

GLASSLAB (Graphics Learning and Smart Sensing Lab)

Data and Computational Literacy

Michael Grossberg

Learning to Code

LATEST POSTS

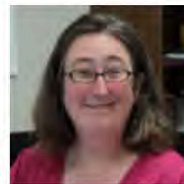
TEACHING TIPS

Is Coding the New Literacy?

BY TERRY S. ATKINSON | Jan 10, 2014



Graduate students in my literacy graduate classes often broach topics extending well beyond our course objectives as they recount their own classroom teaching experiences. Such was the case this past



Ian Smyth

Mother Jones

Is Coding the New Literacy?

Why America's schools need to train a generation of hackers.

TASNEEM RAJA JUNE 16, 2014 10:00 AM

edutopia

PROJECT-BASED LEARNING

Programming Is the New Literacy

Power will soon belong to those who can master a variety of expressive human-machine interactions.

By **Marc Prensky**

January 13, 2008

Coding is not the new literacy

Despite the good intentions behind the premise and approach are flawed. The r new literacy," but that takes a narrow vi

Leaders and trend-setters all agree on one thing



Malala Yousafzai
Nobel Peace Prize Winner

Every girl deserves to take part in creating the technology that will change our world, and change who runs it.



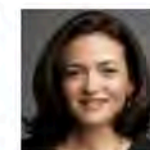
Justin Trudeau
Prime Minister, Canada

Every job we're going to do in the future will rely on technology and be benefited if you are powerful users of the technology that surrounds us.



Bill Gates
Co-Chairman, Bill & Melinda Gates Foundation and Co-Founder, Microsoft

Learning to write programs stretches your mind, and helps you think better, creates a way of thinking about things that I think is helpful in all domains.



Sheryl Sandberg
Chief Operating Officer, Facebook

An understanding of computer science is becoming increasingly essential in today's world. Our national competitiveness depends upon our ability to educate our

Maybe?

What can we do with it anyhow?

code.org

Hour of Code

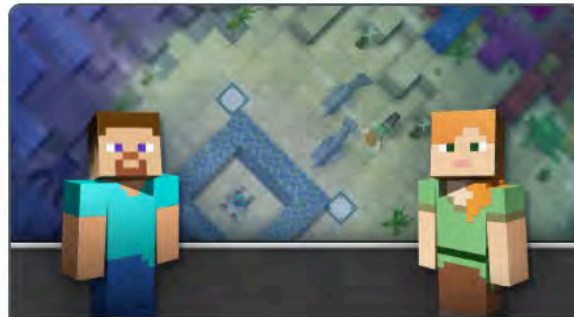
[View more Hour of Code tutorials](#) >

If you don't have time for a full length course, try a one-hour tutorial designed for all ages. Join millions of students and teachers in over 180 countries by starting with an Hour of Code.



Dance Party

Featuring Katy Perry, Madonna, J. Balvin, Sia, Keith Urban, Ciara, and 25 more!



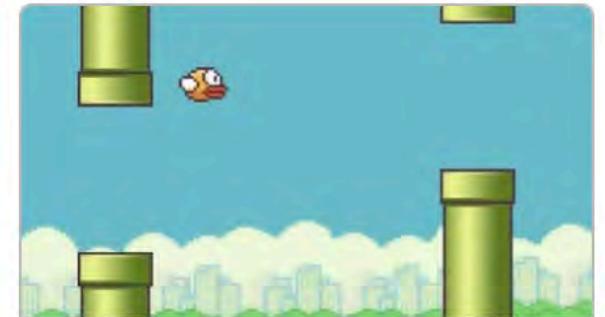
Minecraft

Use your creativity and problem solving skills to explore and build underwater worlds with code!



App Lab

Design an app, code with blocks or JavaScript to make it work, then share your app in seconds.

