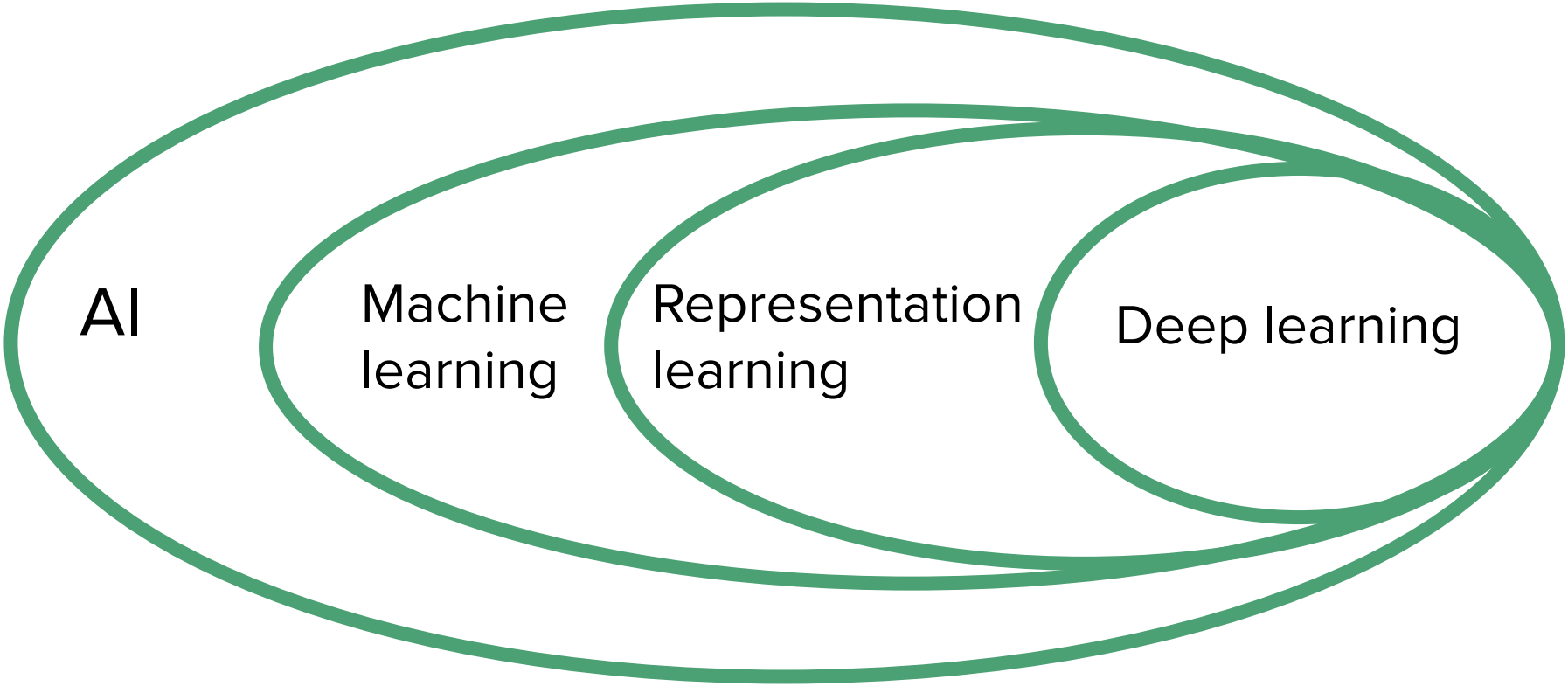
Un panorama desmitificador de la inteligencia artificial

