

Interreg
Greece-Bulgaria

SeeG

European Regional Development Fund



Emerging technologies for SMEs and new Businesses

Asst. Prof. Evangelos Kalampokis

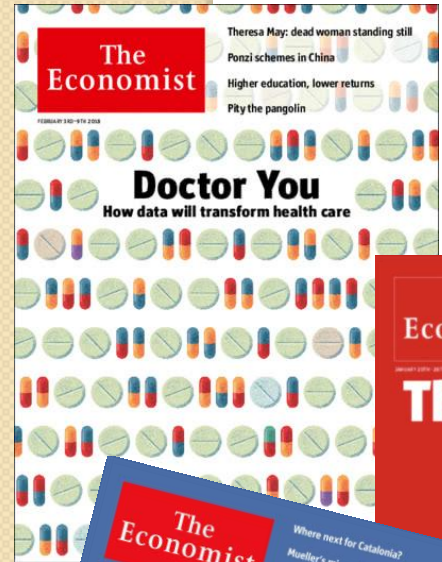
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<https://kalampokis.github.io>

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Emerging Technologies

- Artificial Intelligence (AI) and Machine Learning
- Big Data
- Cloud Computing
- Edge Computing
- Internet of Things (IoT)
- Blockchain
- Virtual and Augmented Reality (VAR)
- Robotics



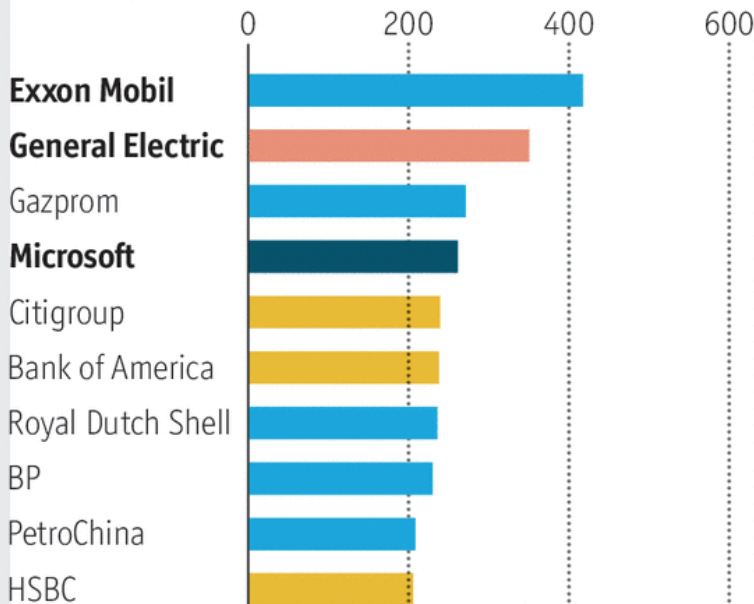
A virtually new world (2006 – 2016)

A virtually new world

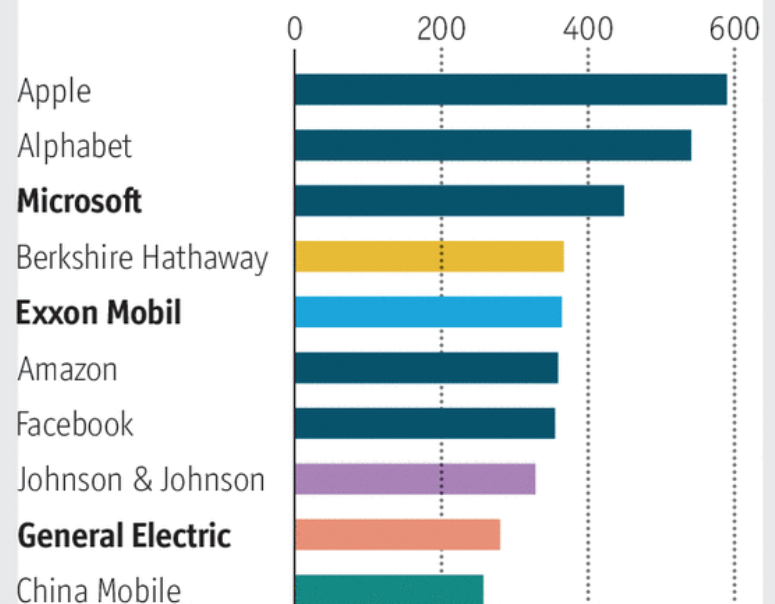
World, largest listed companies by market capitalisation, \$bn

