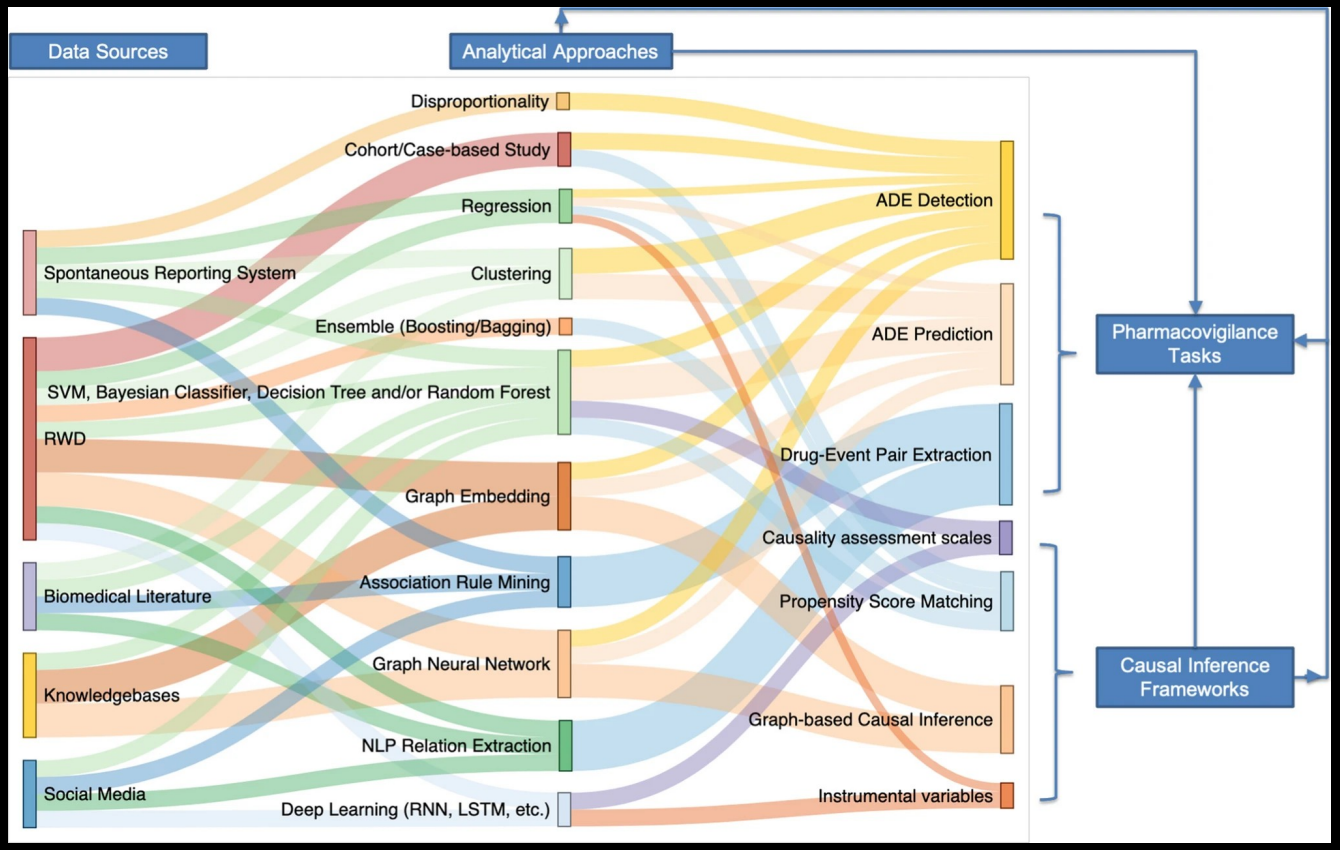
why does a model input lead to its output?

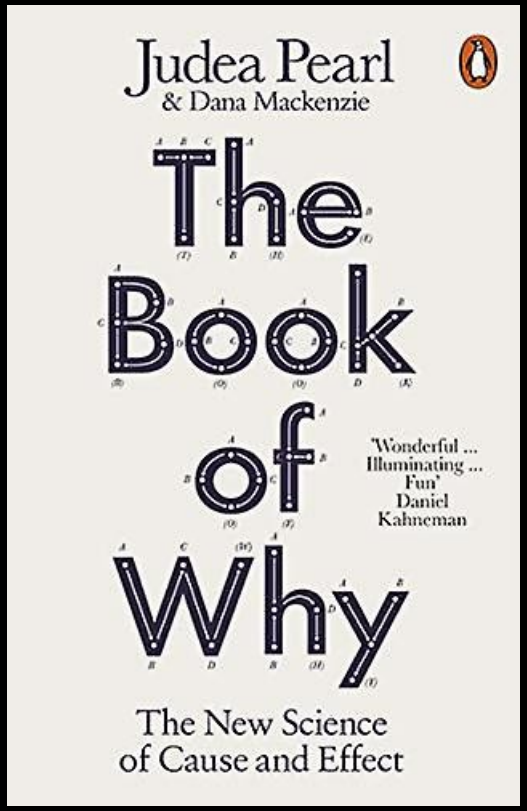
reliable

what information do people need to trust and use the model?

Causal AI

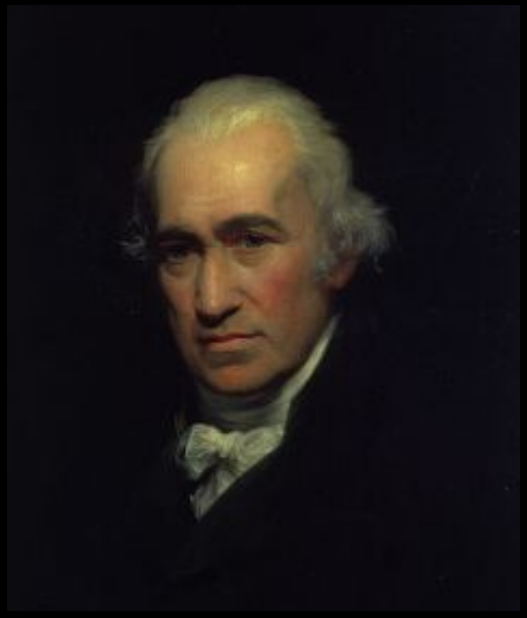
Causal AI is an artificial intelligence system that ***can explain cause and effect***.
Causal AI technology is used by organisations to help explain decision making and the causes for a decision.
By identifying the underlying web of causality for a behaviour or event, ***provide insights that solely predictive AI models might fail to extract from historical data***.
An analysis of causality may be used to supplement human decisions in situations where understanding the causes behind an outcome is necessary (e.g. quantifying the impact of different interventions, policy decisions or performing scenario planning, ...)





Source: Zhao, Y., Yu, Y., Wang, H. et al. Machine Learning in Causal Inference: Application in Pharmacovigilance. Drug Saf 45, 459–476 (2022)

1788: James Watt, *la macchina a vapore*
1824: Carnot, *leggi della termodinamica, entropia, la freccia del tempo*



James Watt
(1736-1819)

Sadi Carnot
(1796-1832)

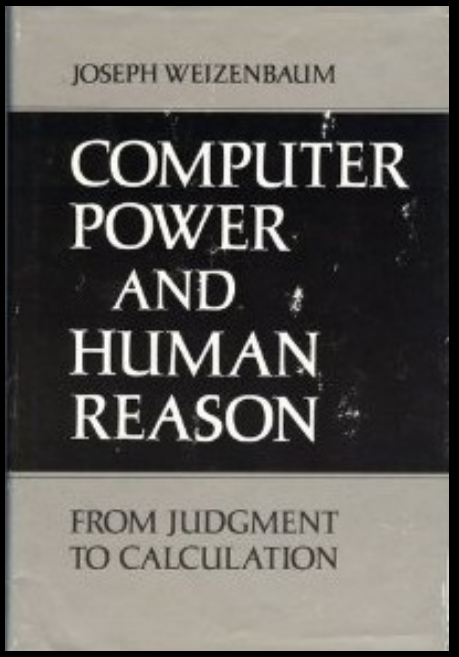
*"reinserire nella meccanica
la scienza delle macchine,
che ne era rimasta separata"*
(Carnot)

36 anni dopo
la macchina
viene compreso
come e perché funzionava ....

