

Informal Synopsis

- “Artificial Intelligence and Machine Learning: Applications to Computer Vision” – subject matter - but maybe mostly I’ll abbreviate to “AI” 😊
- Introduction – who am I – where am I from?
- What is AI/ML/CV – what can it do
- A little (personalized view) of history...and where AI is at.

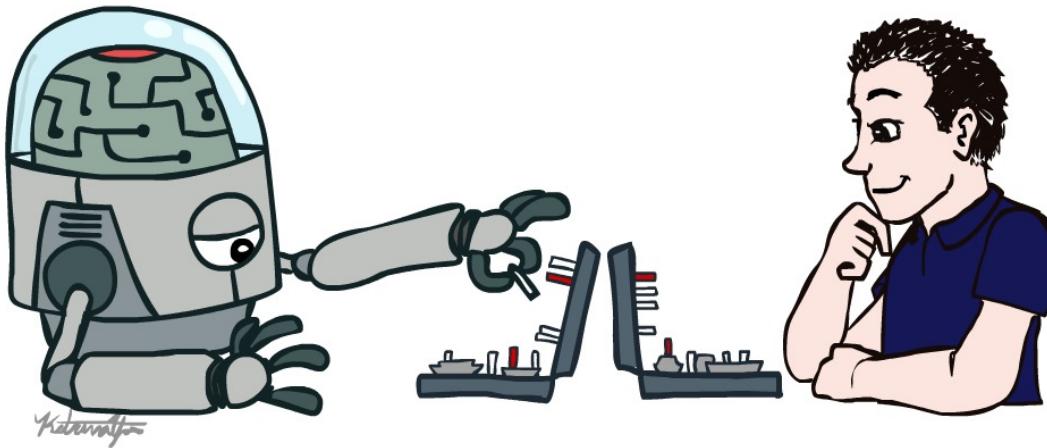
Who am I? - Basic Info

- David Suter – d.suter@ecu.edu.au
- Professor Monash University, Melbourne (previous – 20 years)
- Professor Adelaide University (previous - 10 years)
- Research Professor E C U, Perth (current – 3.5 years)

Is this random? Or is there a pattern?
Where will I be in 3 years time?



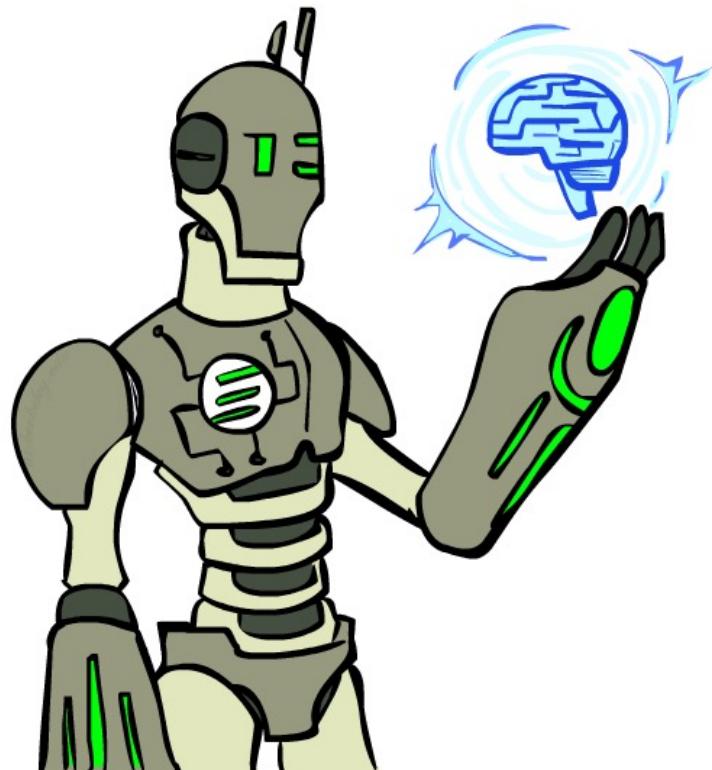
50min talk with 5 min intermission to watch the Olympics



[Some slides adapted from those created by Dan Klein and Pieter Abbeel for CS188 Intro to AI at UC Berkeley. Some others from colleagues at Adelaide University.]

Synopsis

- What is artificial intelligence?
- History....
- What can AI do?
- AI is HERE!



Synopsis – a history intertwined with the events of
the times. Cold war, space age/race,...



What is AI?

The science of making machines that:

What is AI?

The science of making machines that:

Thinking Humanly <p>“The exciting new effort to make computers think . . . <i>machines with minds</i>, in the full and literal sense.” (Haugeland, 1985)</p> <p>“[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning . . .” (Bellman, 1978)</p>	Thinking Rationally <p>“The study of mental faculties through the use of computational models.” (Charniak and McDermott, 1985)</p> <p>“The study of the computations that make it possible to perceive, reason, and act.” (Winston, 1992)</p>
Acting Humanly <p>“The art of creating machines that perform functions that require intelligence when performed by people.” (Kurzweil, 1990)</p> <p>“The study of how to make computers do things at which, at the moment, people are better.” (Rich and Knight, 1991)</p>	Acting Rationally <p>“Computational Intelligence is the study of the design of intelligent agents.” (Poole <i>et al.</i>, 1998)</p> <p>“AI . . . is concerned with intelligent behavior in artifacts.” (Nilsson, 1998)</p>
Figure 1 Some definitions of artificial intelligence, organized into four categories.	