Sector: ■ Energy ■ Financials ■ Health care ■ Industrials ■ IT ■ Telecoms

End 2006



2016*



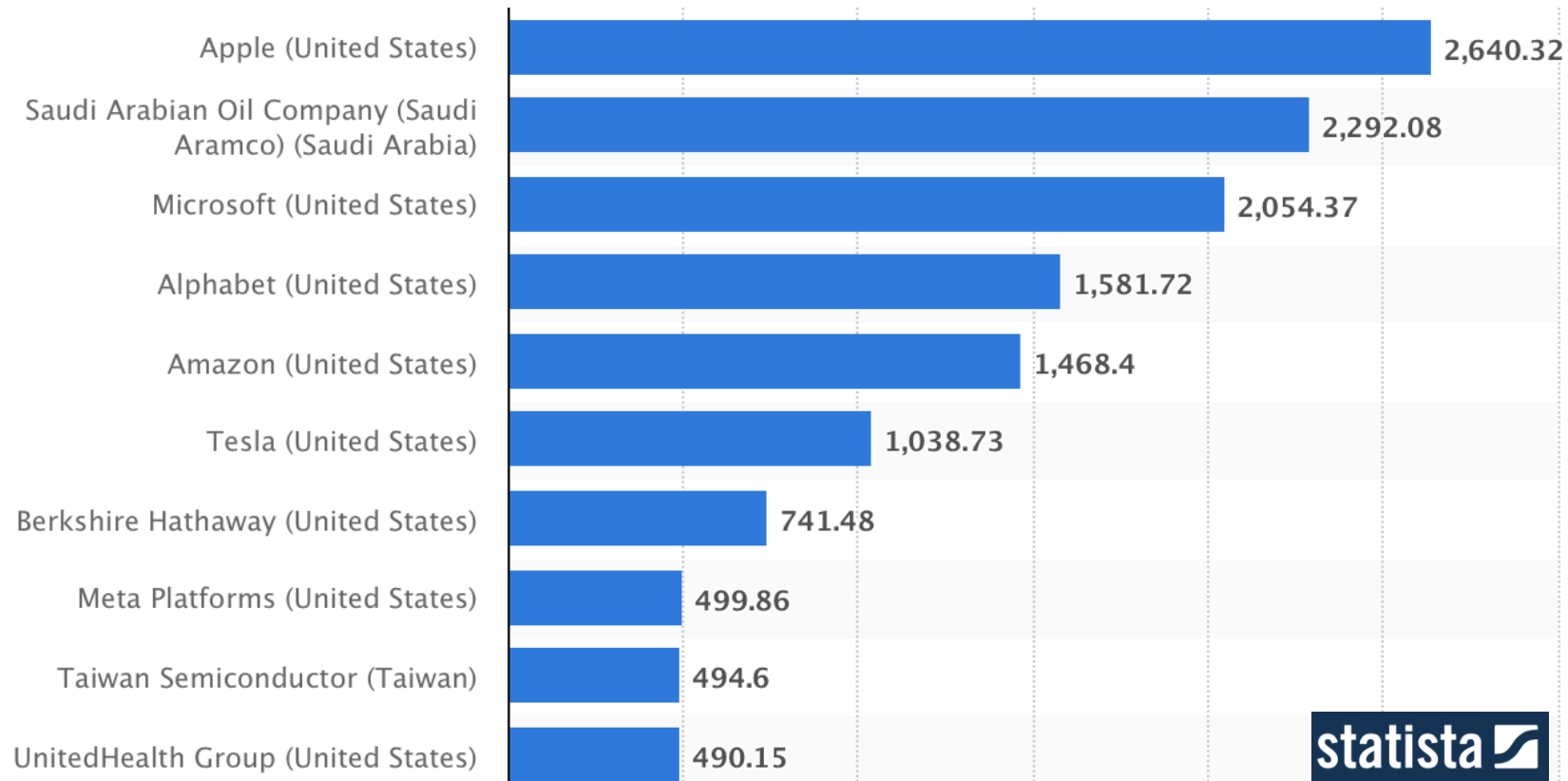
Source: Bloomberg

*At August 24th 2016

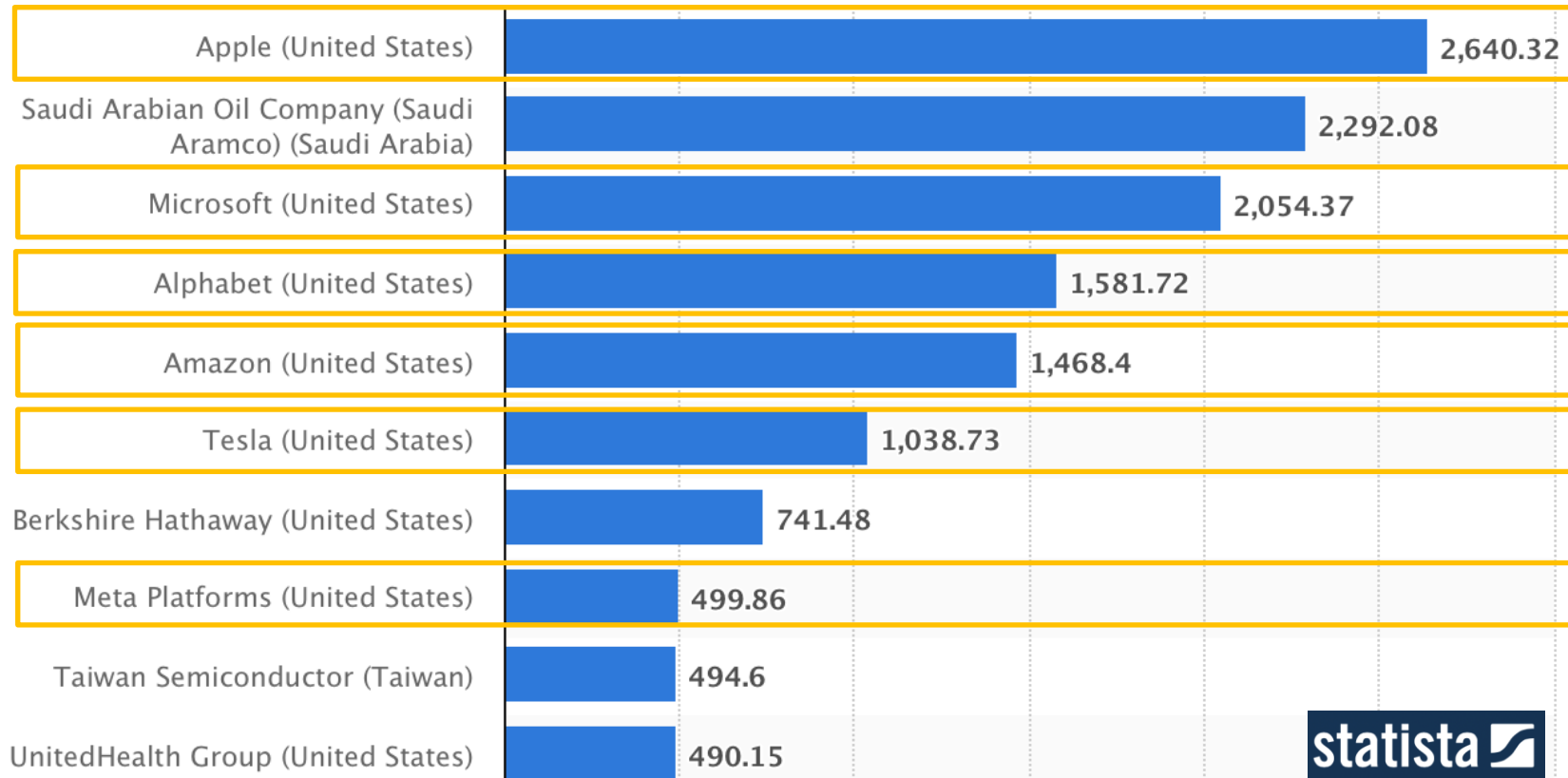
Economist.com

<http://www.economist.com/news/special-report/21707048-small-group-giant-companiessome-old-some-neware-once-again-dominating-global>

Top companies by market capitalization (2022)



Top companies by market capitalization (2022) - ICT



The Economist

Obama the warrior
Misgoverning Argentina
The economic shift from West to East
Genetically modified crops blossom
The right to eat cats and dogs

FEBRUARY 27TH - MARCH 5TH 2010

Economist.com

The data deluge

AND HOW TO HANDLE IT: A 14-PAGE SPECIAL REPORT



March 2010

The data deluge (The Economist, 2010)

- According to an estimate, mankind created **150 exabytes** (billion gigabytes) of data in **2005**.
- In **2010** only, it will create **1,200 exabytes**.
- The data deluge is already starting to transform business, government, science and everyday life
- It has great potential for good

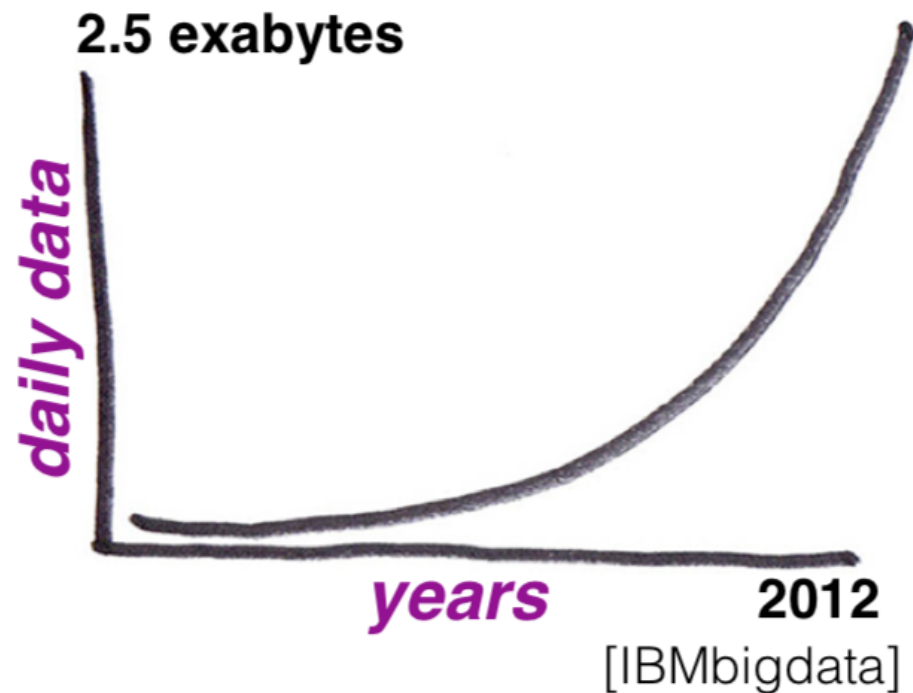
The data deluge (Schmidt, 2010)