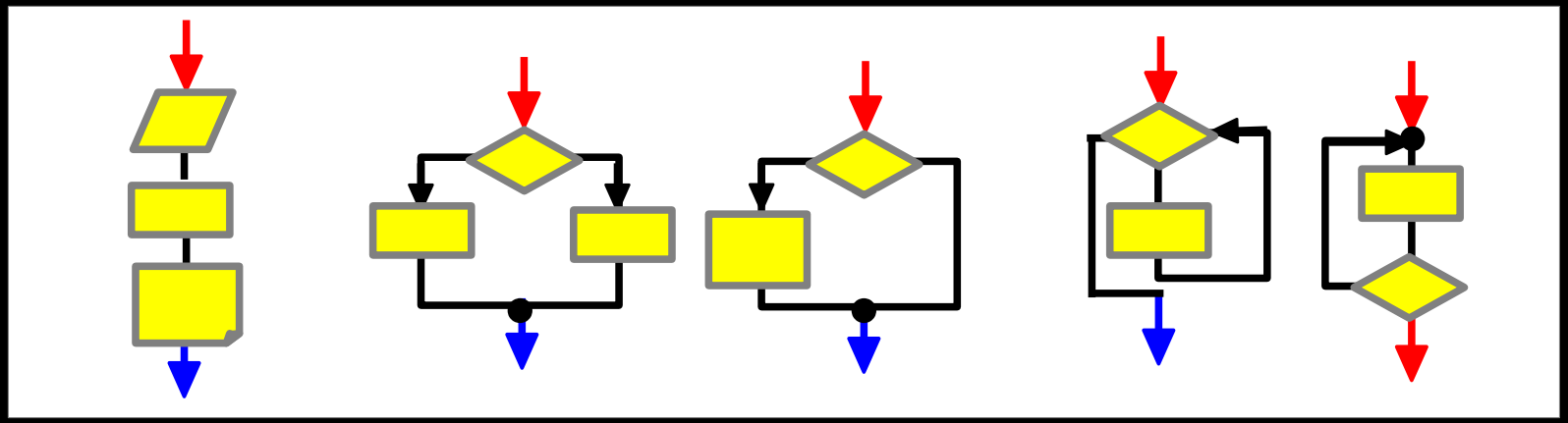
Source: S.Colonna, "Mantenimento dell'equilibrio tra produzione e utilizzazione in un sistema a rete", 2014

1976: Joseph Weizenbaum

Joseph Weizenbaum
(1923-2008)



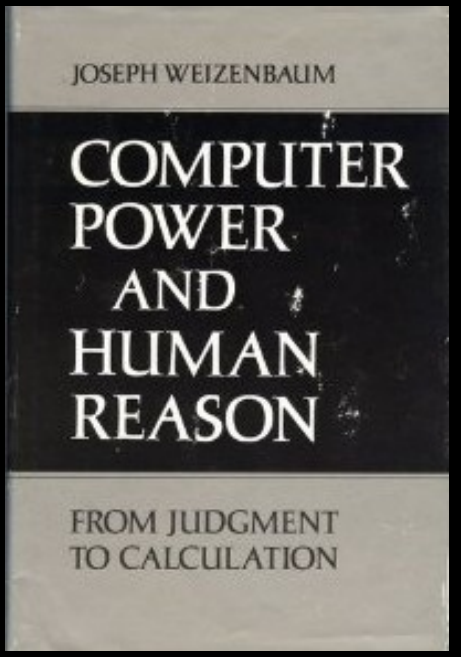
Deciding
is a Computational activity,
something that can ultimately be programmed



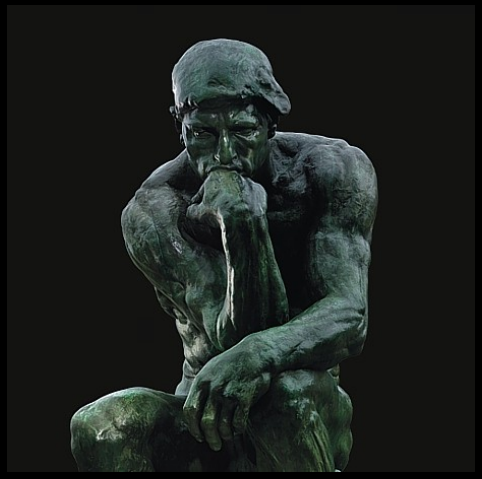
Source: Weizenbaum J., "Computer Power and Human Reason: From Judgment To Calculation", Freeman, 1976

1976: Joseph Weizenbaum

Joseph Weizenbaum
(1923-2008)



<u>Choosing</u>
is the product of Judgment, not Calculation.
It is the capacity to Choose that ultimately makes us Human

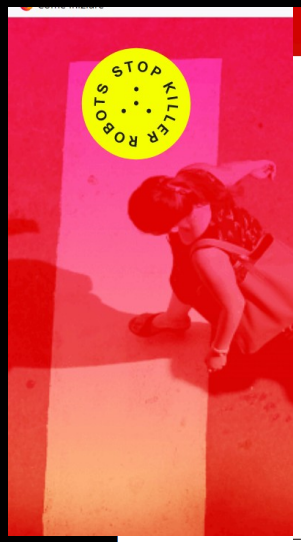


"*la scelta è la madre dell'angoscia*"

Søren Kierkegaard
(1813-1855)

Source: Weizenbaum J., "Computer Power and Human Reason: From Judgment To Calculation", Freeman, 1976

2013: stop killer robot



Less autonomy.

Technology should be used to empower all people, not to reduce us – to stereotypes, labels, objects, or just a pattern of 1's and 0's.
With growing digital dehumanisation, the Stop Killer Robots coalition works to ensure human control in the use of force. Our campaign calls for new international law on autonomy in weapons systems.

More humanity.

ICRC INTERNATIONAL COMMITTEE OF THE RED CROSS

COVID-19 | WHO WE ARE | WHAT WE DO | WHERE WE WORK

concerns for humanity, in effect substituting human decisions about life and death with sensor, software and machine processes.

Ultimately, most of us can agree that an algorithm – a machine process – should not determine who lives or dies, that human life must not be reduced to sensor data and machine calculations.

12 May 202

CORRIERE DELLA SERA

5 Ottobre 2021

"Però bisogna stare attenti, ci sono anche risvolti pericolosi dell'intelligenza artificiale [...] Il sistema di armi letali non può essere lasciato alle macchine. Non possono essere loro a decidere chi uccidere o meno.
Parlo dei droni, non possono avere la capacità autonoma per decidere chi colpire mortalmente, dietro ci deve sempre essere l'intervento umano".
Chiede la giornalista: "Come si può evitare questo pericolo?"
Risponde Parisi: "E' stata fatta una convenzione sulle armi chimiche, bisognerebbe farne una anche su questo".