Rational Decisions

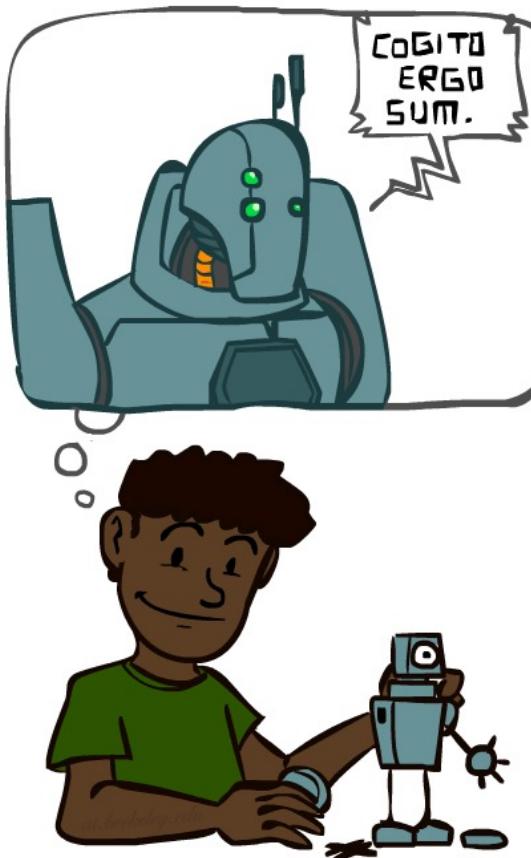
Norvig uses the term **rational** in a very specific, technical way:

- Rational: maximally achieving pre-defined goals
- Rationality only concerns what decisions are made
(not the thought process behind them)
- Goals are expressed in terms of the **utility** of outcomes
- Being rational means **maximizing your expected utility**

Much of this course is about:

Computational Rationality

A (Short) History of AI



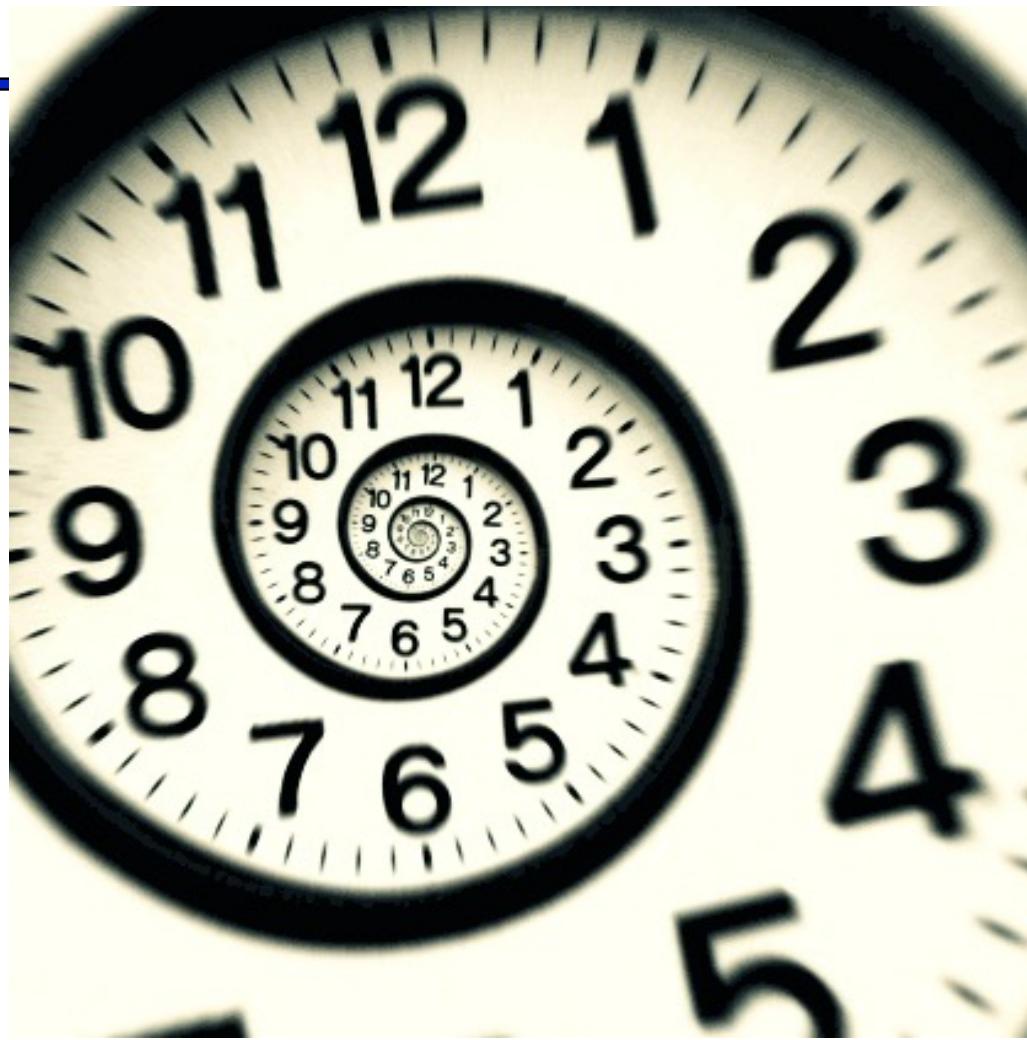
let's take a trip back in time.....





