

Inteligencia Artificial

Introducción

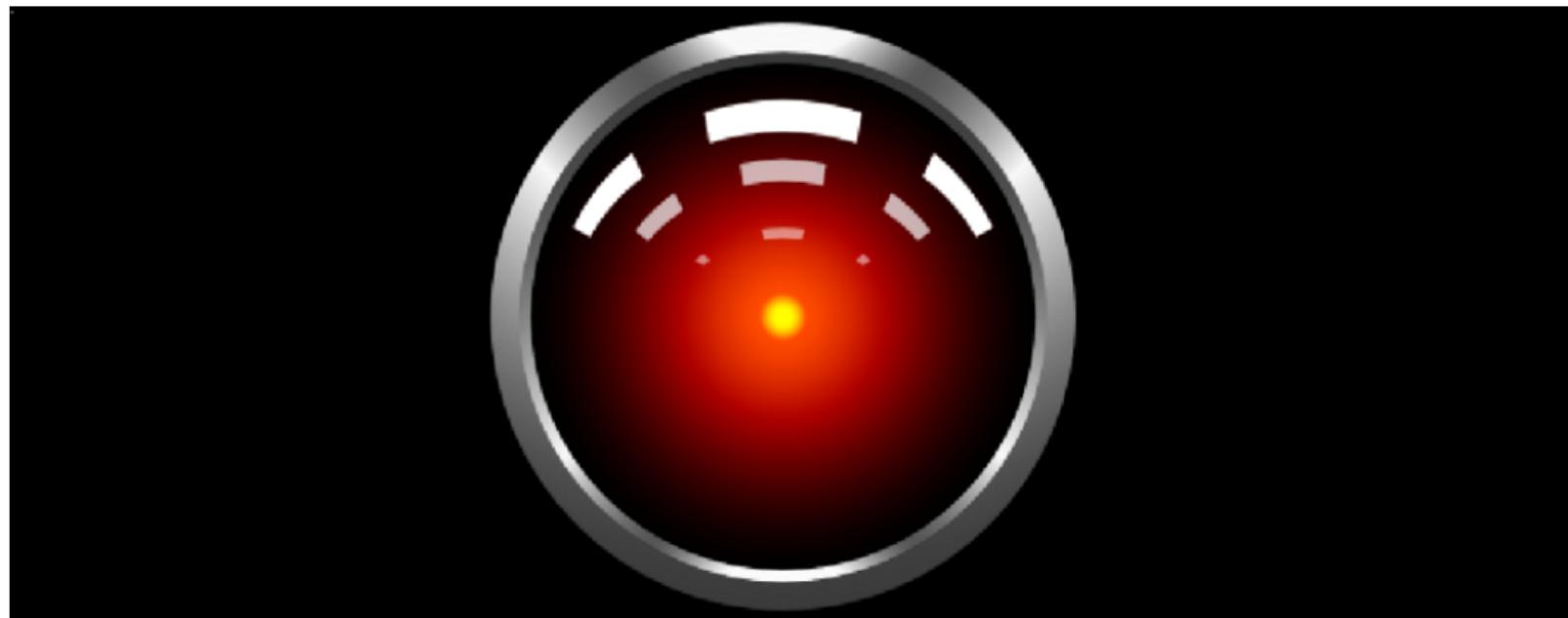


Marco Teran

2021 - Bogotá

Contenido

- 1 Un poco de historia...
 - 2 ¿Qué es la Ingeligencia Artificial?
 - 3 Aprendizaje Computacional
 - Redes Neuronales
 - 4 Aplicaciones



► ver video

Un poco de historia...



The thinking machine



▶ ver video

DeepBlue vs Gasparov (1997)



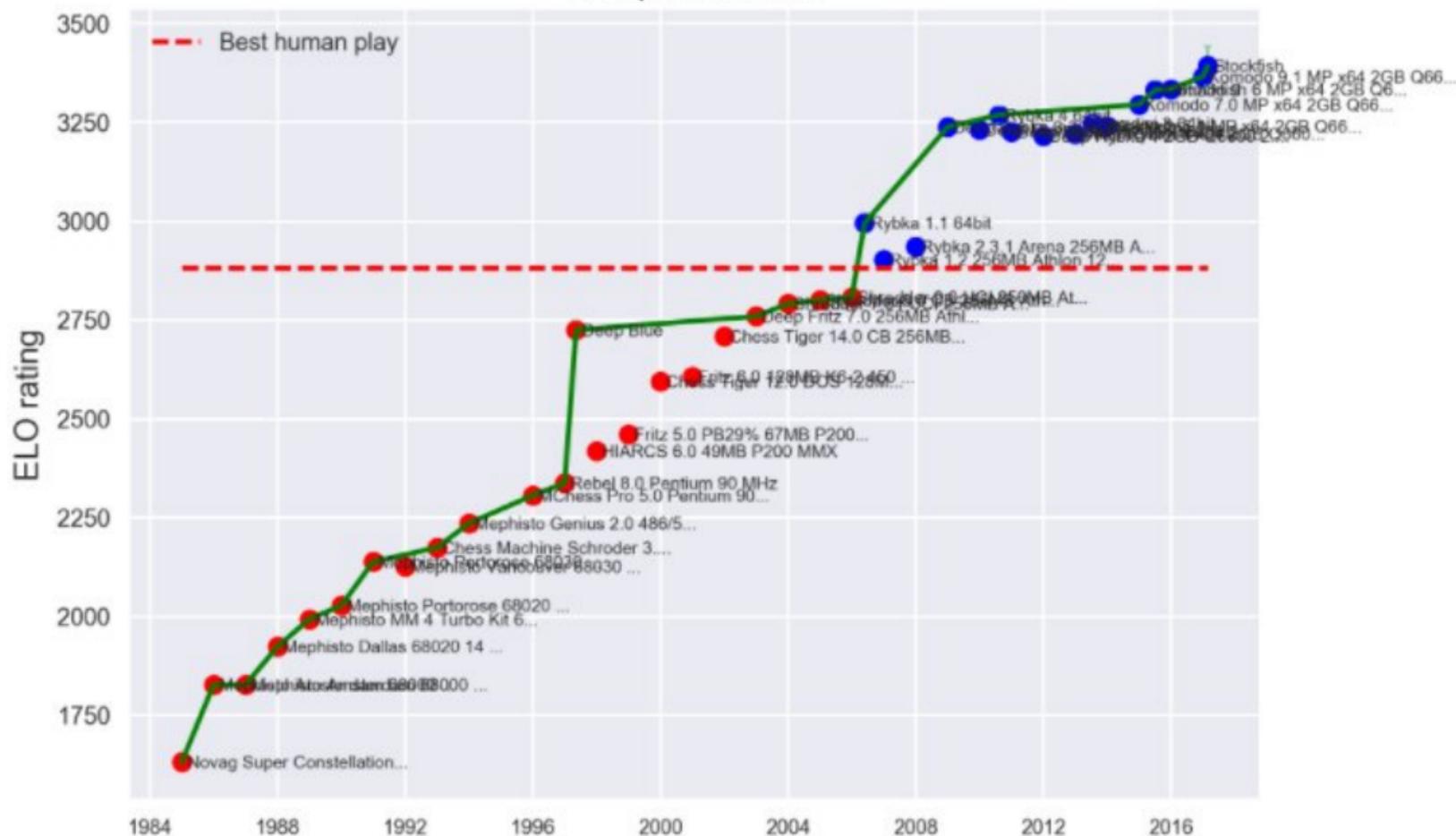
▶ ver video

DeepBlue vs Gasparov (1997)

