



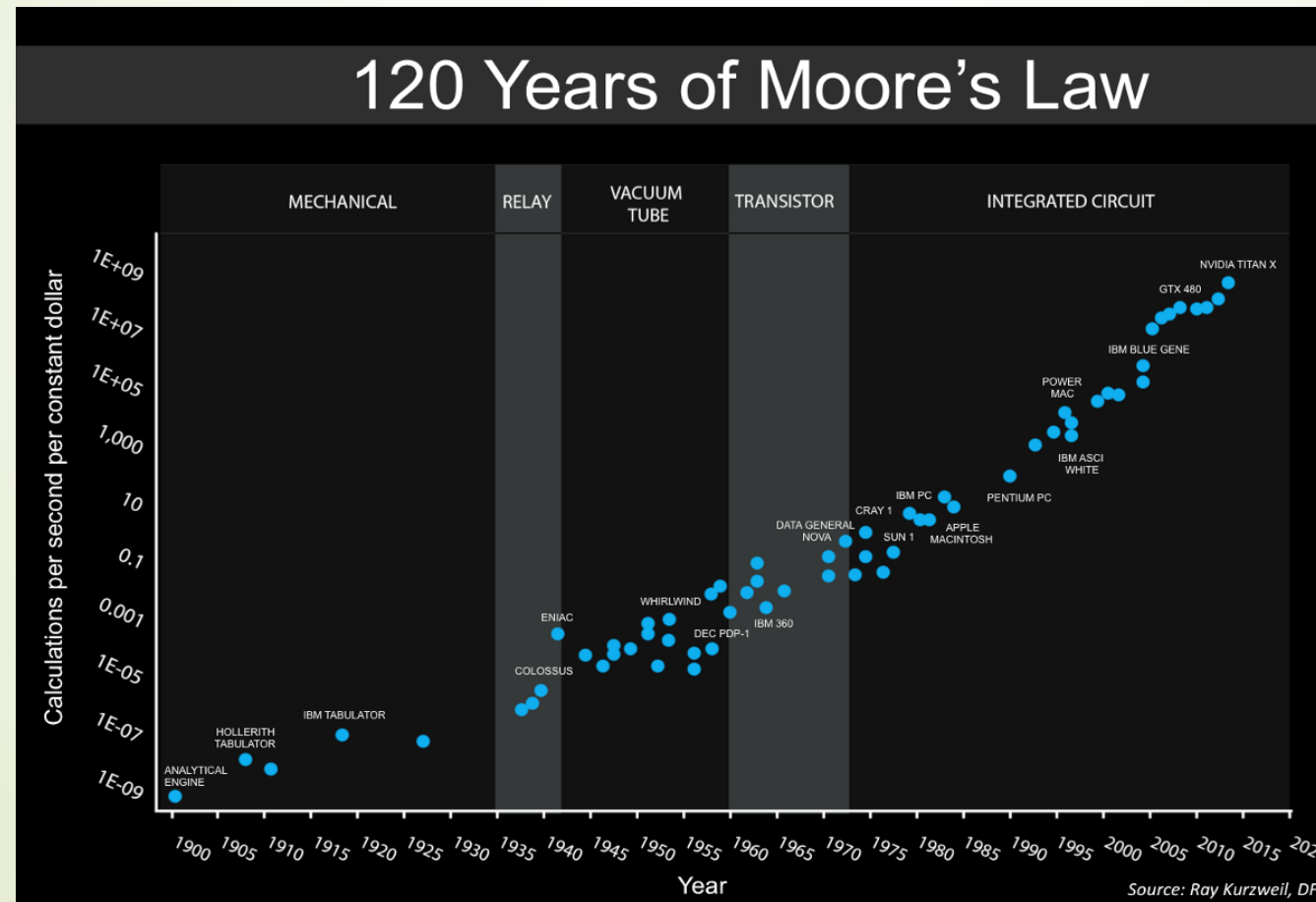
IV. Hoe Zijn Ze zo Ver Geraakt?



IV.1. Hardware

IV.1.a. Wet van Moore (1965)

het aantal transistors in IC's verdubbelt elke 18/24 maanden
nu stilaan fysische grenzen aan het benaderen



IV.1.b. Processing

nieuwe en snellere processoren

CPU: central processing unit

GPU: graphical processing unit

TPU

A New Chip Cluster Will Make Massive AI Models Possible

p

Cerebras says its technology can run a neural network with 120 trillion connections—a hundred times what's achievable today.

FPGA: field programmable gate arrays

IPU: intelligence processing unit

neuromorphic chips



Will Quantum Computing Define The Future Of AI?

IV.1.c. Processing met xG

1979

1991

2001

2008

Mobile communications: from 1G to 5G

Generation	Device	Specifications
1G		<p>1G</p> <p>Year: early 80s</p> <p>Standards: AMPS, TACS</p> <p>Technology: Analog</p> <p>Bandwidth: -</p> <p>Data rates: -</p>
2G		<p>2G</p> <p>Year: 1991</p> <p>Standards: GSM, GPRS, EDGE</p> <p>Technology: Digital</p> <p>Bandwidth: Narrow Band</p> <p>Data rates: < 80 - 100 Kbit/s</p>
3G		<p>3G</p> <p>Year: 2001</p> <p>Standards: UMTS / HSPA</p> <p>Technology: digital</p> <p>Bandwidth: Broad Band</p> <p>Data rates: up to 2 Mbit/s</p>
4G		<p>4G</p> <p>Year: 2010</p> <p>Standards: LTE, LTE Advanced</p> <p>Technology: digital</p> <p>Bandwidth: Mobile Broad Band</p> <p>Data rates: xDSL-like experience</p> <p>1 hr HD movie in 6 minutes</p>

People



5G

Year: 2020-2030

Standards: -

Technology: digital

Bandwidth: Ubiquitous connectivity

Data rates: Fiber-like experience

1 hr HD movie in 6 seconds

Icons: Smart grids, Connected house, eHealth, Domotics, Entertainment, Apps beyond imagination, Smart Car, Car-to-car communication, HD, 3D, 4K, 112, etc.