Before I was born.....





One of the earliest works I have read....

Technical Report 232

Shape From Shading: A Method for Obtaining the Shape of a Smooth Opaque Object From One View

Berthold K. P. Horn

MIT Artificial Intelligence Laboratory

SHAPE FROM SHADING: A METHOD FOR OBTAINING

THE SHAPE OF A SMOOTH OPAQUE OBJECT FROM ONE VIEW

Berthold K. P. Horn

November 1970

But I was just starting high
school...I hadn't really heard
of AI...

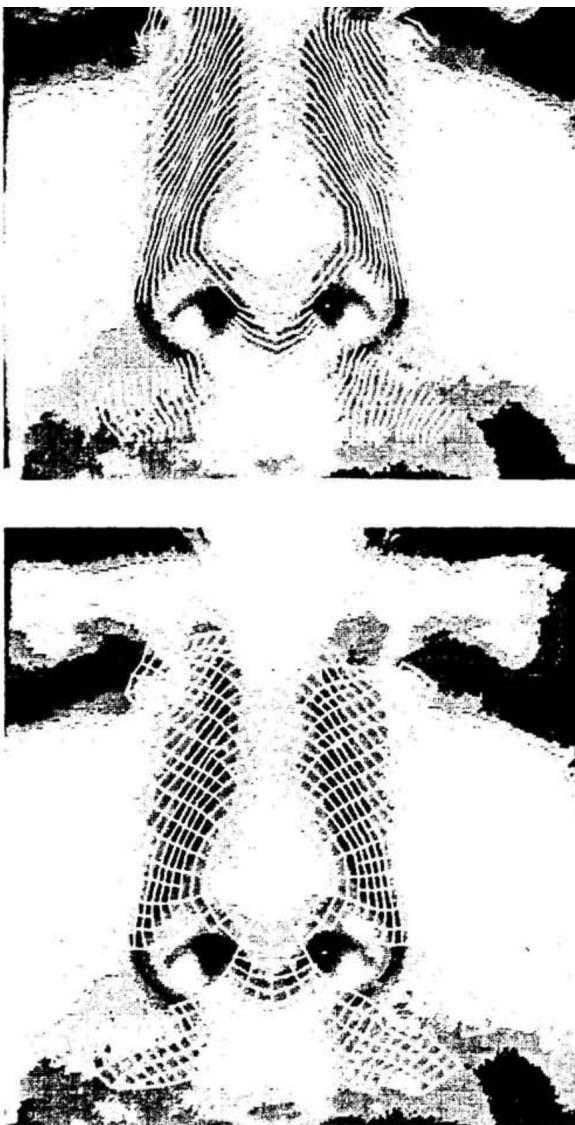


Figure 1: Pictures of a nose with superimposed characteristic solutions and contours. Shape determined from the shading (not intensity contours). See section 4.3



MASSACHUSETTS INSTITUTE OF TECHNOLOGY
ARTIFICIAL INTELLIGENCE LABORATORY

A.I. Memo No. 613

June, 1981

A COMPUTATIONAL THEORY OF
VISUAL SURFACE INTERPOLATION

W.F.L. Grimson

ABSTRACT: Computational theories of structure from motion [Ullman, 1979] and stereo vision [Marr and Poggio, 1979] only specify the computation of three-dimensional surface information at special points in the image. Yet, the visual perception is clearly of complete surfaces. In order to account for this, a computational theory of the interpolation of surfaces from visual information is presented.

The problem is constrained by the fact that the surface must agree with the information from stereo or motion correspondence, and not vary radically between these points. Using the image irradiance equation [Horn, 1977], an explicit form of this *surface consistency constraint* can be derived [Grimson, 1981c].

To determine which of two possible surfaces is more consistent with the surface consistency constraint, one must be able to compare the two surfaces. To do this, a functional from the space of functions to the real numbers is required. In this way, the surface most consistent with the visual information will be that which minimizes the functional. To ensure that the functional has a unique minimal surface, conditions on the form of the functional are derived. In particular, if the functional is a complete semi-norm which satisfies the parallelogram law, or the space of functions is a semi-Hilbert space and the functional is a semi-inner product, then there is a unique (to within an element of the null space of the functional) surface which is most consistent with the visual information.