Giorgio Parisi
Premio Nobel per la Fisica 2021

https://www.stopkillerrobots.org

jobs

white collars' turn

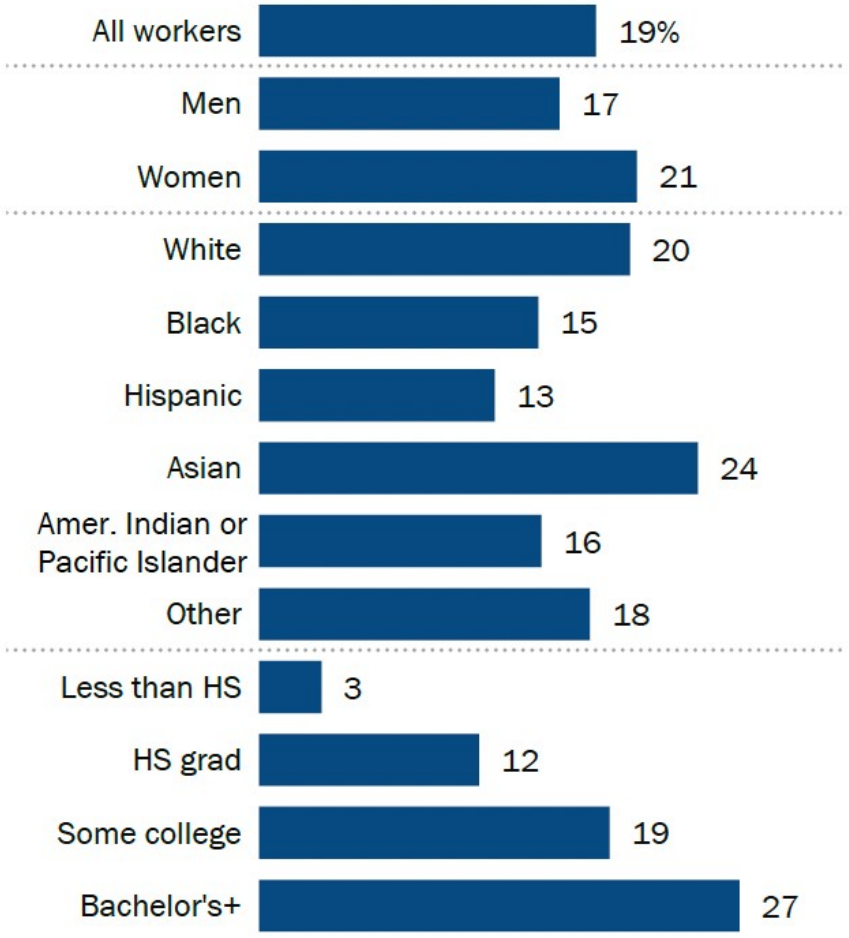
Source: Harris, M. (2024). Should we let AI take our jobs…if it generates less carbon? *Anthropocene*

2023: U.S. Workers More Exposed to AI

Pew Research Center

What shares of workers are most exposed to AI in their jobs?

% of U.S. workers employed in jobs that are the most exposed to AI in 2022



Jobs in U.S. that are likely to have high, medium or low exposure to AI

High exposure

- Budget analysts
- Data entry keyers
- Tax preparers
- Technical writers
- Web developers

Medium exposure

- Chief executives
- Veterinarians
- Interior designers
- Fundraisers
- Sales managers

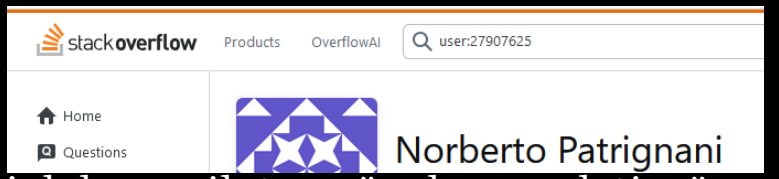
Low exposure

- Barbers
- Child care workers
- Dishwashers
- Firefighters
- Pipelayers

Note: Occupations are grouped by the

Source: Rakesh Kochhar (2023, July 26). Which U.S. Workers Are More Exposed to AI on Their Jobs?, Pew Research Center

deskilling: gli LLM programmeranno da soli?



- l'arte di programmare è sempre cambiata: una volta si programmava con carta, penna e schede perforate, oggi abbiamo ambienti di sviluppo (IDE) con feedback interattivi dal compilatore, "code-completion" per trovare le funzioni, librerie, ... abbiamo ***stackoverflow***! (28M utenti)
- l'arte di programmare cambierà ancora con gli LLM (chatgpt, copilot, gemini, ...)
- non chiamiamola IA, sono **tool** che aiutano nel processo di sviluppo software, NON generano un programma completo
- sono solo "*search engine*" per cercare e copiare risposte su ***stackoverflow***?
- l'arte di programmare (*the ability to break a problem down into a logical process of steps*) sarà difficile da automatizzare
- la gestione degli errori / anomalie del codice fornito da LLM è inaffidabile quindi ironicamente ***potrebbe richiedere più tempo testare codice fornito da LLM*** che non investire nella creazione di un sistema robusto e trasparente ***scritto da un umano***
- nel caso di un "critical error" un umano deve esaminare il codice fornito da LLM e potrebbe essere impossibile / difficile scoprire la provenienza / "intenzione" (!) del codice, quindi il debugging diventa ancora più difficile
- l'arte di programmare rischia di diventare "*prompt engineering*", una attività noiosa ("*it's is a little bit boring that someone hands you all of it*") e di impedire la crescita professionale che deriva dall'esperienza pratica nel tempo
- i primi studi nei corsi di Computer Science sull'impatto degli LLM nell'arte della programmazione sono preoccuanti: all'aumentare dell'uso degli LLM per compiti che richiedono "critical thinking", i risultati degli studenti peggiorano, incontrano maggiori difficoltà nell'affrontare progetti software impegnativi, emerge l'importanza di coltivare l'esperienza del debugging per mantenere l'affidabilità dei sistemi, LLM possono fornire supporto ma è necessario ***bilanciare il loro uso con lo sviluppo di capacità di risolvere problemi in modo autonomo***

Source: McCabe, A.T. (2024). *Ironies of Programming Automation: Exploring the Experience of Code Synthesis via Large Language Models*, Programming '24: 8th International Conference on the Art, Science, and Engineering of Programming, Lund, Sweden March 11 - 15, 2024.
Jošt, G.; Taneski, V., Karakatič, S. (2024). *The Impact of Large Language Models on Programming Education and Student Learning Outcomes*. Appl. Sci. 14, 4115.

"The choice isn't between automation and non-automation, it's between whether you use the technology in a way that creates shared prosperity, or more concentration of wealth."

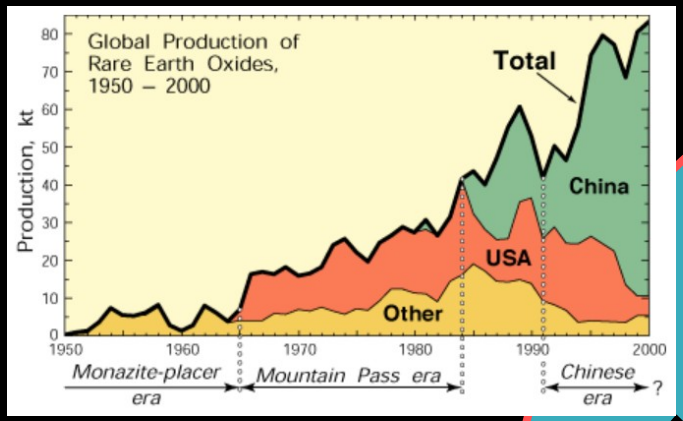
Erik Brynjolfsson, 2019
Director of M.I.T. Initiative on the Digital Economy

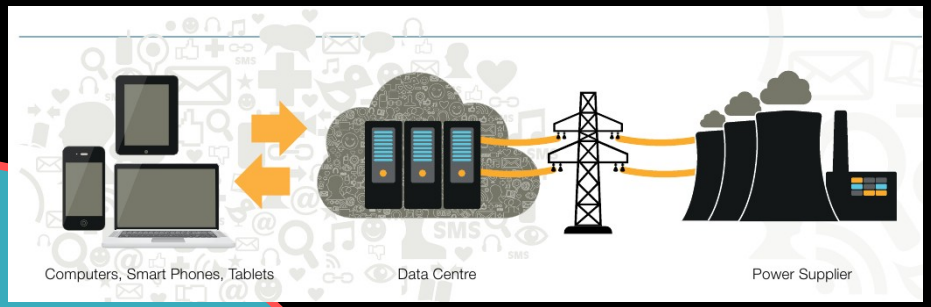
"La scelta non è tra automazione e non automazione, la scelta è se usare la tecnologia in modo da ***condividere il valore creato*** *oppure usare la tecnologia* ***per una maggiore concentrazione della ricchezza***"