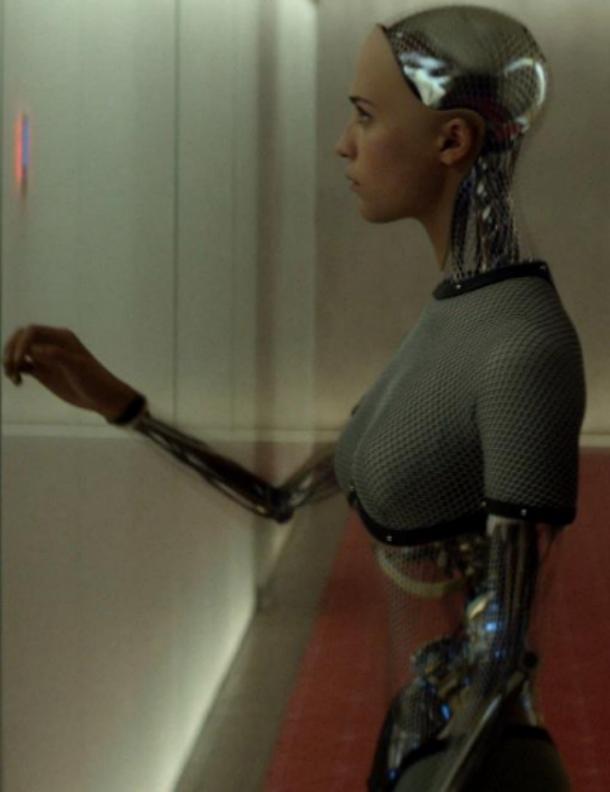


▶ ver video

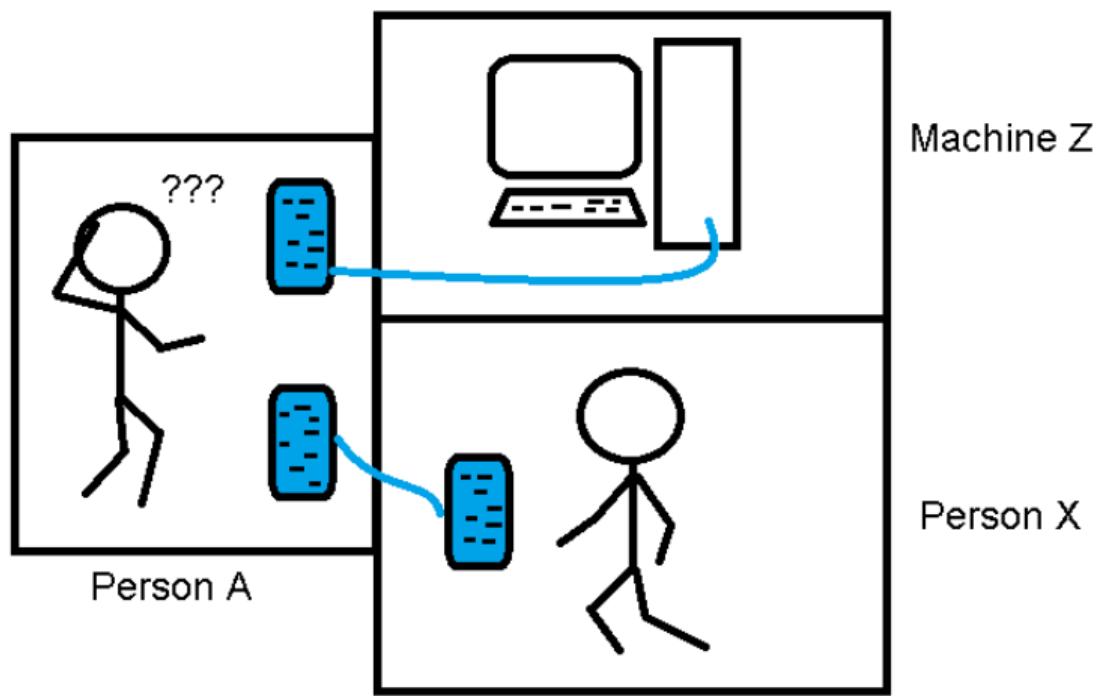
computer chess



¿Qué es la Ingelingencia Artificial?

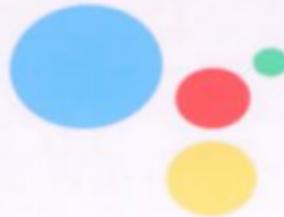


El test de turing



El test de turing





Hi, how can I help?



Google Duplex (2018)



Google Duplex

Advancing AI for Everyone



▶ ver video

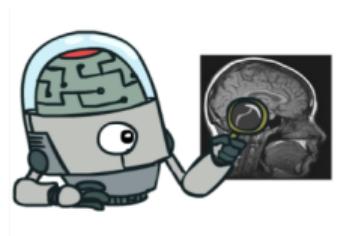
Inteligencia Artificial

La noción de **inteligencia** puede ser definida de varias formas:

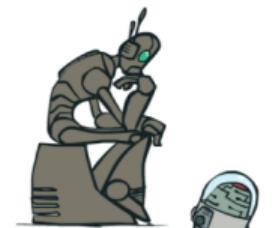
“the ability to take the right decisions, according to some criterion
(e.g. survival and reproduction, for most animals)”

La toma de buenas decisiones requiere **conocimiento** en forma **operacional**.

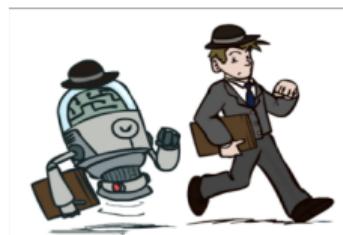
Cuatro enfoques



(a) Pensar como humano



(b) Pensar razonablemente



(c) Actuar como humano



(d) Actuar razonablemente

¿Qué es IA?

La ciencia de hacer máquinas que:

- Piensen como las personas.
- Actúen como las personas (acciones y comportamientos de humanos)
- Piensen y actúen racionalmente.

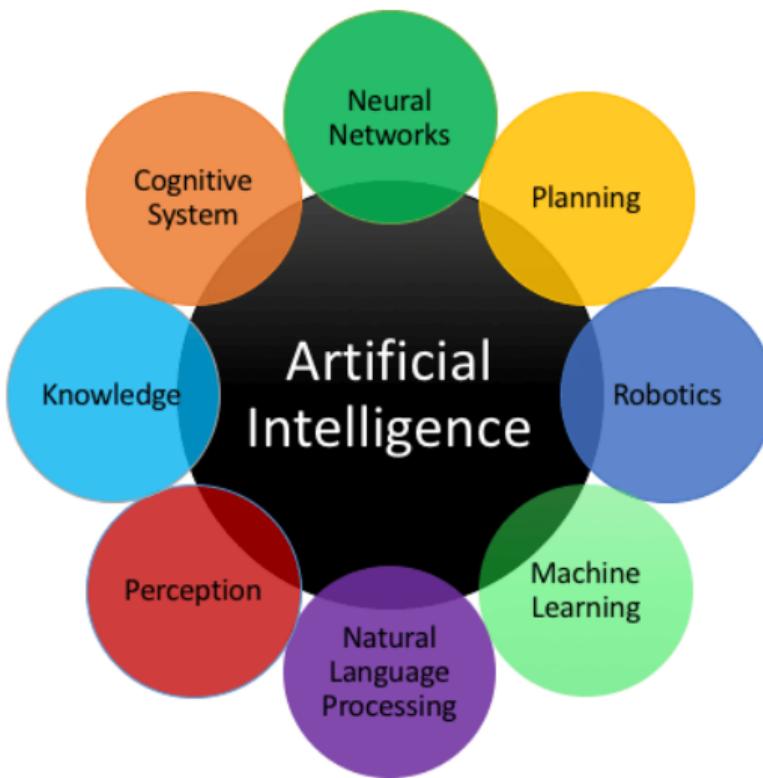
Agente: el software responsable por la inteligencia.

Robot: el hardware usado para reemplazar al humano.

Inteligencia Artificial hoy en día:

Racionalidad Computacional

- Racionalidad: Alcanzar, de manera óptima, objetivos predefinidos
- Objetivos → función de utilidad
- Actuar razonalmente → maximizar la utilidad



Requerimientos para un agente ideal:

- Representación del Conocimiento/Razonamiento
- Aprendizaje computacional
- Percepción
- Planeación
- Robótica
- Lenguaje
- Planeación

Aprendizaje Computacional

“Los computadores sólo pueden hacer lo que se les dice que hagan”

“¿Y qué tal si le decimos a la máquina que aprenda por si misma y mejore continuamente?”

1993

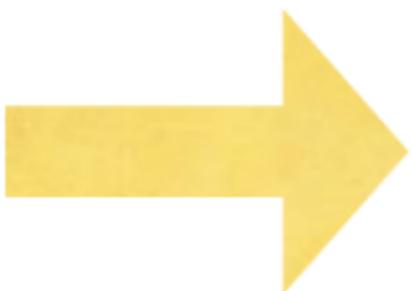
1997

1994

1968

1994

1995



1993

1997

1994

1968

1994

1945

Aprendizaje de maquina

Programación tradicional



Machine Learning



Aprendizaje de maquina

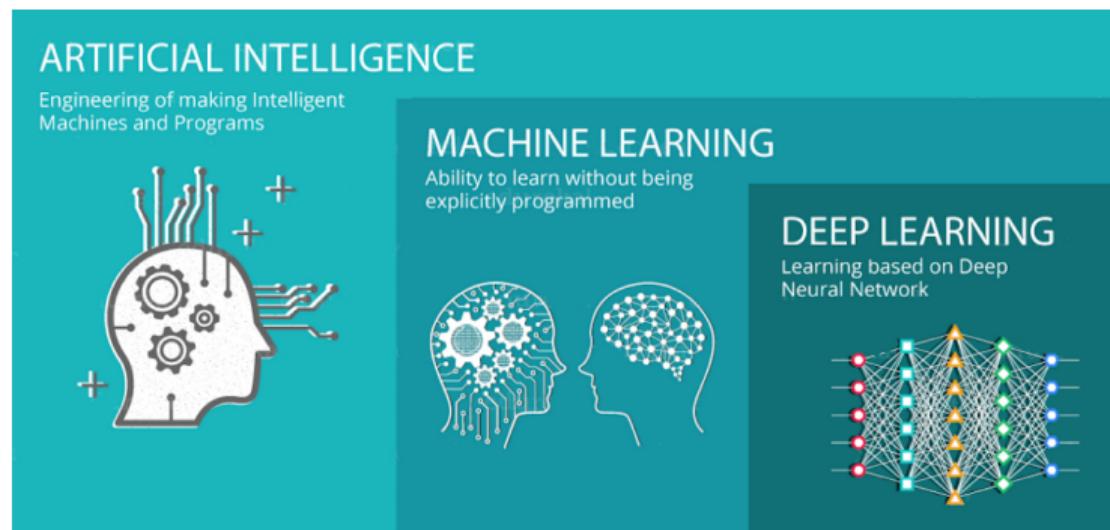
La noción de aprendizaje puede ser definida de varias formas:

“The acquisition of knowledge or skills through study, experience, or being taught”

“the act of acquiring new, or modifying and reinforcing, existing knowledge, behaviors, skills, values, or preferences”

El **aprendizaje de máquina (machine learning)** estudia algoritmos computacionales que permiten a un agente aprender a hacer cosas (acciones, decisiones, ...)