It can be shown, based on the above conditions plus a condition of rotational symmetry, that there is a vector space of possible functionals which measure surface consistency, this vector space being spanned by the functional of quadratic variation and the functional of square Laplacian [Brody and Horn, 1981]. Arguments based on the null spaces of the respective functionals are used to justify the choice of the quadratic variation as the optimal functional.

Algorithms for computing the surface which minimizes quadratic variation in the case of exact surface interpolation and in the case of surface approximation are outlined and illustrated on a series of synthetic and actual surface interpolation examples.

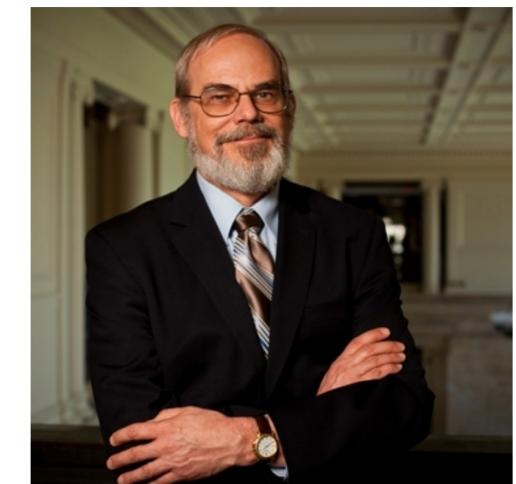
This report describes research done at the Artificial Intelligence Laboratory of the Massachusetts Institute of Technology. Support for the laboratory's artificial intelligence research is provided in part by the Advanced Research Projects Agency of the Department of Defense under Office of Naval Research contract N00014-80-C-0505 and in part by National Science Foundation Grant MCS77-07569.

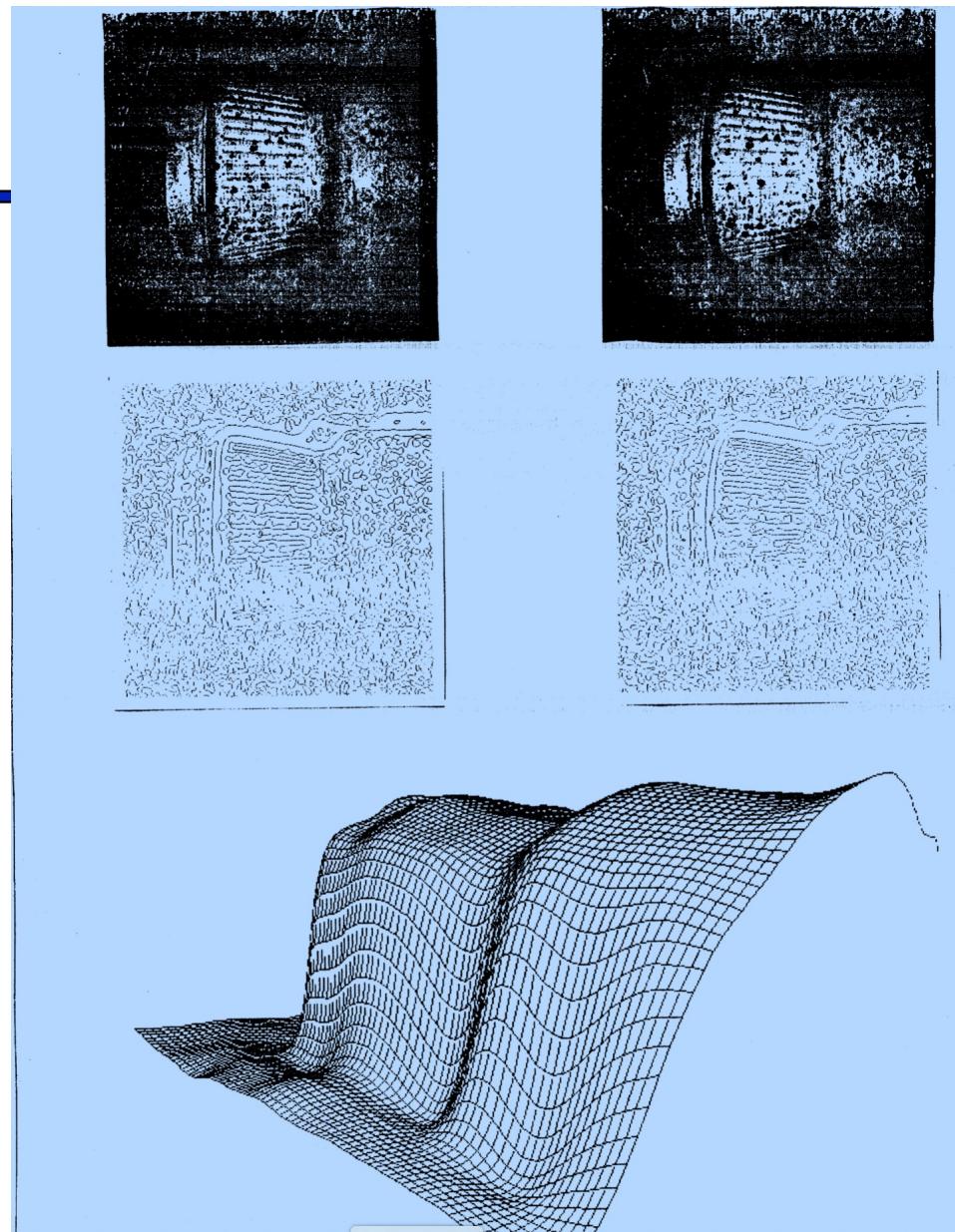
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Professor Eric Grimson named next chancellor

Current head of the Department of Electrical Engineering and Computer Science to succeed Phillip L. Clay.