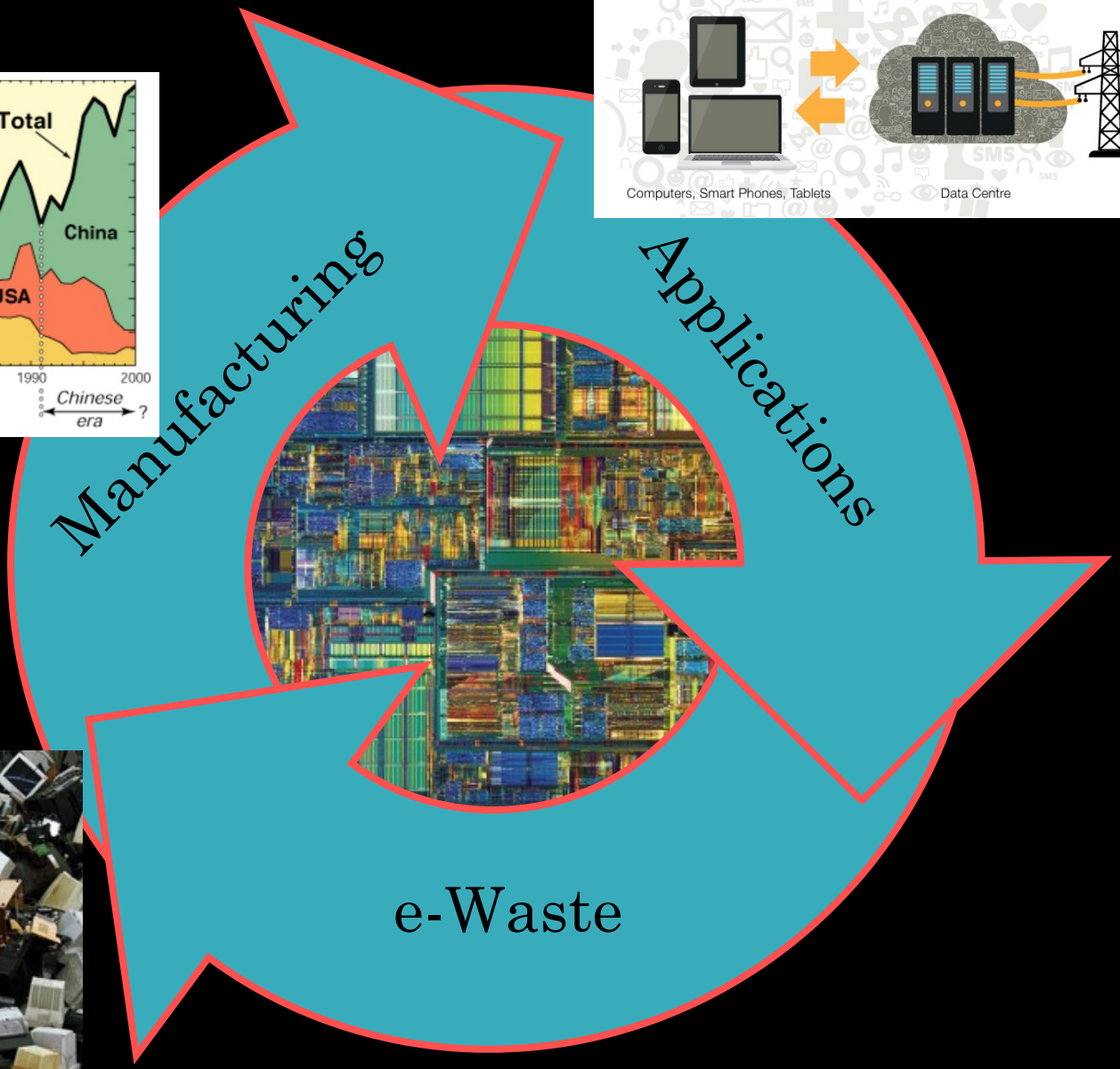
Source, Roose K., The Hidden Automation Agenda of the Davos Elite, The New York Times, Jan 25 2019

planet

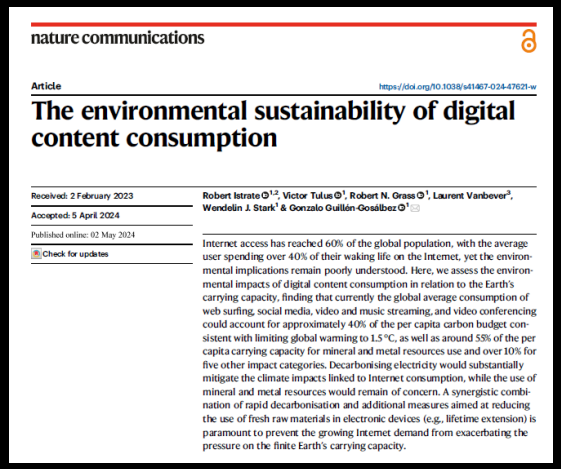
ICT life-cycle environmental impact







environmental impacts of digital content consumption



nature communications

Article

https://doi.org/10.1038/s41467-024-47621-w

The environmental sustainability of digital content consumption

Received: 2 February 2023

Accepted: 5 April 2024

Published online: 02 May 2024

Check for updates

Robert Istrate[1,2], Victor Tulus[1], Robert N. Grass[1], Laurent Vanbever[3], Wendelin J. Stark[1] & Gonzalo Guillén-Gosálbez[1]

Internet access has reached 60% of the global population, with the average user spending over 40% of their waking life on the Internet, yet the environmental implications remain poorly understood. Here, we assess the environmental impacts of digital content consumption in relation to the Earth's carrying capacity, finding that currently the global average consumption of web surfing, social media, video and music streaming, and video conferencing could account for approximately 40% of the per capita carbon budget consistent with limiting global warming to 1.5 °C, as well as around 55% of the per capita carrying capacity for mineral and metal resources use and over 10% for five other impact categories. Decarbonising electricity would substantially mitigate the climate impacts linked to Internet consumption, while the use of mineral and metal resources would remain of concern. A synergistic combination of rapid decarbonisation and additional measures aimed at reducing the use of fresh raw materials in electronic devices (e.g., lifetime extension) is paramount to prevent the growing Internet demand from exacerbating the pressure on the finite Earth's carrying capacity.

501 kg CO_2 per capita per year
stringent carbon budget
IPCC-6th Assessment Report(2021)

energy

41% of the per capita carbon budget
consistent with a high likelihood (67%)
of limiting global warming to 1.5 °C
above the pre-industrial level

