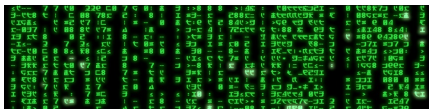
Inteligencia Artificial

Introducción



Marco Teran

UTADEO
UNIVERSIDAD DE BOGOTÁ JORGE TADEO LOZANO

2021 - Bogotá

Contenido

Un poco de historia...

The thinking machine

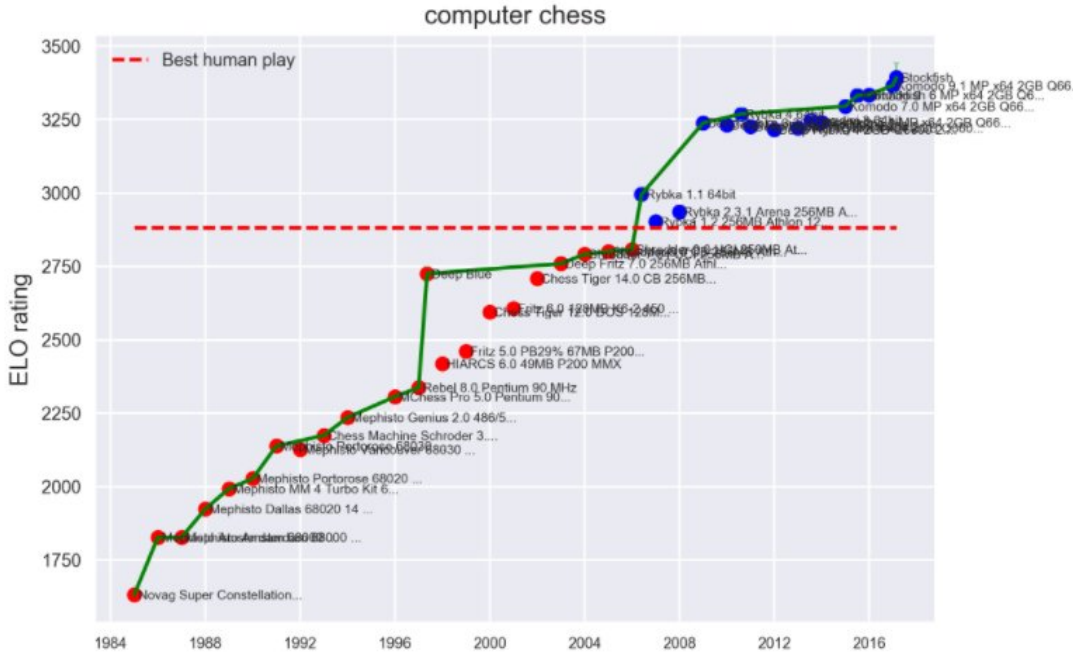
ver video

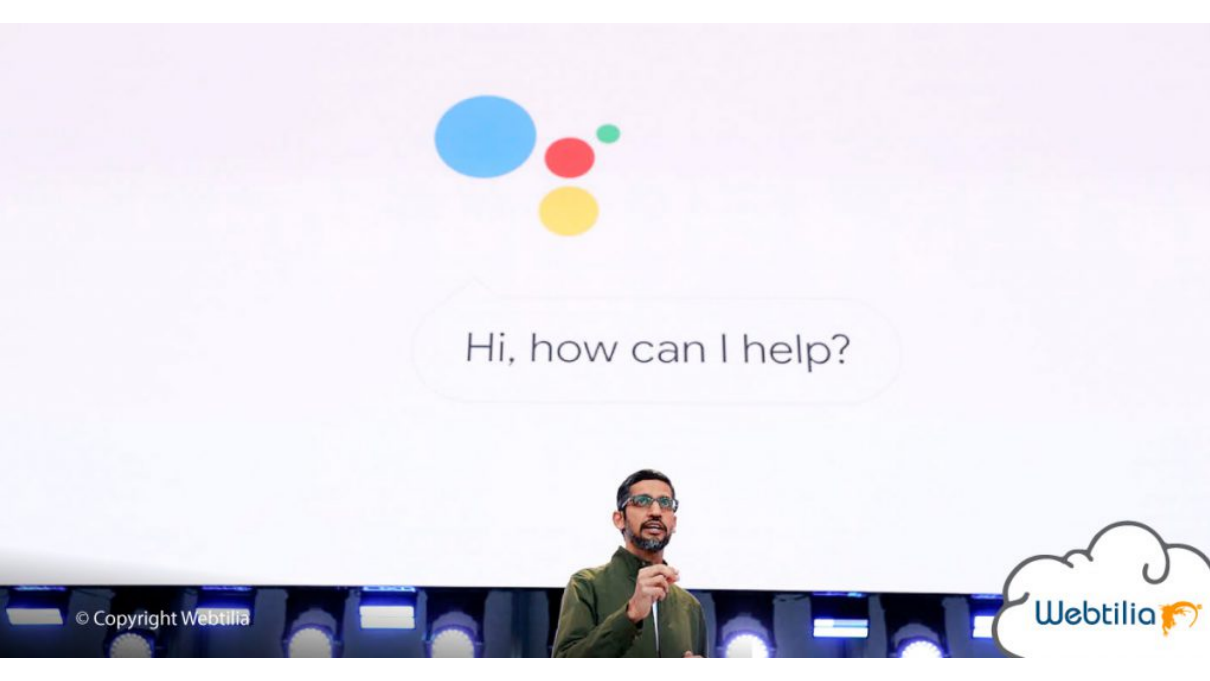
DeepBlue vs Gasparov (1997)

ver video

DeepBlue vs Gasparov (1997)

ver video


computer chess
Best human play
ELO rating
3500
3250
3000
2750
2500
2250
2000
1750
1984
1988
1992
1996
2000
2004
2008
2012
2016
Stockfish
Komodo 7.0 MP x64 2GB Q66...
Rybka 1.1 64bit
Rybka 2.3.1 Arena 256MB A...
Deep Blue
Chess Tiger 14.0 CB 256MB...
Fritz 5.0 PB29% 67MB P200...
HIARCS 6.0 49MB P200 MMX
Rebel 8.0 Pentium 90 MHz
Mephisto Genius 2.0 486/5...
Chess Machine Schroder 3....
Mephisto Portorose 68020 ...
Mephisto MM 4 Turbo Kit 6...
Mephisto Dallas 68020 14 ...
Novag Super Constellation...