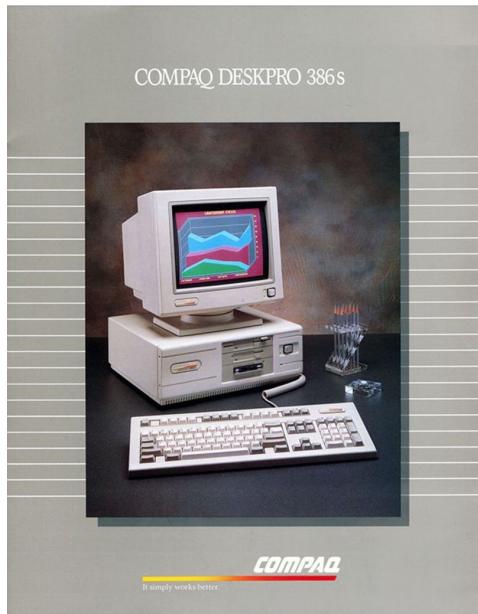
News Office
February 10, 2011







1986! - I started a PhD



Ronald Reagan US President, Margaret Thatcher UK Prime Minister, 1st time can invest in Microsoft, Saddam Hussain offers peace with Iran, US bombs Libya, Beirut bombings, kidnappings; Apartheid in South Africa being more strongly opposed....

Europe still split "in half" by Iron Curtain – Soviet controlled eastern block, Germany divided.....

Compaq beats IBM to the market when it announces the Deskpro 386, the first computer on the market to use Intel's new 80386 chip, a 32-bit microprocessor - the introduction of a 32-bit architecture. made graphical operating environments for IBM PC practical

Compaq Deskpro 386 Pricing

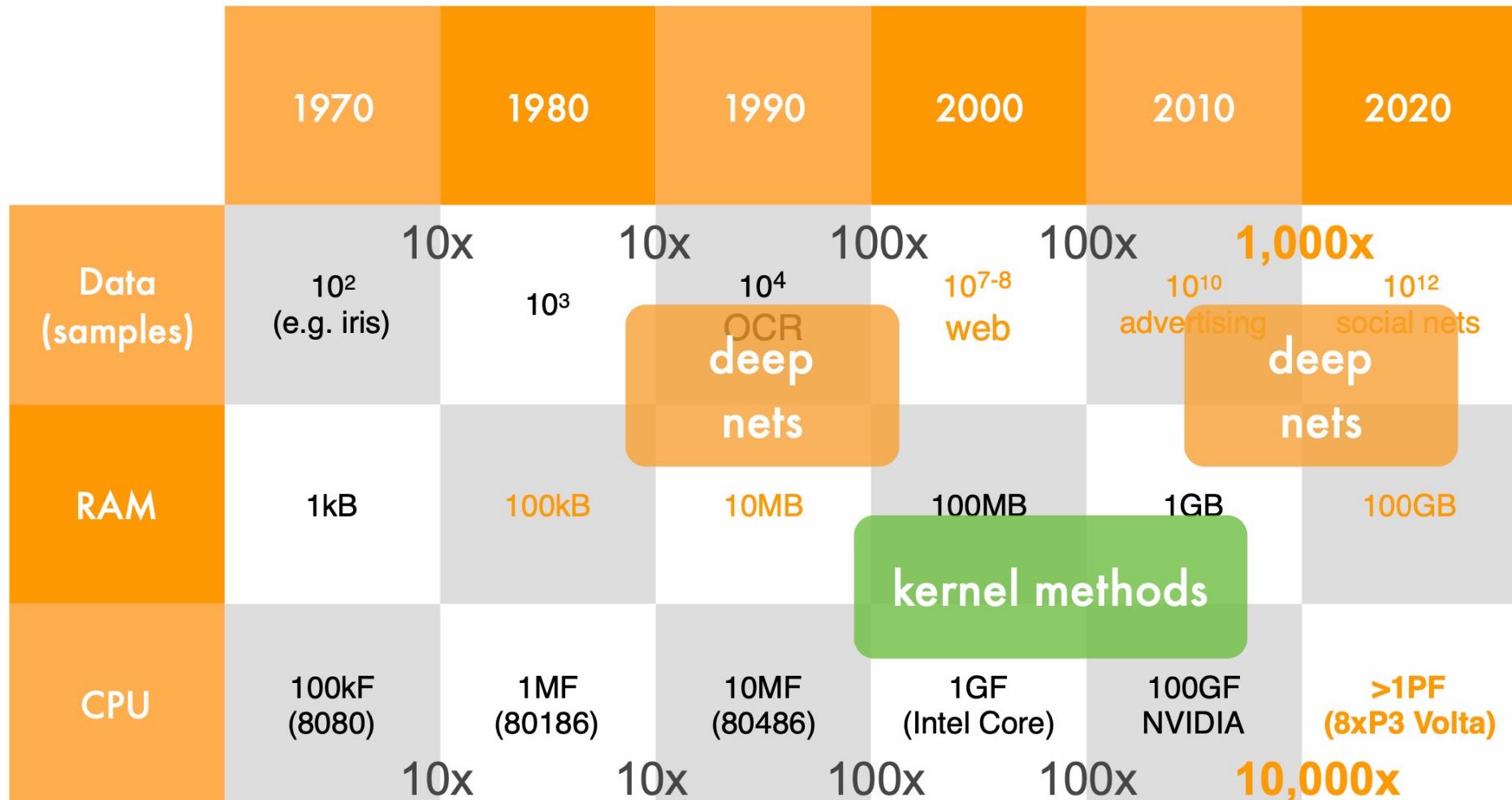
The base price was \$6,499 for a system with 1 MB of RAM, MS-DOS 3.1, a single 1.2 MB floppy drive, and a 40 MB hard drive. The price didn't include a monitor or video card. A basic CGA/monochrome video card was \$199 and an EGA card was \$599. A color monitor was \$799. By the time you added the video card and a monitor, a complete system cost almost \$8,000. In 2017 dollars, that would be nearly \$18,000.