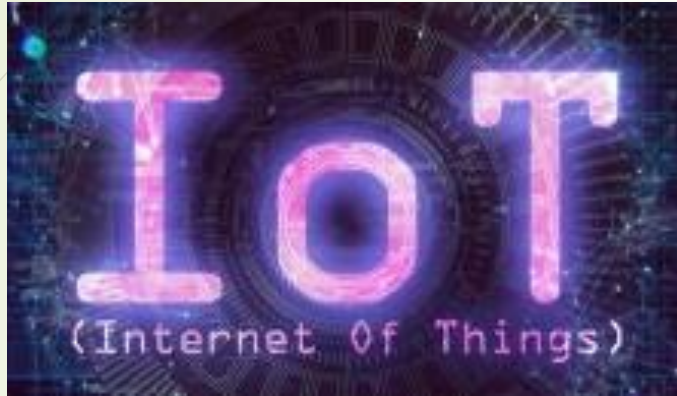
People & Things

5G is about Communication, Storage, Processing...

2018



IV.1.c. IoT “on the edge”



(1999)



Edge AI
use case

In-home smart cameras can recognize that a person(s) has entered an area

nest IQ cameras,
aws DeepLens

On-device facial recognition and object recognition, where user data doesn't leave the device

apple neural engine
huawei AI processor

Instantaneous driving decisions

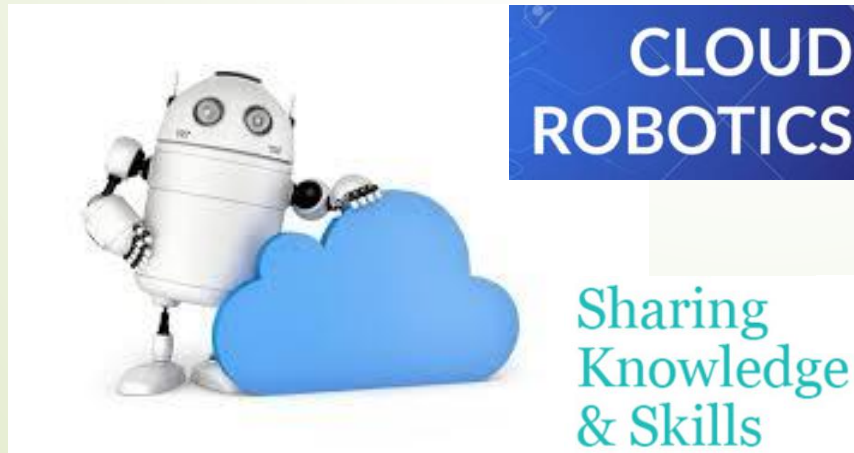
tesla custom AI chip

Vision for baby monitors, drones, robots, and other devices that can respond to situations without internet connection

intel Myriad X

IV.1.d. Opslag

veel snellere en betere opslagmogelijkheden: in the cloud (1996)