digital content consumption
requires on average

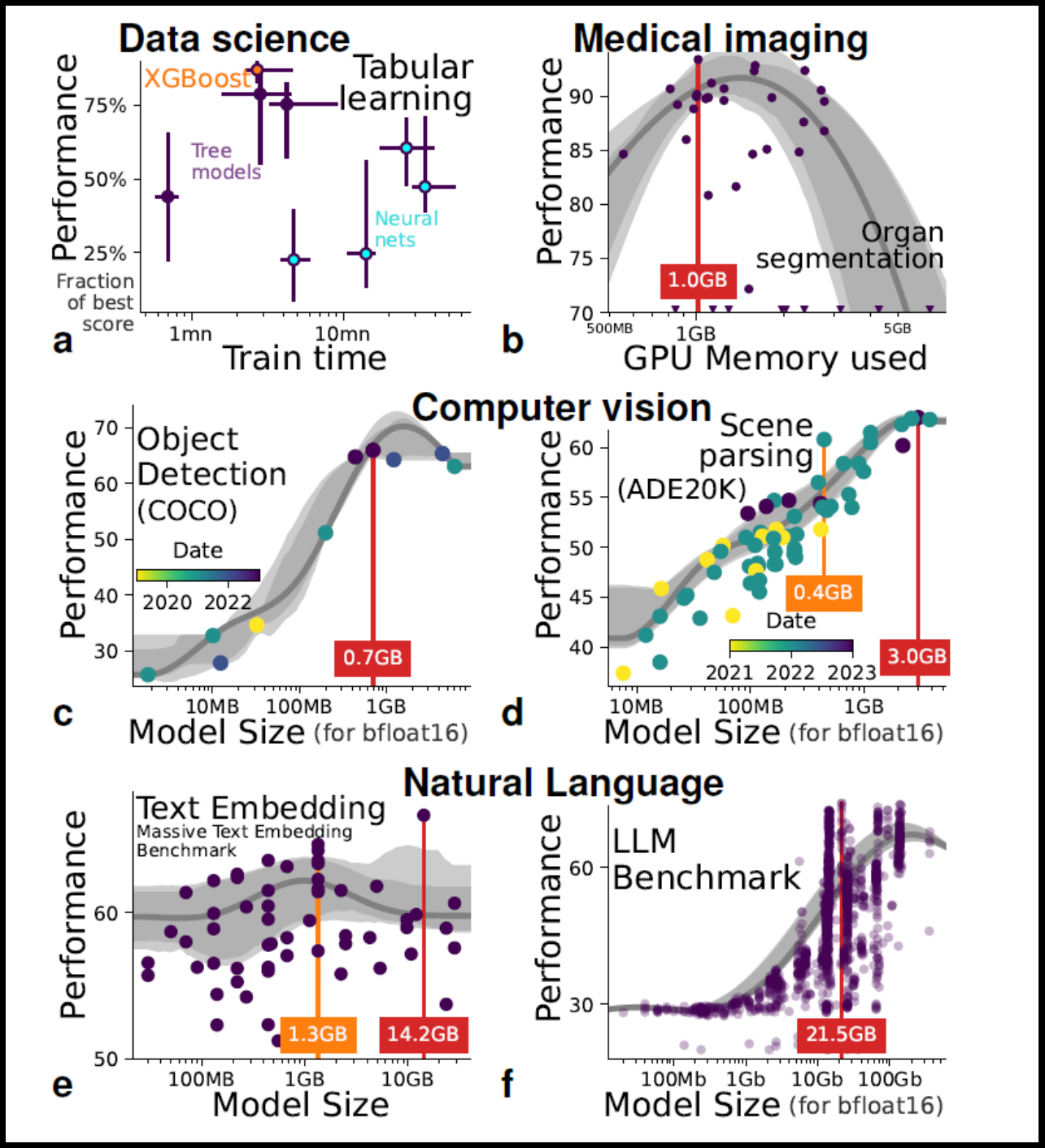
55% of the per capita carrying capacity
for mineral and metal resources use

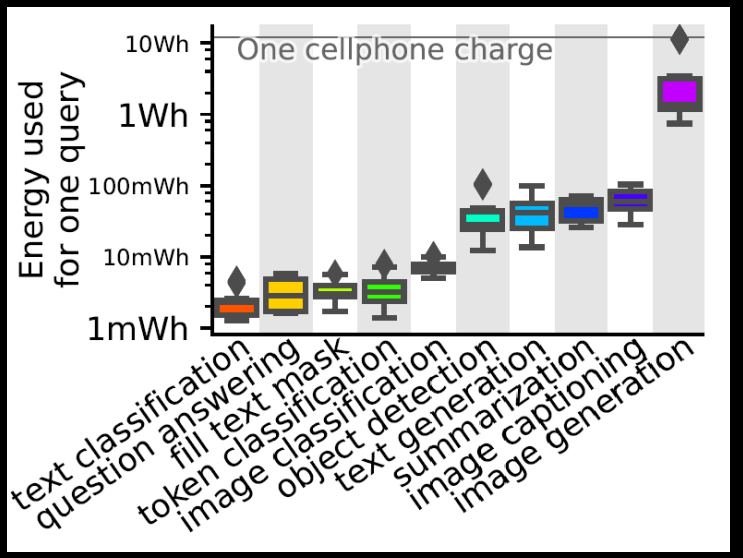
matter

respecting planetary limits requires
- *decarbonization*
- *extension of devices' lifetime (from possession to use)*
- ***digital sobriety***

Source: Istrate, R. et al. (2024). The environmental sustainability of digital content consumption, *Nature Communications*, 15:3724

"bigger-is-better" is not (always) true





1 query ~ 1 charge

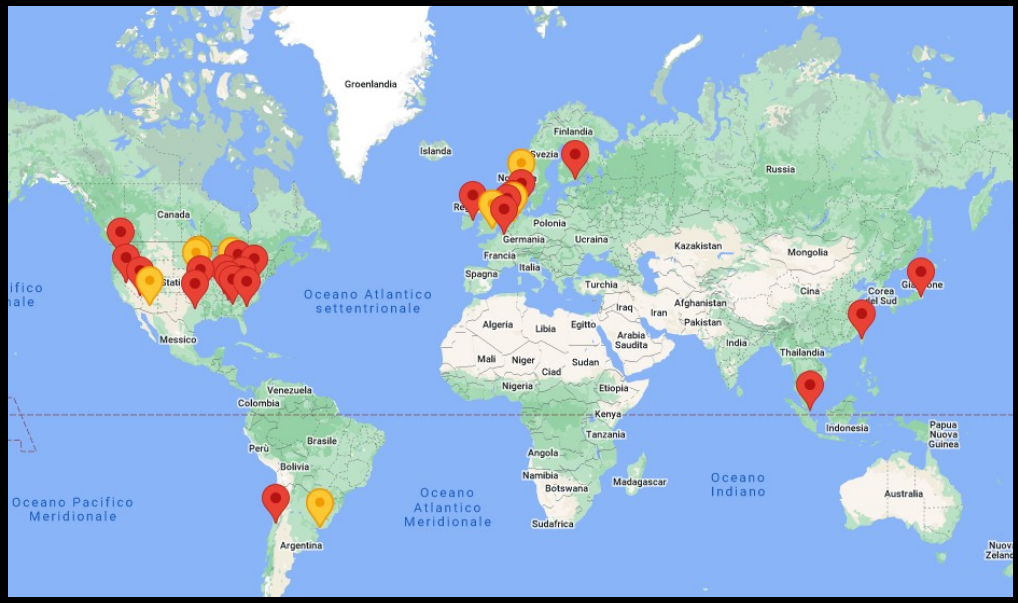
scale shouldn't be a requirement for science

scale comes with a concentration of power

Source: Gael Varoquaux, Alexandra Sasha Luccioni, Meredith Whittaker (2024). Hype, Sustainability, and the Price of the Bigger-is-Better Paradigm in AI, arXiv:2409.14160v1, 21 Sep 2024.

2024: inside the Microsoft / Google infrastructures that run *chatgpt / gemini*

source: microsoft.com



source: google.com

artificial neural network's idea: Rosenblatt (1958)
what is the difference? The planetary network of gigantic datacenters

Source: What runs ChatGPT? Inside Microsoft's AI supercomputer, Featuring Mark Russinovich, Zachary Cavanell, May 24 2023

2024: chatgpt daily power consumption

THE NEW YORKER

DAILY COMMENT

THE OBSCENE ENERGY DEMANDS OF A.I.

How can the world reach net zero if it keeps inventing new ways to consume energy?

By Elizabeth Kolbert

March 9, 2024

BUSINESS INSIDER

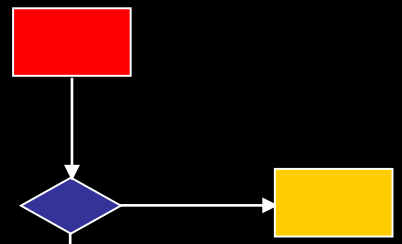
AI

ChatGPT is probably using up more than half a million kilowatt-hours of electricity to respond to some 200 million requests a day

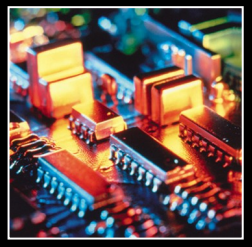
Lakshmi Varanasi Mar 10, 2024, 2:14 AM CET Share Save

chatgpt = circa 500.000 Kwh al giorno = 67.000 famiglie
Italia 2023: famiglia di 4 persone consuma in media 7,5 Kwh al giorno
Terna: nel 2023 consumi elettrici pari a circa 800.000.000 Kwh al giorno = 306,1 TWh / anno

che fare?