- In August 2010 at the Techonomy conference in Lake Tahoe, CA, Google CEO Eric Schmidt:
 - “Every two days now we create **as much information as we did from the dawn of civilization up until 2003**. That’s something like five exabytes of data”
 - Schmidt noted that he doesn’t believe people are ready for what’s coming

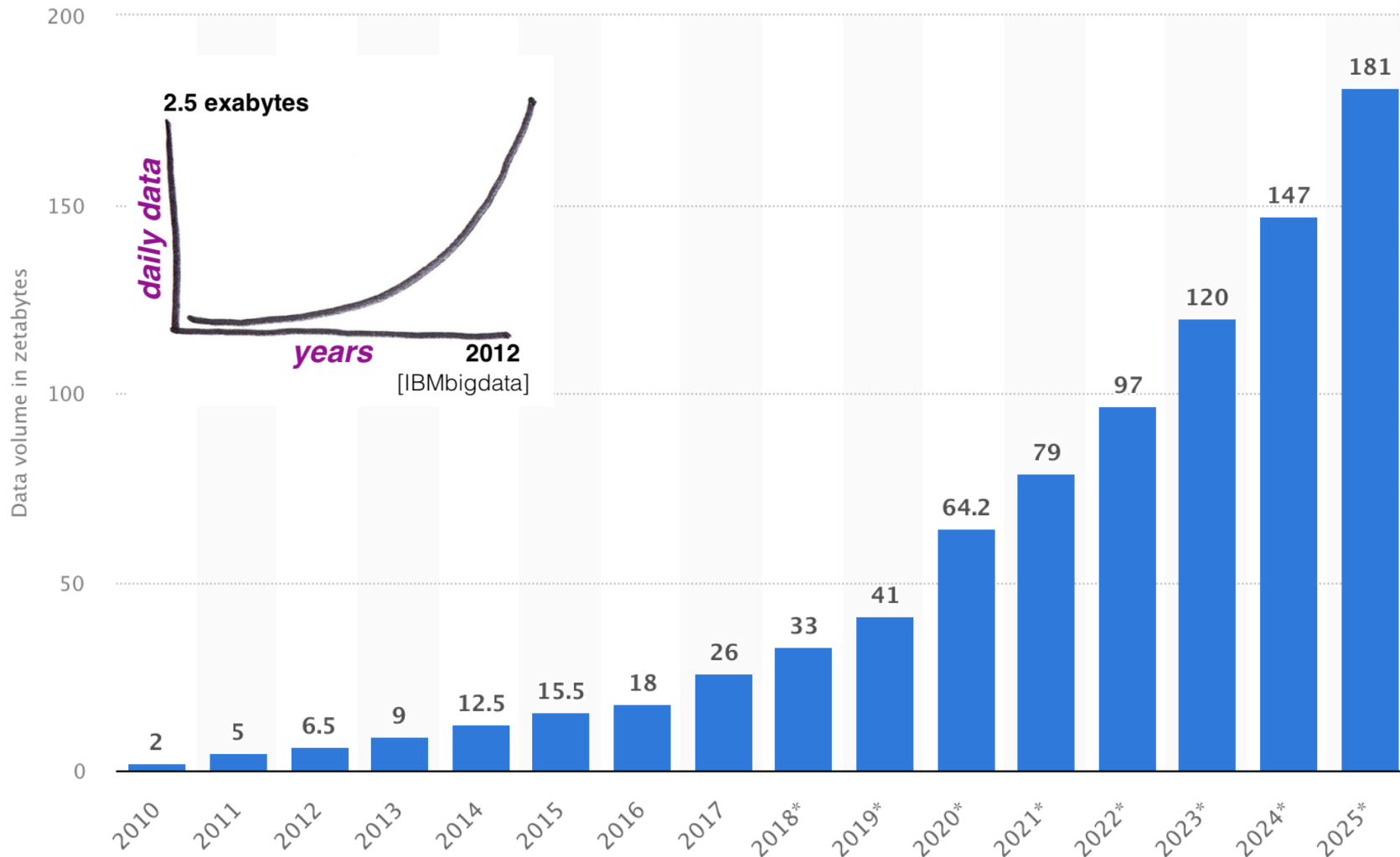


Big Data

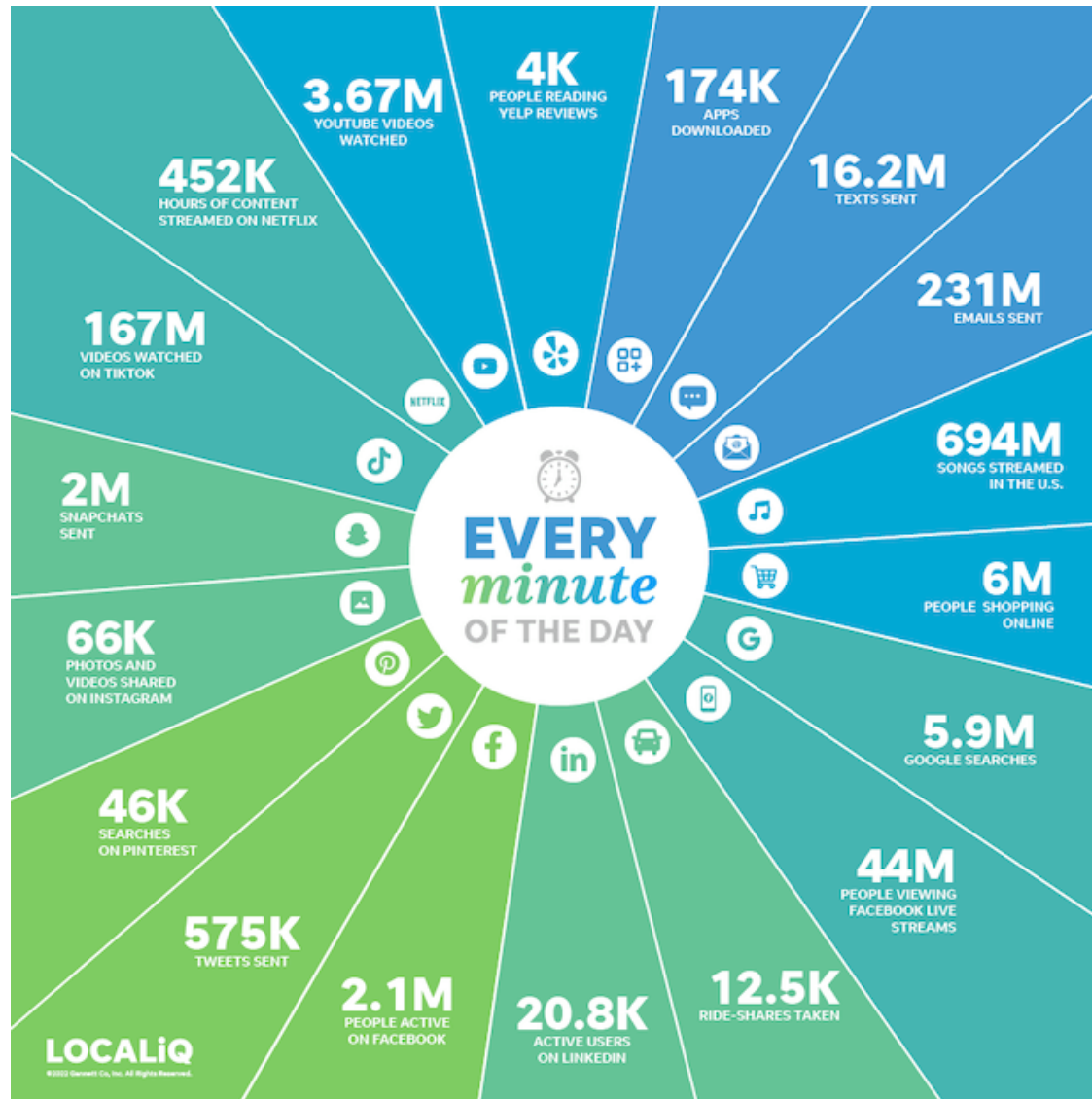
- Big data refers to the large, diverse sets of information that grow at ever-increasing rates.