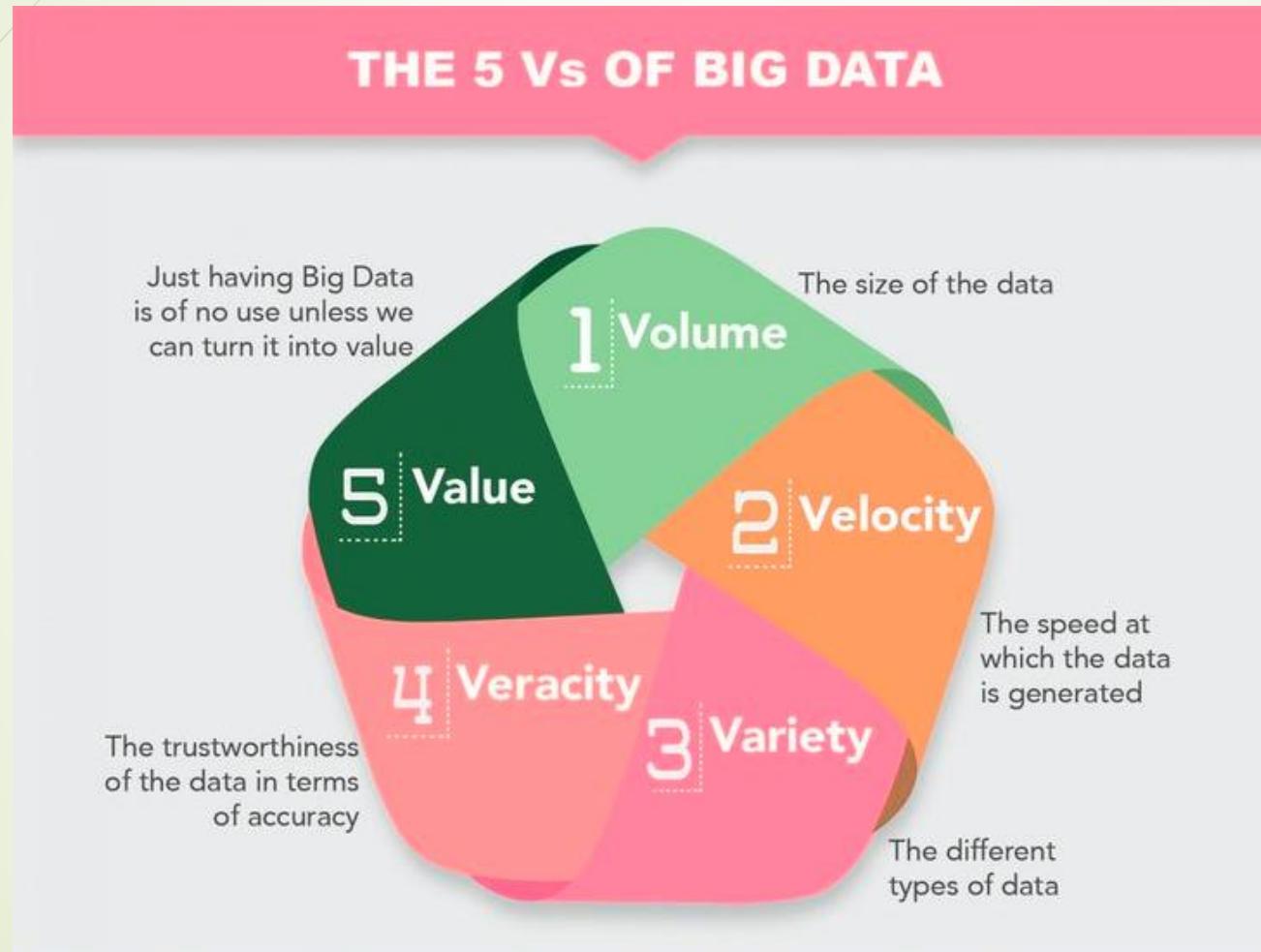


IV.2. Data



Knowledge-Driven

IV.2.a. Input: Big Data



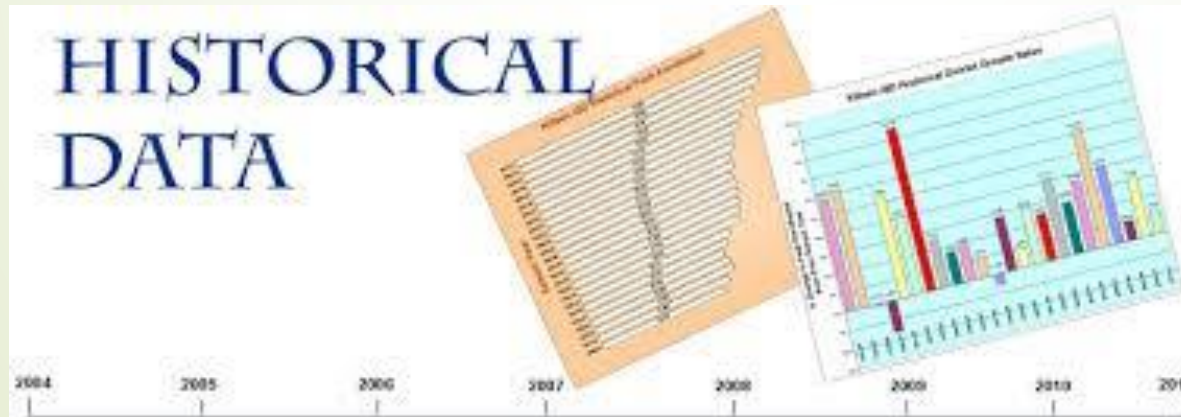
William Bruce Cameron:

“Not everything that can be counted counts, and not everything that counts can be counted.”

IV.2.b. “The Unreasonable Effectiveness of Data”



High-Dimensional Data

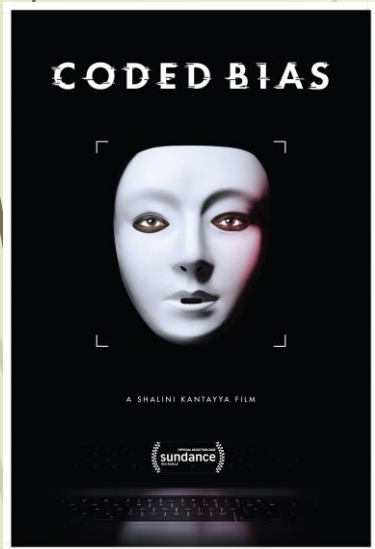


Our Behaviour in This Pandemic Has Seriously Confused AI Machine Learning Systems

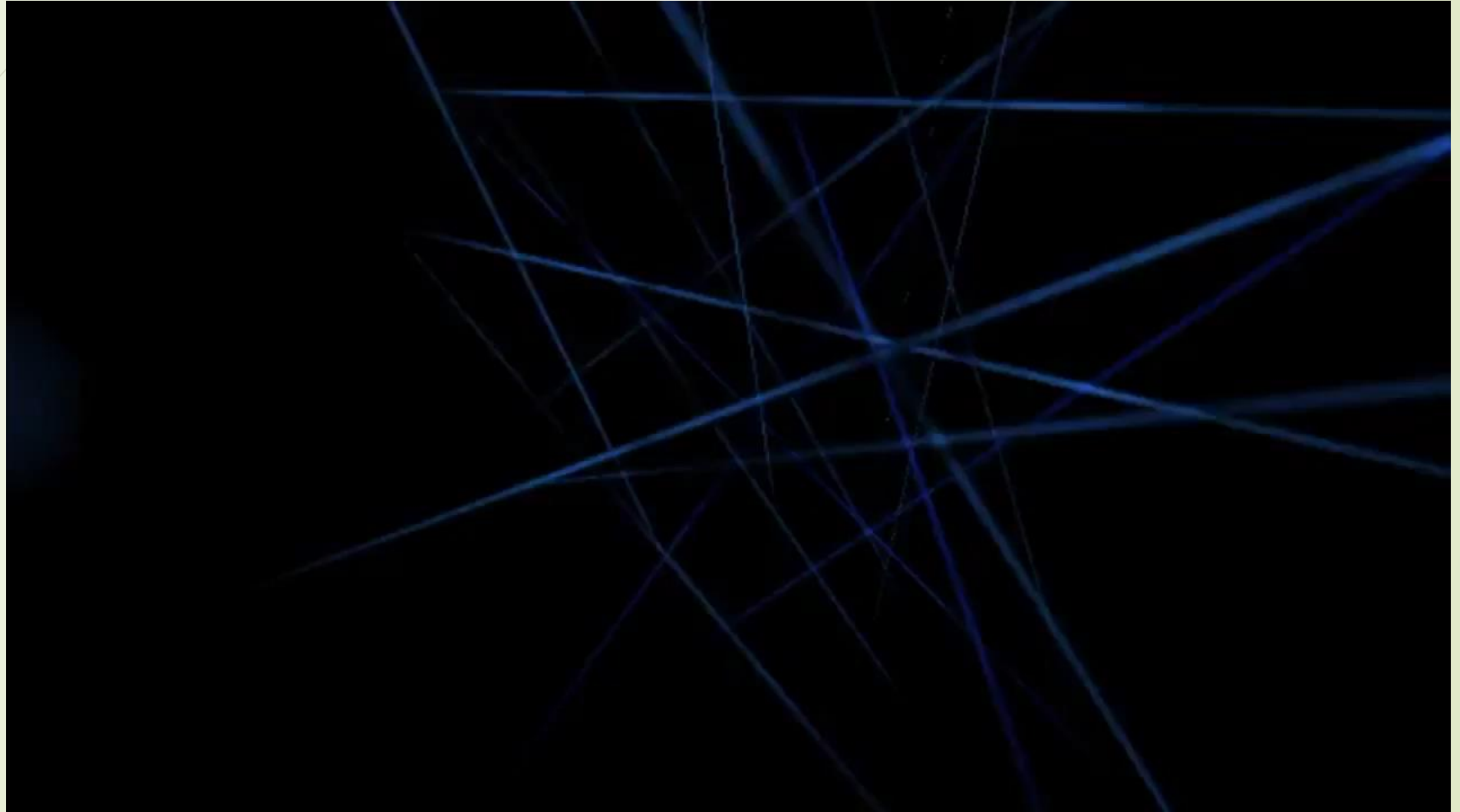
IV.2.b. “The Unreasonable Effectiveness of Data”