Technology



Market

Law

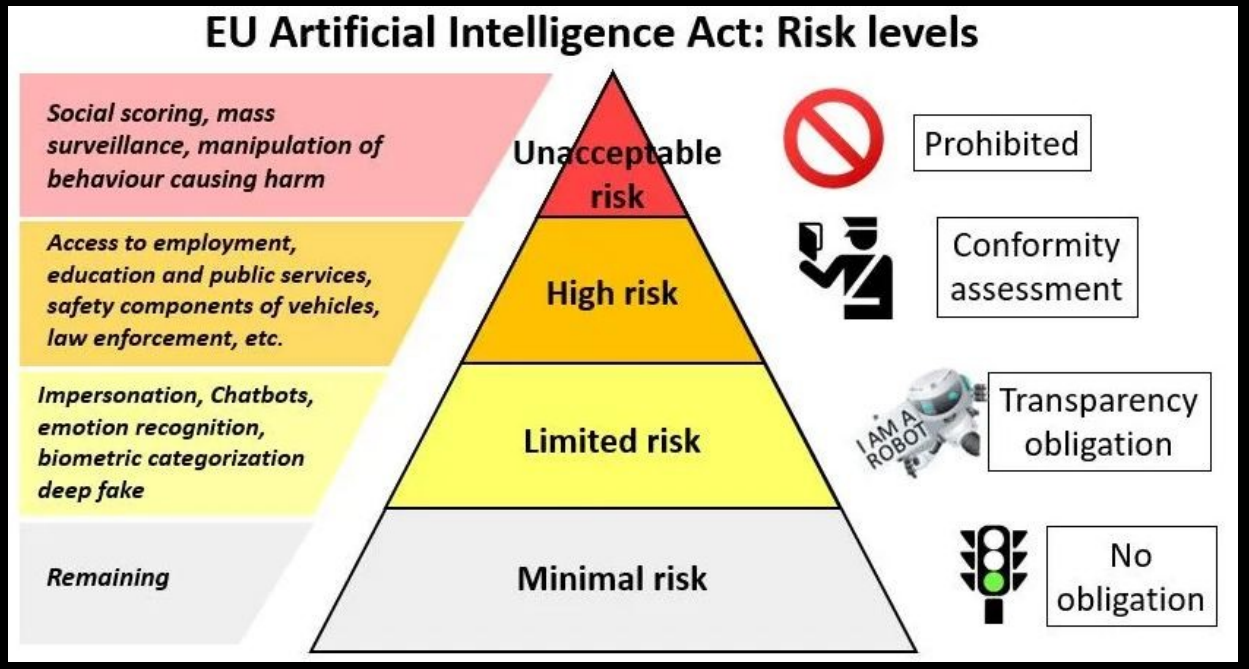
- rights
- hard laws

Education

- ethics
- soft laws

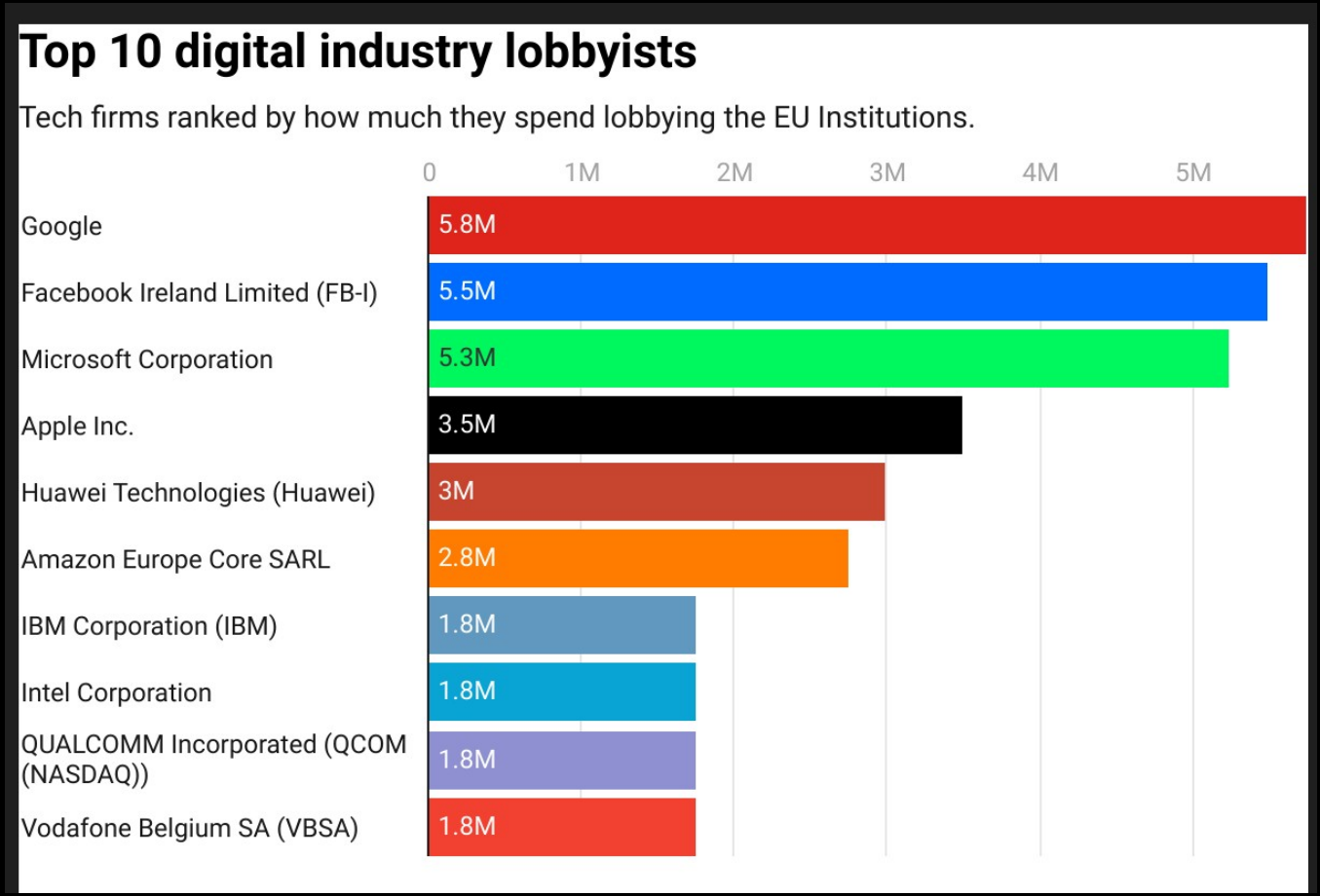
Source: Lessig, L. (1999), *Code and other laws of cyberspace*, Basic Books

2023, June 14: EU AI ACT



"*The tech industry,*
with its billions of dollars and deep political networks,
has been both nimble and creative in its response to anything perceived as a policy threat.
There are relevant ***lessons from the European experience*** *around the* ***perils of shifting from a "rights-based" regulatory framework****, as in the GDPR,*
to a "risk-based" approach*, as in the* ***upcoming AI Act*** *and*
how ***the framing of "risk" (as opposed to rights)***
could tip the playing field in favor of
industry-led voluntary frameworks and technical standards"
AI Now Institute, 2023

Big Tech, big lobbies



612 companies, groups and business associations lobbying the EU's digital economy policies. Together, they spend over €97 million annually lobbying the EU institutions.
This makes tech the biggest lobby sector in the EU by spending, ahead of pharma, fossil fuels, finance, and chemicals.