Volume of data created, captured, copied, and consumed worldwide



What Happens in an Internet Minute in 2022



Other sources of big data

- Satellites
- Surveillance cameras
- Electronic health record (EHR)
- Traffic sensors
- Wearables (Apple watch, Fitbit, etc.)
- Smartphones (6.3bn worldwide)
- Sensor data from production machinery
- eCommerce data
- Government data
- Media (news, etc.)
- Books (Google digitized 40 million books)

Data: The world's most valuable resource



**The
Economist**

JUNE 25TH–JULY 1ST 2016

Inside China's Ministry of Truth

Trump in trouble

Who are the Niger Delta Avengers?

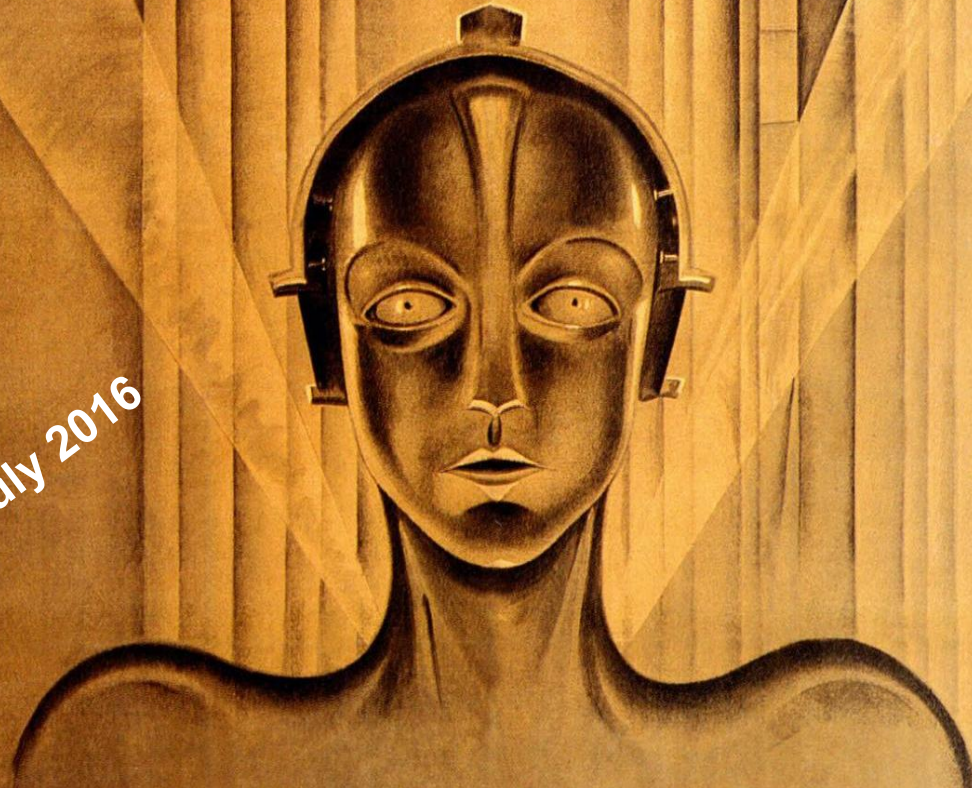
The flaws in executive pay

Motorcycles that fly

March of the machines

A SPECIAL REPORT ON ARTIFICIAL INTELLIGENCE

July 2016



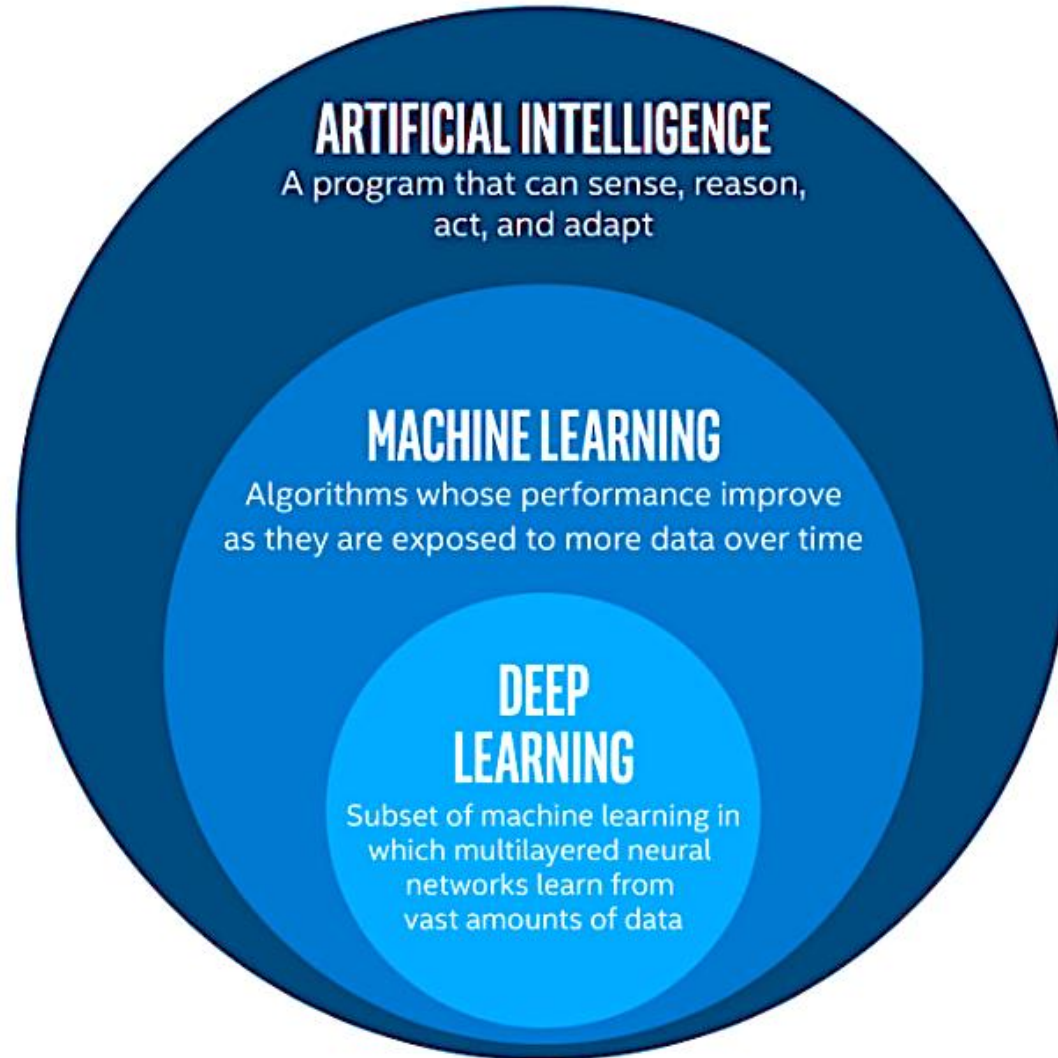
Artificial Intelligence

- The European Commission's High-Level Expert Group on Artificial Intelligence defines AI as
 - “systems that display **intelligent behaviour** by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals”.

Several Definitions for Artificial Intelligence

- **Artificial Intelligence is...**
 - “... the science and engineering of making intelligent machines” ... “[where] intelligence is the computational part of the ability to achieve goals in the world” (original definition by [John McCarthy](#) who coined the term ‘Artificial Intelligence’ in 1955)
 - “... a field of computer science that focuses on creating machines that can learn, recognize, predict, plan, and recommend — plus understand and respond to images and language” ([Salesforce](#)’s definition).
 - “... the ability of machines to exhibit human-like intelligence” ([McKinsey](#)’s definition)