IV.2.c. Jammerlijk Geval van Bias



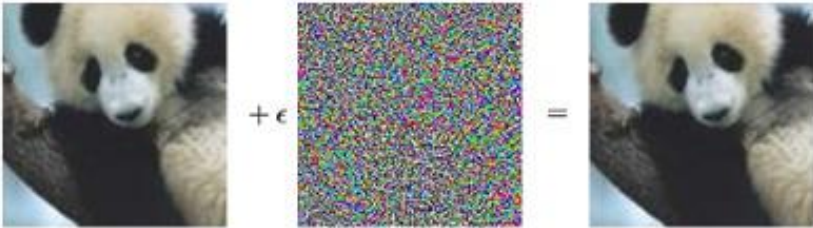
IV.2.c. Jammerlijk Geval van Bias



Futurism (2017) This 'Racist' soap dispenser at Facebook offices does not work for black people

IV.2.d. Data + Noise

Panda or Gibbon?



"panda"
57.7% confidence

+ ϵ

"gibbon"
99.3% confidence

The diagram illustrates the effect of adding noise to a panda image. On the left is a clear image of a panda with a label "panda" and a confidence of 57.7%. In the middle is a square of random noise with a plus sign and the Greek letter epsilon. On the right is the resulting image, which is a gibbon, with a label "gibbon" and a confidence of 99.3%.



gibbon

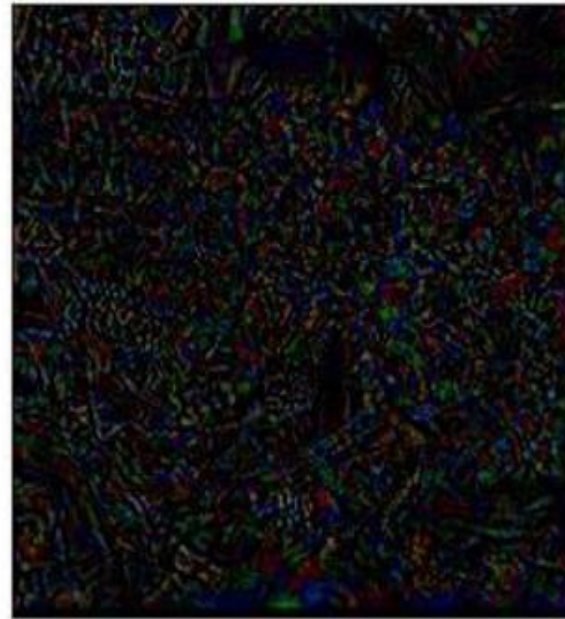


IV.2.d. Data + Noise

school bus (1.00)



Perturbation



guacamole (0.98)



IV.2.d. Ethiek: Respect voor Waarden

Digid8: dating app met genetische informatie: als op basis van DNA-analyse er mogelijkheid bestaat tot erfelijke genetische ziekte, wordt persoon niet voorgesteld

- 1) **verantwoord**: geen enkel risico: bescherming van mensen en maatschappij primordiaal
- 2) **onverantwoord**: zelf keuze kunnen maken en kinderen zijn geen noodzakelijk gevolg
- 3) **conditioneel**: opleggen van in-vitro-fertilisatie en embryo-selectie

Technology drives our societies but Ethics defines them



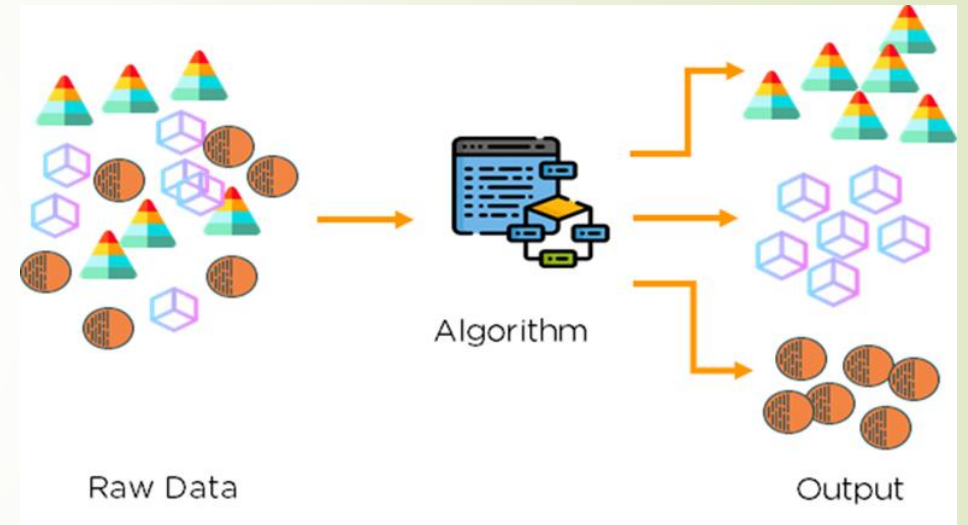
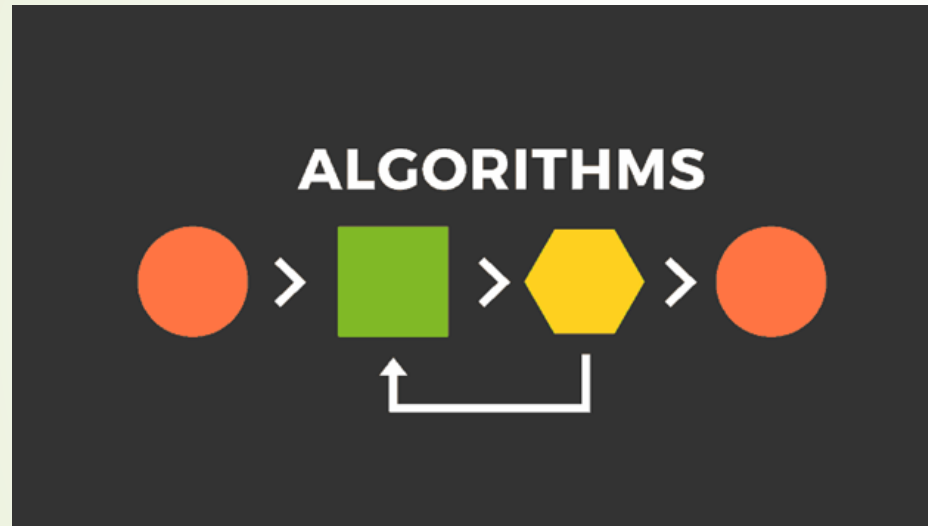
Voor goede genen, swipe naar rechts