Hi, how can I help?
© Copyright Webtilia
Webtilia

Google Duplex (2018)

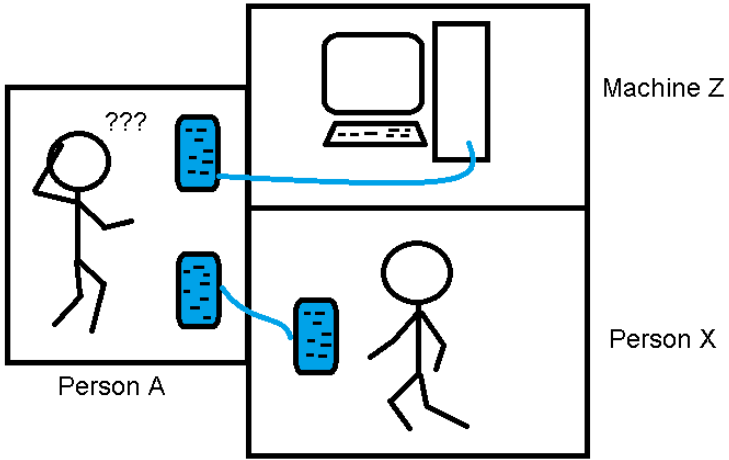
Google Duplex

Advancing AI for Everyone

ver video

¿Qué es la Ingeligencia Artificial?

El test de turing



El test de turing

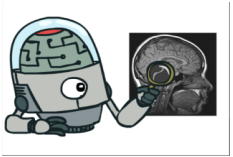
Inteligencia Artificial

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)"

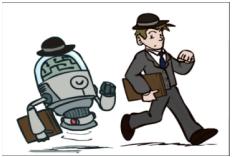
La toma de buenas decisiones requiere **conocimiento** en forma **operacional**.

Cuatro enfoques



(a) Pensar como humano

(b) Pensar racionalmente



(c) Actuar como humano

(d) Actuar racionalmente

¿Qué es IA?

La ciencia de hacer máquinas que:

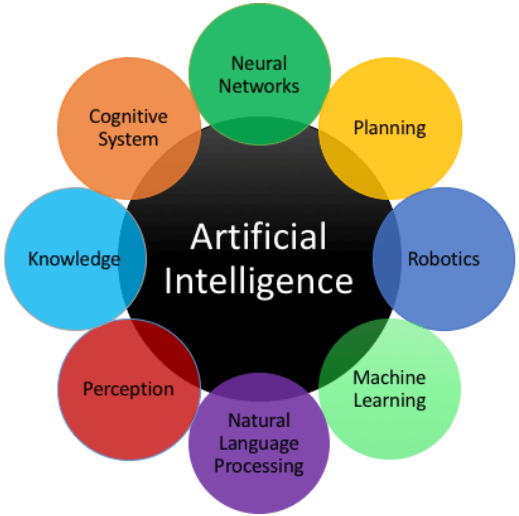
- Piensen como las personas.
- Actúen como las personas (acciones y comportamientos de humanos)
- Piensen y actúen racionalmente.

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 $\rightarrow$ función de utilidad
- Actuar racionalmente $\rightarrow$ maximizar la utilidad



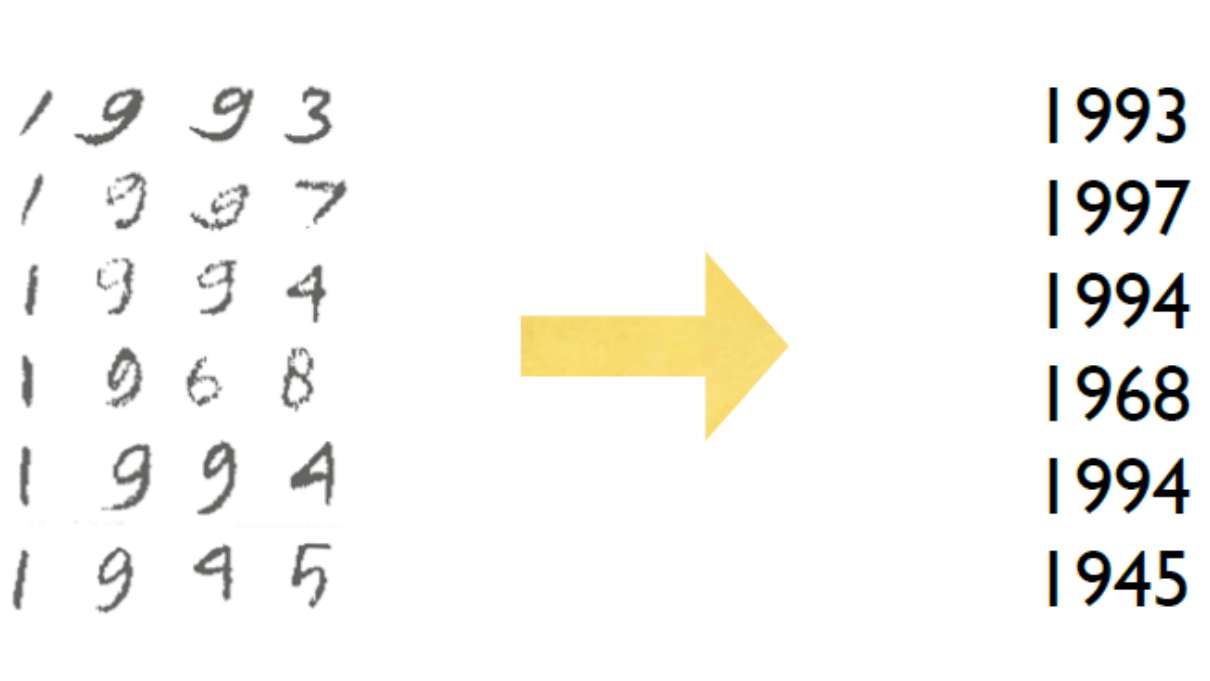
Requerimientos para un agent ideal:

- Representación del Conocimiento/Razonamient
- 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
1945

Aprendizaje de maquina

Programación tradicional

Machine Learning

Aprendizaje de maquina

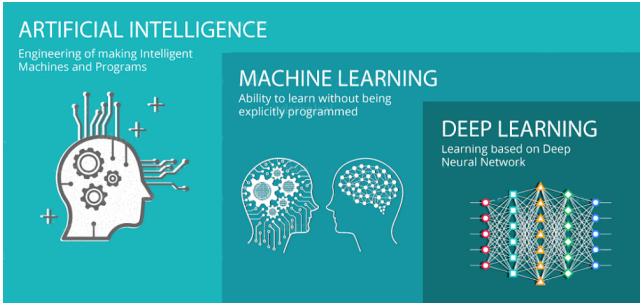
La noción de aprendizaje puede ser definida de varias formas:

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

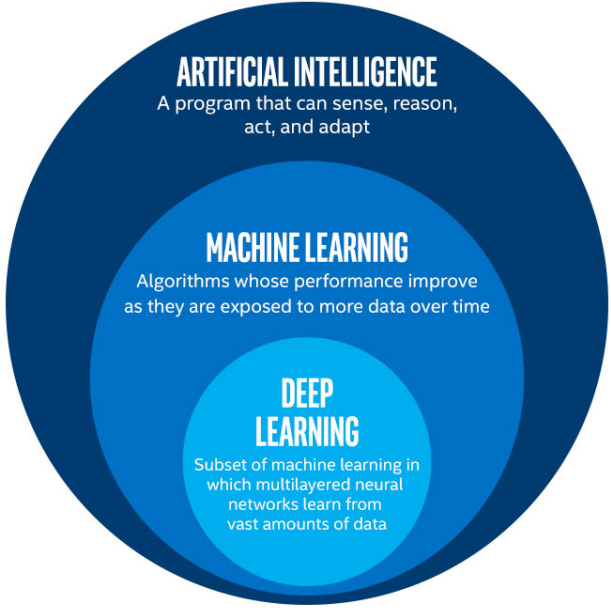
"the act of acquiring new, or modifying and reinforcing, existing knowledge, behaviors, skills, values, or preferences"

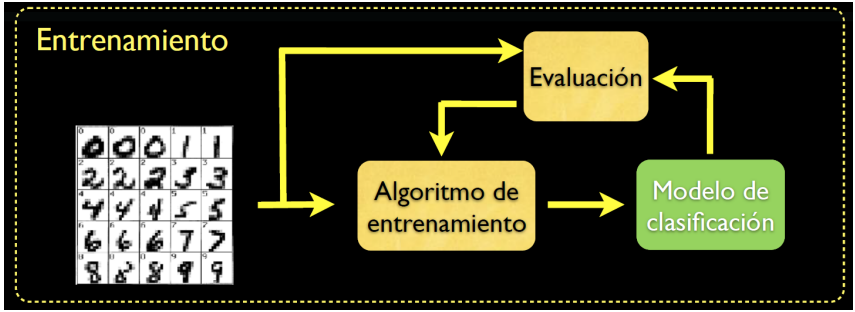
El **aprendizaje de máquina (machine learning)** estudia algoritmos computacionales que permiten a un agente aprender a hacer cosas (acciones, decisiones, ...)

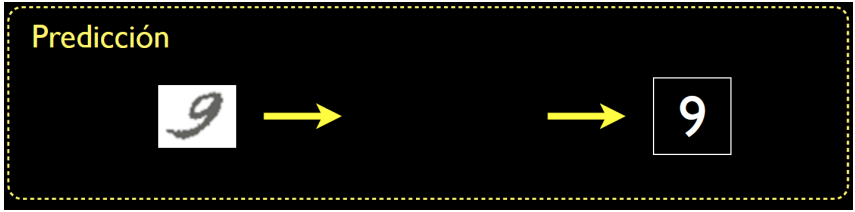
Inteligencia Artificial

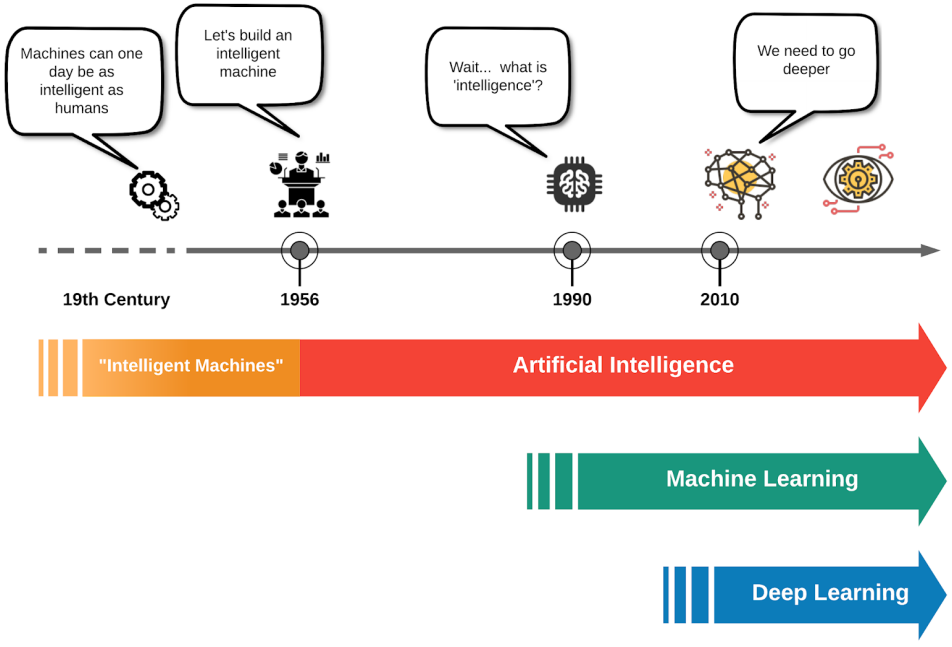


- **Inteligencia Artificial (Artificial Intelligence):** Cualquier técnica que permita a los ordenadores imitar el comportamiento humano
- **Aprendizaje de maquina (Machine Learning):** Capacidad de aprender sin ser programado explícitamente
- **Aprendizaje profundo (Deep Learning):** Extraer patrones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

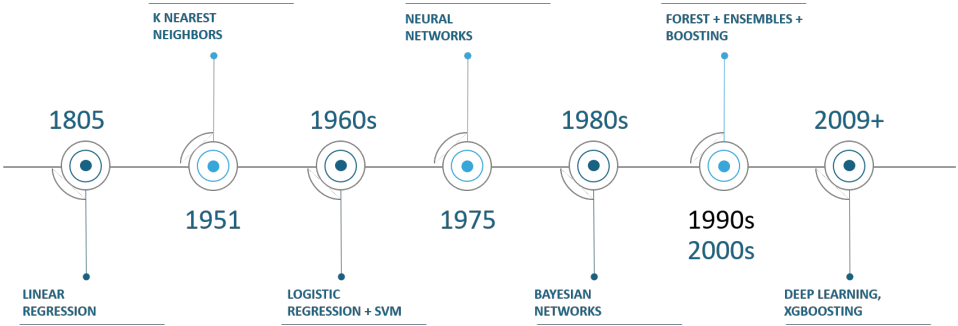

ARTIFICIAL INTELLIGENCE
A program that can sense, reason, act, and adapt
MACHINE LEARNING
Algorithms whose performance improve as they are exposed to more data over time
DEEP LEARNING
Subset of machine learning in which multilayered neural networks learn from vast amounts of data


