Data, Knowledge and Common Sense Reasoning

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Data

Two aspects to it:

1. As conveying knowledge (what is your question?)
From Google to Wikipedia and the weather,…

Restricted to few in the past and available to all today.

2. As an instrument to train computers to perform perceptual tasks and spot patterns (machine learning, neural nets)
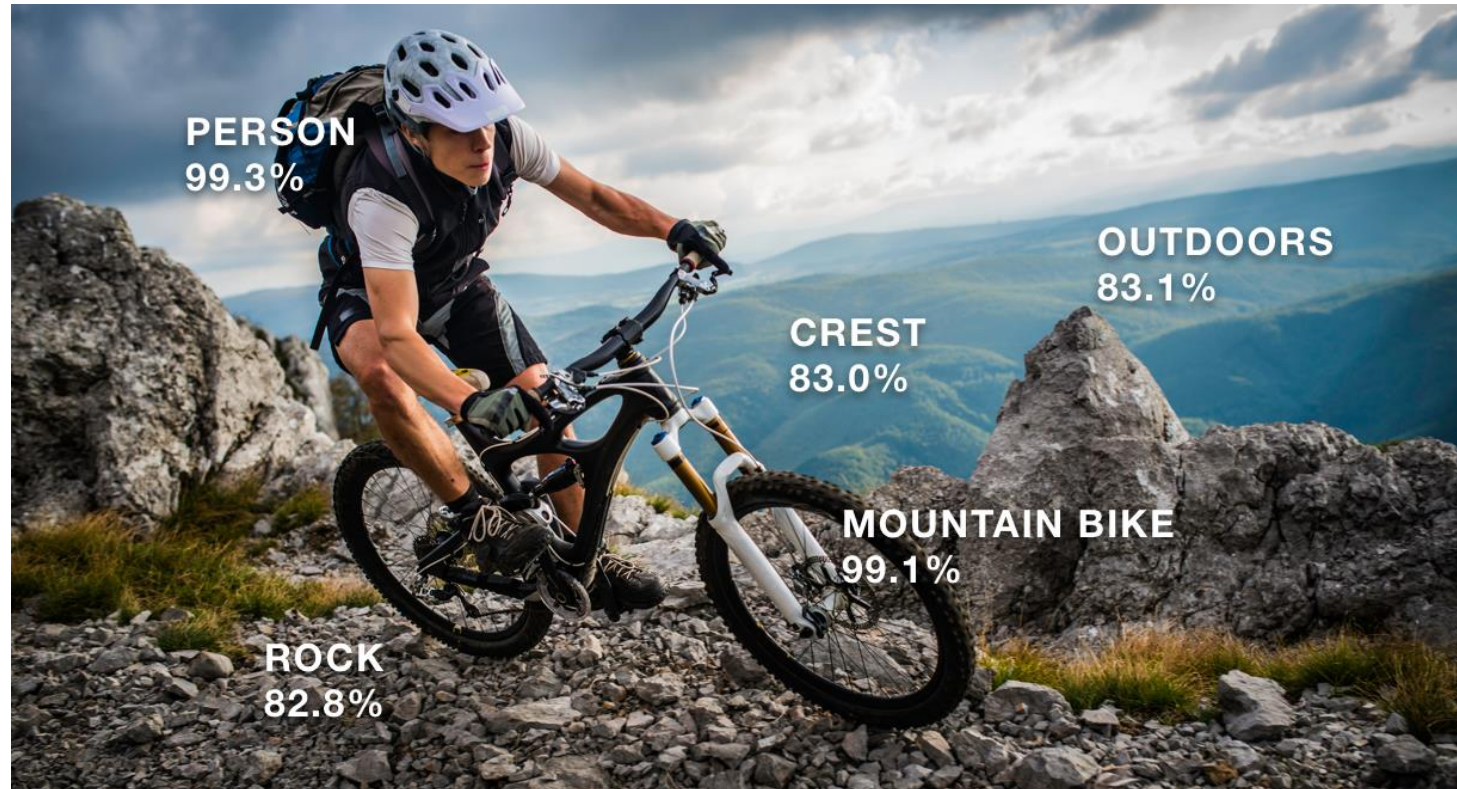
Machine learning

It relies on having access to vast amounts of "similar" data.