Een datingapp met DNA-profielen is nog geen nazipraktijk, maar **Lode Lauwaert**, **Massimiliano Simons** en **Mauritz Kelchtermans** hebben wel veel vragen.

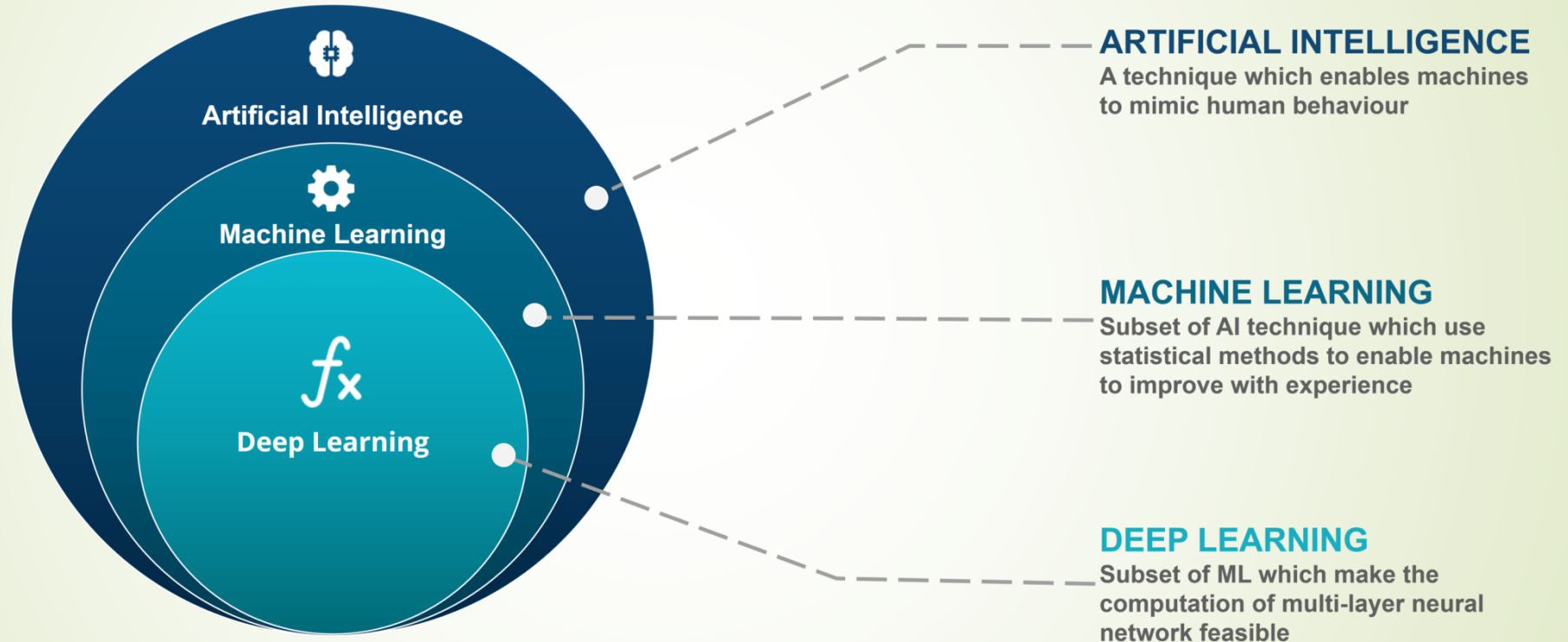


IV.3. Software

IV.3.a. Throughput: Algorithmes

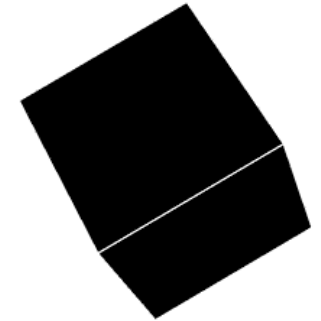
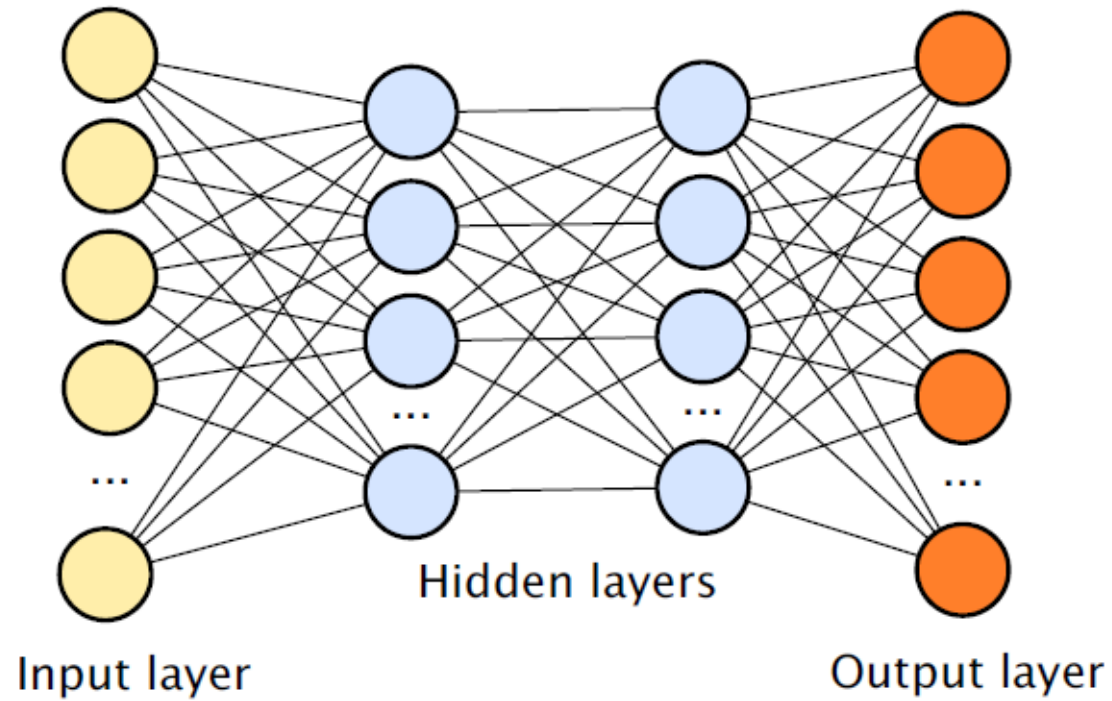