Compaq Deskpro 386 Specifications

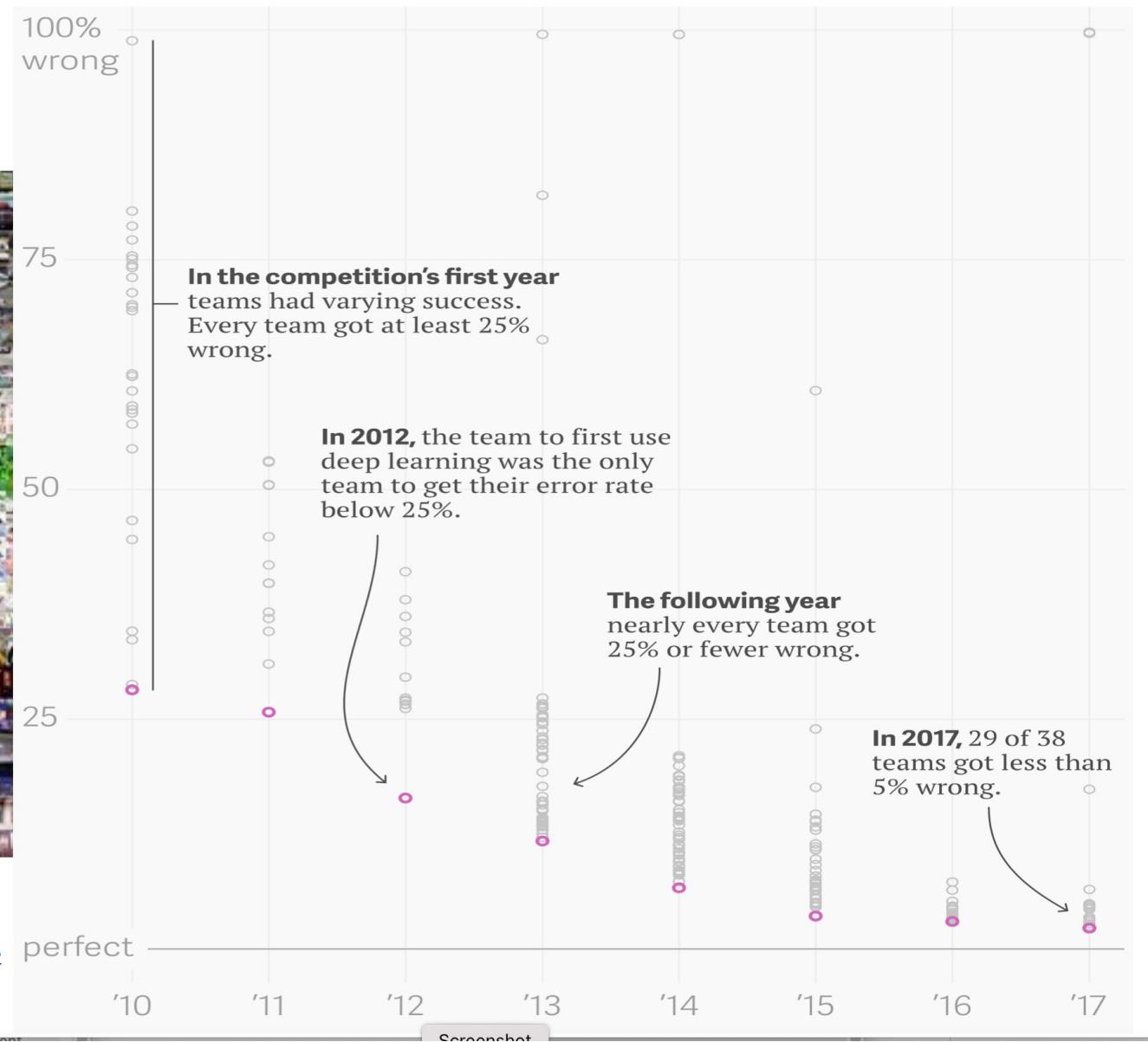
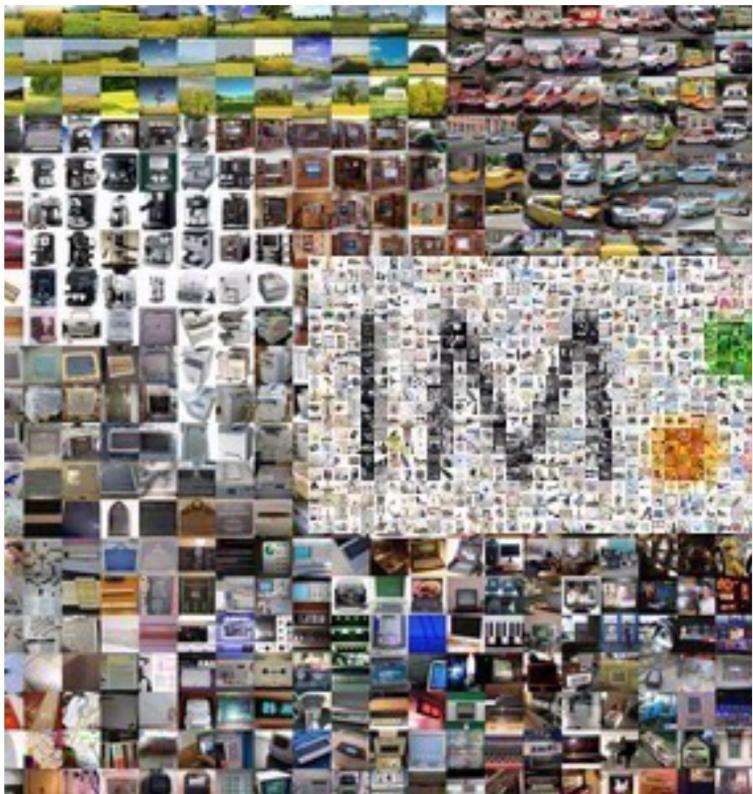
The Compaq Deskpro 386 had a 32-bit expansion slot for RAM (it could use up to 14 megabytes), four 16-bit slots and three 8-bit slots. The Deskpro 386 came with a 32-bit memory board with 1 megabyte of RAM from the factory. Five of the slots were open for user expansion. BTW – Linux was still 5 years away from being released.....