Source: https://corporateeurope.org/en/2021/08/lobby-network-big-techs-web-influence-eu

2024: Licensing AI

Computer Law & Security Review 52 (2024) 105899

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Licensing high-risk artificial intelligence: Toward ex ante justification for a disruptive technology

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ABSTRACT

The regulation of artificial intelligence (AI) has heavily relied on ex post, reactive tools. This approach has proven inadequate, as numerous foreseeable problems arising out of commercial development and applications of AI have harmed vulnerable persons and communities, with few (and sometimes no) opportunities for recourse. Worse problems are highly likely in the future. By requiring quality control measures *before* AI is deployed, an ex

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AI *Assisi Act*, 15 Settembre 2024

CORTILE DI FRANCESCO
francescanesimo è cultura

- "***innovazione responsabile***": cura degli ecosistemi e degli umani
non massimizzazione dei profitti
- IA "intelligenza artificiale" fuorviante e contribuisce al fenomeno di antropomorfizzazione,
più preciso: "***macchine calibrate con (tanti) dati***" (linguaggio disconnesso dal pensiero!)
- IA come ***strumento*** di accesso alle informazioni; ***comprensione, interpretazione, ricerca della verità non delegabili alla tecnologia***
- IA regolata come tutte le tecnologie, non subita per il potere e la ricchezza di pochi
- IA dipende dal lavoro di molti ***umani, sfruttati per caricare e "pulire" i dati***
- IA ***consuma quantità enormi di energia e acqua***, deve diventare ecosostenibile
- IA non va usata contro altri esseri umani (mala / mis / dis-informazione)
- IA richiede deontologia professionale e norme condivise
- concentrazione ***potere in poche mani*** (Big Tech),
va bilanciato con strumenti di ***controllo democratico***
- ***tecnologia non è neutra***, tecnologia e società di plasmano a vicenda
- ***tecnologie come strumenti*** per liberare gli umani da incombenze usuranti, ripetitive, disumanizzanti, alienanti
- IA dovrebbe essere una "***tecnologia conviviale***" (aperta e gestita da comunità)
- IA ***usata con saggezza***, estrarre informazioni dai dati, scovare interessanti correlazioni, traduzioni multilingue e multimodali, sintesi di testi lunghi, ...
- tempo, attenzione, fiducia, reputazione come ***risorse pregiate***
- ***supervisionare gli output***, informare lettori se testo generato da IA (evitare "*io*")
- distinguere ***correlazioni*** tra dati e relazioni di ***causa-effetto***
- fornitori di tecnologie aderenti al "***ACM Code of Ethics and Professional Conduct***"
- giornalismo professionale cita le fonti, fornisce prospettive diverse, aiuta ad affrontare "***caos epistemico***"
- evitare delega completa alle tecnologie, evitare "***de-skilling***"
- non tutto ciò che è ***tecnicamente possibile***,
è ***socialmente desiderabile***, ***ambientalmente sostenibile*** ed ***eticamente accettabile***

macchine calibrate con (tanti) dati a scuola?

https://insegnareindigitale.zanichelli.it/ia

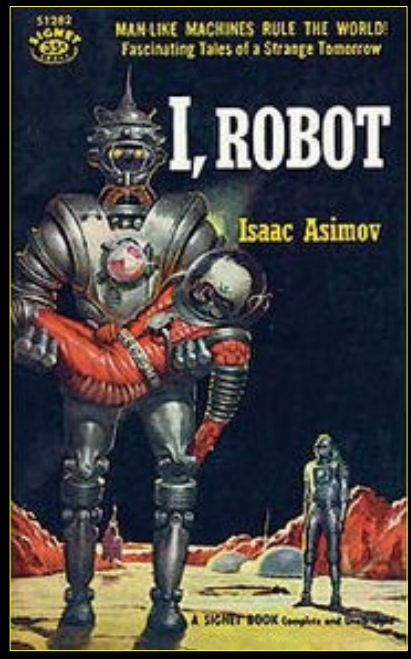
Isaac Asimov
(1920 - 1992)

1942: 3 Laws of Robotics

1st Law
A robot may not injure a human being or,
through inaction,
allow a human being to come to harm.

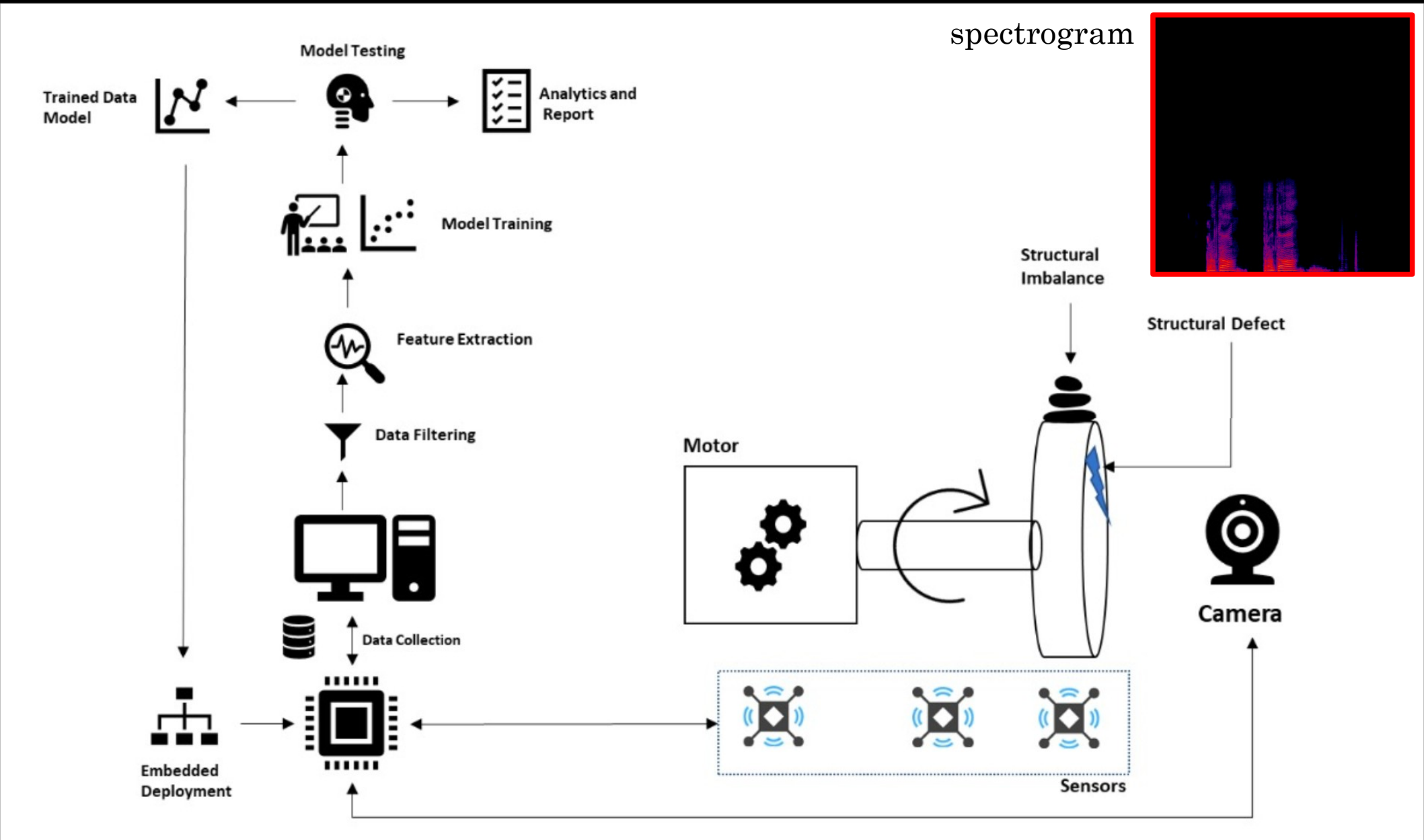
2nd Law
A robot must obey orders given to it by human beings,
except where such orders
would conflict with the First Law.

3rd Law
A robot must protect its own existence
as long as such protection
does not conflict with the First or Second Law.



es.
1. leggere l'opera più famosa di Asimov
2. sulla traccia delle 3 Leggi della Robotica scrivere un breve racconto
3. collegarsi ad un chatbot (gemini, chapgpt, etc.) e chiedere di scrivere un breve racconto sulla traccia delle 3 Leggi della Robotica
4. confrontare i due testi
5. il racconto scritto dagli umani può essere migliorato?