IV.3.b. Throughput: Machine Learning & Deep Learning



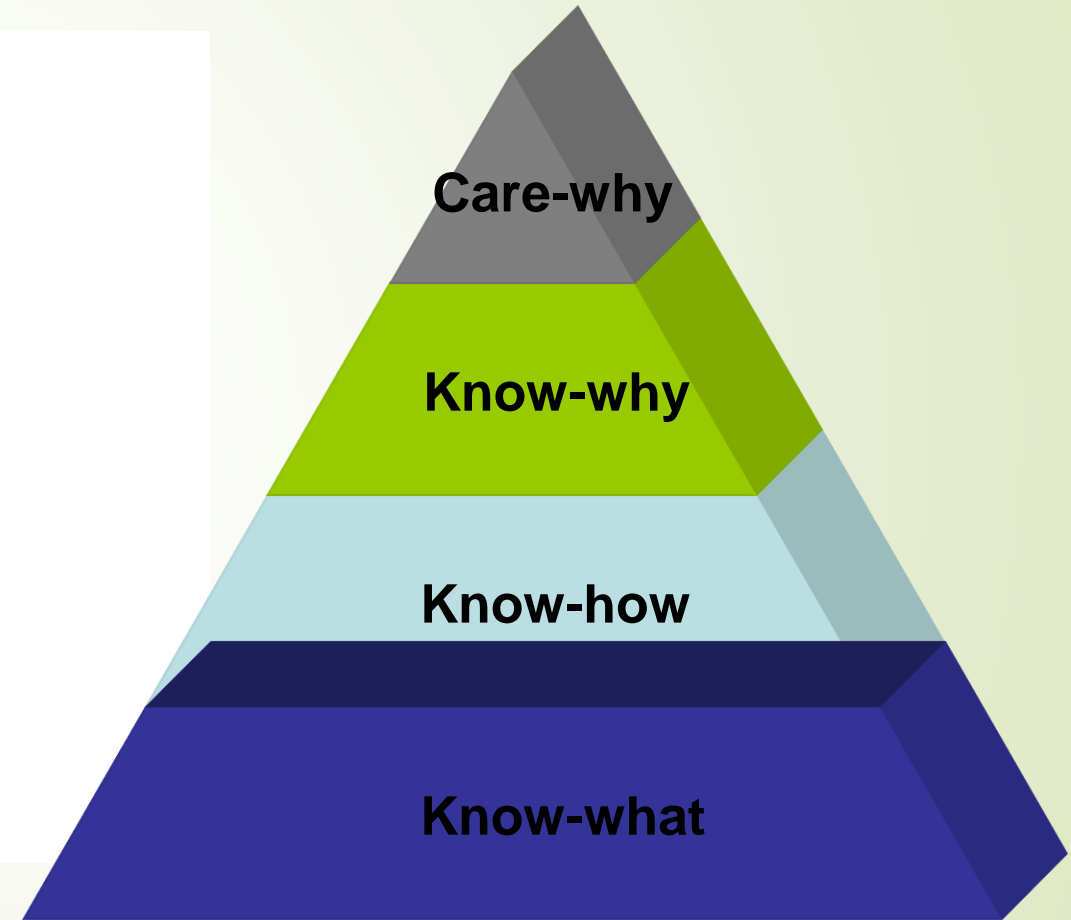
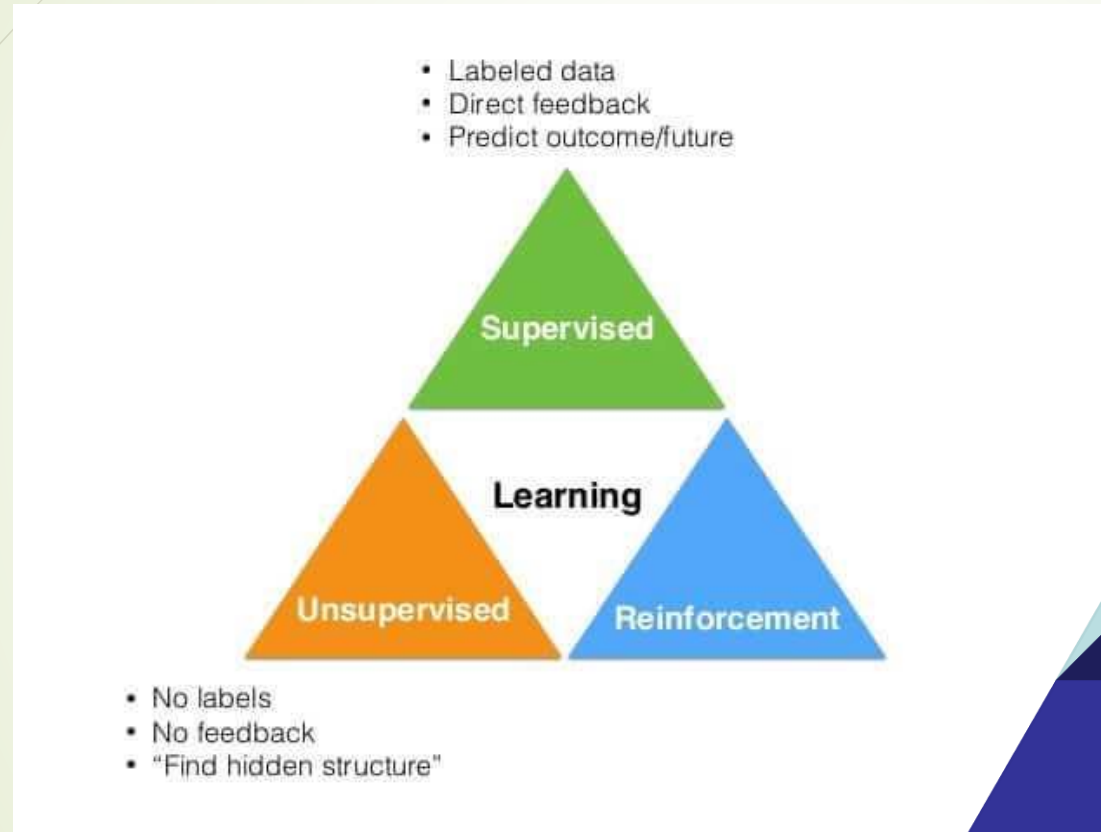
BETTER??
FASTER
CHEAPER