Entrenamiento
Evaluación
Algoritmo de entrenamiento
Modelo de clasificación


Predicción
9


Machines can one day be as intelligent as humans
Let's build an intelligent machine
Wait... what is 'intelligence'?
We need to go deeper
19th Century
1956
1990
2010
"Intelligent Machines"
Artificial Intelligence
Machine Learning
Deep Learning

Línea del tiempo del Machine Learning



Redes Neuronales

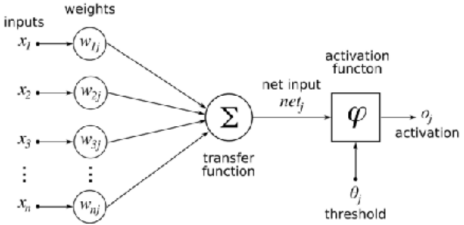
McCulloch & Pitts Artificial Neuron

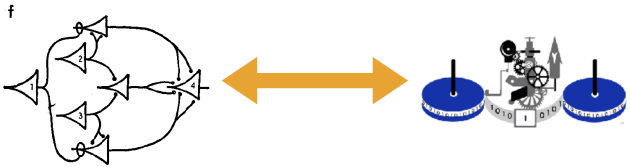
BULLETIN OF
MATHEMATICAL BIOPHYSICS
VOLUME 5, 1943