By 1990 I had finished...and claimed to

- Improve a little on Terzopoulos (who claimed to improve a little on Grimson...)
 - And I had become enthusiastic about neural networks...even grandly pronouncing it was the only way to go....
 - But real capability was severely limited....still.
-
- But then, I – and much of the community – lost interest in neural networks.... For maybe 15-20 years....



Classify Images

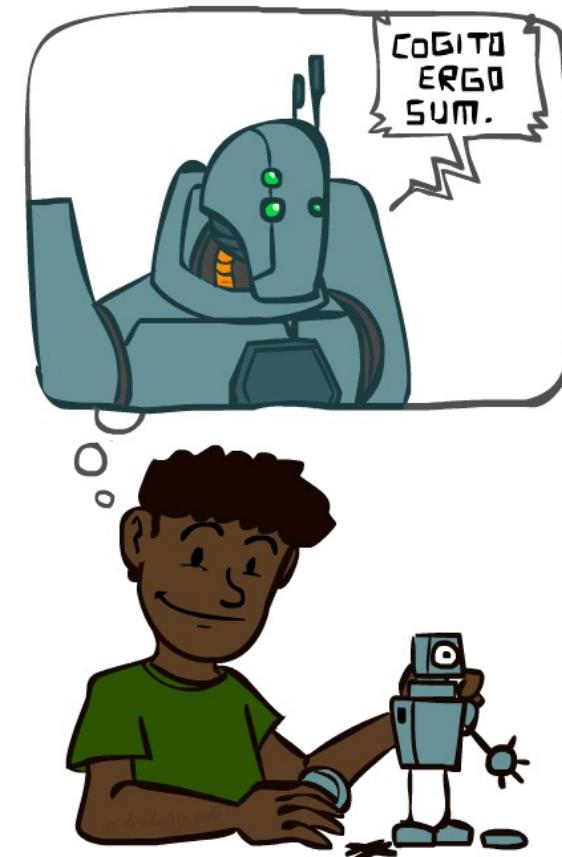


Yanofsky, Quartz

<https://qz.com/1034972/the-data-that-changed-the-direction-of-ai-research-and-possibly-the-world/>