Problematic with corner cases.

Works with visual (eg. face recognition), and auditory inputs (Shazam).
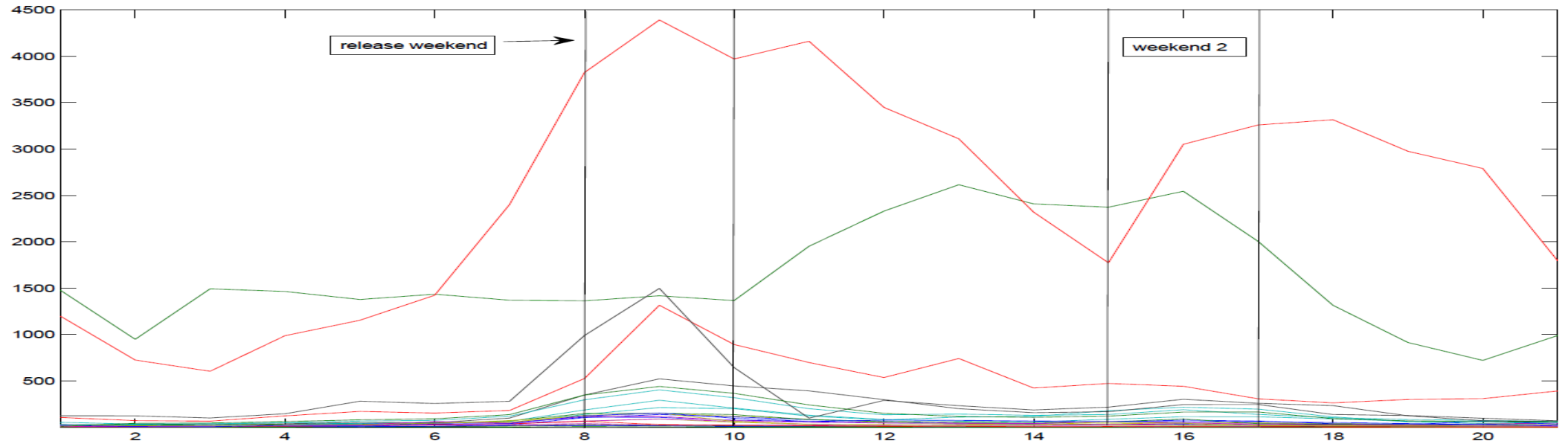
Easy to recognize this

Hard to recognize this one

Discovering patterns

Predicting the future with machine learning

Measuring attention flows

S. Asur and Bernardo A. Huberman, *Proceedings of the ACM Conference on Web Intelligence (2010)*

Predictions

Movie	Predicted	Actual
Dear John	30.71 M$	30.46 M$
The Crazies	16.8 M$	16.07 M$

AI, knowledge and intelligence

What do people mean nowadays when they say AI?

They mean machine learning and neural nets. Great for discovering patterns in oceans of data

And what about different kinds of knowledge?