A LOGICAL CALCULUS OF THE
IDEAS IMMANENT IN NERVOUS ACTIVITY

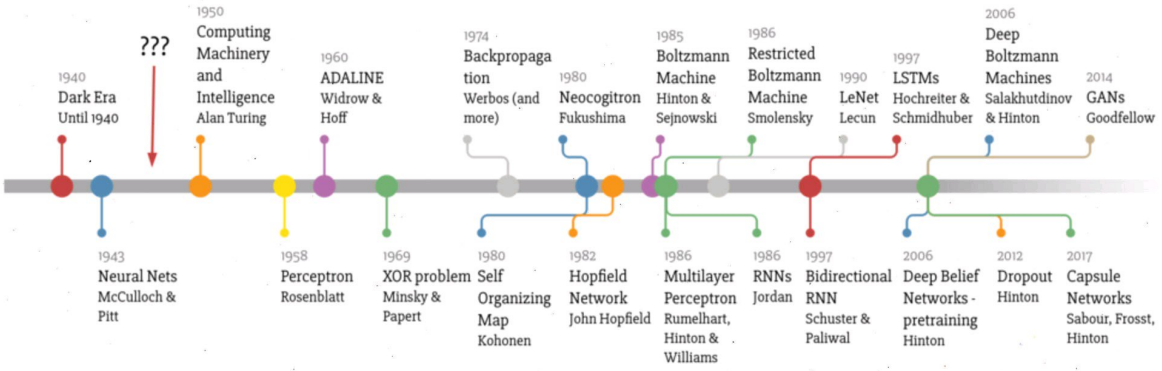
WARREN S. MCCULLOCH AND WALTER PITTS

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

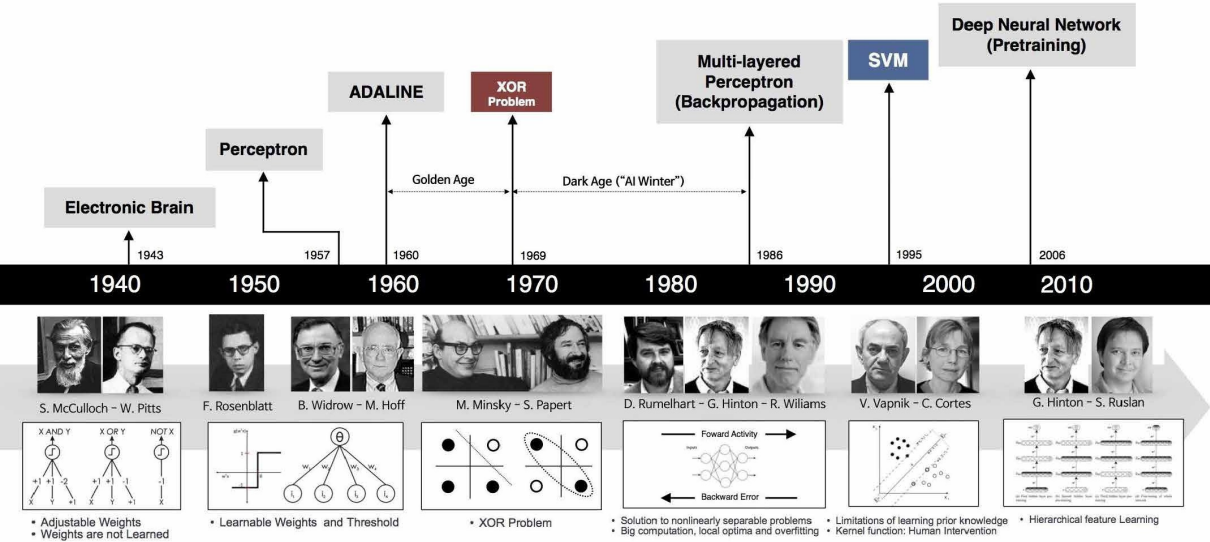


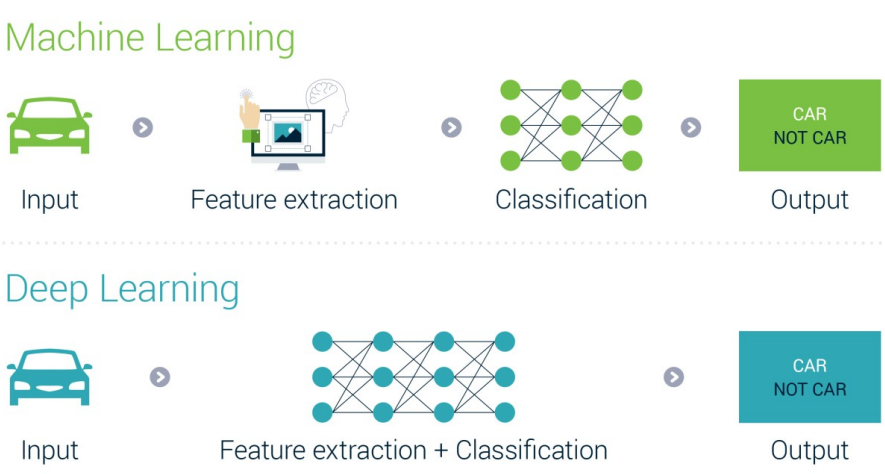


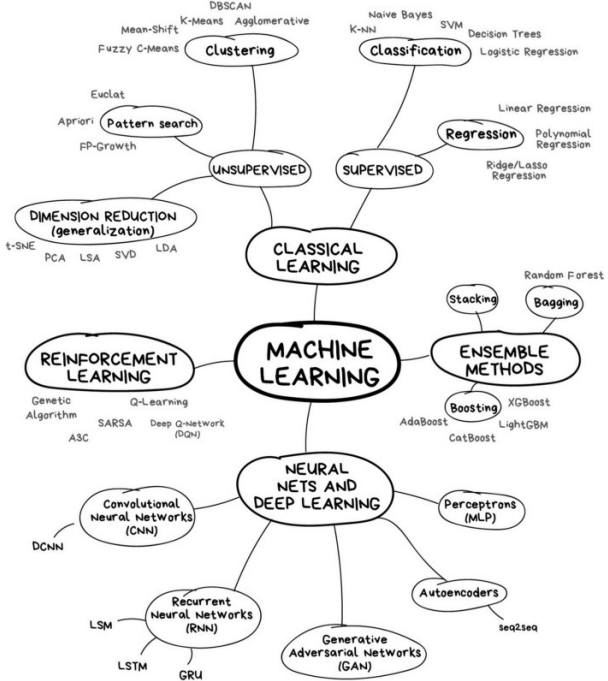
Deep Learning Timeline



Made by Favio Vázquez



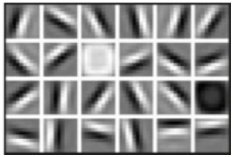

Machine Learning
Input
Feature extraction
Classification
CAR
NOT CAR
Output
Deep Learning
Input
Feature extraction + Classification
CAR
NOT CAR
Output


MACHINE LEARNING
CLASSICAL LEARNING
UNSUPERVISED
Clustering
DBSCAN
K-Means
Agglomerative
Mean-Shift
Fuzzy C-Means
Pattern search
Euclat
Apriori
FP-Growth
DIMENSION REDUCTION (generalization)
t-SNE
PCA
LSA
SVD
LDA
SUPERVISED
Classification
Naive Bayes
K-NN
SVM
Decision Trees
Logistic Regression
Regression
Linear Regression
Polynomial Regression
Ridge/Lasso Regression
ENSEMBLE METHODS
Stacking
Bagging
Random Forest
Boosting
XGBoost
AdaBoost
LightGBM
CatBoost
REINFORCEMENT LEARNING
Genetic Algorithm
ASC
SARSA
Q-Learning
Deep Q-Network (DQN)
NEURAL NETS AND DEEP LEARNING
Convolutional Neural Networks (CNN)
DCNN
Perceptrons (MLP)
Recurrent Neural Networks (RNN)
LSM
LSTM
GRU
Generative Adversarial Networks (GAN)
Autoencoders
seq2seq

¿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?

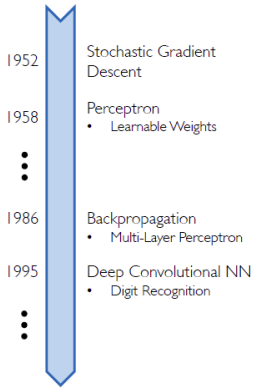


(g) Características de bajo nivel: Líneas y bordes

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

(i) Características de alto nivel: Estructura facial

¿Por qué ahora



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

IMAGENET

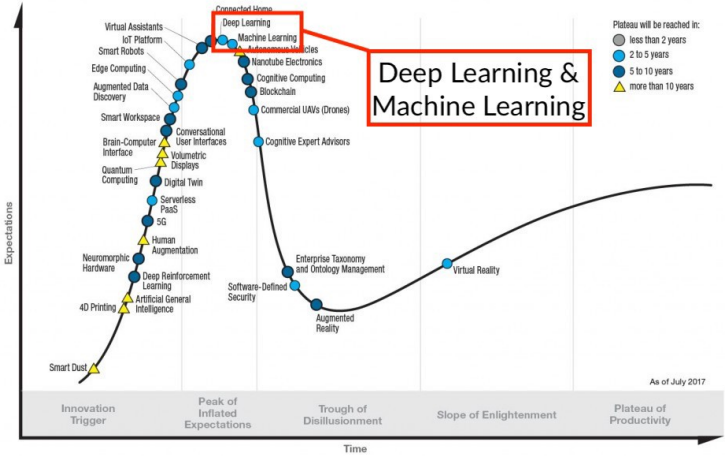
2. **Hardware**
   - Unidades de procesamiento gráfico (GPU)
   - Masivamente paralelizable

3. **Software**
   - Técnicas mejoradas
   - Nuevos modelos
   - Toolboxes

TensorFlow

Apicaciones

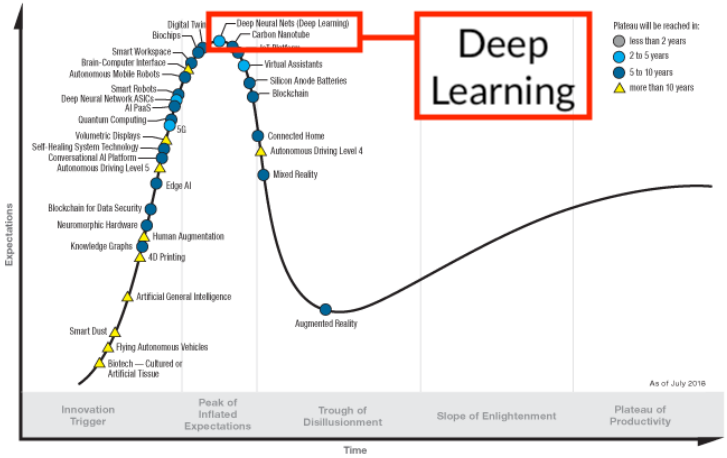
Gartner Hype Cycle for Emerging Technologies, 2017