Inteligencia Artificial



- **Inteligencia Artificial (Artificial Intelligence)**: Cualquier técnica que permita a los ordenadores imitar el comportamiento humano
- **Aprendizaje de maquina (Machine Learning)**: Capacidad de aprender sin ser programado explícitamente
- **Aprendizaje profundo (Deep Learning)**: Extraer patrones de datos utilizando redes neuronales (neural networks)

ARTIFICIAL INTELLIGENCE

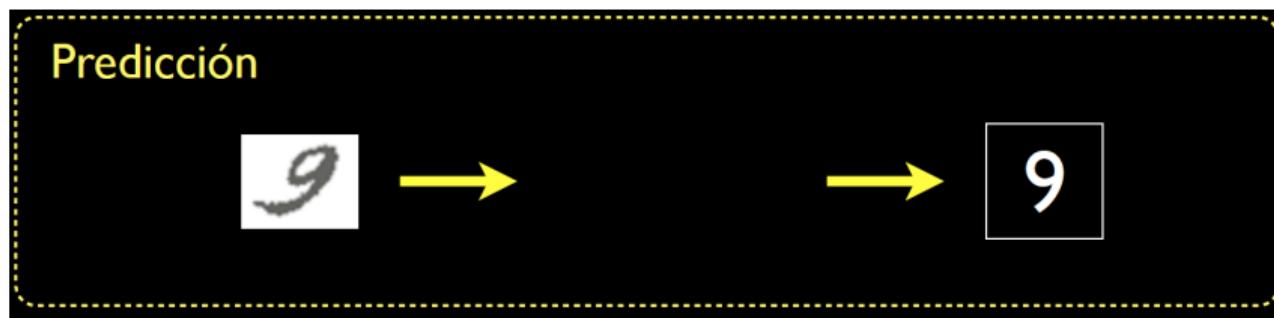
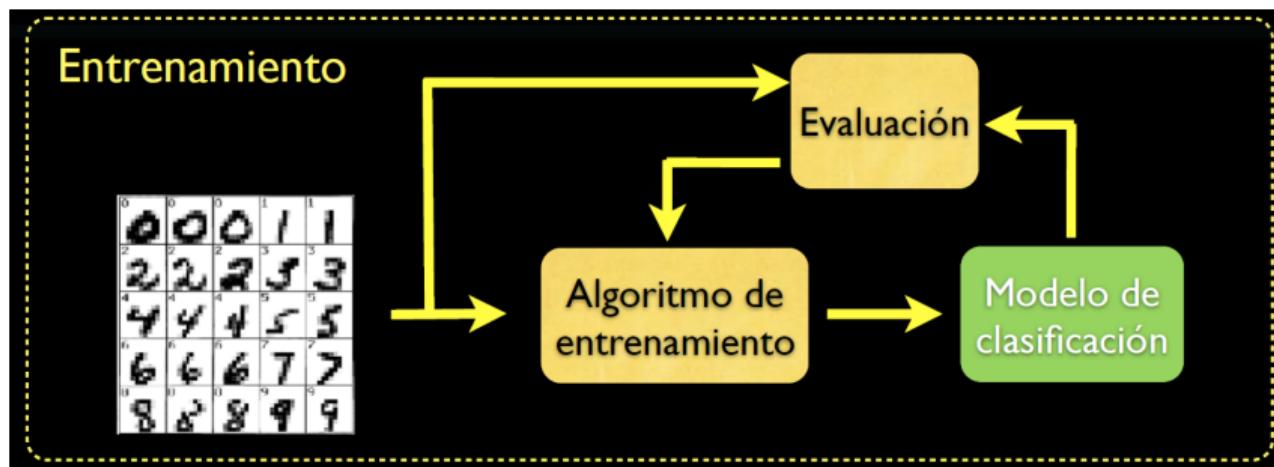
A program that can sense, reason,
act, and adapt

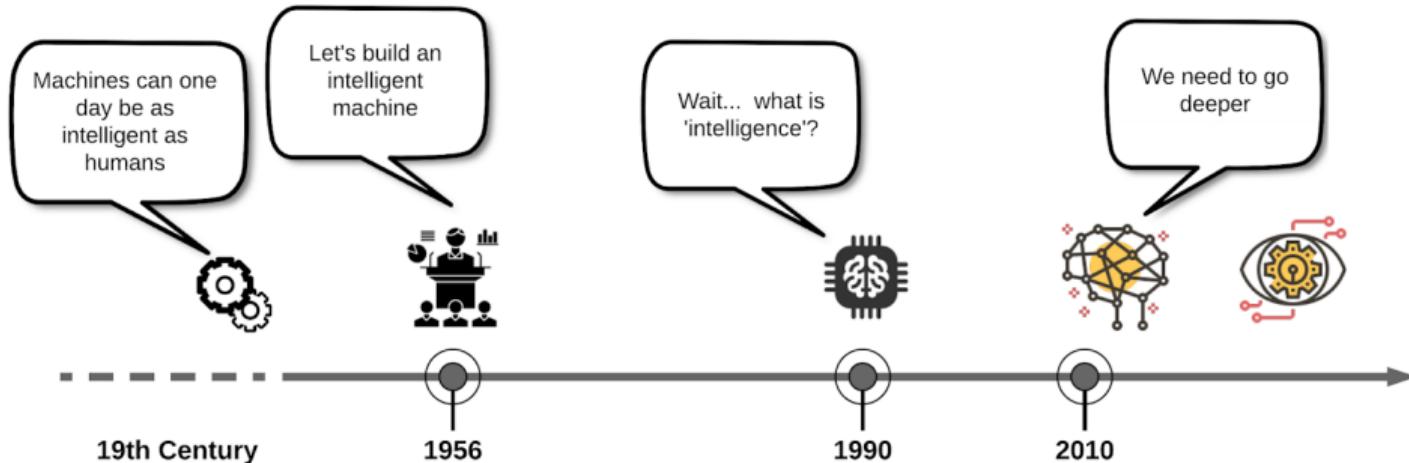
MACHINE LEARNING

Algorithms whose performance improve
as they are exposed to more data over time

DEEP LEARNING

Subset of machine learning in
which multilayered neural
networks learn from
vast amounts of data





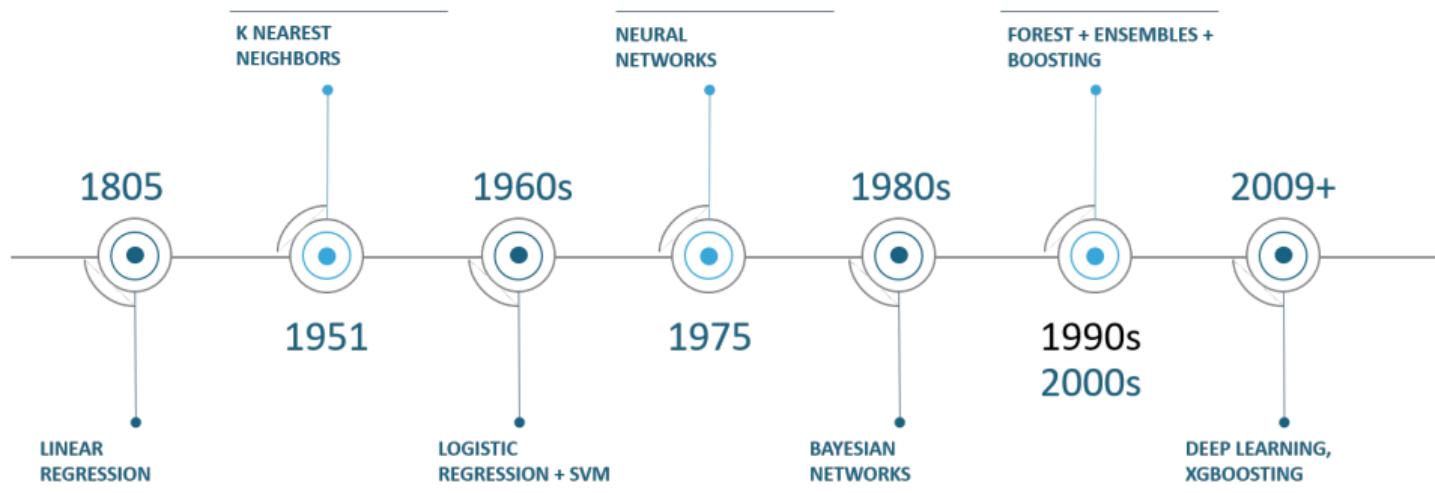
||| "Intelligent Machines"

Artificial Intelligence

||| Machine Learning

||| Deep Learning

Línea del tiempo del Machine Learning



Redes Neuronales

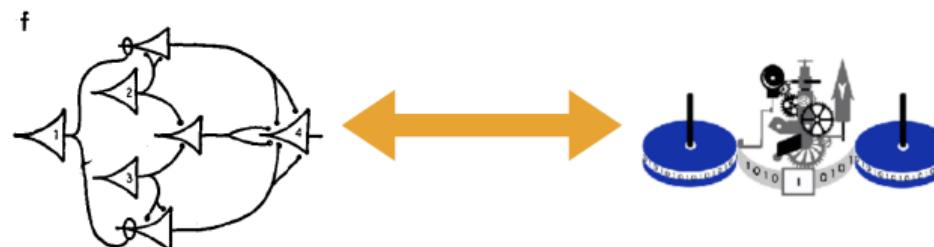
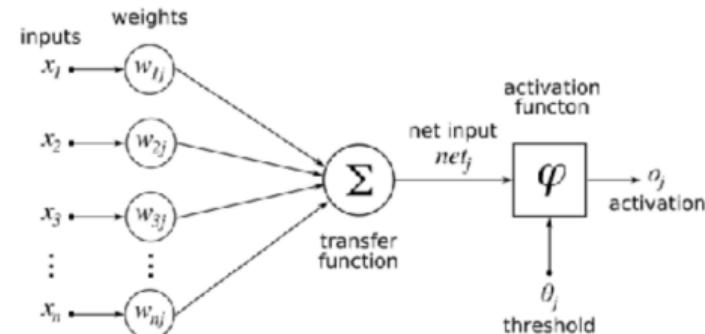
McCulloch & Pitts Artificial Neuron

BULLETIN OF
MATHEMATICAL BIOPHYSICS
VOLUME 5, 1943

A LOGICAL CALCULUS OF THE
IDEAS IMMANENT IN NERVOUS ACTIVITY

WARREN S. McCULLOCH AND WALTER PITTS

FROM THE UNIVERSITY OF ILLINOIS, COLLEGE OF MEDICINE,
DEPARTMENT OF PSYCHIATRY AT THE ILLINOIS NEUROPSYCHIATRIC INSTITUTE,
AND THE UNIVERSITY OF CHICAGO