 - “... a constellation of technologies that extend human capabilities by sensing, comprehending, acting and learning – allowing people to do much more” ([Accenture](#)’s definition)
 - “... a set of computer science techniques that enable systems to perform tasks normally requiring human intelligence” ([Economist Intelligence Unit](#)’s definition)
 - “... the study of the modelling of human mental functions by computer programs.” ([Collins Dictionary](#) definition)

What AI comprises



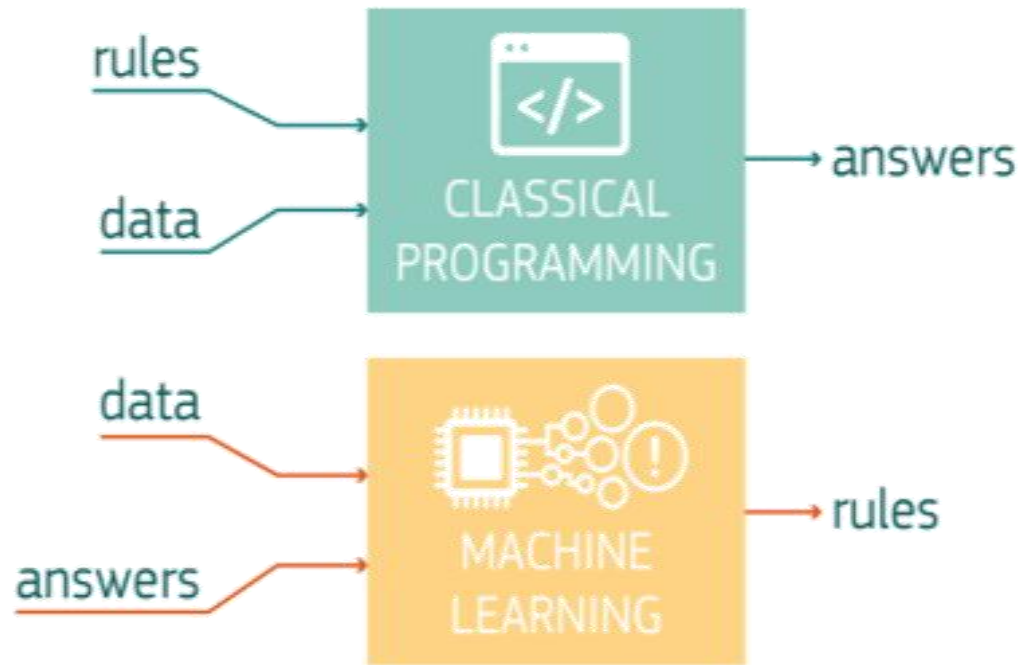
Machine Learning

- Machine learning (ML) is at the core of most of today's AI systems
- ML focuses on the development of algorithms that can analyse **data, typically large in volume** and complex in structure, to identify any regularities that can be used, for example, to **make predictions, recommendations or decisions.**

Deep Learning

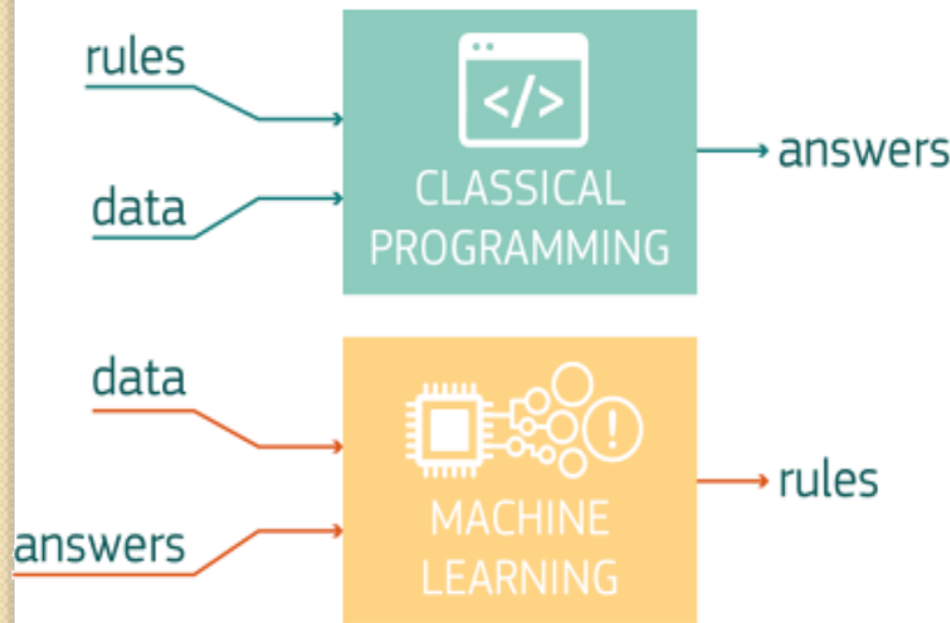
- A special type of ML are so-called “deep learning” algorithms
- These identify mathematical equations that are **highly complex** relative to other AI algorithms, often involving millions of calculations and parameters.
- Deep learning is typically used for some of the most complex problems, such as in **computer vision, speech recognition or natural language processing.**

Difference between classical programming and Machine Learning



Source: European Commission (2018a), *Artificial Intelligence: A European Perspective*, <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/artificial-intelligence-european-perspective>.

Credit card example



A credit card company that uses a collection of rules, **often defined by experts**, based on which transactions are classified as fraudulent

The rules are automatically **found from the data** using an algorithm instead of being defined by an expert.

How Machine Learning works?