gartner.com/SmarterWithGartner

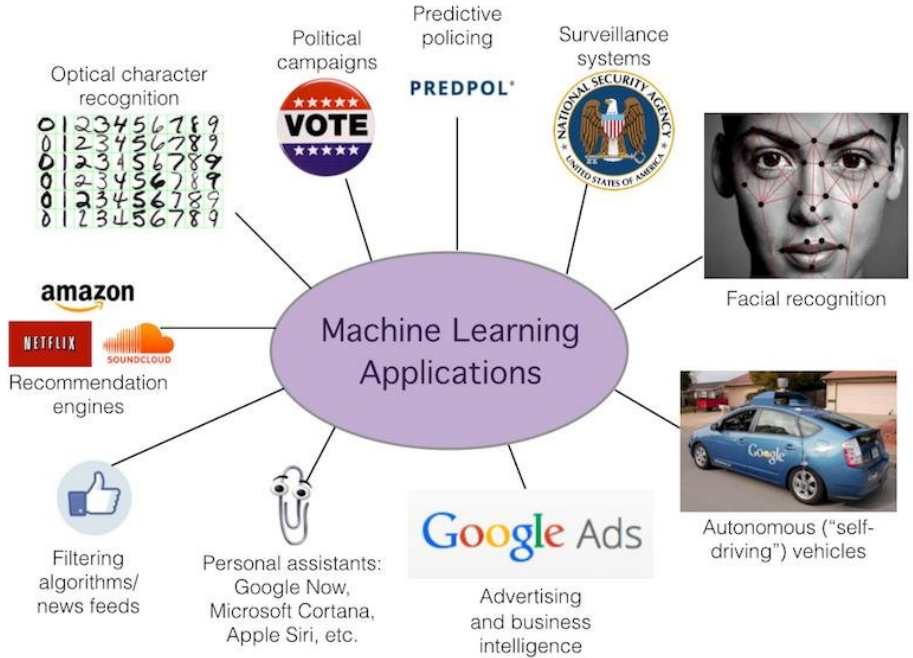
Gartner

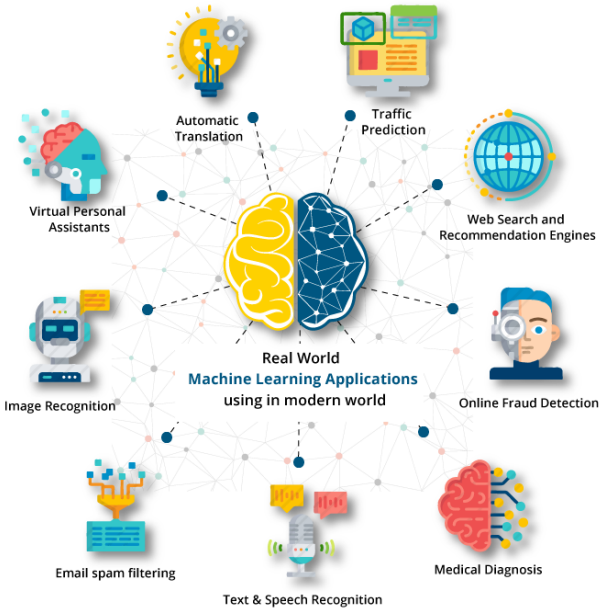
Hype Cycle for Emerging Technologies, 2018



gartner.com/SmarterWithGartner

Gartner


Optical character recognition
Political campaigns
VOTE
Predictive policing
PREDPOL
Surveillance systems
NATIONAL SECURITY AGENCY
UNITED STATES OF AMERICA
Facial recognition
Machine Learning Applications
amazon
NETFLIX
SOUNDCLOUD
Recommendation engines
Autonomous ("self-driving") vehicles
Filtering algorithms/ news feeds
Personal assistants: Google Now, Microsoft Cortana, Apple Siri, etc.
Google Ads
Advertising and business intelligence


Automatic Translation
Traffic Prediction
Virtual Personal Assistants
Web Search and Recommendation Engines
Real World
Machine Learning Applications
using in modern world
Image Recognition
Online Fraud Detection
Email spam filtering
Text & Speech Recognition
Medical Diagnosis

MACHINE LEARNING USE EXAMPLES

THE SELF DRIVING GOOGLE CAR

WEB SEARCH RESULTS

SOCIAL LISTENING APPLICATIONS

MARKET PRICING MODELS

TEXT BASED SENTIMENT ANALYSIS

FRAUD DETECTION

PATTERN RECOGNITION

CREDIT SCORING

PREDICTION OF SUCCESS AND FAILURE

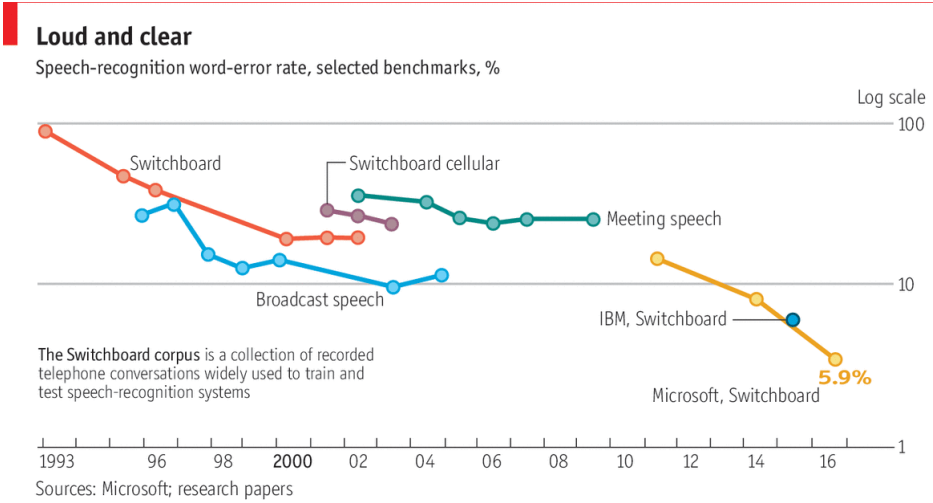
ONLINE RECOMMENDATION OR OFFERS ON BIG ECOMMERCE SITES (AMAZON, NETFLIX)