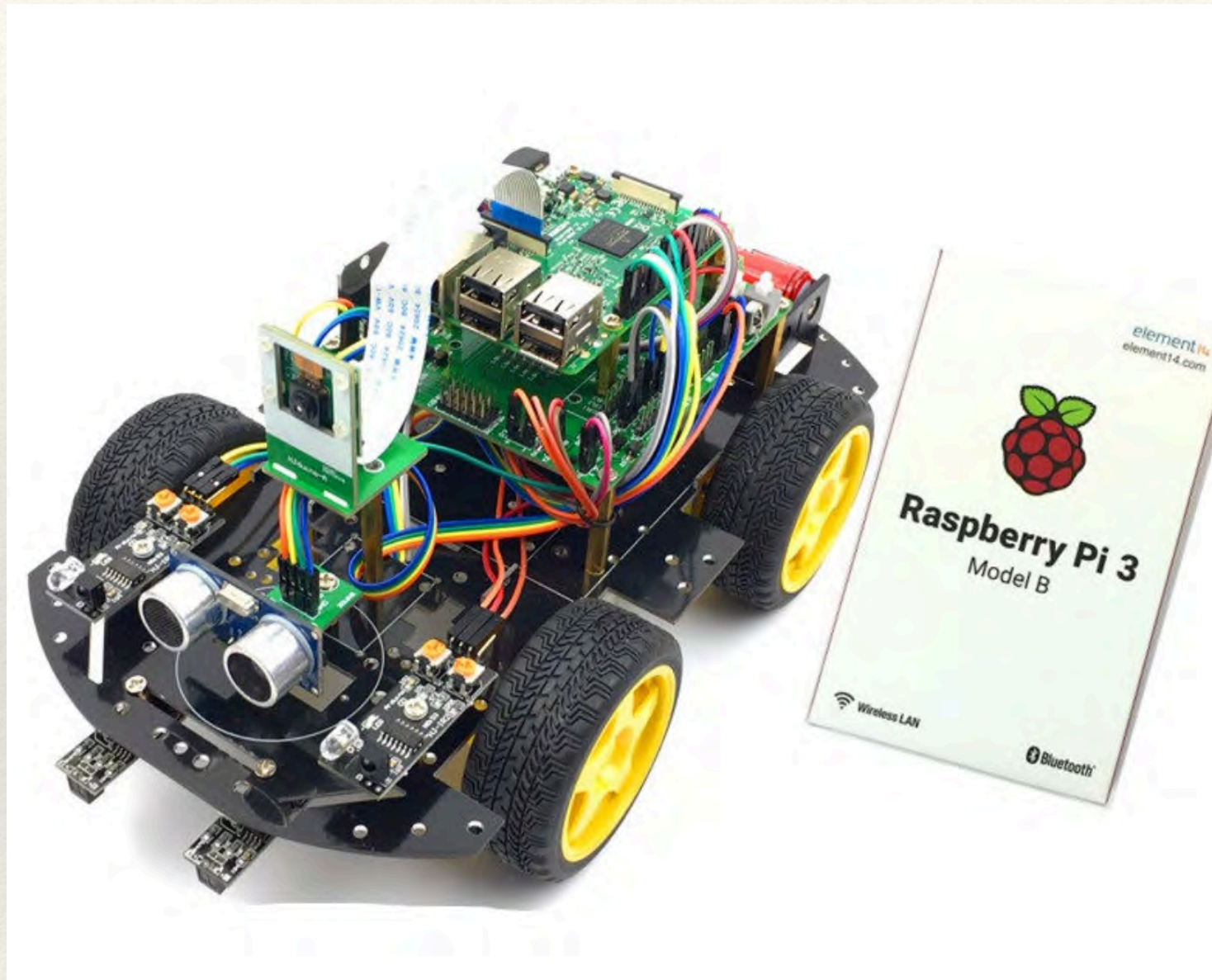


Flappy Code

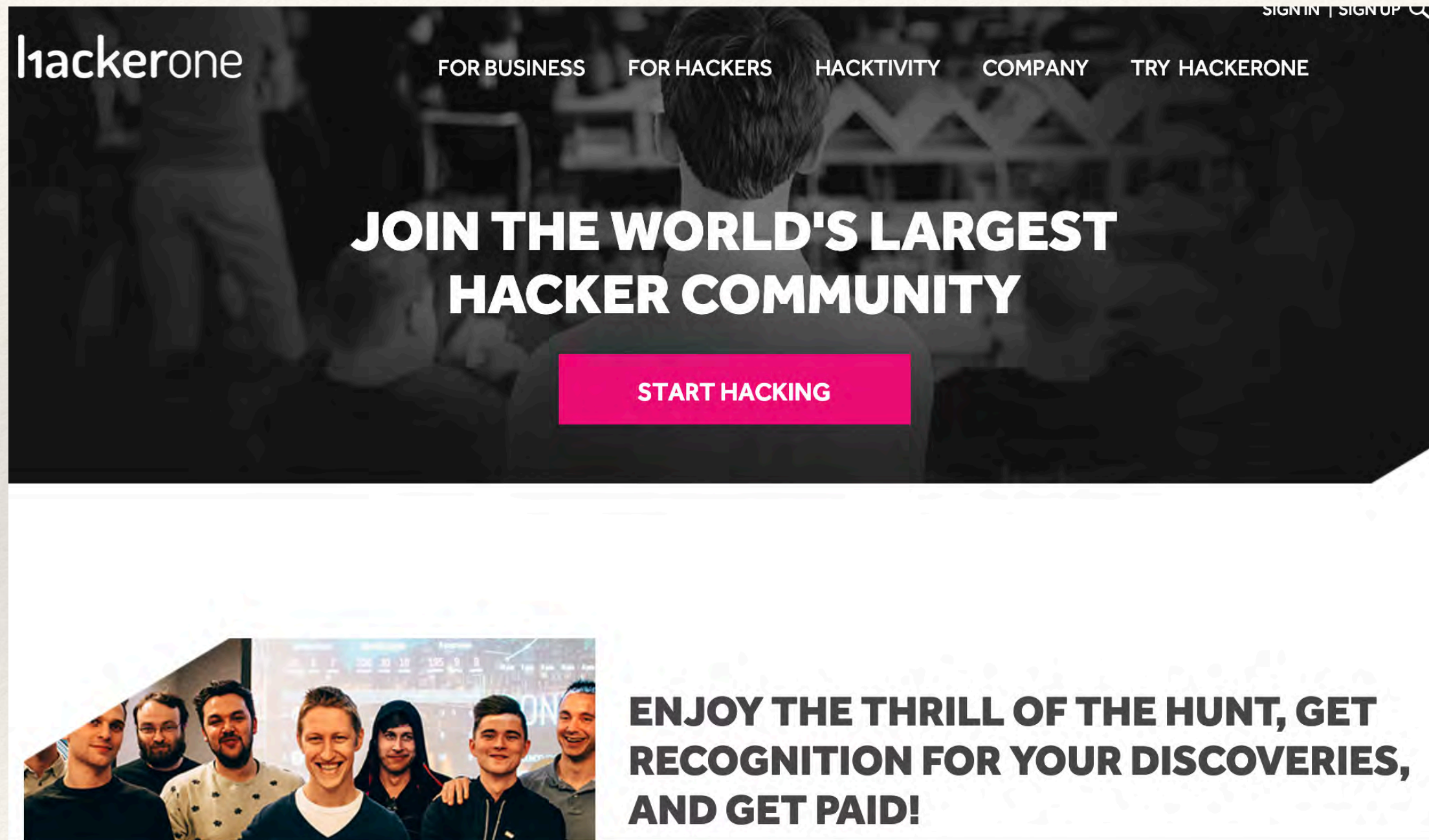
Wanna write your own game in less than 10 minutes? Try our Flappy Code tutorial!

Games, animations, more games

Program a Robot?



(Ethical) Hacking



The image is a screenshot of the HackerOne website. At the top left is the 'hackerone' logo. To its right is a navigation menu with links: 'FOR BUSINESS', 'FOR HACKERS', 'HACKTIVITY', 'COMPANY', and 'TRY HACKERONE'. In the top right corner, there are links for 'SIGN IN' and 'SIGN UP' next to a search icon. The main section features a dark background with a blurred image of a person's head and shoulders. Overlaid on this is the text 'JOIN THE WORLD'S LARGEST HACKER COMMUNITY' in large, white, bold, sans-serif capital letters. Below this text is a bright pink rectangular button with the text 'START HACKING' in white, bold, sans-serif capital letters. At the bottom of the page, there is a horizontal banner. On the left side of the banner is a photograph of a group of seven diverse young adults smiling. To the right of the photo, the text 'ENJOY THE THRILL OF THE HUNT, GET RECOGNITION FOR YOUR DISCOVERIES, AND GET PAID!' is written in bold, black, sans-serif capital letters.

hackerone

SIGN IN | SIGN UP

FOR BUSINESS FOR HACKERS HACKTIVITY COMPANY TRY HACKERONE

**JOIN THE WORLD'S LARGEST
HACKER COMMUNITY**

START HACKING

**ENJOY THE THRILL OF THE HUNT, GET
RECOGNITION FOR YOUR DISCOVERIES,
AND GET PAID!**

Important but limited application?

Another perspective

Programming = Automation

How do humans acquire superpowers?