IV.3.b. Throughput: Machine Learning & Deep Learning



Deep and Wide

IV.3.c. Data-gestuurde Algoritmes



I'm not a robot



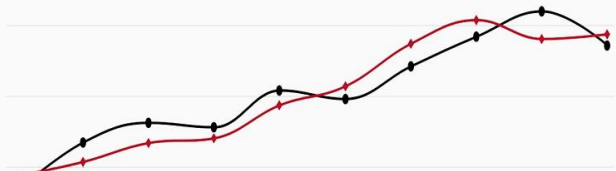
reCAPTCHA
Privacy - Terms

IV.3.c. Data-gestuurde Algoritmes



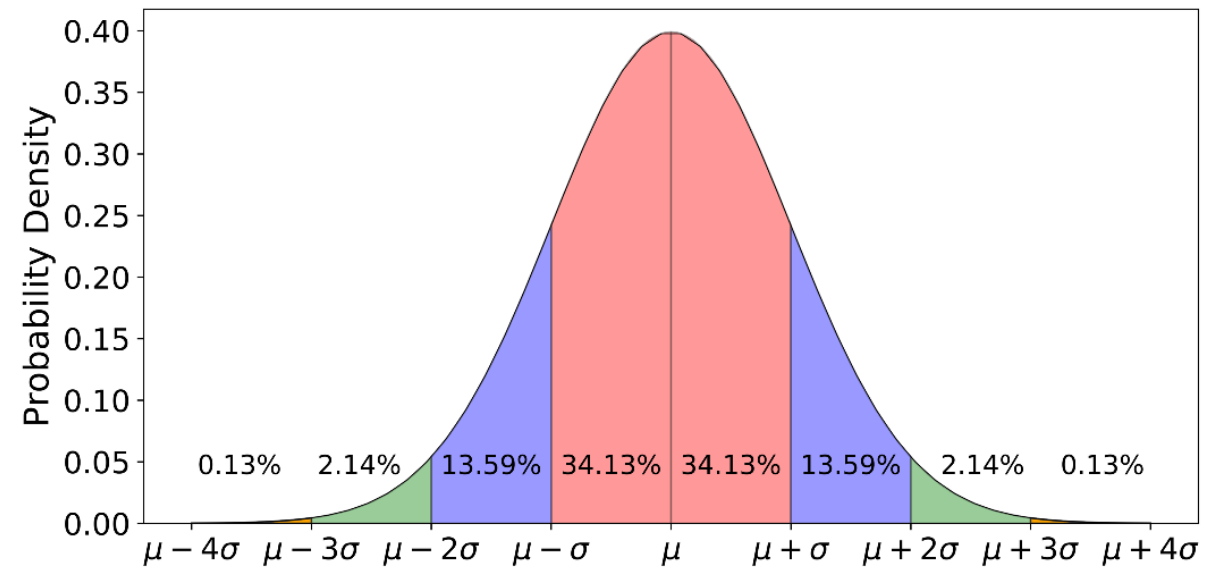
IV.3.d. Data-gestuurde Algoritmes

Per capita cheese consumed
Correlates with
**Number of people who died by
becoming tangled in their bedsheets**