SQUADEX

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

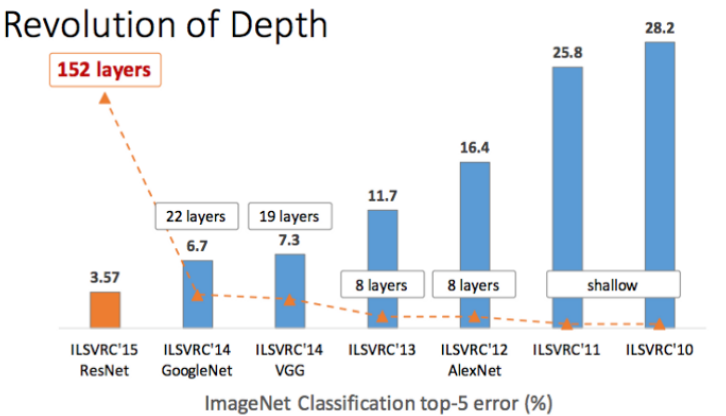
Reconocimiento de Voz



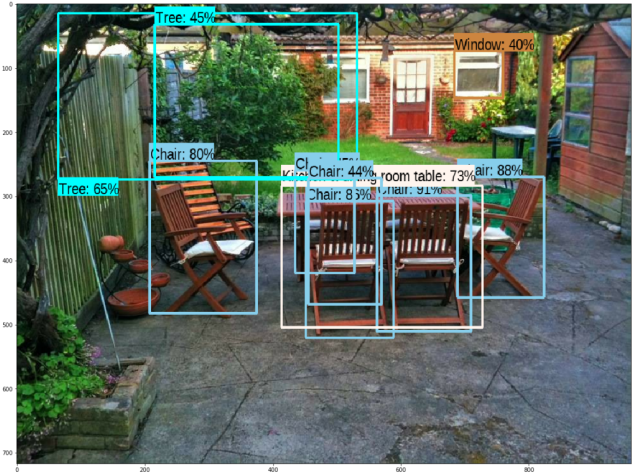
Reconocimiento de Voz

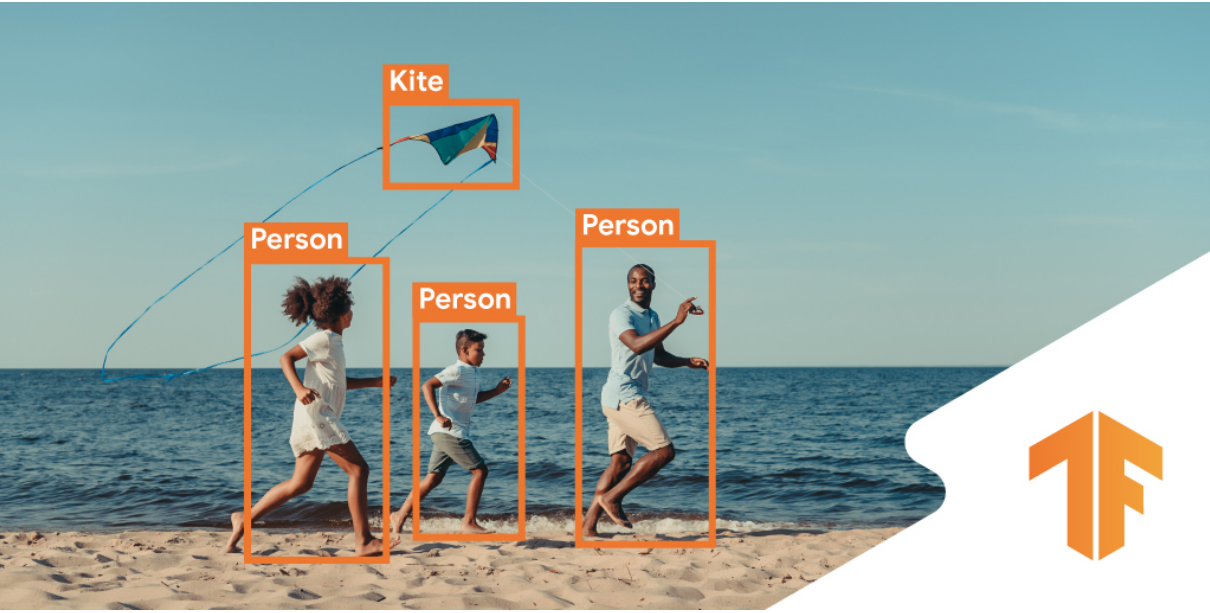
ver video

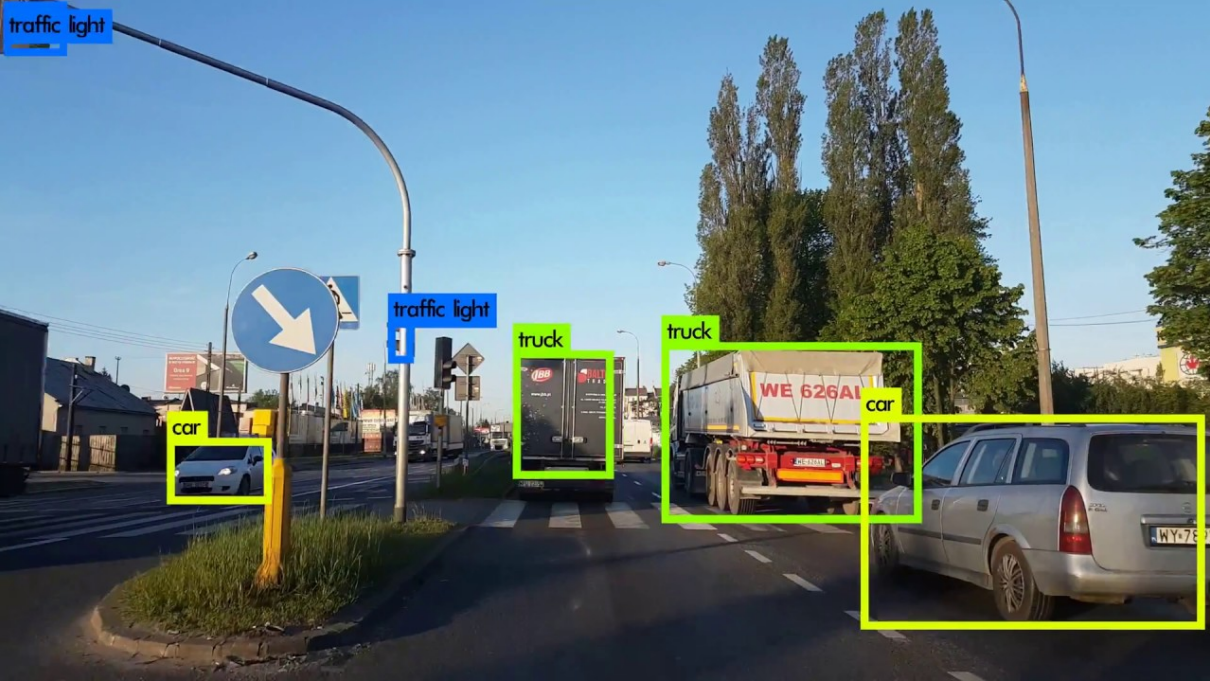
Visión por Computador



Detección de objetos

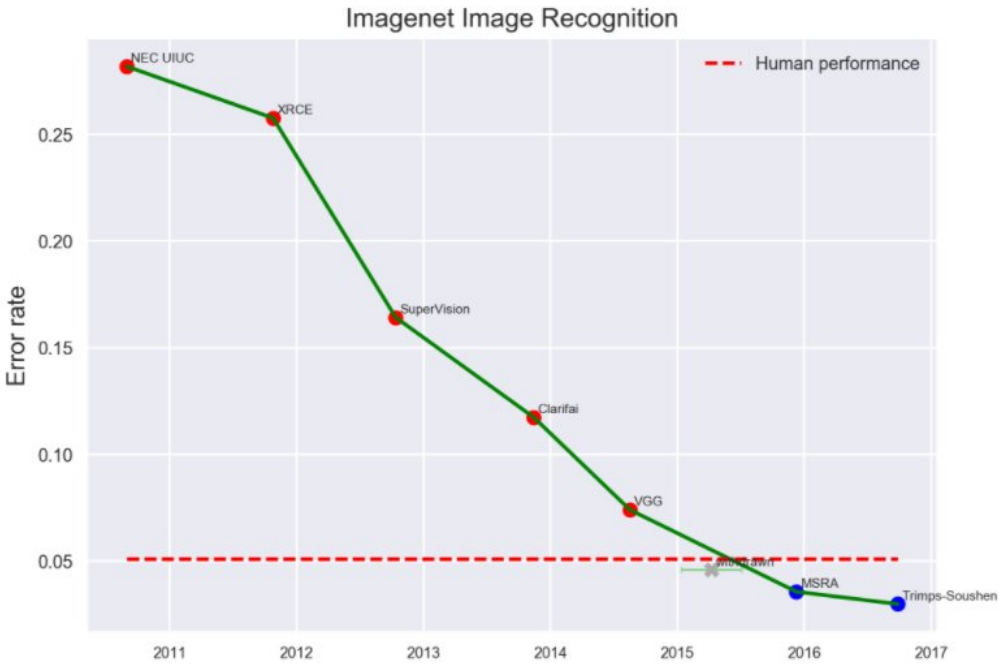



Kite
Person
Person
Person


traffic light
traffic light
truck
truck
car
car

Detección de objetos