- Let's play a game called “guess the painter”.
- We will give you just two pictures with the painters' name.
- After that, we are going to give you just pictures and you have to answer “who is the painter?”

“Who is the painter” game

Claude Monet



Van Gogh



“Who is the painter” game

- Picture #1



“Who is the painter” game

- Picture #2



“Who is the painter” game

- Picture #3



“Who is the painter” game

- Picture #4



“Who is the painter” game

- Picture #5



“Who’s the painter” ?

- **Answers**

1 – Gogh

2 – Monet

3 – Monet

4 – Gogh

5 – Gogh

How your brain worked

- As soon as you saw those pictures, in your mind, you already have a formula (**a set of rules**)
- Monet: Use bright colors, pictures liken female, it's like a dream
- Gogh: Use simple colors, pictures liken male, we can feel powerful. Rough.

How Machine Learning works

- Machine learning does the same thing.
- It learns the data given by the user. We call it as a "**training set**"
- Then, it applies the formula that was built when the machine analyzed the training set to the data set that we want to forecast. We call it as a "**test set.**"
- It can be wrong, but generally as we provide the machine with the qualified test data, we can get the better prediction.

The third great wave

- The McKinsey Global Institute says AI is contributing to a transformation of society “happening ten times faster and at 300 times the scale, or roughly 3,000 times the impact” of the Industrial Revolution.



The end of free will?

- The algorithm was developed in order to automate thinking, to remove difficult decisions from the hands of humans



General AI vs. Narrow AI

ARTIFICIAL INTELLIGENCE

GENERAL AI

CONSCIOUSNESS

AGENCY

EMOTIONS

INTUITION

CREATIVITY

ABSTRACT CONCEPTS

NARROW AI

NATURAL LANGUAGE PROCESSING (NLP)

AUTOMATED PLANNING

KNOWLEDGE-BASED SYSTEMS

SPEECH RECOGNITION

COMPUTER/MACHINE VISION

PREDICTION AND PATTERN RECOGNITION

AI examples in daily life

- Spam detection and email categorization
- Face ID for unlocking our phones
- Text Editors or Autocorrect
- Digital Assistants (Siri, Alexa, etc.)
- Recommendation systems (Social Media feeds, Amazon, Netflix etc.)
- Google Translate
- (Semi) Autonomous cars

In the news

The New York Times

THE SHIFT

The Brilliance and Weirdness of ChatGPT

A new chatbot from OpenAI is inspiring awe, fear, stunts and attempts to circumvent its guardrails.

The Washington Post
Democracy Dies in Darkness

ENERGY

How to Save Your Job from ChatGPT

Analysis by Trung Phan | Bloomberg

December 10, 2022 at 2:34 p.m. EST

ChatGPT: Optimizing Language Models for Dialogue

- Everybody's testing out OpenAI 's ChatGPT chatbot.
- Is it intelligence? Is it insightful? Is it creative?
- Not sure, but for now it is a lot of fun and quite amazing how far Natural Language Generation has come!
- ChatGPT released on Nov. 30. You can try it here
 - <https://openai.com/blog/chatgpt/>



← **Tweet**



We're witnessing the death of the college essay in realtime. Here's the response to a prompt from one of my 200-level history classes at Amherst

Solid A- work in 10 seconds

↻ Reset Thread

🌙 Dark Mode

💬 OpenAI Discord

🔗 Learn More

🔑 Log out



Can you write me a 4 paragraph academic essay comparing and contrasting the theories of nationalism of Benedict Anderson and Ernest Gellner?



Benedict Anderson and Ernest Gellner both have theories about the origins and nature of nationalism, but their perspectives differ in key ways. Anderson believes that nationalism is a cultural construct, arising from the development of print capitalism and the creation of imagined communities. Gellner, on the other hand, sees nationalism as a product of modernization and industrialization, with nations being formed as a means of organizing society and providing a shared identity.

One key difference between the two theories is the role of culture. For Anderson, culture is central to the creation of nationalism, as the spread of print media allows for the creation of imagined communities that transcend physical boundaries. This allows for the development of a national identity based on shared cultural experiences and practices. In contrast, Gellner downplays the importance of culture in the formation of nationalism, arguing that it is primarily a function of economic and political developments. He sees nations as being

E

Can you write a poem in the style of Constantine Cavafy about Thessaloniki?



Thessaloniki, city of the sea,
With your bustling streets and vibrant energy,
You capture the hearts of all who come to see,
Your rich history and diverse community.

In your harbor, the ships come and go,
Bringing goods and people from near and far,
Your bustling markets and vibrant shops,
A reflection of your vibrant soul.

From your ancient walls to your modern streets,
You are a city of contrasts and surprises,
A melting pot of cultures and traditions,
That come together to form your unique identity.

Thessaloniki, city of the sea,
You are a treasure to behold,
A place where the past and present meet,
A beacon of light in a world of uncertainty.

We are grateful to call you home,
And to be a part of your vibrant story,
Thessaloniki, city of the sea,
May you continue to thrive and prosper,
Forever shining bright.

Cloud Computing

- Of course in order to create AI algorithms based on massive amounts of data computing power is needed.
- Cloud computing is the on-demand delivery of IT resources over the Internet with pay-as-you-go pricing.

Cloud Computing

- Instead of buying, owning, and maintaining physical data centers and servers, you can access technology services, such as computing power, storage, and databases, on an as-needed basis from a cloud provider like Amazon Web Services (AWS) or Google Cloud Platform (GCP)






Cloud Computing for SMEs

- Reduce IT costs by not having to maintain legacy infrastructure.
- Low initial investment, providing SMEs with more liquidity, flexibility and cash flow
- Disaster-proof the data
- Auto-updates will keep SMEs from falling behind

eCommerce

- Cloud computing and Dropshipping enables new businesses to create and operate an eCommerce site with low initial investment.
- Dropshipping is an order fulfillment method where a business doesn't keep the products it sells in stock.

| 4 Επιβεβαίωση παραγγελίας | |
|---|--------------------------|
|  | PACK MARKETPLACES |
| Κόστος εγγραφής | 0 € |
| Μηνιαία Αμοιβή | 99 € |
|  | 599 € |
|  | shopify |
| Θέμα Amsterdam | |
| Κατάλογος Εξατομικευμένος | 395 € |
| <hr/> | |
| Μερικό σύνολο | 1.093 € |
| ΦΠΑ | 229,53 € |
| Σύνολο | 1.322,53 € |

Open Data

- **Open data** is data that can be freely used, re-used and redistributed by anyone - subject only, at most, to the requirement to attribute and sharealike.