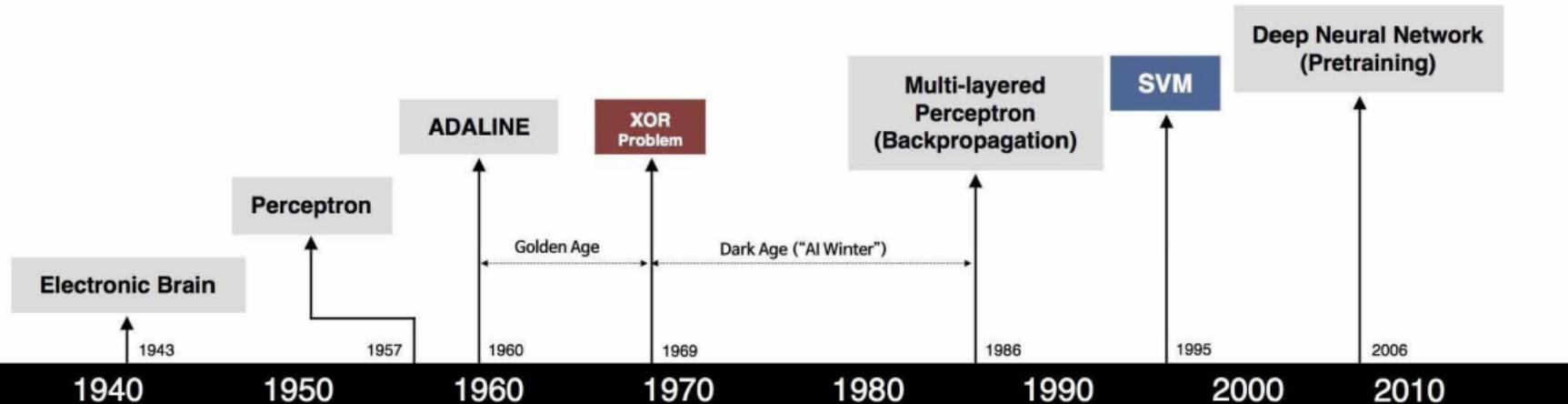


Machine Learning



Deep Learning





S. McCulloch - W. Pitts



F. Rosenblatt



B. Widrow - M. Hoff



M. Minsky - S. Papert



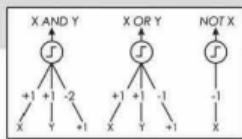
D. Rumelhart - G. Hinton - R. Williams



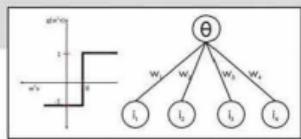
V. Vapnik - C. Cortes



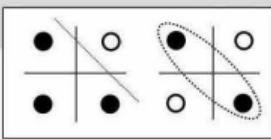
G. Hinton - S. Ruslan



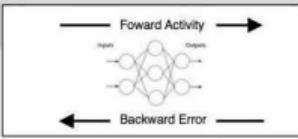
- Adjustable Weights
- Weights are not Learned



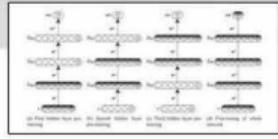
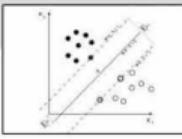
- Learnable Weights and Threshold



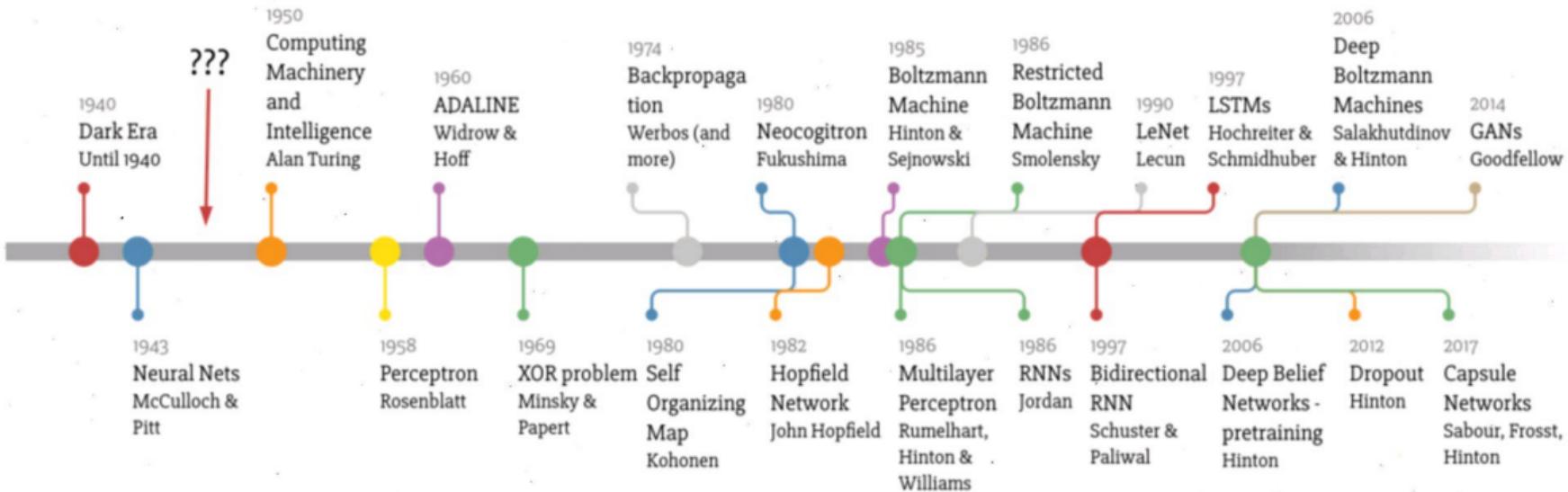
- XOR Problem

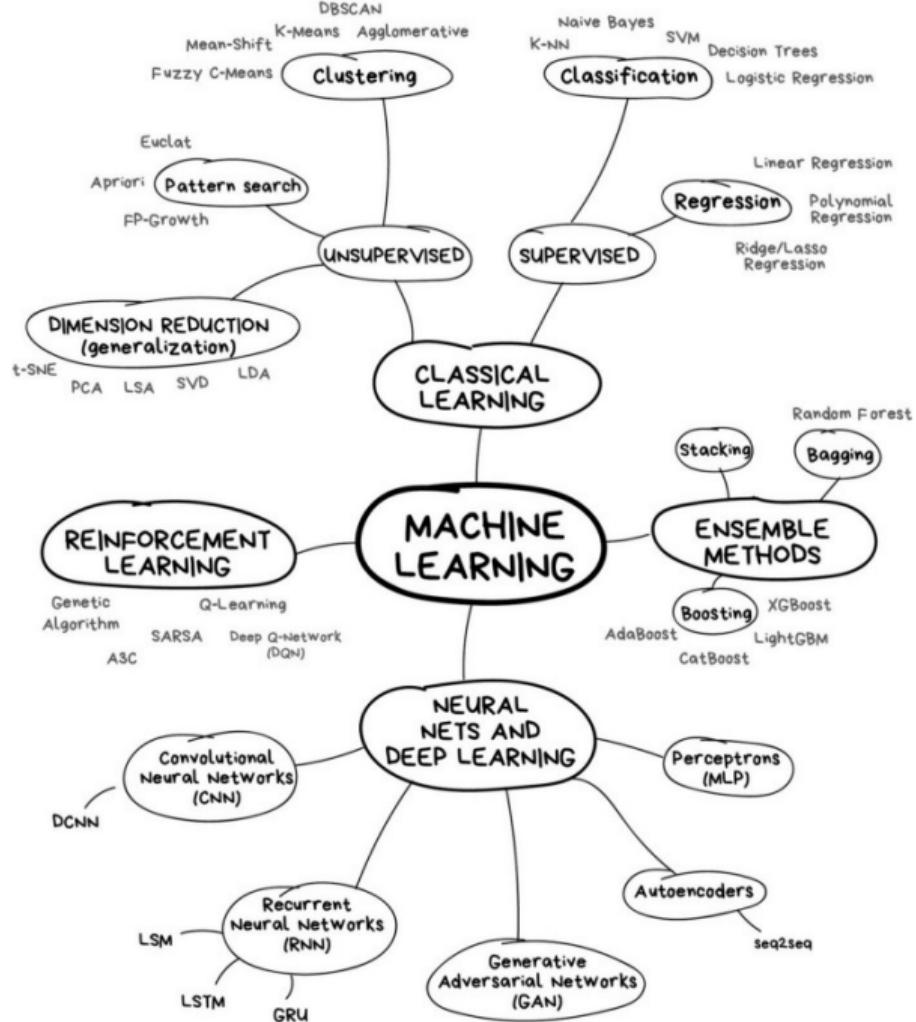


- Solution to nonlinearly separable problems
- Big computation, local optima and overfitting
- Limitations of learning prior knowledge
- Kernel function: Human Intervention



Deep Learning Timeline

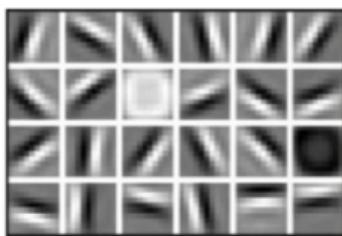




¿Por qué Deep Learning y por qué ahora?

¿Por qué el Deep Learning?

- Las características diseñadas a mano consumen mucho tiempo, son frágiles y no se pueden escalar en la práctica.
- ¿Podemos aprender las **características subyacentes** directamente de los datos?



(g) Características de bajo nivel: Líneas y bordes



(h) Características de nivel medio: Ojos, nariz y oídos



(i) Características de alto nivel: Estructura facial

¿Por qué ahora

1952	Stochastic Gradient Descent
1958	Perceptron <ul style="list-style-type: none">• Learnable Weights
⋮	⋮
1986	Backpropagation <ul style="list-style-type: none">• Multi-Layer Perceptron
1995	Deep Convolutional NN <ul style="list-style-type: none">• Digit Recognition
⋮	⋮

Las redes neuronales se remontan a décadas atrás, así que ¿por qué el resurgimiento?