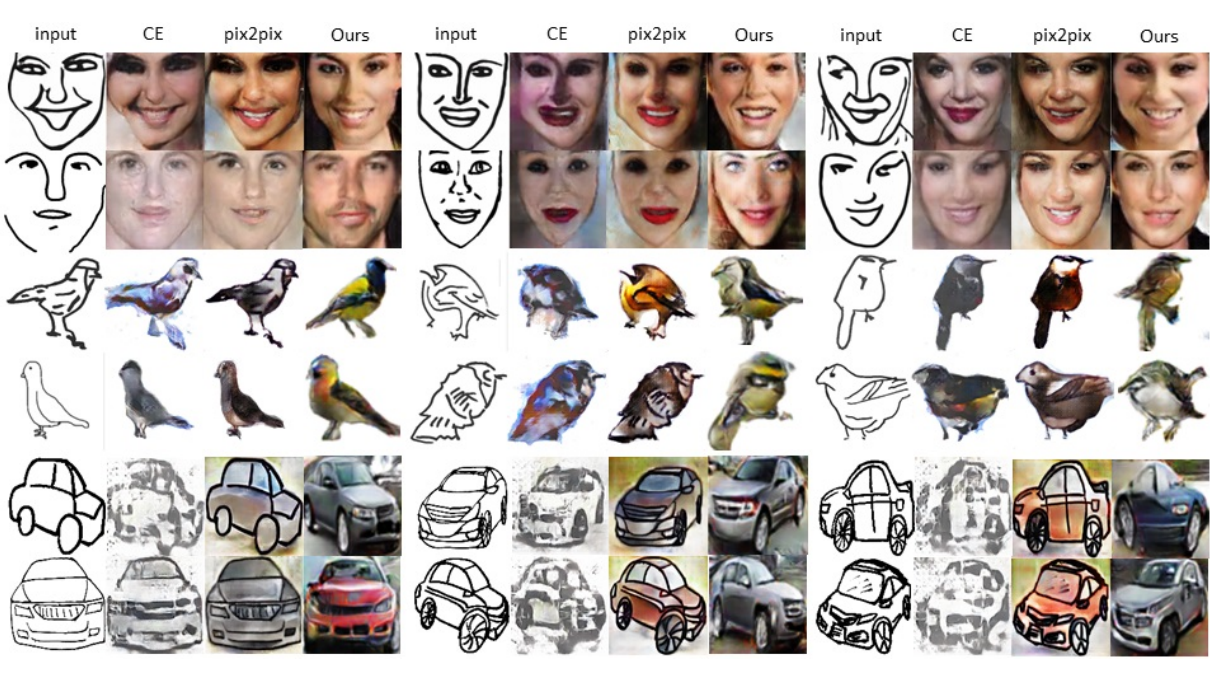
demo


Imagenet Image Recognition
Human performance
NEC UIUC
XRCE
SuperVision
Clarifai
VGG
MSRA
Trimps-Soushen
Error rate
0.25
0.20
0.15
0.10
0.05
2011
2012
2013
2014
2015
2016
2017

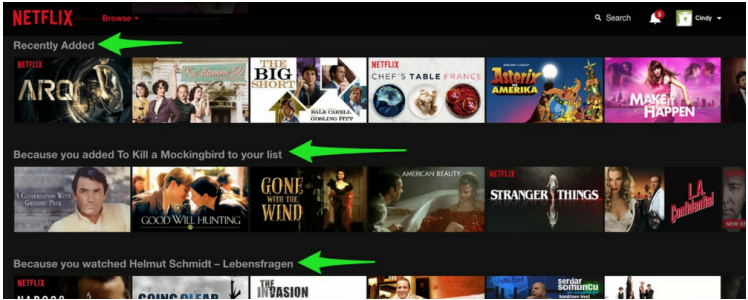
Semantic Segmentation

Style transfer

Style transfer


input
CE
pix2pix
Ours
input
CE
pix2pix
Ours
input
CE
pix2pix
Ours

Recommender systems



Muchas gracias por su atención

¿Preguntas?

Contacto: Marco Teran
e-mail: marcot.terandelah@utadeo.edu.co