GOVDATA

Das Datenportal für Deutschland



DATA.GOV.SK

PORTÁL OTVORENÝCH DÁT

data.gouv.fr BETA

INNOVATION TRANSPARENCE . OUVERTURE



Australian Government



data.gov.au



data.gov.gr



DATA.GOV

EMPOWERING PEOPLE



DATA.GOV.UK Beta

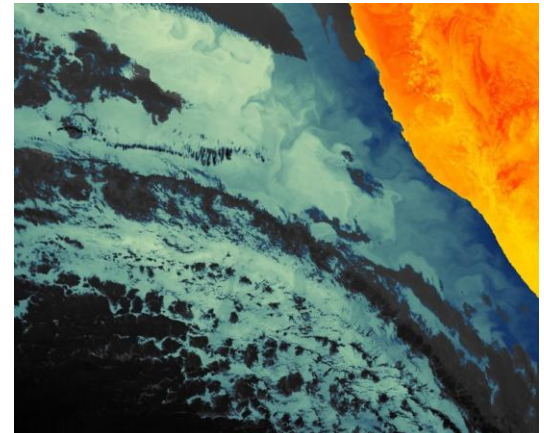
Opening up Government

datos.gob.es

reutiliza la información pública

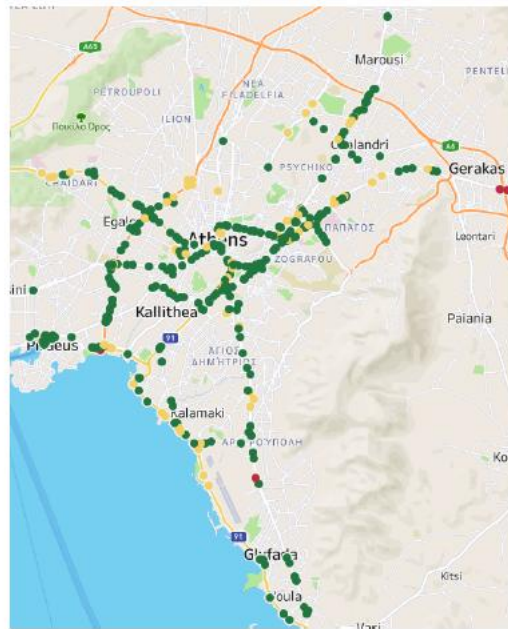
Open satellite data

- **Copernicus** is the European Union's Earth observation program
- Copernicus main objective is to provide a large amount of reliable and up to date open-access data based on satellite information and in situ (on site) observations
- It delivers **16 terabytes per day**




Open Traffic Data

- 425 sensors, hourly data



<http://data.gov.gr>

 **govgr** BETA data.gov.gr

[Home](#) [Datasets](#) [API](#)

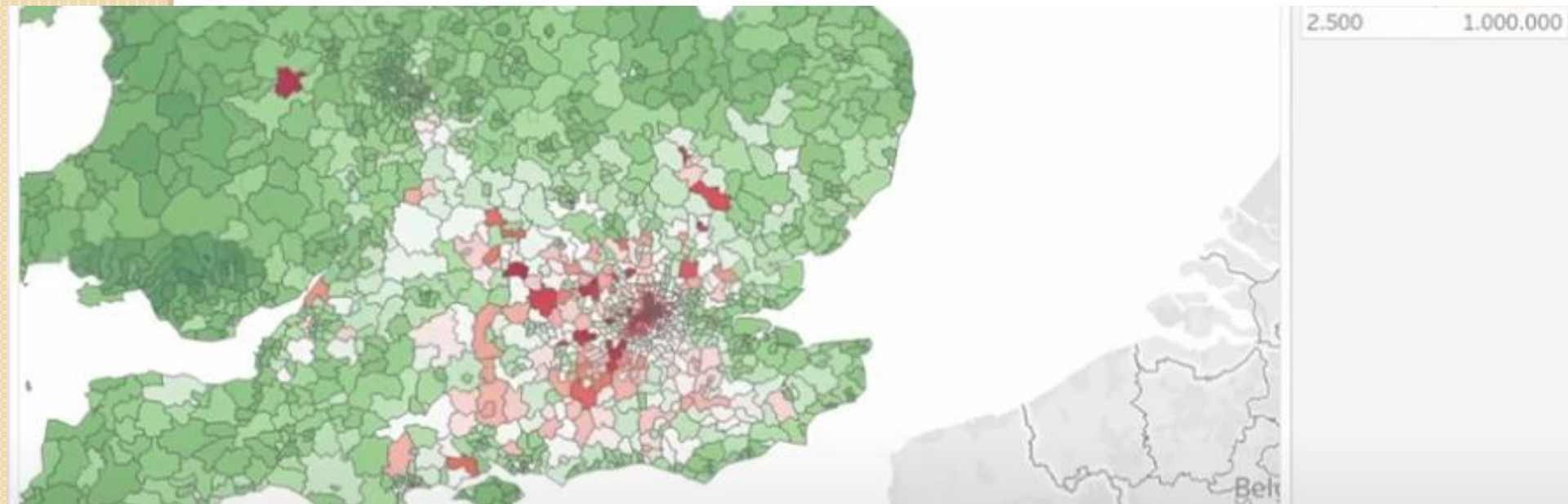
Private Sector

Road Traffic for the Attica region

| | |
|---------------------|------------------|
| Published by | Region of Attica |
| Last updated | 2022-12-10 |
| Start date | 2020-11-05 |
| Topic | Transportation |

Price paid data

- Our Price Paid Data includes information on all property sales in England and Wales that are sold for value and are lodged with the Land Registry for registration



<http://www.transportapi.com>

- TransportAPI is a transport solutions platform that seeks to create a **single, comprehensive source of UK transport information.**

Codifying Transport Intelligence

The only single source of public transport data via
API in the UK

[FIND OUT MORE](#)