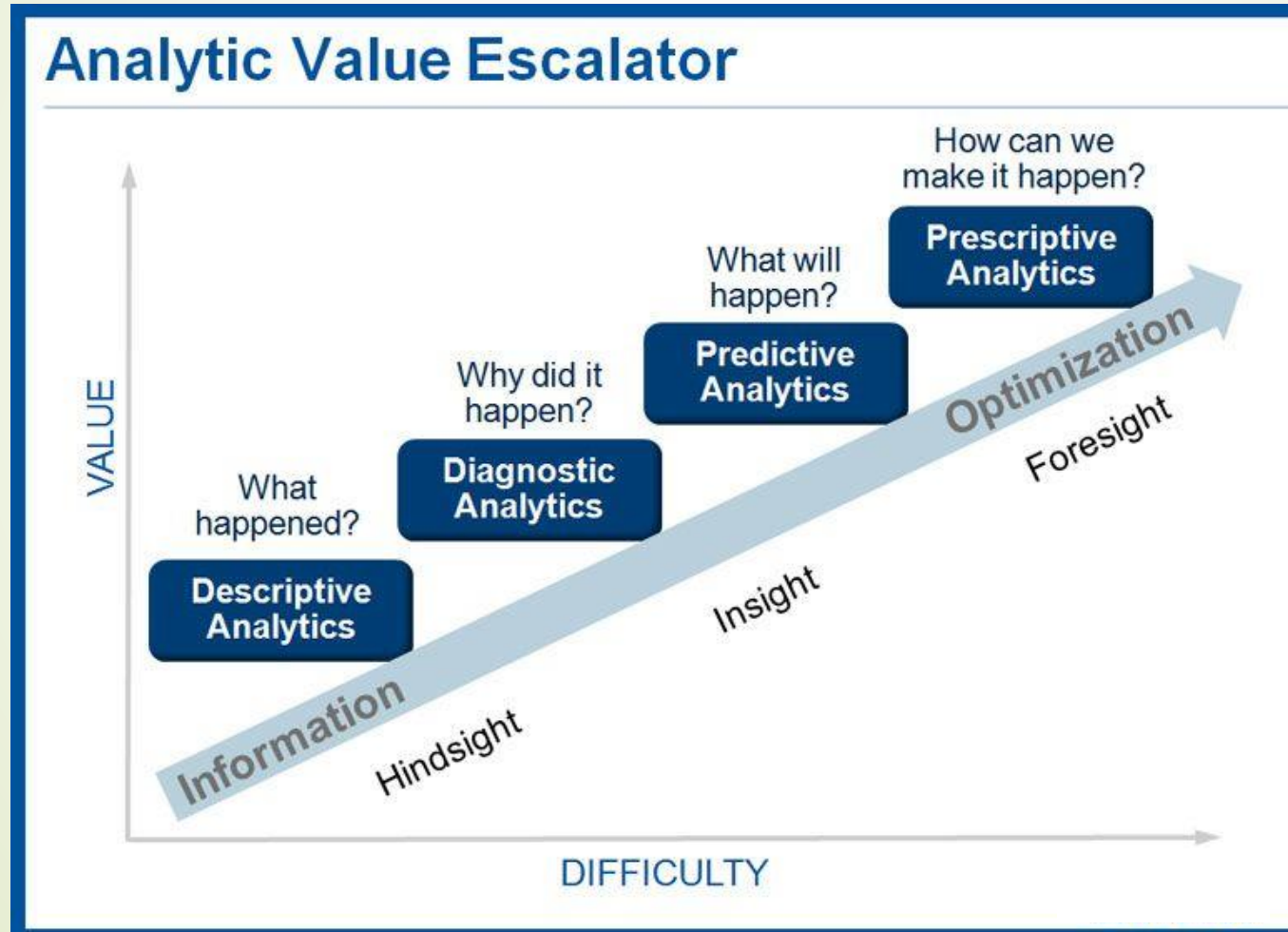


**correlation
does NOT imply
causation**

Normal Distribution



IV.3.e. Output: Voorspellingen voor Aanbevelingen, Opties, Beslissingen



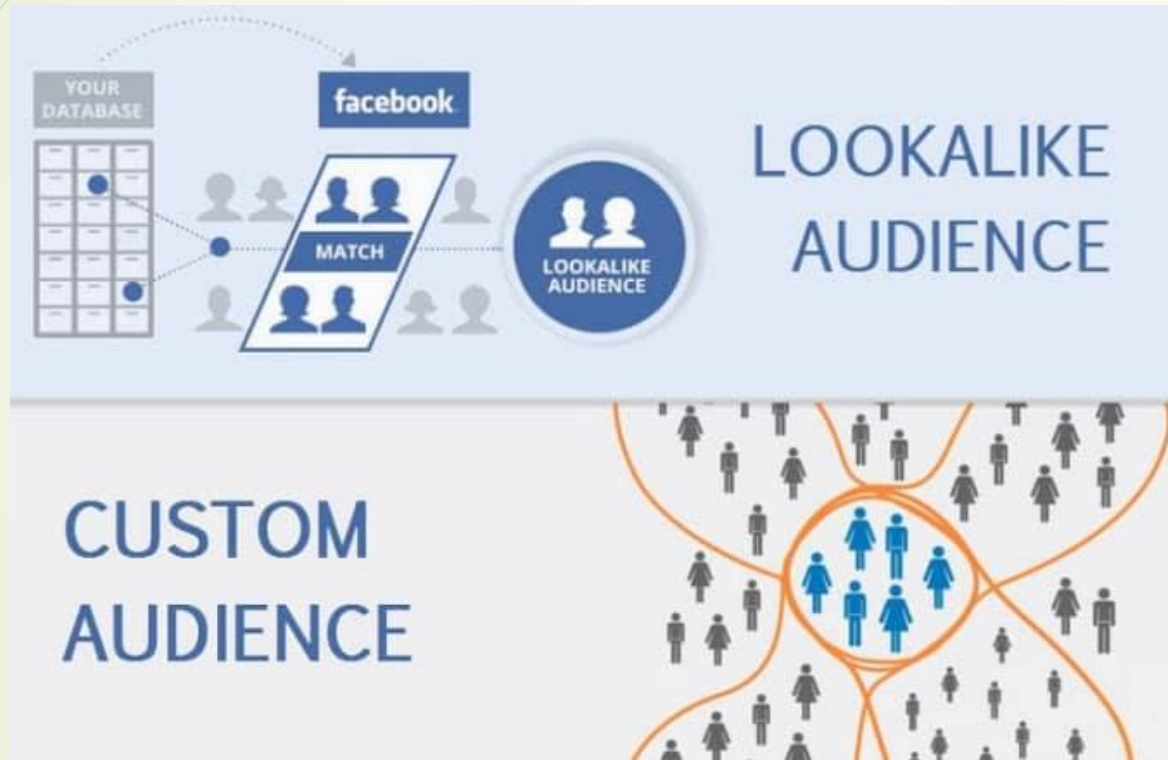
IV.3.e. Output: Voorspellingen voor Aanbevelingen, Opties, Beslissingen



IV.3.f. Output: Voorspellingen voor Aanbevelingen, Opties, Beslissingen



IV.3.f. Output: Voorspellingen voor Aanbevelingen, Opties, Beslissingen



Getest: tot vijf keer meer pastinaak verkocht in Eeklo na gerichte advertentiecampagne op Facebook

IV.3.f. Output: Voorspellingen voor Aanbevelingen, Opties, Beslissingen



Shipping-before-shopping in plaats van shopping-before-shipping

IV.3.g. Waarom Nood aan Opvolging?

Schaal en snelheid

Speed and scale

Machine-gestuurd

MACHINE DRIVEN

Ondoorzichtig: wie, wat, hoe?

Opacity

Normen en Waarden?

Values & Norms

Beslissingen gedelegeerd

Decision Making And
Delegation of Authority

Automatisch/Autonoom

Autonomous
versus
Automatic



Intermezzo