1. Big Data

- Conjuntos de datos más grandes
- Recolección y almacenamiento más fácil

IMGENET



2. Hardware

- Unidades de procesamiento gráfico (GPU)
- Masivamente paralelizable



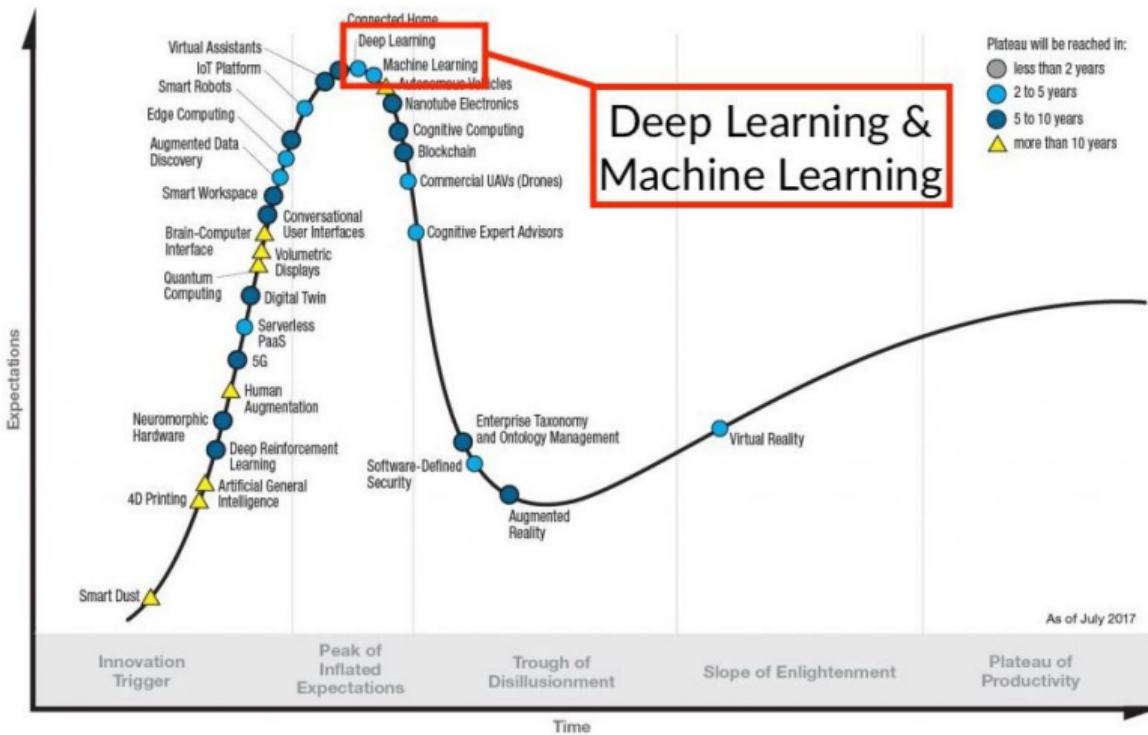
3. Software

- Técnicas mejoradas
- Nuevos modelos
- Toolboxes



Aplicaciones

Gartner Hype Cycle for Emerging Technologies, 2017

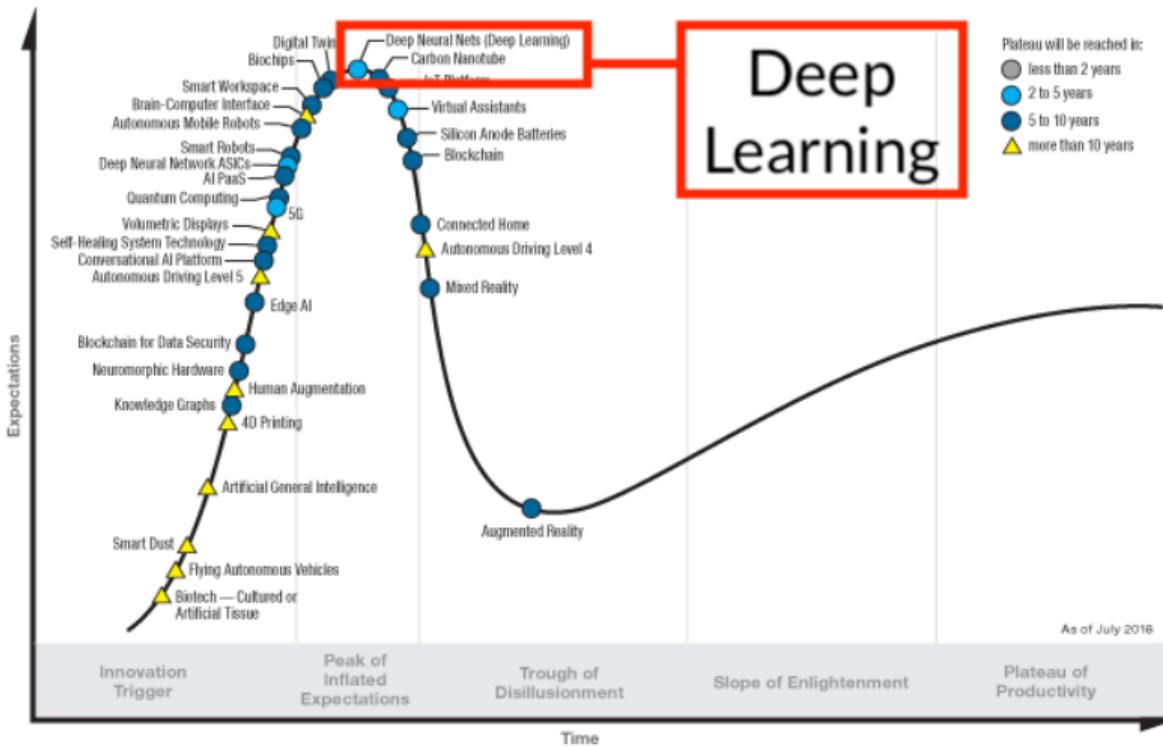


gartner.com/SmarterWithGartner

Source: Gartner (July 2017)
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Gartner®