Limited by the Environment



Agricultural Revolution

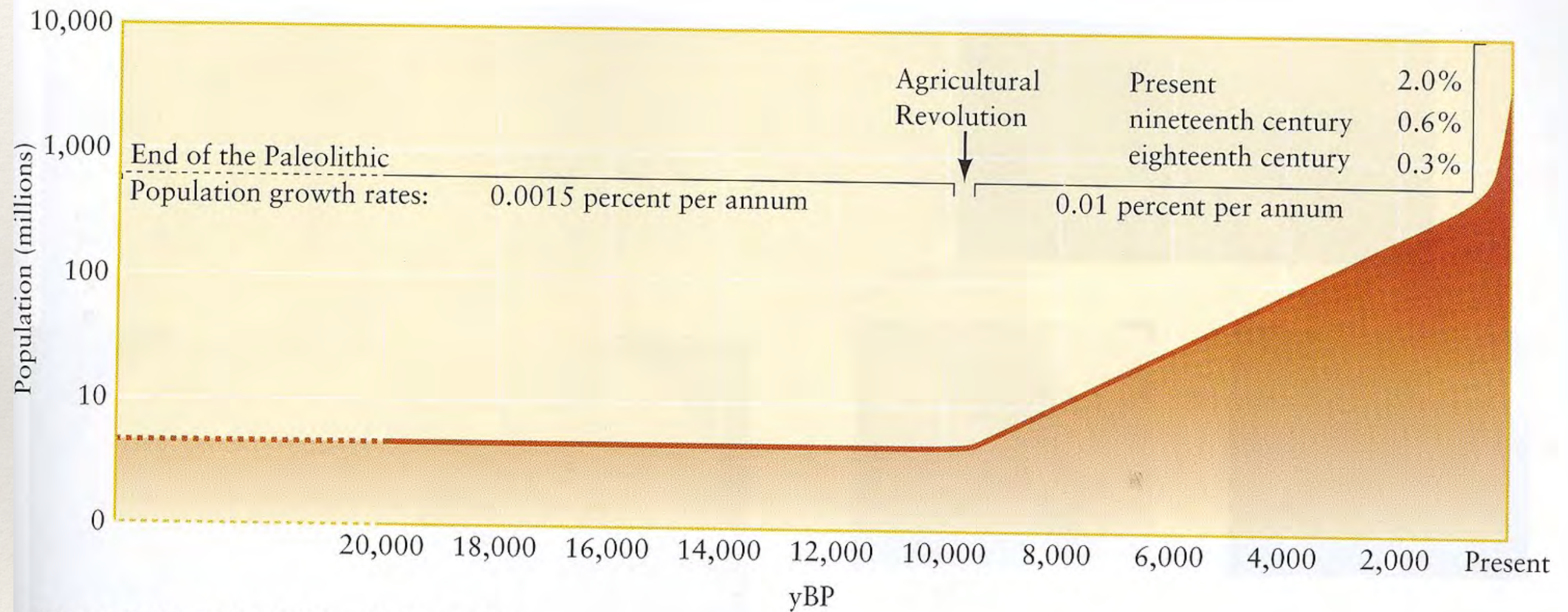


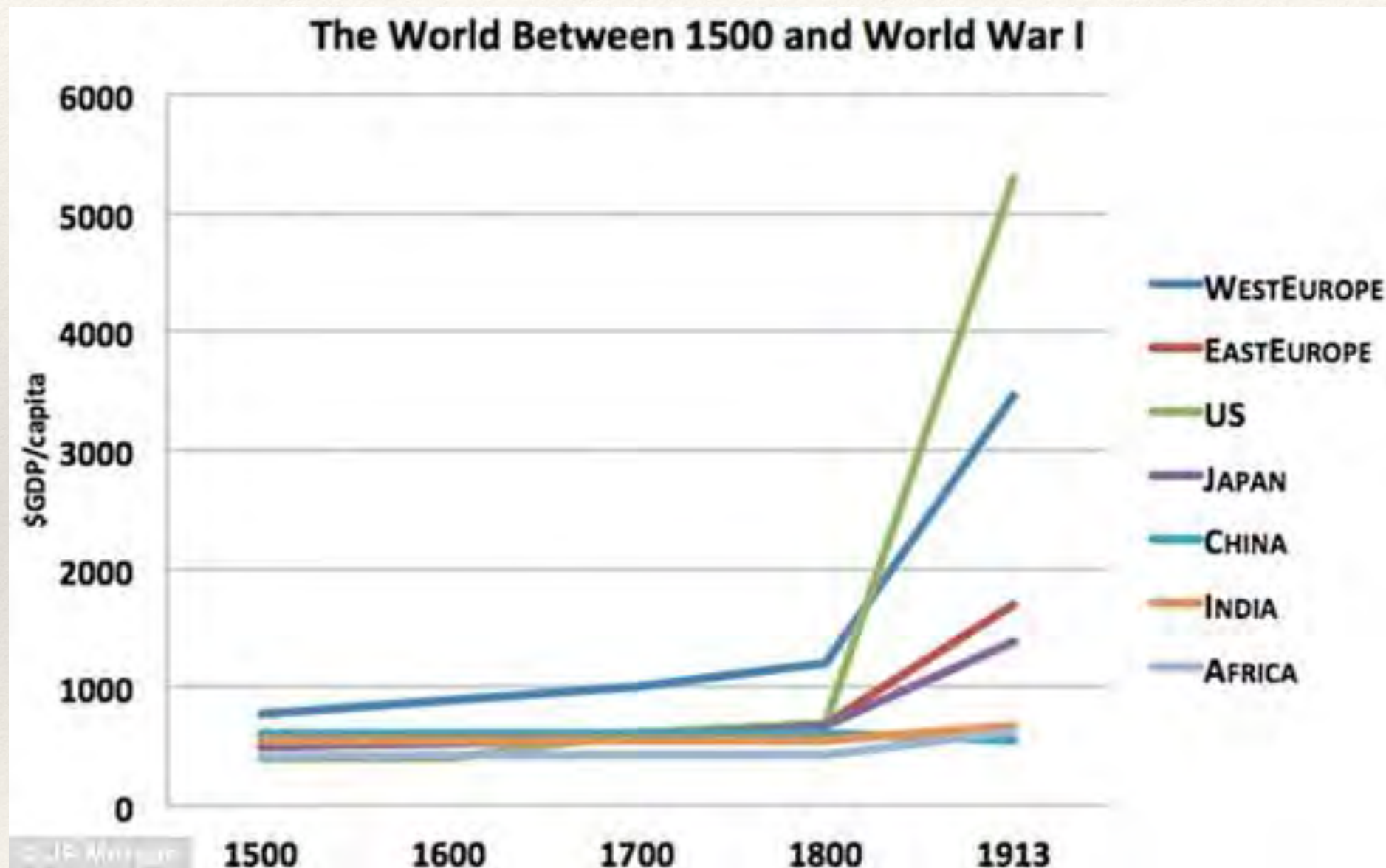
FIGURE 12.9 ■ World Population Size

This graph shows the trend in population size on a global scale. Until 10,000 yBP and the advent of agriculture, population remained constant, numbering less than 10,000,000 people. After the agricultural revolution, however, population skyrocketed.