Common sense reasoning   Language

          Planning   Analogy

And most importantly

The flexibility of human thought, especially as conditions in the environment change.
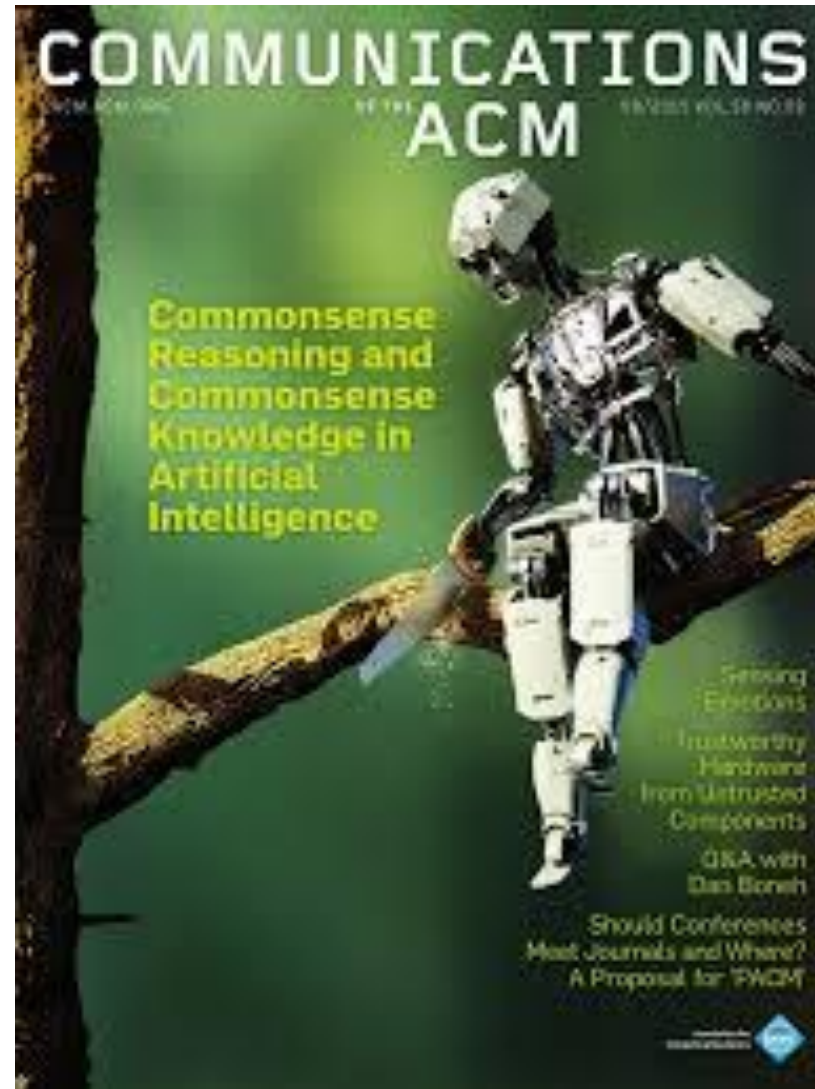
It cannot easily deal with causal relations. The why? of a child.

Common sense reasoning: hard to encode

A child knows why this is funny and makes no sense

Common sense reasoning-hard

The future:
a realistic view

Solving the hard problems

Sensor fusion and IoT

The understanding of complex scenes and situations

Solving scientific, social and technical problems

Orchestrating large distributed processes

The answer:

Distributed intelligence and its underlying mechanism:

Cooperation

EXAMPLES

Social animals and insects

Organizations
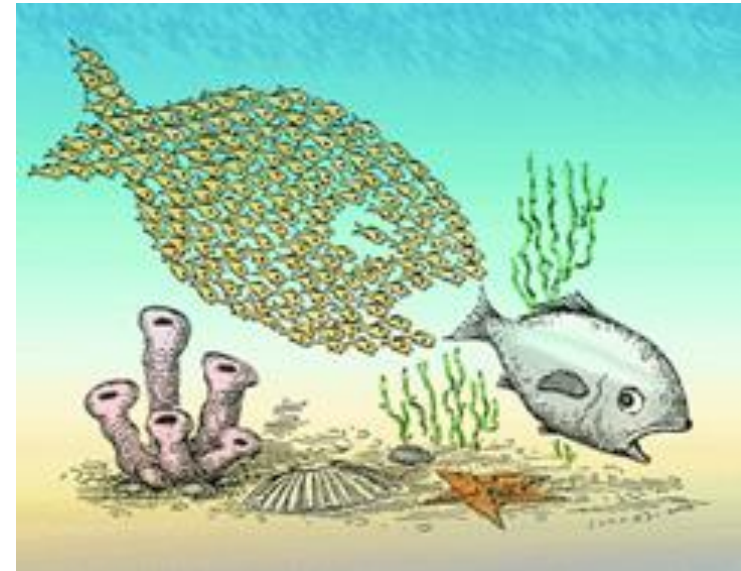
Scientific and technical societies