Hype Cycle for Emerging Technologies, 2018

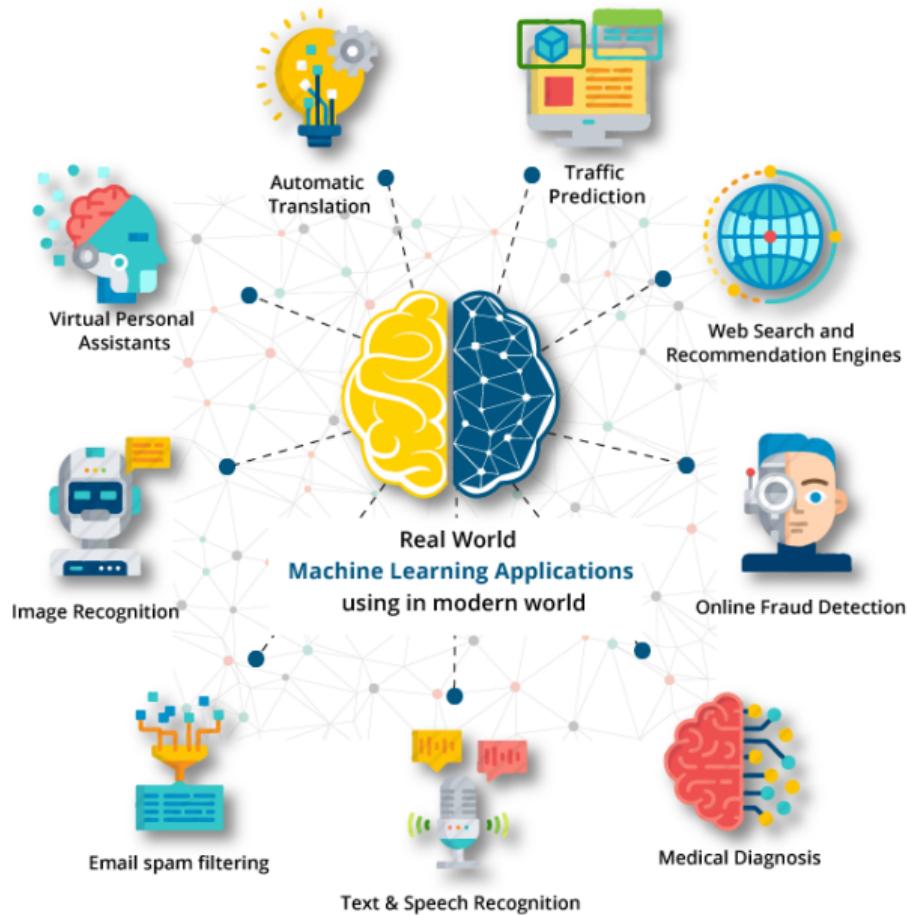


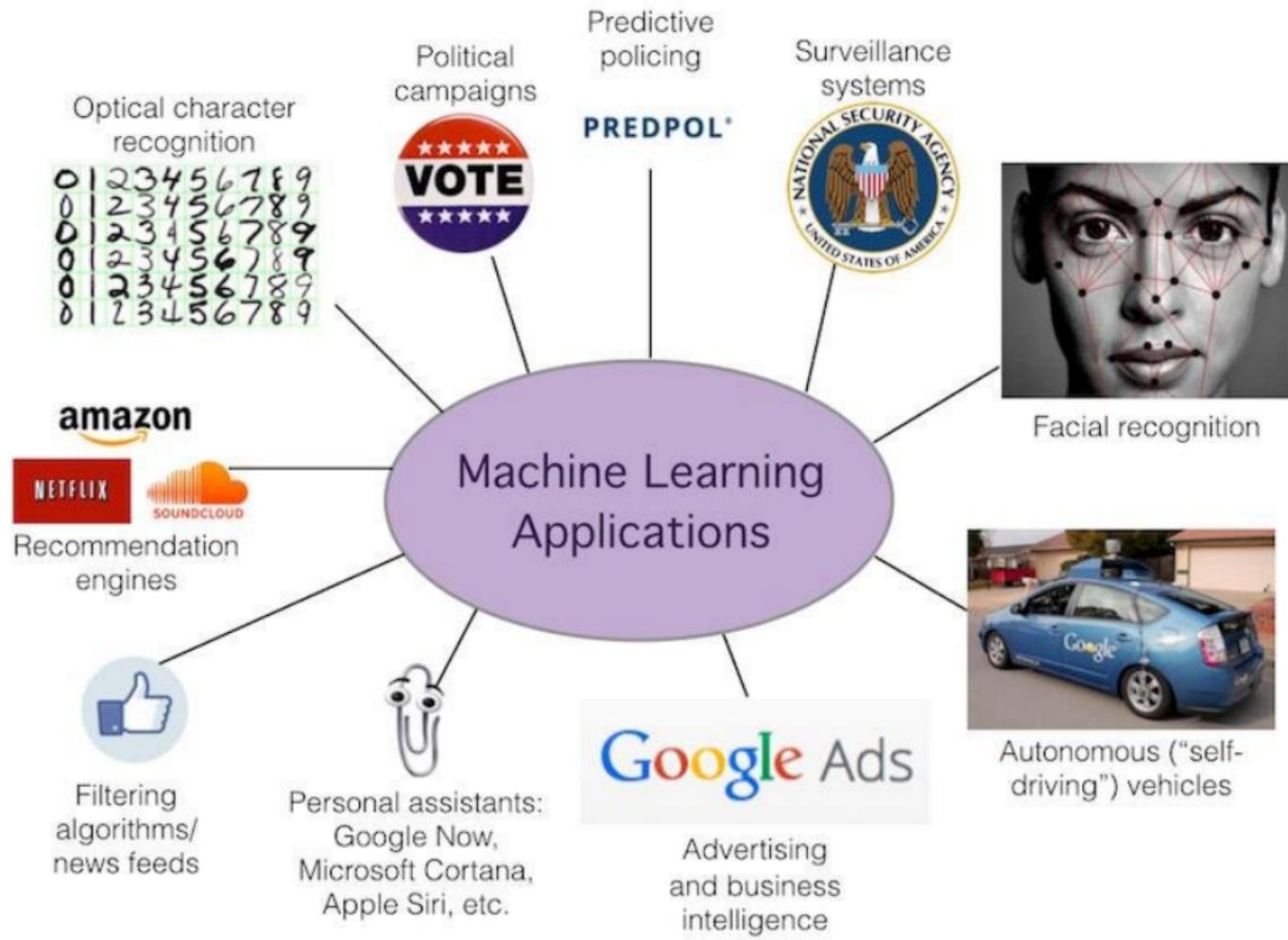
gartner.com/SmarterWithGartner

Source: Gartner (August 2018)

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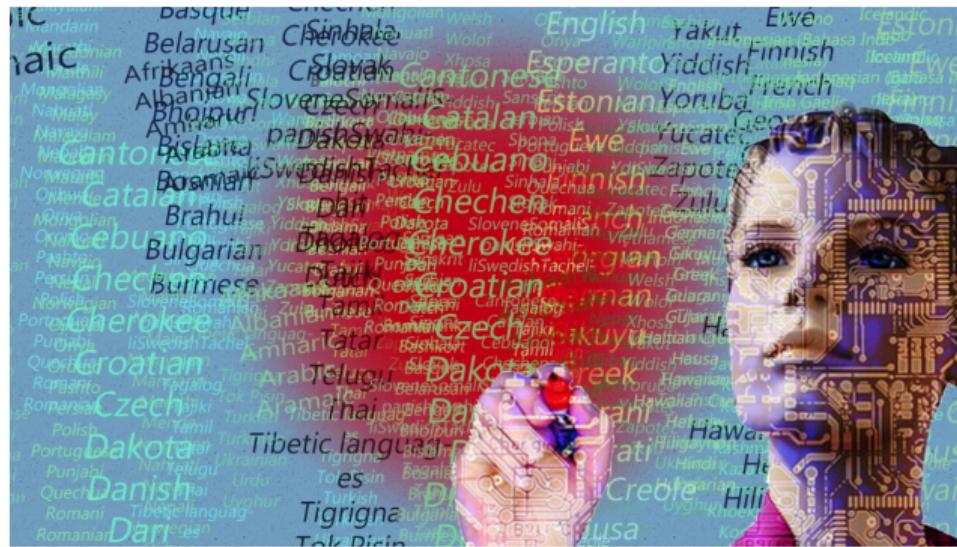
Gartner





Procesamiento de lenguaje natural

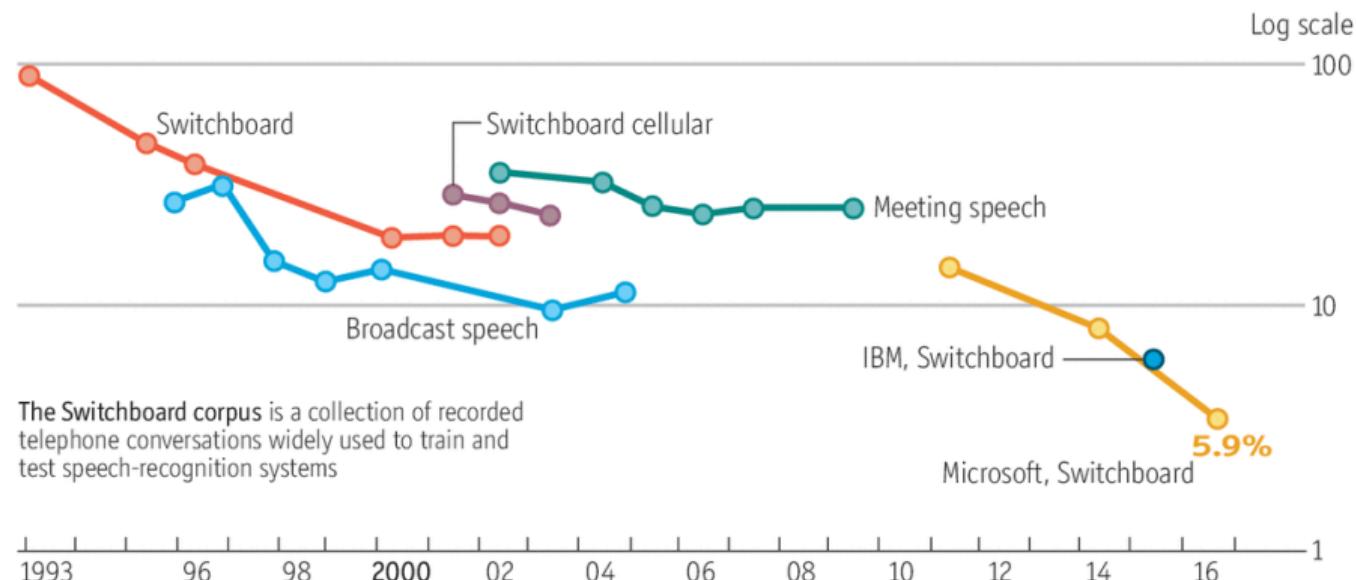
- Dado un texto, predecir la temática
 - Dado un email, predecir si este es un spam
 - Dado un texto, predecir el idioma y su traducción a otro lenguaje



Reconocimiento de Voz

Loud and clear

Speech-recognition word-error rate, selected benchmarks, %



The **Switchboard corpus** is a collection of recorded telephone conversations widely used to train and test speech-recognition systems