Limited by our muscles



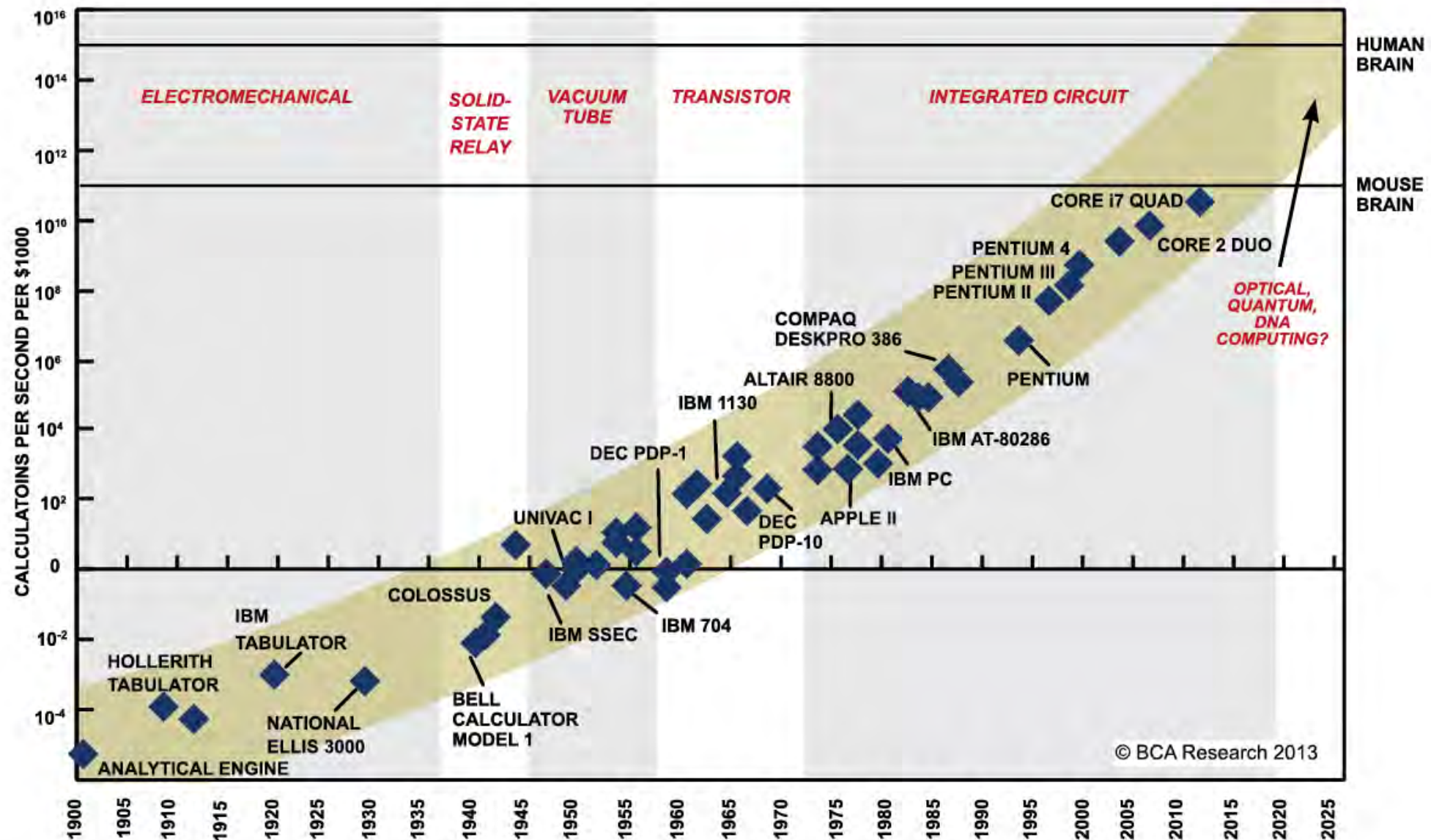
Industrial Revolution



Limited by what we can calculate

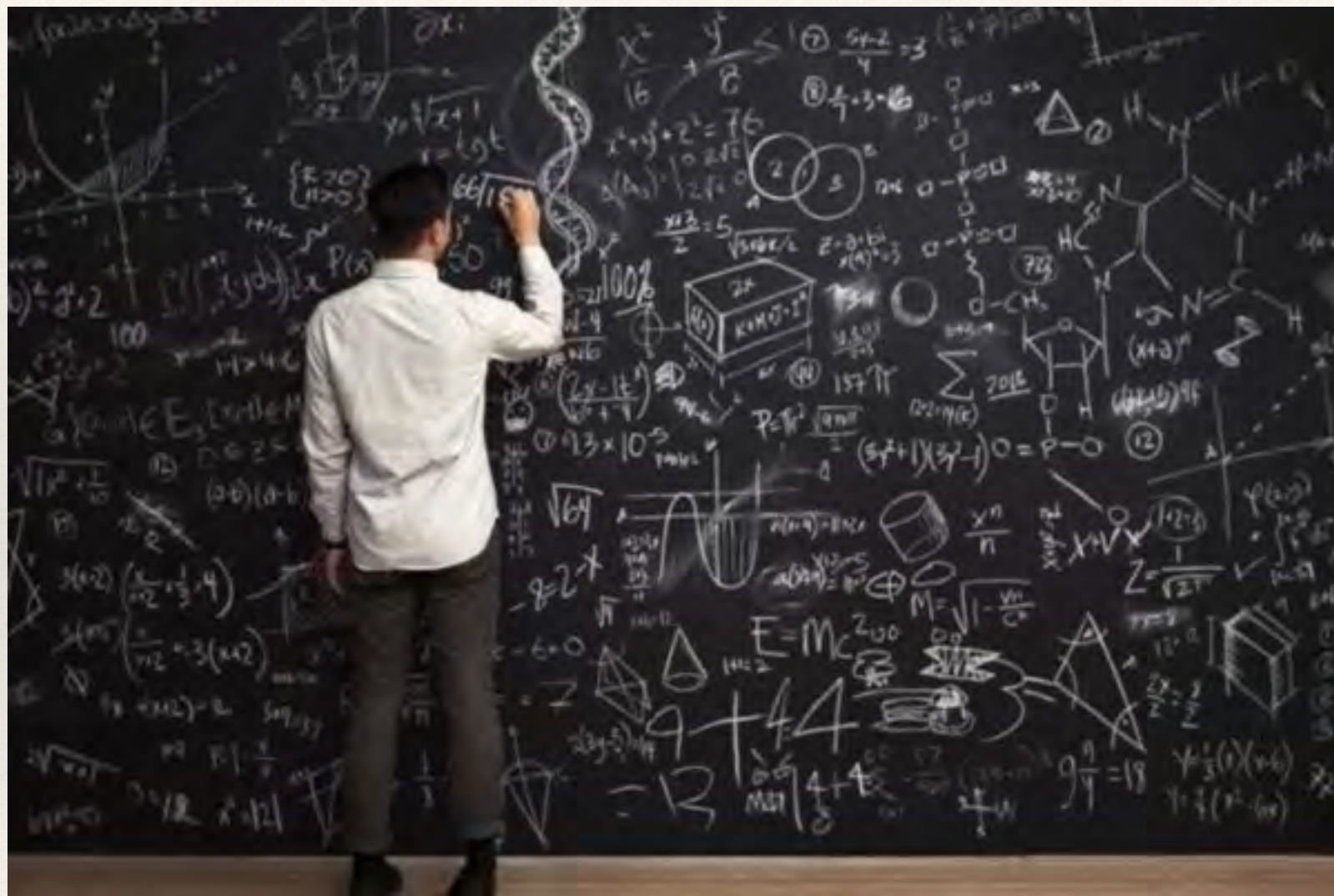


Computational Revolution



SOURCE: RAY KURZWEIL, "THE SINGULARITY IS NEAR: WHEN HUMANS TRANSCEND BIOLOGY", P.67, THE VIKING PRESS, 2006. DATAPOINTS BETWEEN 2000 AND 2012 REPRESENT BCA ESTIMATES.

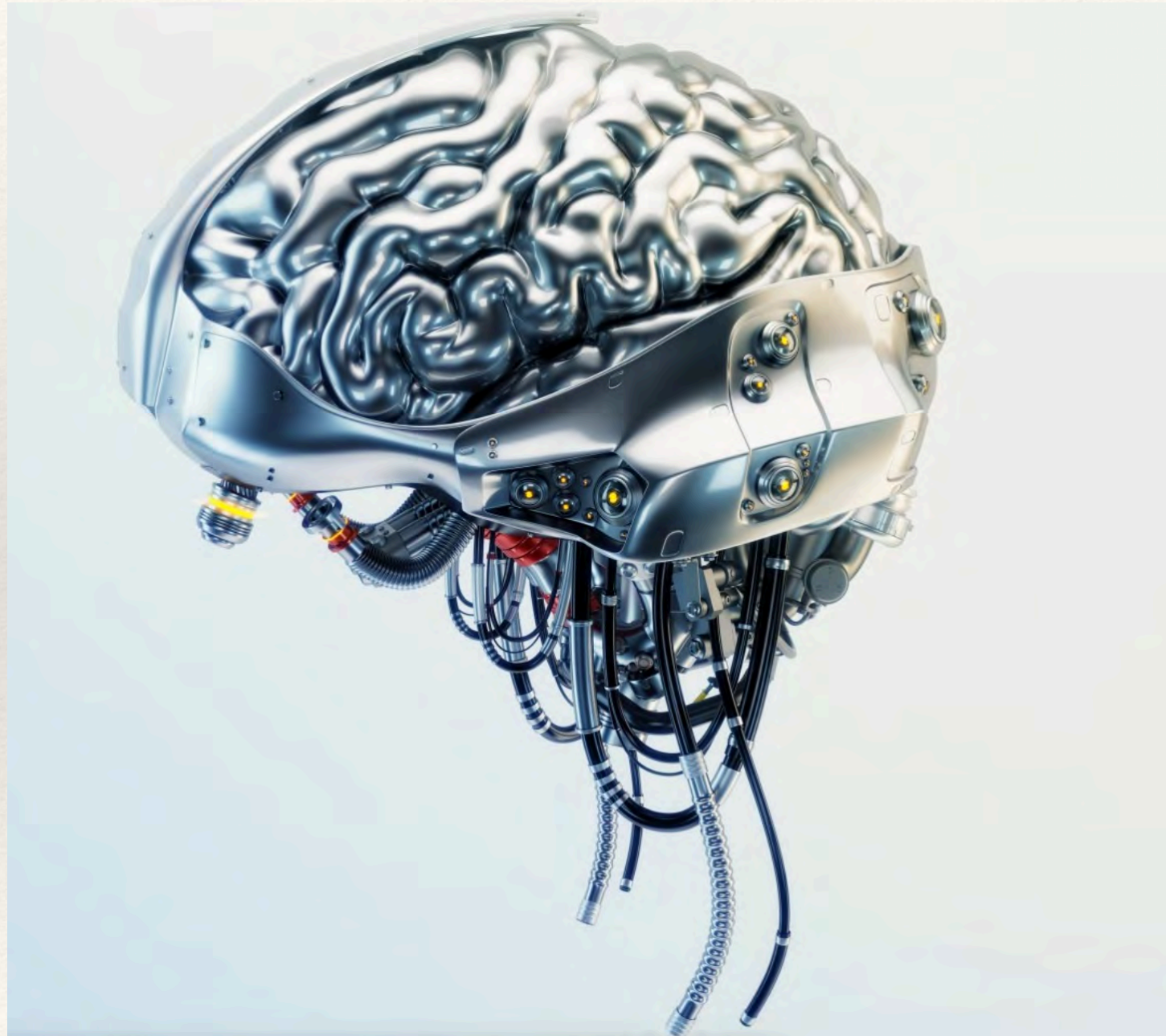
Limited by what we can understand



An aerial photograph of a river with a grid of handwritten numbers overlaid on it. The numbers are in various colors (red, green, blue, yellow) and are arranged in a grid-like pattern across the river's surface. The text "Data Revolution" is superimposed in the center of the image in a large, red, serif font.

Data Revolution

Can we (partially) Automate Understanding?