Jury systems

Reliable computing
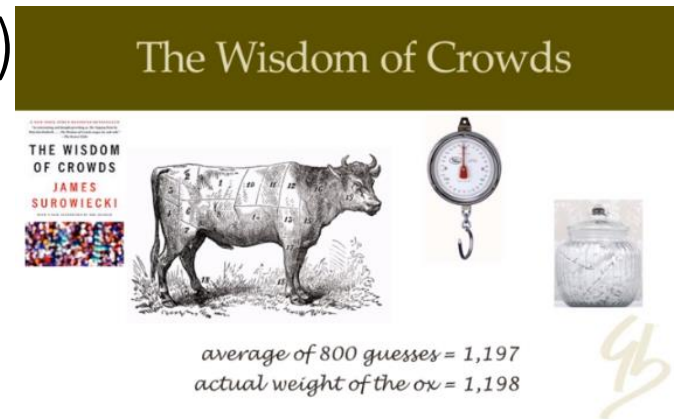
Crowdsourcing (eg, Wikipedia)

Benefits

- Cooperative processes often outperform the best one.

- The distribution of performance is *universal* and with a heavy tail.

- Instead of the usual bell shaped curve of ability, we see a different performance distribution.

Two types of distributed intelligence

1.- Wisdom of the crowd: many minds better than few; even if they don't interact.

Francis Galton (1907)

The Wisdom of Crowds

THE WISDOM OF CROWDS
JAMES SUROWIECKI

average of 800 guesses = 1,197
actual weight of the ox = 1,198

Marquis de Condorcet (1785): A group should reaches a decision by majority vote.
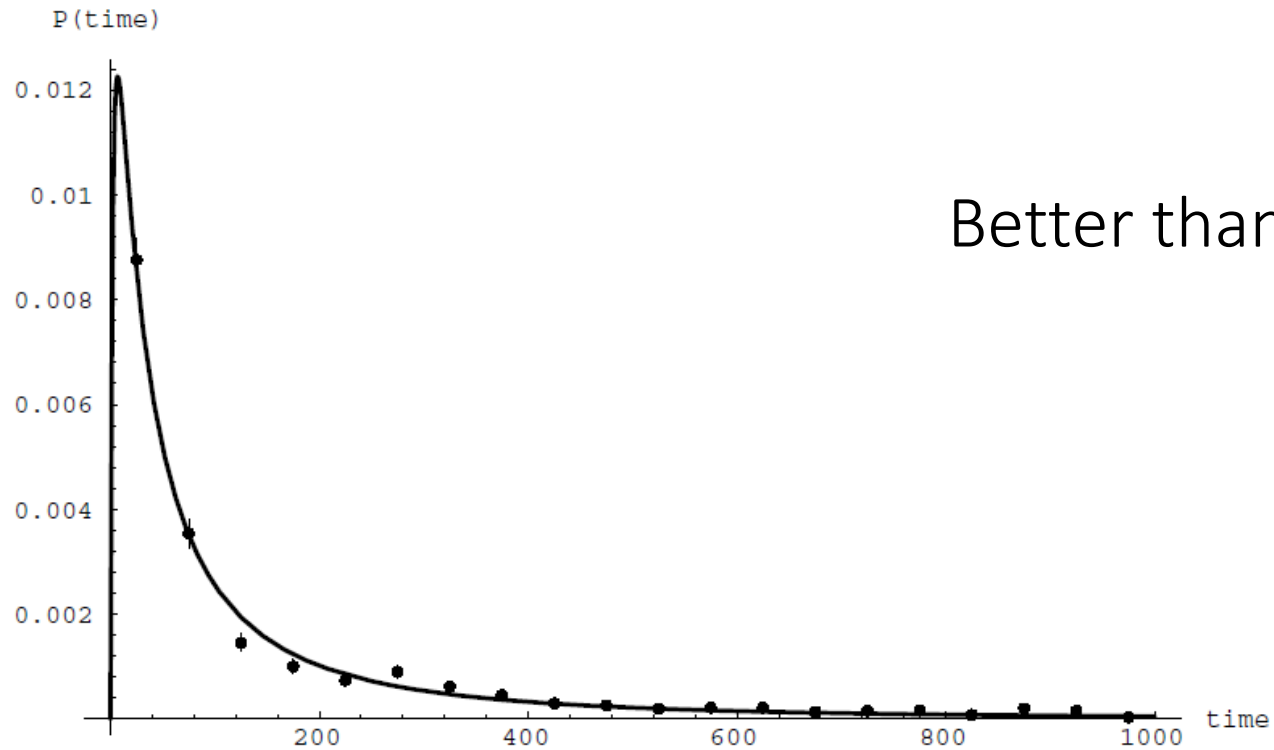
Two types of distributed intelligence

2.- Cooperative systems:

Agents, programs, insects, people, etc. exchange information that changes the state of those who receive it.