A (Short) History of AI

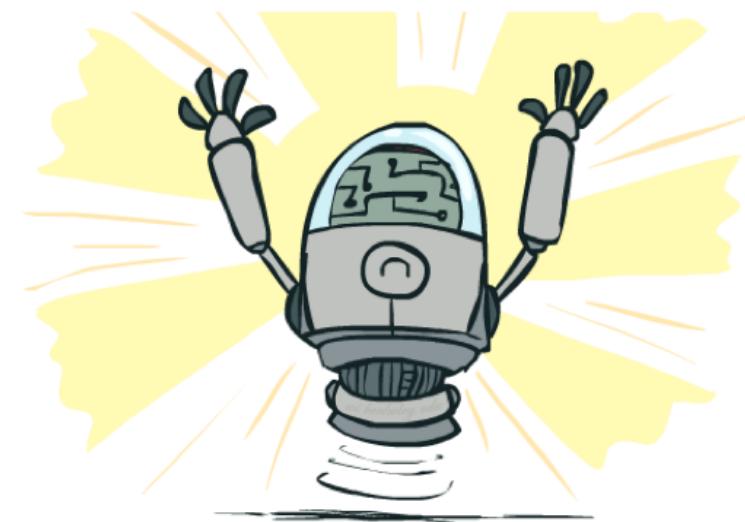
- **1940-1950: Early days**
 - 1943: McCulloch & Pitts: Boolean circuit model of brain
 - 1950: Turing's "Computing Machinery and Intelligence"
- **1950—70: Excitement: Look, Ma, no hands!**
 - 1950s: Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's Geometry Engine
 - 1956: Dartmouth meeting: "Artificial Intelligence" adopted
 - 1965: Robinson's complete algorithm for logical reasoning
- **1970—90: Knowledge-based approaches**
 - 1969—79: Early development of knowledge-based systems
 - 1980—88: Expert systems industry booms
 - 1988—93: Expert systems industry busts: "AI Winter"
- **1990—: Statistical approaches**
 - Resurgence of probability, focus on uncertainty
 - General increase in technical depth
 - Agents and learning systems... "AI Spring"?
- **2000—: Where are we now?**
 - Deep Learning is definitely very popular and successful!



What Can AI Do?

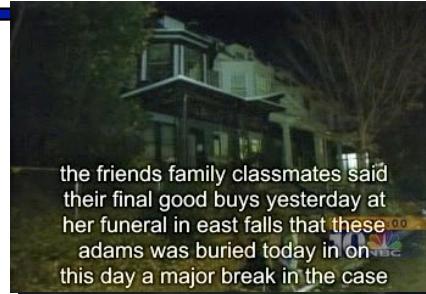
Quiz: Which of the following can be done at present?

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



Natural Language

- Speech technologies (e.g. Siri)
 - Automatic speech recognition (ASR)
 - Text-to-speech synthesis (TTS)
 - Dialog systems



AI as seen from 1968 (film made) c.f. moon walk 1969, AI birth (1956?)



2001: A Space Odyssey - Trailer

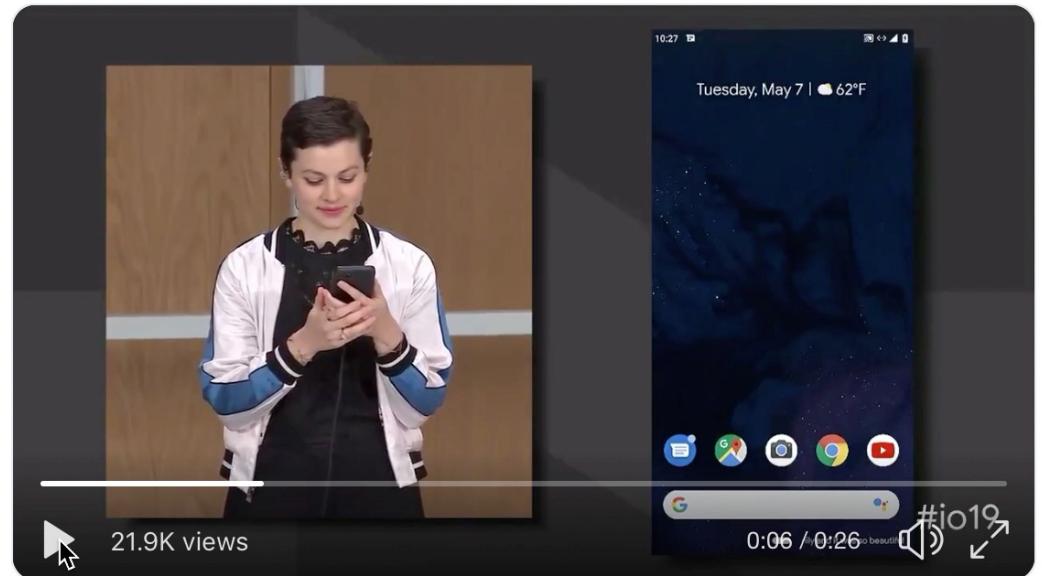
AI is here....service robots, chatbots and “assistants” are here...speech, *vision*,
spatial awareness



Service
Robot
Xiamen,
PRC,
Nov 2018

Google
Major
Announce
ments,
May 7
2019

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



Follow the money!...who's made/making money....where investing?

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

Internet/Tech/Comm
s – invariably
investing heavily in
AI

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

Source Wikipedia

7/1/18