Partially Happening Now

MACHINE LEARNING

How Artificial Intelligence Is Changing Science



7



The latest AI algorithms are probing the evolution of galaxies, calculating quantum wave functions, discovering new chemical compounds and more. Is there anything that scientists do that can't be automated?

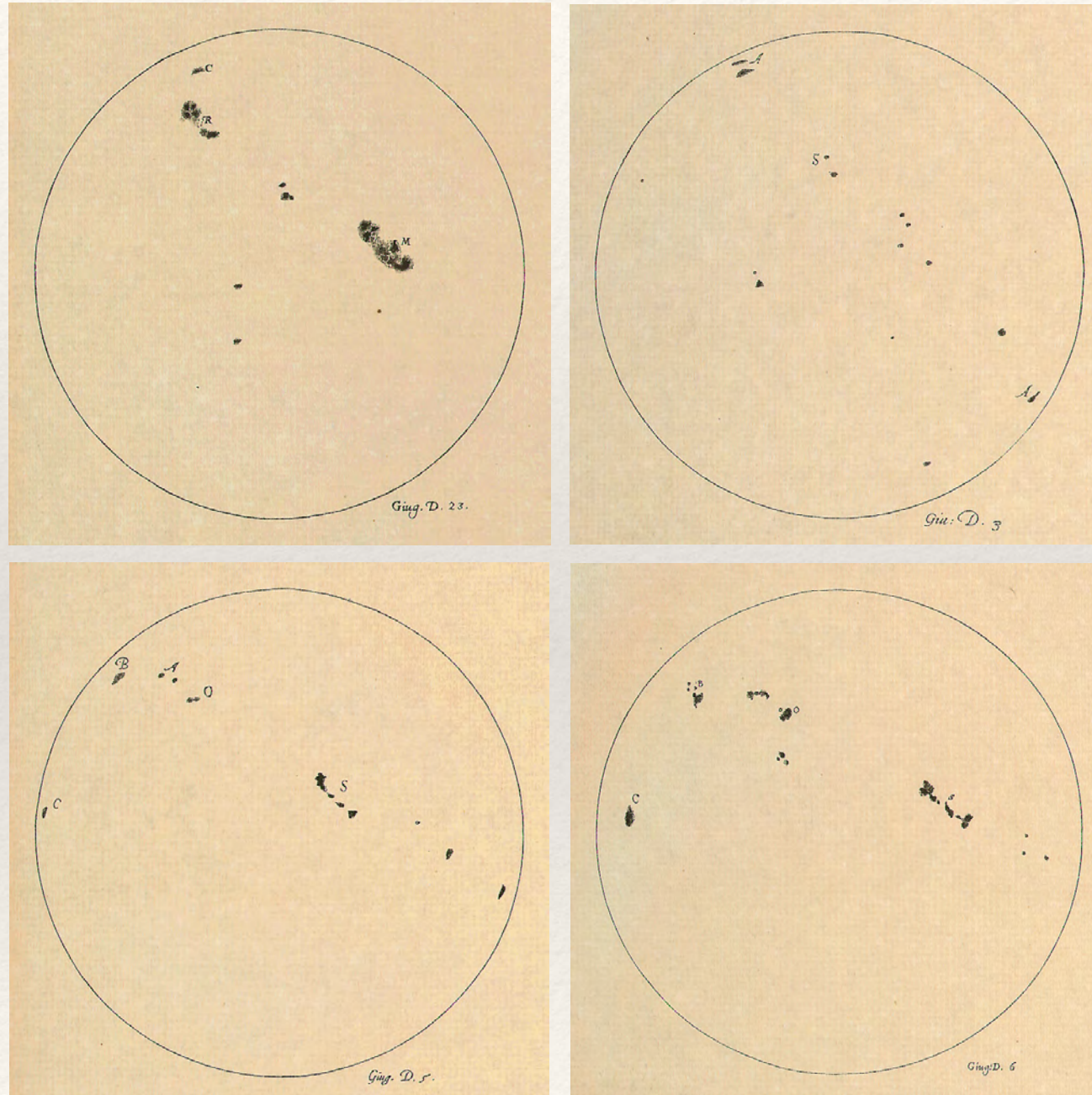
Where is this coming from?

Throughout Human History



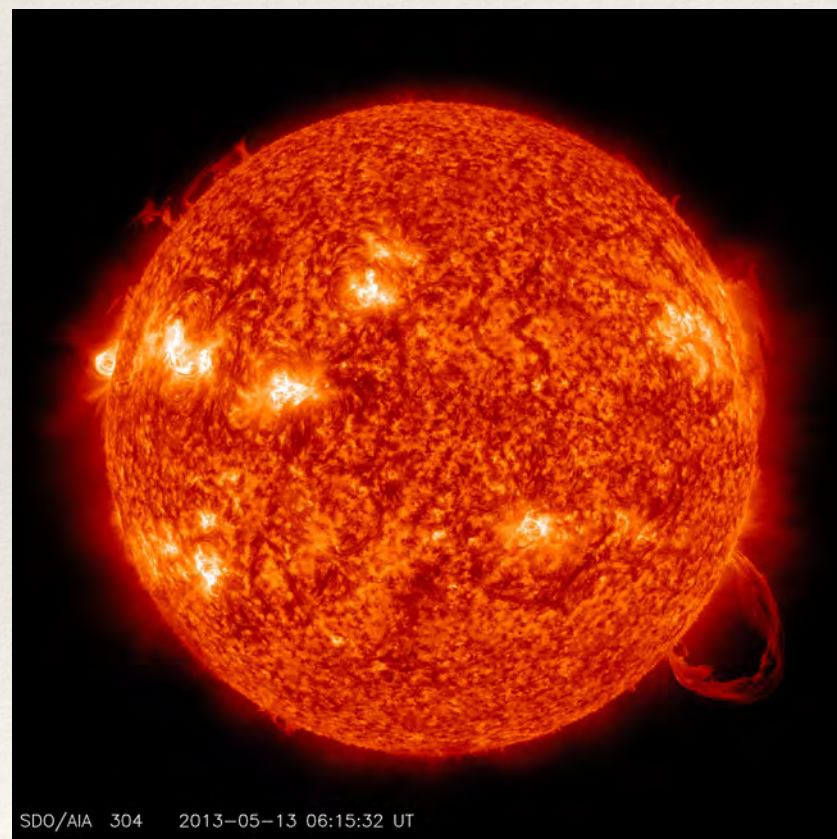
Data difficult to collect and store

Galileo's Hand-drawn Sunspots

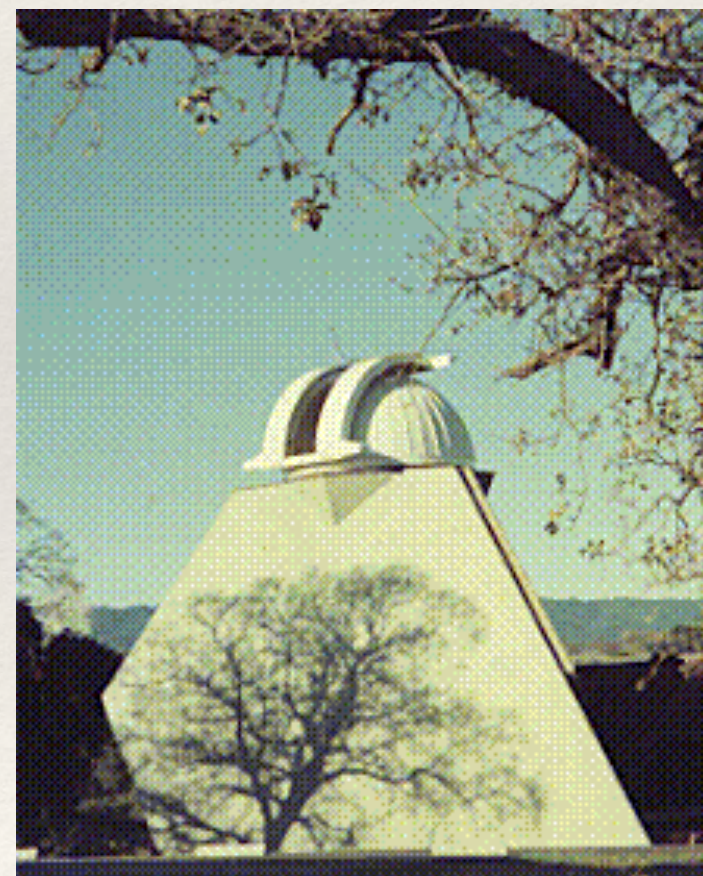


VS.