Examples: manufacturing, neural networks, jury deliberations, etc.

Universal law

The distribution of performance is log-normal

Better than the best!

Observed in scientific productivity, income distributions, etc.

Distributed problem solving

Cryptarithmetic: an example of constraint satisfaction problems

Find letter-> number assignments such that it makes sense as a sum.

```
    S E N D              9 5 6 7
+   M O R E          +   1 0 8 5
-----------          -----------
  M O N E Y            1 0 6 5 2
```
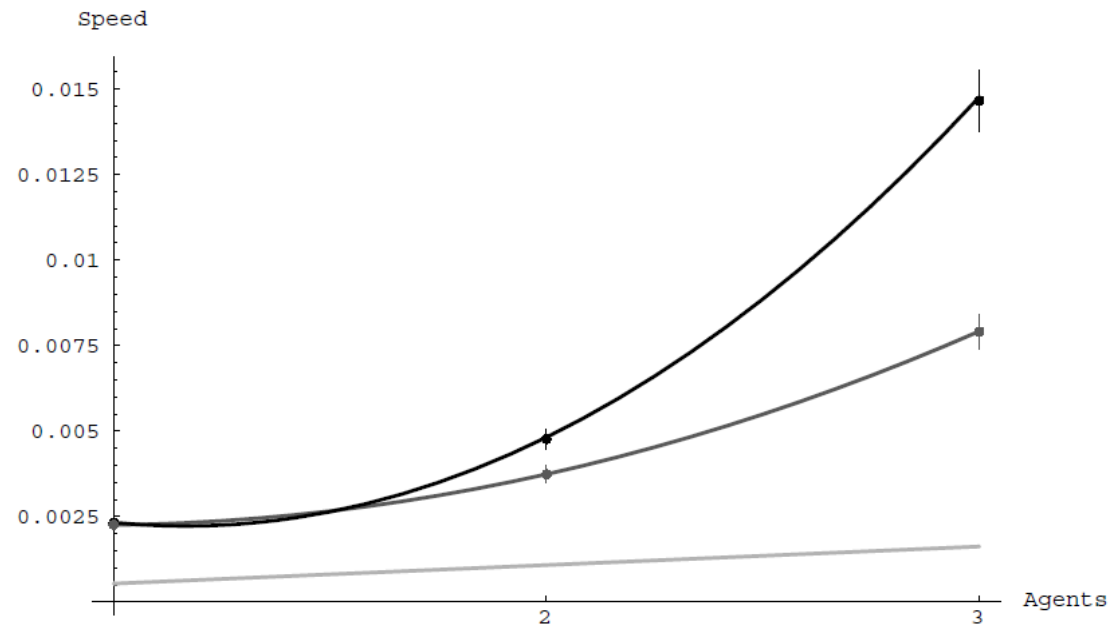
How hard are these problems?

Let T be the number of states in the search space,

And S the number of solutions,

T/S measures the complexity of the problem.

problem	ratio of speeds	T/S	fraction of hints that are subsets of solutions
$AB + AC = DE$	7	210	0.9–1.0
$WOW + HOT = TEA$	45	1844	0.5–0.6
$CLEAR + WATER = SCOTT$	145	181440	0.1–0.2
$DONALD + GERALD = ROBERT$	315	3628880	0.004

The value of diversity

Non-linear speed-up!

Should we be afraid of AI?

It will steal jobs

It will make decisions without human supervision

We'll all stay at home with nothing to do

....

Should we be afraid of AI?

Well, every time machines were created, they also generated new sources of work.

Modern agriculture
Calculators
Robots
Automated navigation for airplanes

Artificial Intelligence is better than none

GRACIAS!