Sources: Microsoft; research papers

Economist.com

Reconocimiento de Voz

FAR-FIELD

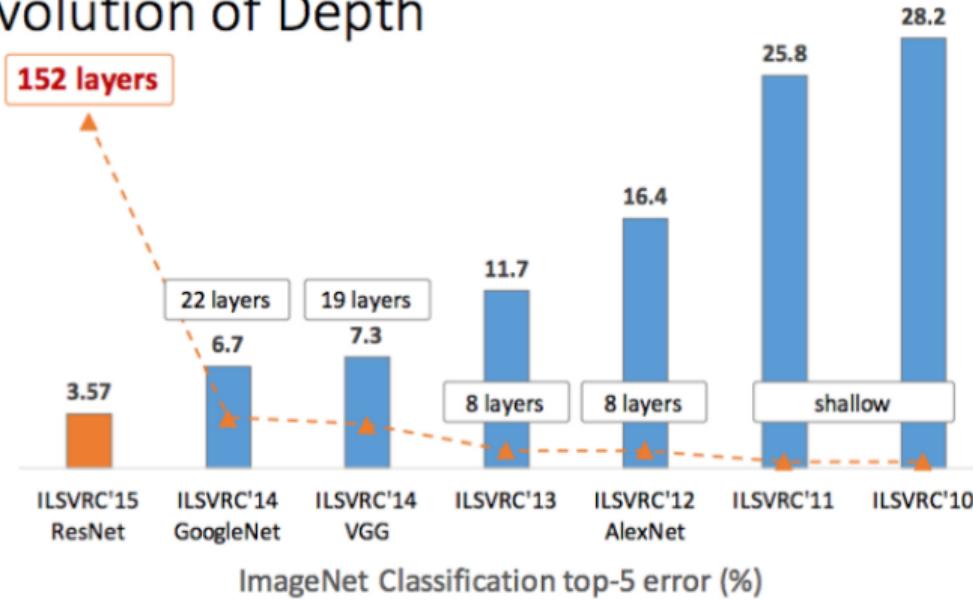
VOICE RECOGNITION



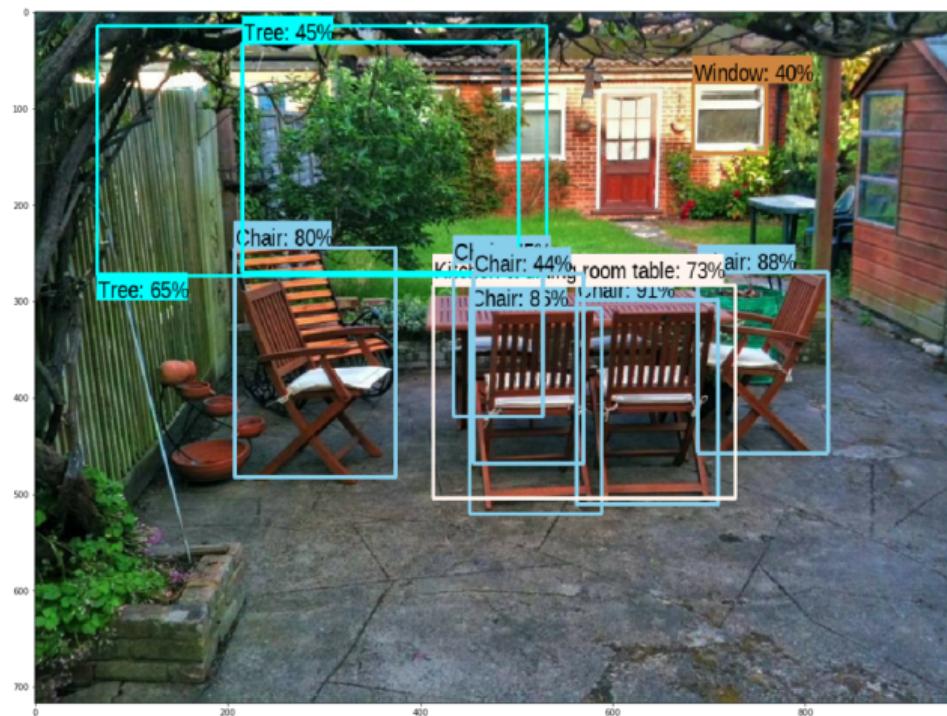
▶ ver video

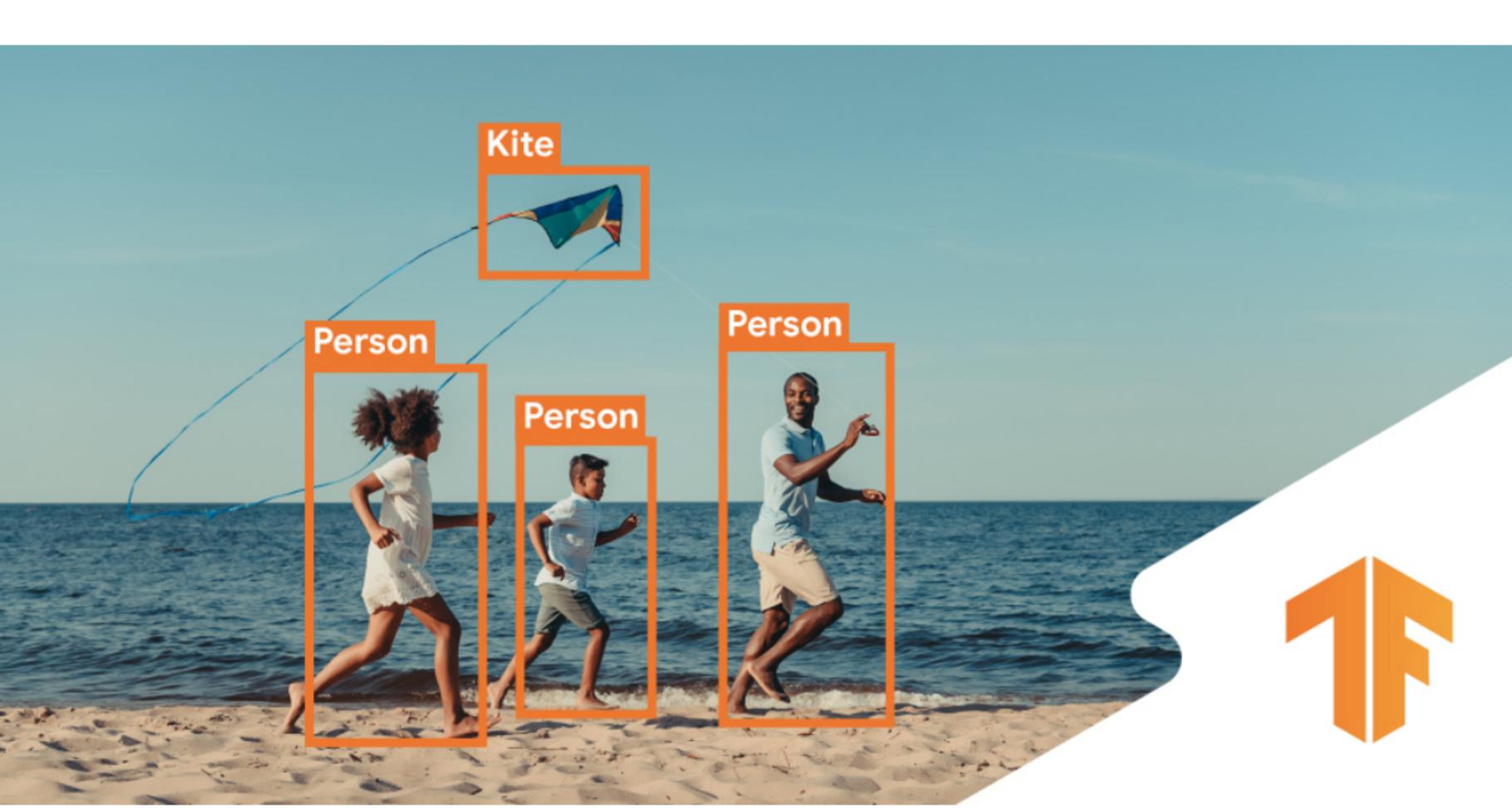
Visión por Computador

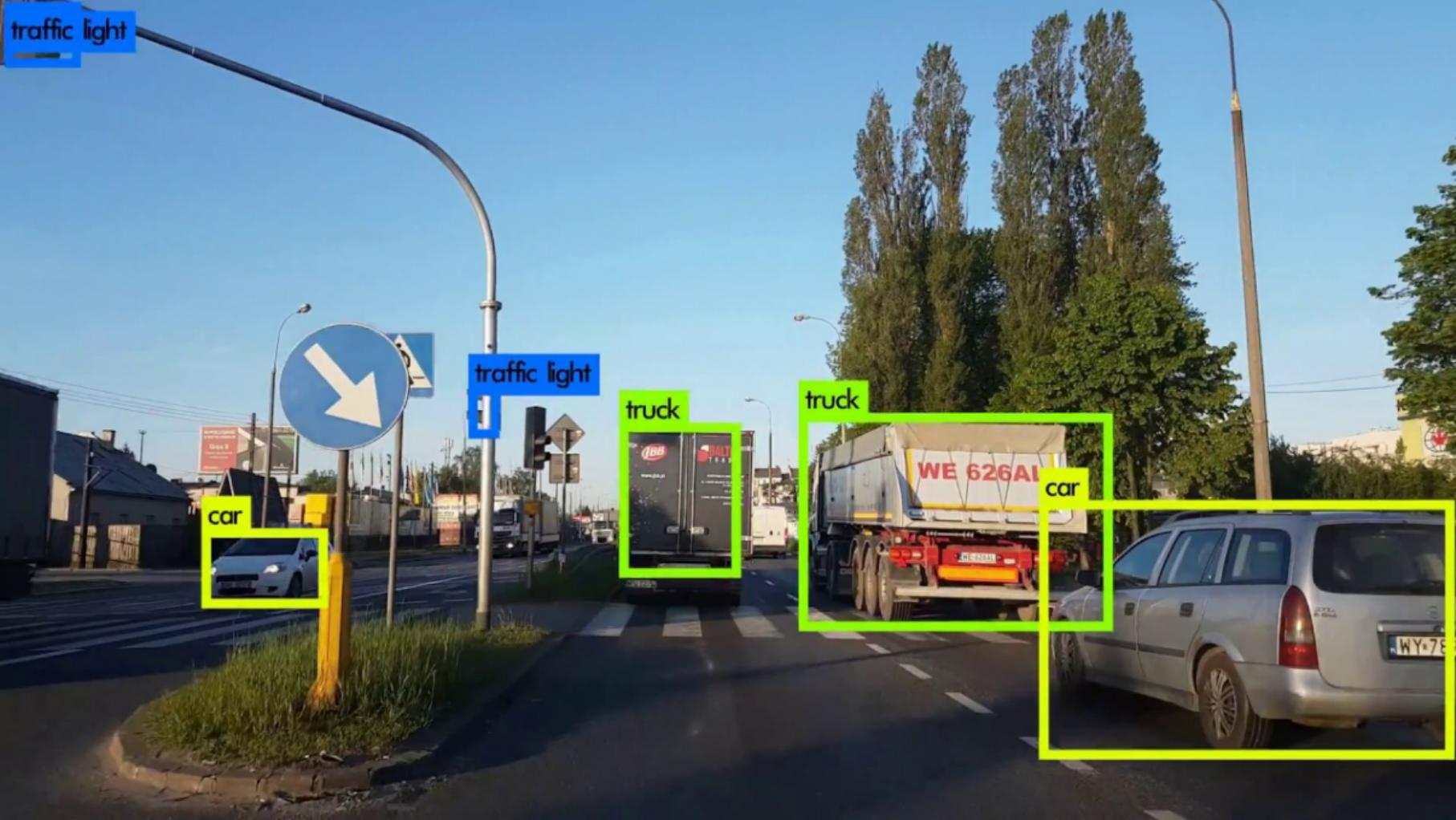
Revolution of Depth



Detección de objetos





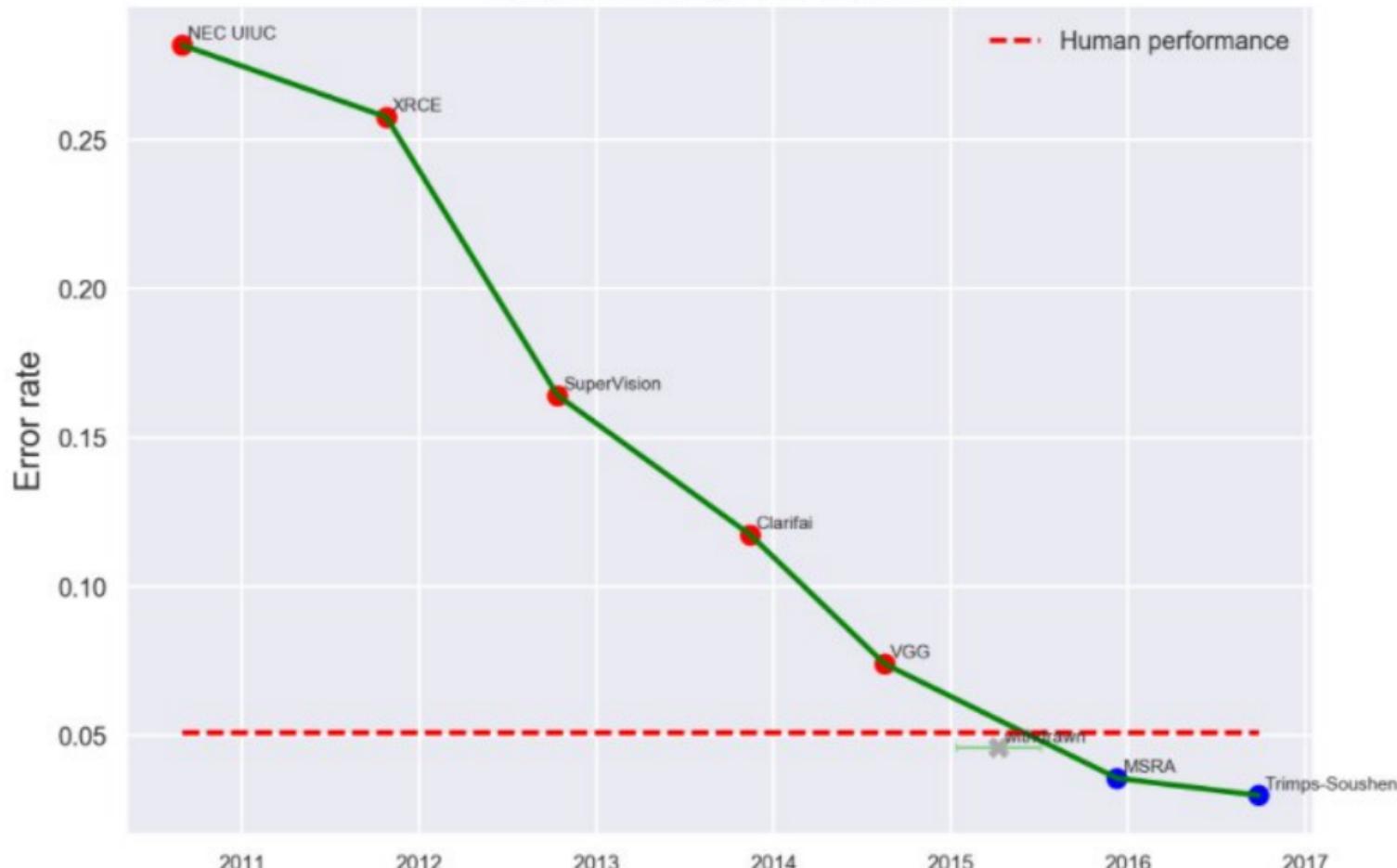


Detección de objetos



▶ demo