UltraHD video of the Sun 24-7



From NASA SDO



Wilcox Solar Observatory

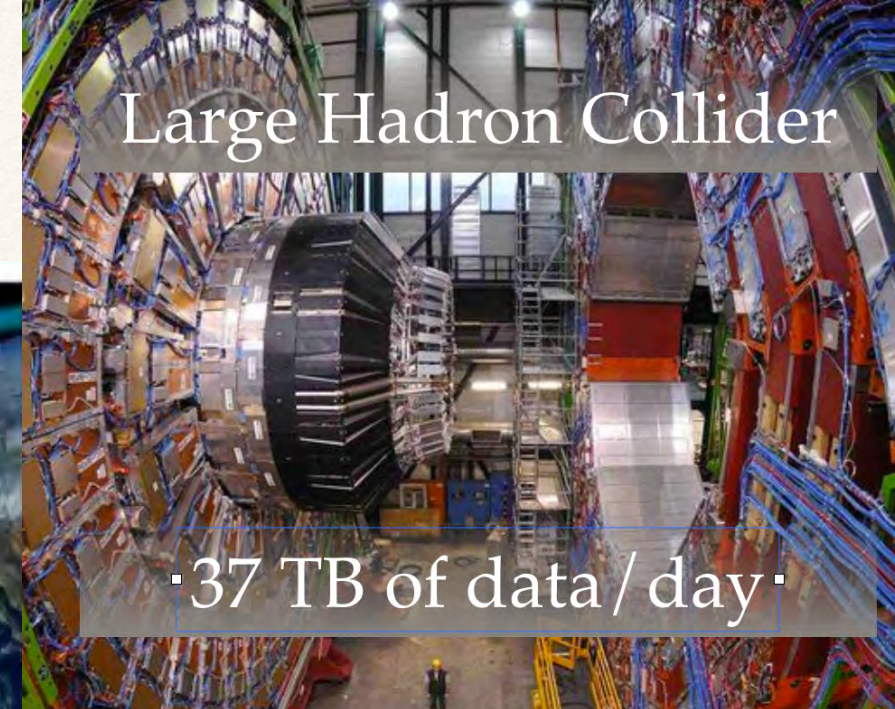
Flood of Data

GOES 9,10,12
NOAA-15,16,17,18
LandSat 5,7
DMSP F13,14,15,16
Meteosat 6,7,8,9
CBERS-2,2B
SPOT-2,4,5
ENVISAT
Resourcesat 1
CARTOSAT-1,2,2A
RADARSAT-1,2
KOMPSAT-1
THEO-1
GOMs
GMS-5
METEOR-3
OKEAN
Feng-Yun



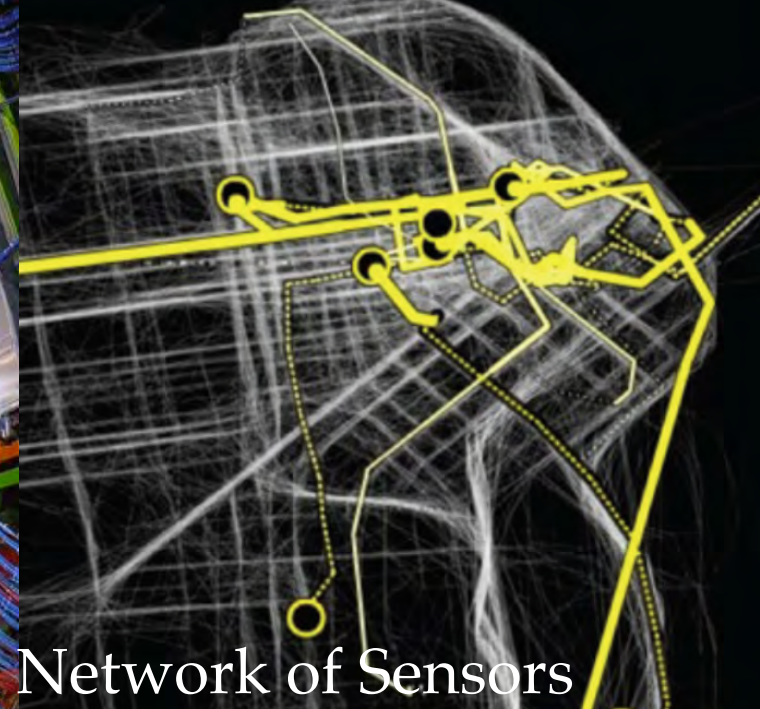
1 Sensor (MODIS) = 125 GB/DAY

Flood of Data



Large Hadron Collider

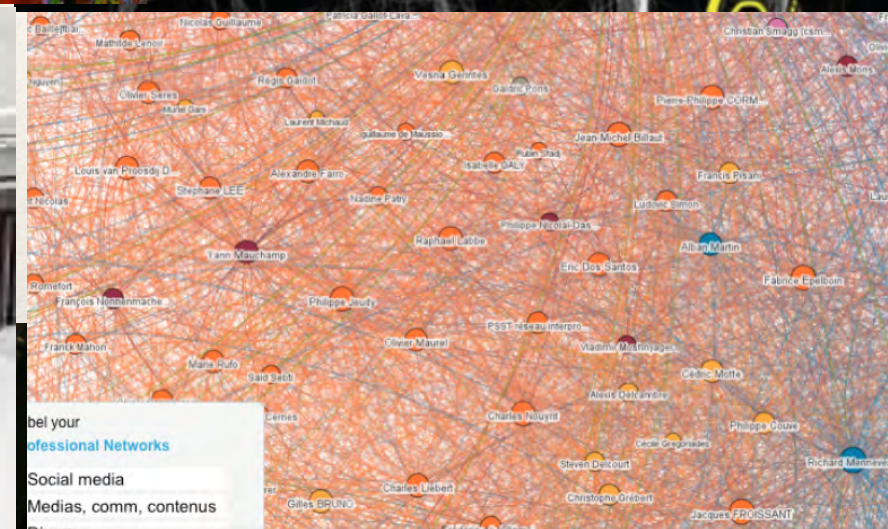
37 TB of data/day



Network of Sensors



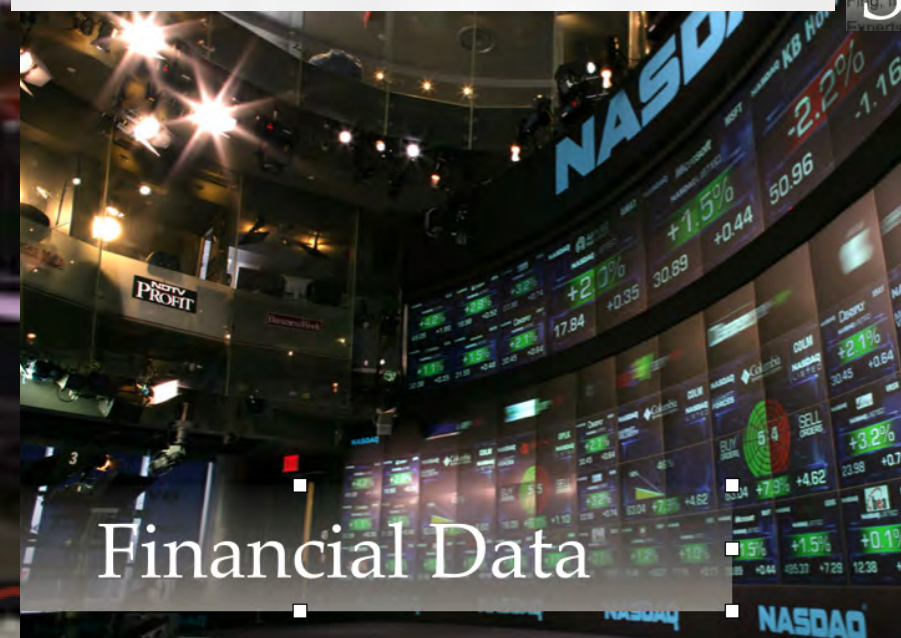
Model/Simulation Output



Social Network Data



Health Data



Financial Data



Security Data

Every two days now
we create as much
information as we
did from the dawn of
civilization up until
2003

Eric Schmidt, former CEO
Google, 2010



Perfect Storm: Big Data + Machine Learning

Old AI: IBM 1997



We know the rules.