IoT (Internet of Things) scenario with (Tiny) ML (deployed on microcontrollers, low power consumption, etc.)



working with open LLMs locally

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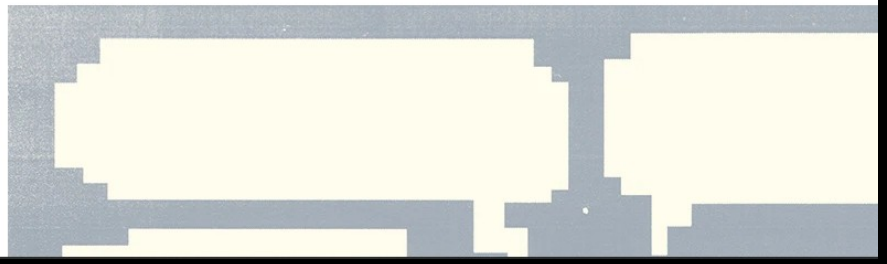
TECHNOLOGY FEATURE | 16 September 2024

Forget ChatGPT: why researchers now run small AIs on their laptops

Artificial-intelligence models are typically used online, but a host of openly available tools is changing that. Here's how to get started with local AIs.

By Matthew Hutson



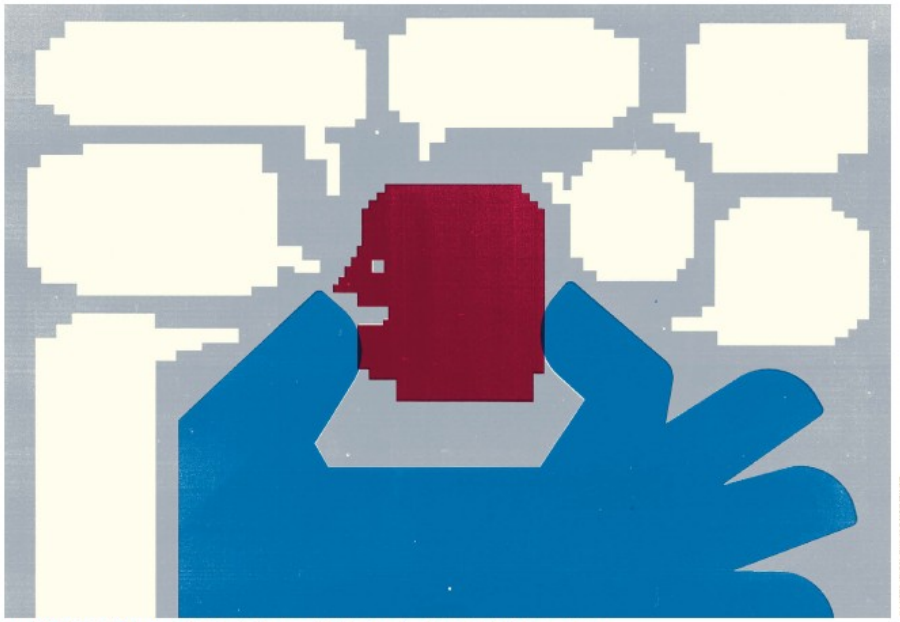


ILLUSTRATION: THE PROJECT TWINS

FORGET CHATGPT: HOW TO RUN AI LOCALLY ON A LAPTOP

Researchers typically use AIs online, but a host of openly available tools means they don't have to. **By Matthew Hutson**

The website histo.fyi is a database of structures of immune-system proteins called major histocompatibility complex (MHC) molecules. It includes images, data tables and amino-acid sequences, and is run by bioinformatician Chris Thorpe, who uses artificial intelligence (AI) tools called large language models (LLMs) to convert those assets into readable summaries. But he doesn't use ChatGPT, or any other web-based LLM. Instead, Thorpe runs the AI on his laptop.

Over the past couple of years, chatbots based on LLMs have won praise for their ability to write poetry or engage in conversations. Some LLMs have hundreds of billions of parameters – the more parameters, the greater the complexity – and can be accessed only online. But two more recent trends have blossomed. First, organizations are making 'open weights' versions of LLMs, in which the weights and biases used to train a model are publicly available, so that users can download and run them locally, if they have the computing power. Second, technology firms are making scaled-down versions that can be run on consumer hardware – and that rival the performance of older, larger models.

Researchers might use such tools to save money, protect the confidentiality of patients or corporations, or ensure reproducibility. Thorpe, who's based in Oxford, UK, and works at the European Molecular Biology Laboratory's European Bioinformatics Institute in Hinxton, UK, is just one of many researchers exploring what the tools can do. That trend is likely to grow, Thorpe says. As computers get faster and models become more efficient, people will increasingly have AIs running on their laptops or mobile devices for all but the most intensive needs. Scientists will finally have AI assistants at their fingertips – but the actual algorithms, not just remote access to them.

Big things in small packages

Several large tech firms and research institutes have released small and open-weights models over the past few years, including Google DeepMind in London; Meta in Menlo Park, California; and the Allen Institute for Artificial Intelligence in Seattle, Washington. ('Small' is relative – these models can contain some 30 billion parameters, which is large by comparison with earlier models.)

Although the California tech firm OpenAI hasn't open-weighted its current GPT models, its partner Microsoft in Redmond, Washington, has been on a spree, releasing the small

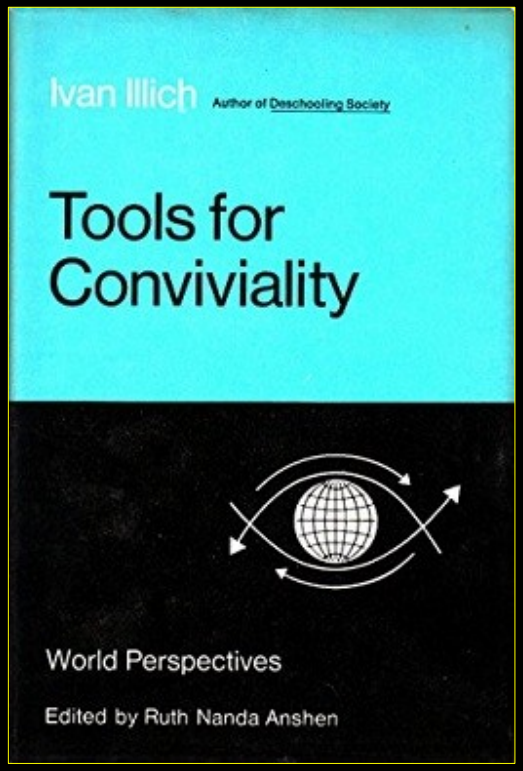
Source: Hudson, M. (2024). Forget ChatGPT: How to Run AI Locally on a Laptop, nature, vol.633, 19 September 2024

1973: tecnologie conviviali

Ivan Illich
(1926-2002)

"... ***dare alle persone strumenti che garantiscano il loro diritto a lavorare con efficienza indipendente***"

Ivan Illich, 1973



basate su una comunità
aperte e libere
decentrate
interoperabili

Source. Illich, I. (1973). *Tools for Conviviality*, Harper & Row - Milani, C. (2022). *Tecnologie conviviali*, Eleuthera.

days without technology

Photo: www.playingaceschess.org

non chiamiamola "intelligenza artificiale", ma
"***macchine calibrate con (tanti) dati***";
discontinuità:
dal *software algoritmico*
al *software* "*statistico*"

nel nostro tempo,
(come persone esperte di informatica, o *computer professionals*)
dobbiamo ***assumerci la responsabilità*** di dire
cosa ***può*** essere e
cosa ***non può*** essere automatizzato

sappiamo ***come è fatto*** un sistema e ***come funziona***:
è tempo di chiedersi ***come e perché*** progettarlo?
chi lo userà, per ***quali*** scopi?
fino alla domanda cruciale: ***se*** progettarlo

verso una saggezza digitale / sobrietà digitale
basata su ***tecnologie conviviali***

Non chiamiamola "intelligenza artificiale"

grazie!