Imagenet Image Recognition



Semantic Segmentation

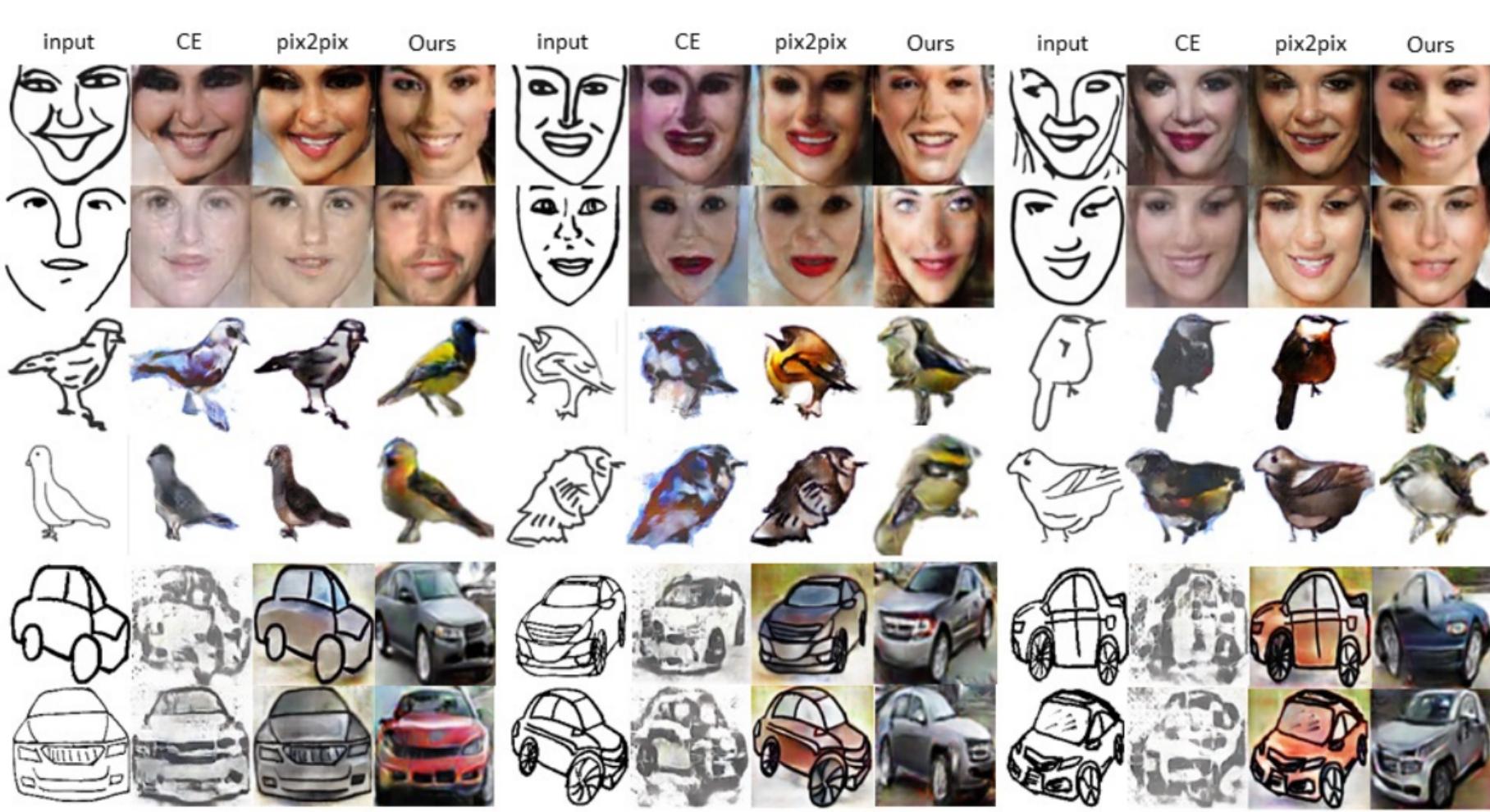


Style transfer

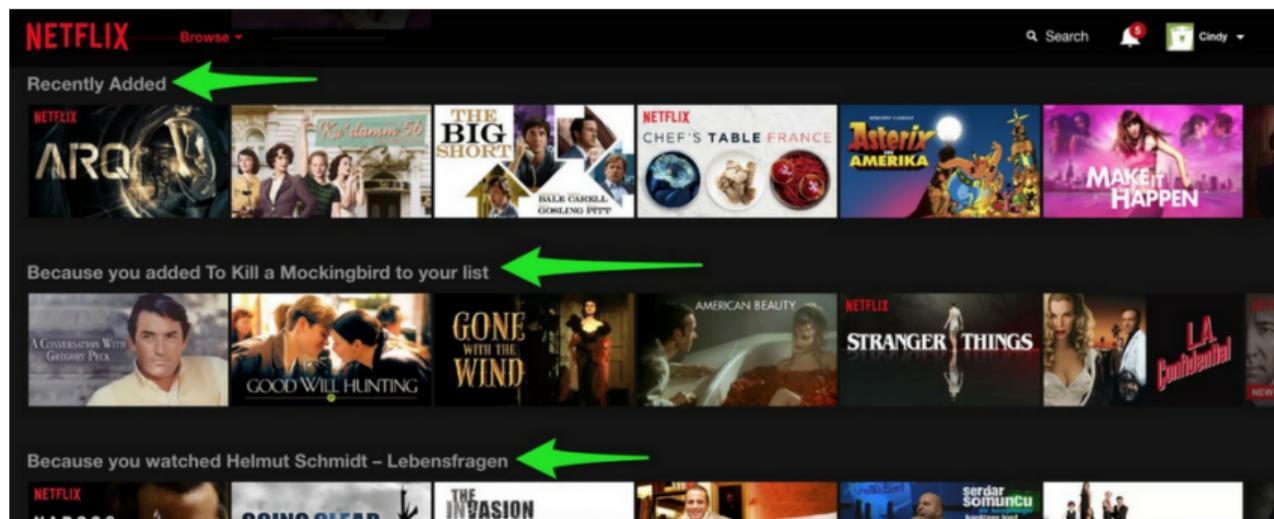
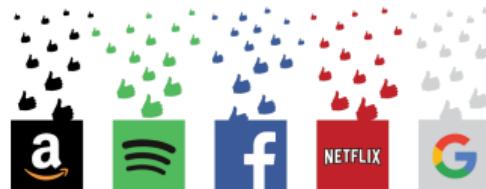


Style transfer





Recommender systems



Recently Added

Because you added *To Kill a Mockingbird* to your list

Because you watched *Helmut Schmidt – Lebensfragen*

Muchas gracias por su atención

¿Preguntas?

Contacto: Marco Teran
webpage: marcoteran.github.io/