19 Dec 2013

Playing Atari with Deep Reinforcement Learning

Volodymyr Mnih Koray Kavukcuoglu David Silver Alex Graves Ioannis Antonoglou

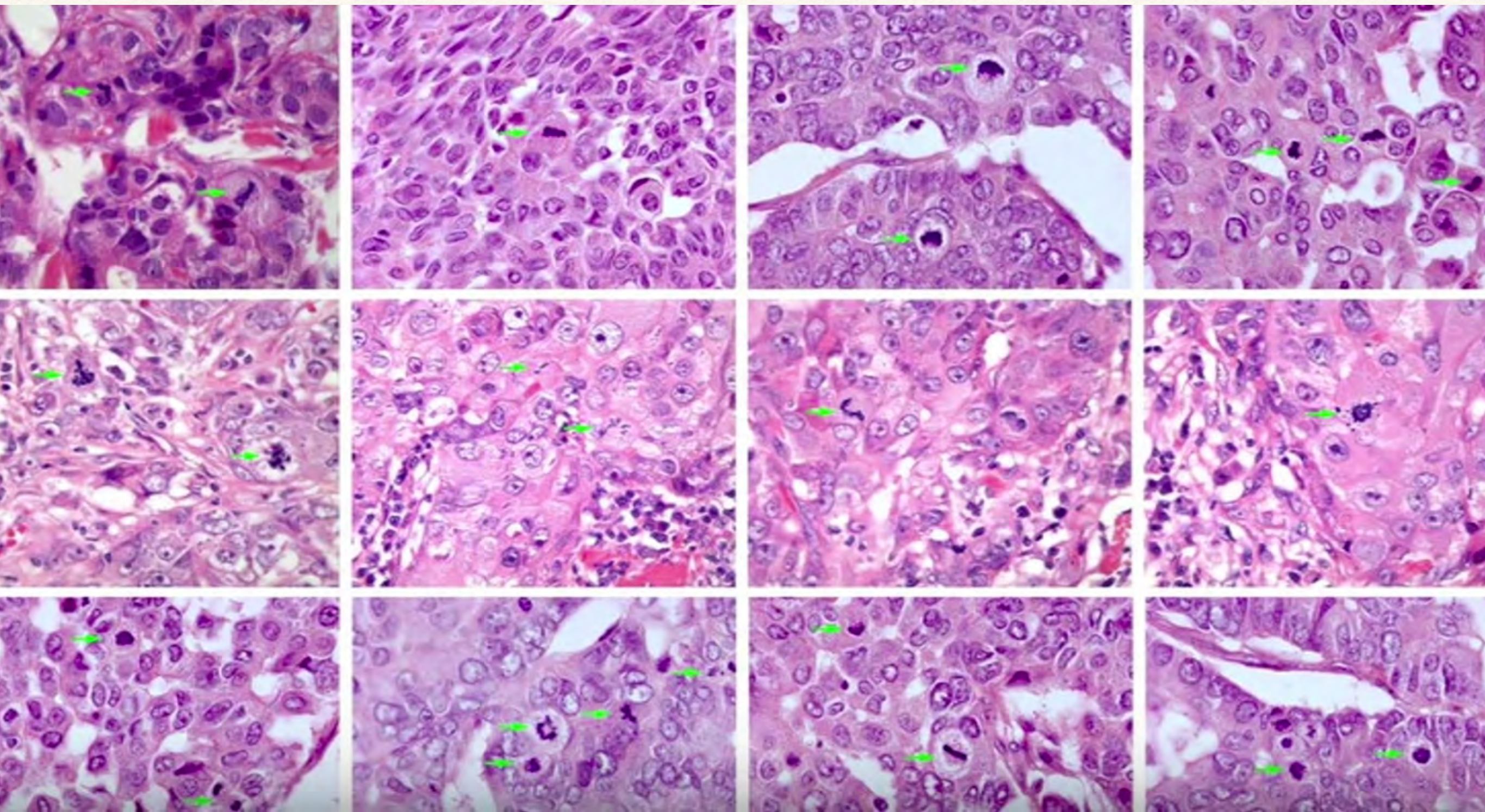
Daan Wierstra Martin Riedmiller

DeepMind Technologies



Figure 1: Screen shots from five Atari 2600 Games: (*Left-to-right*) Pong, Breakout, Space Invaders, Seaquest, Beam Rider

It learns the rules.



What rules?



Completed • \$40,000

Merck Molecular Activity Challenge

Thu 16 Aug 2012 – Tue 16 Oct 2012 (3 years ago)

Help develop safe and effective medicines by predicting molecular activity.

Help enable the development of safe, effective medicines.

Deep Learning How I Did It:
Merck 1st place interview

Geoffrey Hinton

Computer scientist



Proposal

Q: Why do we need to learn to code?

A: Those who do can use data and computation to automate their understanding.



How?