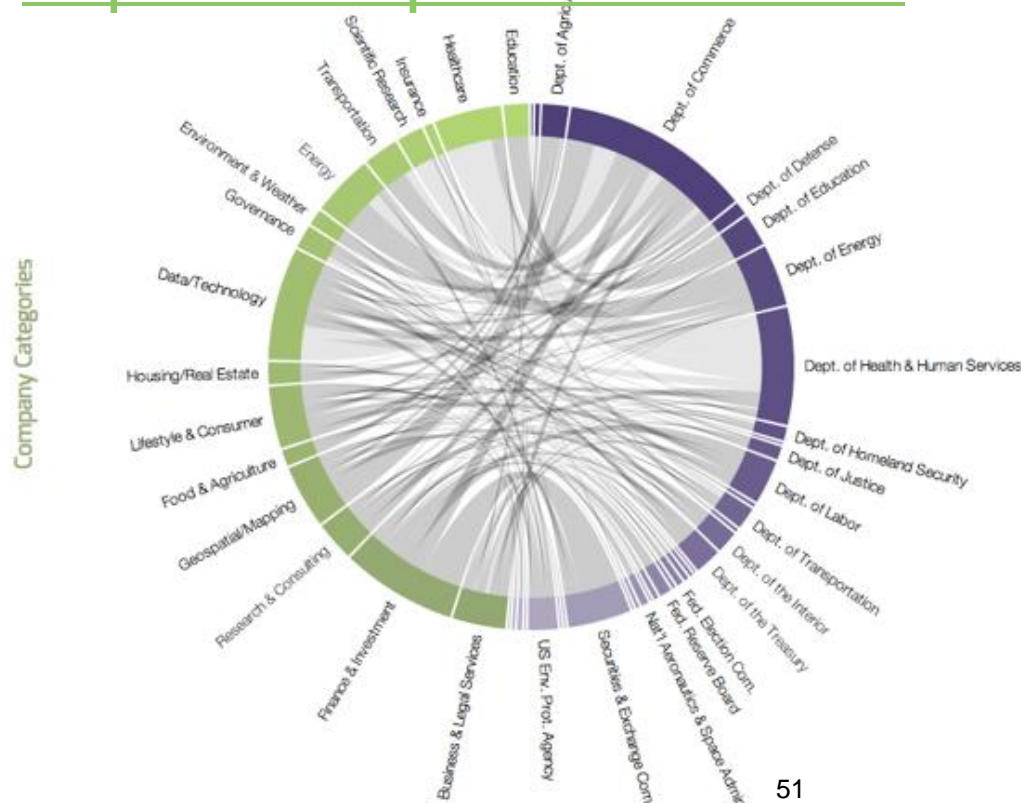


| | START 1000 free hits per day forever | GROW From £10 per month* | ENTERPRISE From £8K per month* |
|---|---|------------------------------------|--|
| Train Service Live Departures | ✓ | ✓ | ✓ |
| Train Service Timetables | ✓ | ✓ | ✓ |
| Tube Service Live Departures | ✓ | ✓ | ✓ |
| Tube Service Timetables | ✓ | ✓ | ✓ |
| Rail Coach Timetables | ✓ | ✓ | ✓ |
| TfL Bus Timetables | ✓ | ✓ | ✓ |
| TfL Bus Live Departures | ✓ | ✓ | ✓ |
| Non TfL Bus Timetables Traveline | ✓ | ✓ | ✓ |
| Non TfL Bus Live Departures | ✓ | ✓ | ✓ |
| Public Transport Journey Planning | ✓ | ✓ | ✓ |
| Car Based Journey Planning | ✓ | ✓ | ✓ |
| Cycle Based Journey Planning | ✓ | ✓ | ✓ |
| Developer support via forum | ✓ | ✓ | ✓ |
| Tutorials | ✓ | ✓ | ✓ |
| Transport Buzz Tweets | x | ✓ | ✓ |
| Mapping Performance Indicators Tube/Train | x | ✓ | ✓ |
| Service Level Agreements | x | ✓ | ✓ |
| No Throttling | x | x | ✓ |
| No rate limiting | x | x | ✓ |
| | Sign Up | Sign Up | Enquire |



Open Data Companies

- Open Data 500 is a study of U.S. companies that use **Open Government Data** to generate new business and develop new products and services - <http://www.opendata500.com/>

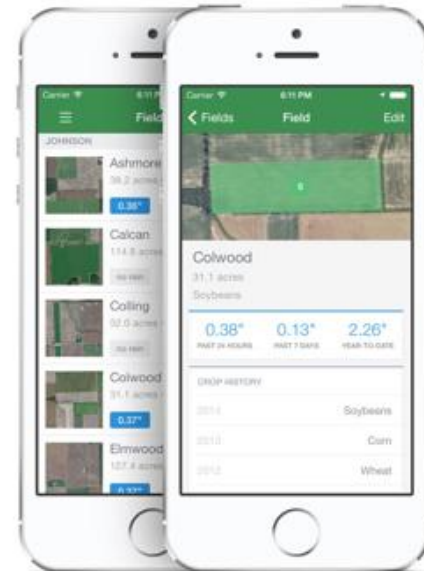


Federal Agencies



FarmLogs

- Farm app that harvest big data
- Although the platform is new, it is used by 15% of U.S. farmers and across 130 countries
- “When you come into our product as a new farmer you can start clicking on your field and we already know the rain fall and crop history and what yield looks like for those fields”
- Open Data
 - Weather data from the National Oceanic and Atmospheric Administration
 - Pricing from the Chicago Mercantile Exchange
 - National Agriculture Statistics Service, which supplies crop history for 23 million fields in the form of satellite imagery.
 - Crowdsourcing: Data from specific farms (e.g. about fertilizer, seeds, yield data etc.)



Pre-trained AI models

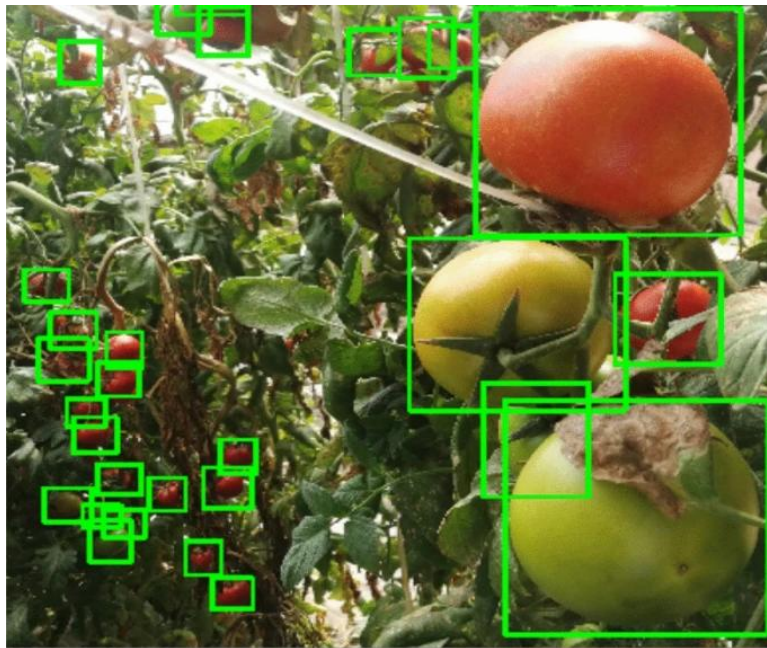
- A pre-trained model refers to a model created by someone else and **trained on a large dataset to solve a similar problem.**
- SMEs can use a pre-trained model as a starting point, instead of building a model from scratch.
- Examples of successful large-scale pre-trained language models are Bidirectional Encoder Representations from Transformers (**BERT**) and the Generative Pre-trained Transformer (**GPT-n**) series.

YOLO algorithm for object detection

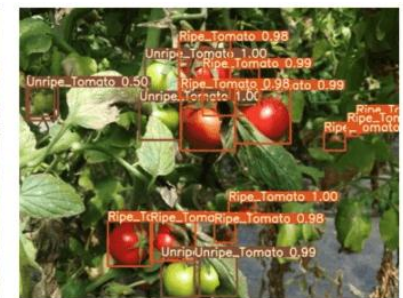
- You Only Look Once (YOLO) is a state-of-the-art, real-time object detection algorithm.
- YOLO is **open-source**
- YOLO has a wide range of real-world applications:
 - Security – for example, detecting people in restricted areas
 - Manufactory – detecting anomalies in production
 - Healthcare

YOLO in agriculture

- Artificial Intelligence and robotics are playing a major role in modern agriculture.
- YOLO to identify the types of fruits and vegetables for efficient harvest.



(a)



(b)



(c)



(d)

YOLO in livestock farming

- Help farmers to identify the position and activity of each cow on real time monitoring system.



BERT for NLP

- BERT is Google's **open-source** machine learning framework for **natural language processing**
- A massive dataset of **3.3 Billion words** has contributed to BERT's continued success.
- BERT's training was made possible thanks to the novel Transformer architecture and sped up by using TPUs—**64 TPUs** trained BERT over the course of **4 days**.



BERT tasks

- BERT can be used on a wide variety of language tasks:
 - Can determine how positive or negative a movie's reviews are. (Sentiment Analysis)
 - Helps chatbots answer your questions. (Question answering)
 - Predicts your text when writing an email (Gmail). (Text prediction)
 - Can write an article about any topic with just a few sentence inputs. (Text generation)
 - Can quickly summarize long legal contracts. (Summarization)
 - Can differentiate words that have multiple meanings (like 'bank') based on the surrounding text. (Polysemy resolution)