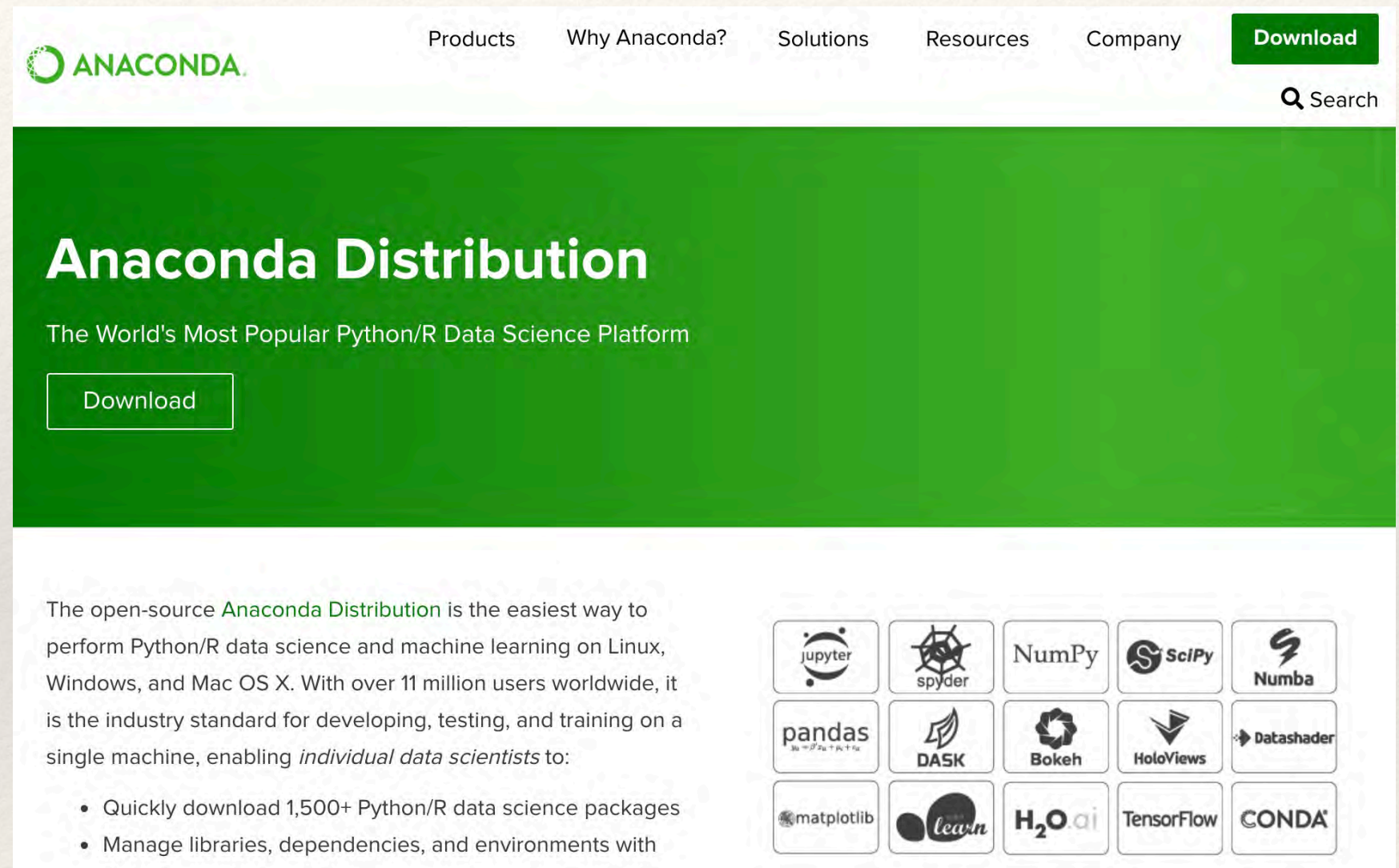
Many Paths

One Path



Anaconda Distribution

All-in-one Packaging



The screenshot shows the Anaconda Distribution website. At the top is a navigation bar with links for Products, Why Anaconda?, Solutions, Resources, Company, and a green Download button. A search bar is on the right. The main header features the Anaconda logo and the title 'Anaconda Distribution' in large white text on a green background, with the subtitle 'The World's Most Popular Python/R Data Science Platform' and a white Download button. Below this, a paragraph describes the open-source distribution as the easiest way to perform Python/R data science and machine learning on Linux, Windows, and Mac OS X, mentioning over 11 million users and its role as an industry standard. A bulleted list highlights two key features: quickly downloading 1,500+ Python/R data science packages and managing libraries, dependencies, and environments. To the right of the text is a grid of 15 logos for various data science and machine learning libraries and tools.

Products Why Anaconda? Solutions Resources Company [Download](#)

[Search](#)

Anaconda Distribution

The World's Most Popular Python/R Data Science Platform

[Download](#)

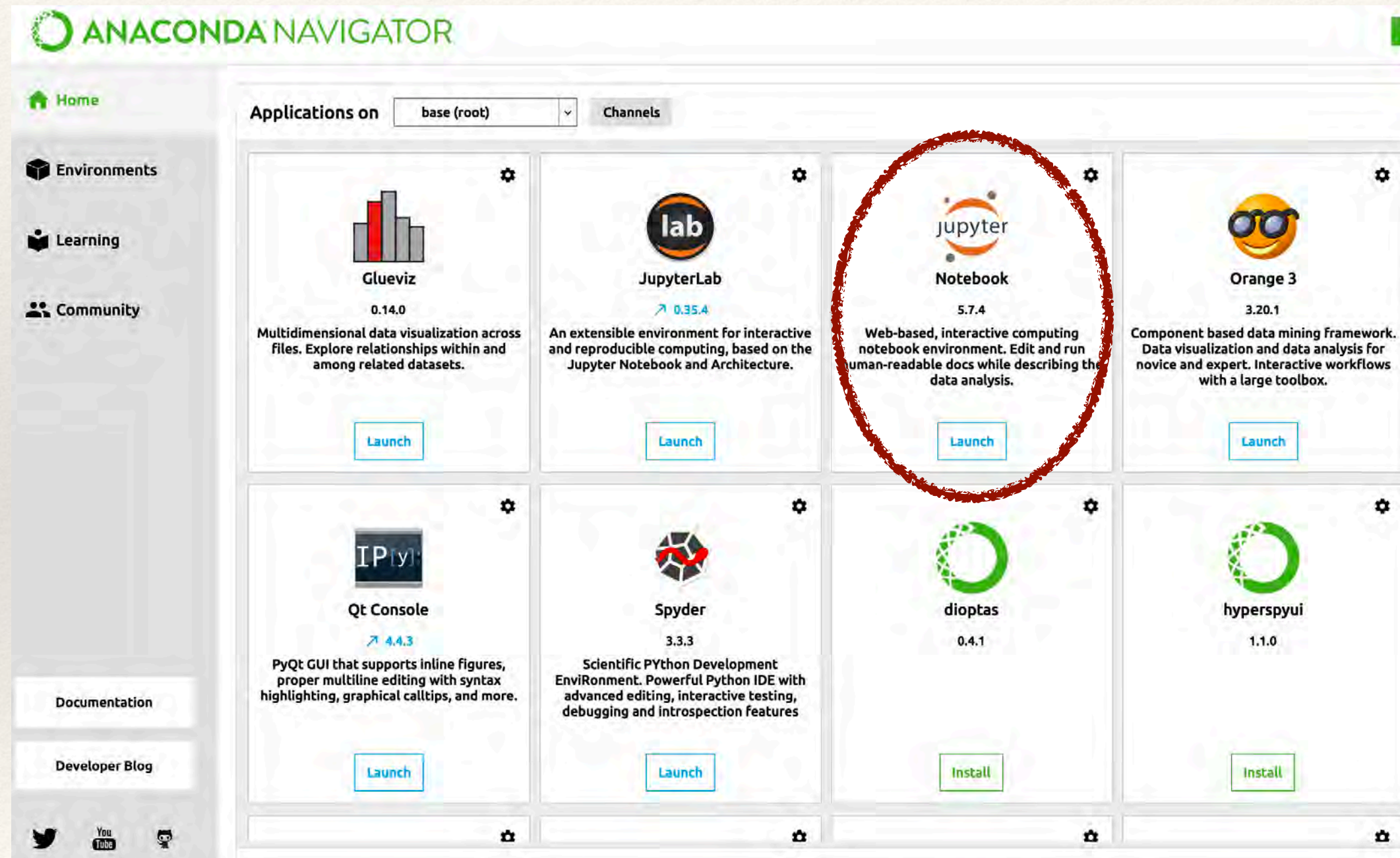
The open-source [Anaconda Distribution](#) is the easiest way to perform Python/R data science and machine learning on Linux, Windows, and Mac OS X. With over 11 million users worldwide, it is the industry standard for developing, testing, and training on a single machine, enabling *individual data scientists* to:

- Quickly download 1,500+ Python/R data science packages
- Manage libraries, dependencies, and environments with

Logos displayed in the grid:

- jupyter, spyder, NumPy, SciPy, Numba
- pandas, DASK, Bokeh, HoloViews, Datashader
- matplotlib, lewin, H₂O.ai, TensorFlow, CONDA

Jupyter Notebook



ccnyhub.org

If you can't (don't want to) install locally

jupyter

Sign in

Username:

grossberg

Password:

.....

Sign In

jupyter

Quit

Logout

Control Panel

Files

Running

Clusters

Formgrader

Assignments

Nbextensions

Select items to perform actions on them.

Upload

New ▾

0 ▾ /

Name ▾

Last Modified

File size

<input type="checkbox"/>	0 ▾	/				
<input type="checkbox"/>	Folder	csc473S2019			a month ago	
<input type="checkbox"/>	Folder	DSE1020-2018			3 months ago	
<input type="checkbox"/>	Folder	Misc-Notebooks			4 months ago	
<input type="checkbox"/>	File	7thGradeScienceFair.ipynb	Running	2 months ago	23.4 KB	
<input type="checkbox"/>	File	bar example.ipynb		2 months ago	596 B	
<input type="checkbox"/>	File	Dates.ipynb	Running	2 months ago	3.38 KB	
<input type="checkbox"/>	File	Untitled.ipynb		3 months ago	8.86 KB	
<input type="checkbox"/>	File	Untitled1.ipynb	Running	10 days ago	81.6 KB	
<input type="checkbox"/>	File	Untitled2.ipynb	Running	14 days ago	72 B	
<input type="checkbox"/>	File	companies.csv		3 years ago	470 KB	
<input type="checkbox"/>	File	companies.json		3 years ago	1.12 MB	
<input type="checkbox"/>	File	indicators_by_company.csv		3 years ago	150 MB	
<input type="checkbox"/>	File	input.txt		3 months ago	5.83 MB	