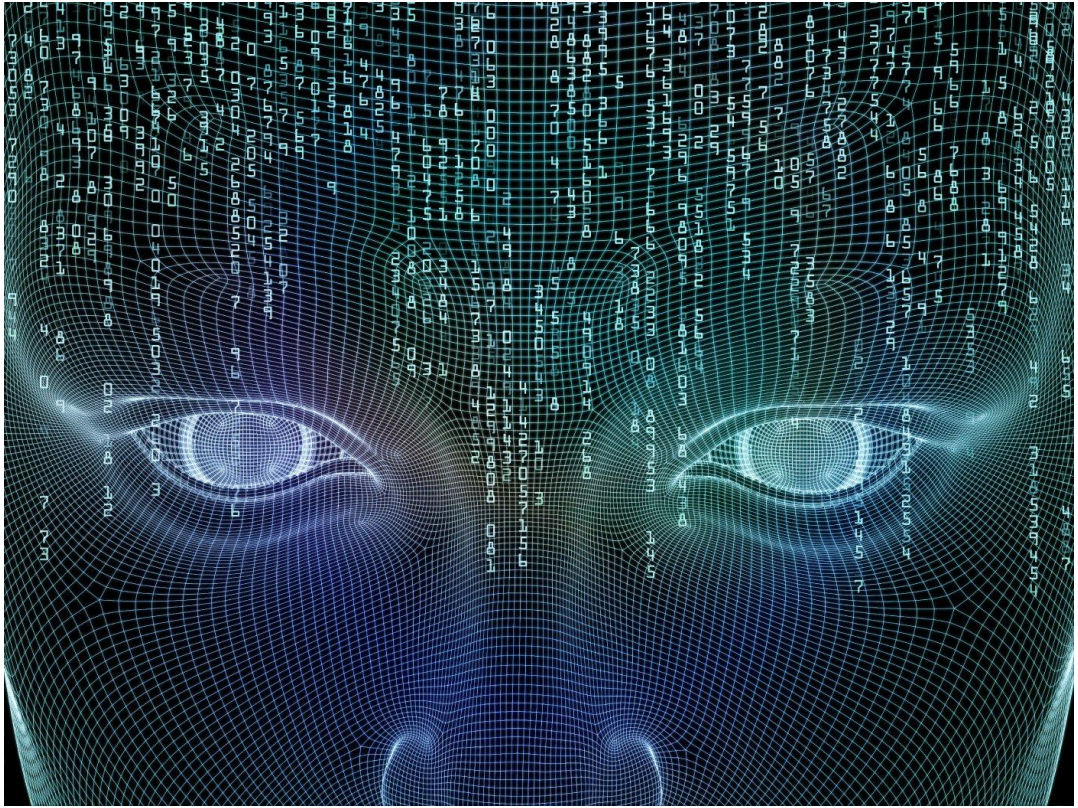
Enrique Balp Straffon

SYNX.CO

Inteligencia Artificial, machine learning, deep learning



¿Qué es la inteligencia artificial?



Tenemos una idea antropomórfica, incluso mágica y misteriosa.

La definición de ente inteligente es ambigua

El efecto AI:

"Cada vez que entendemos una parte de ella, deja de ser mágica; decimos, 'Oh, eso es sólo un cálculo'."

¿Conciencia artificial?

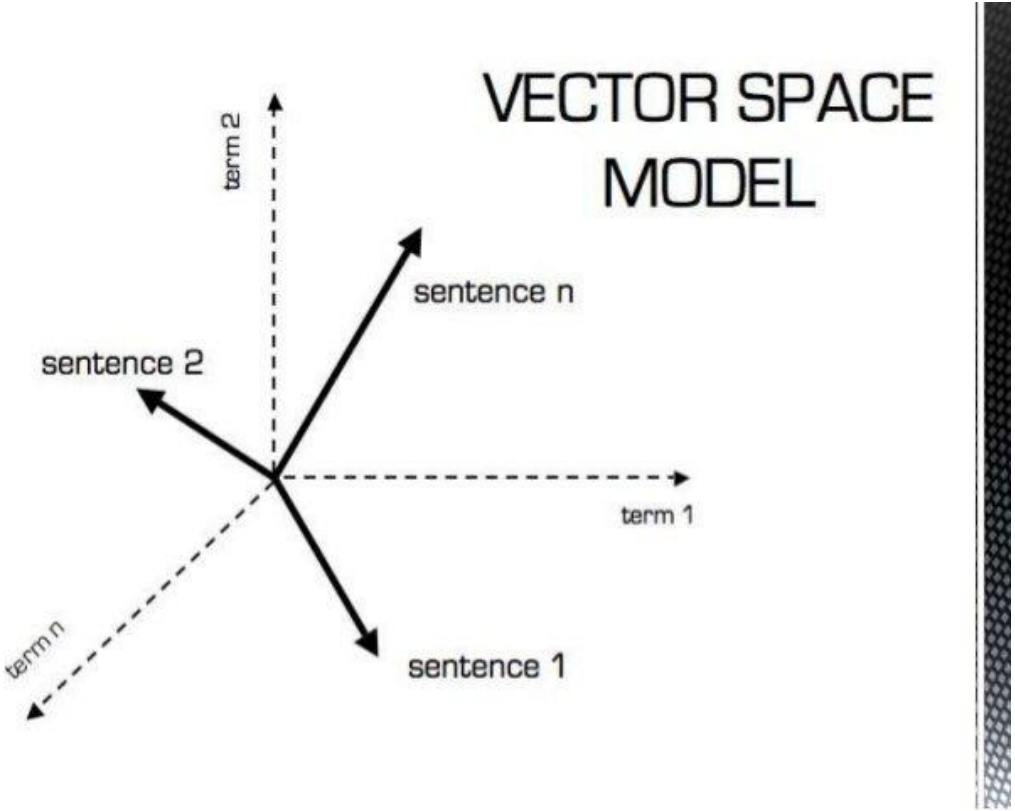
Machine learning o aprendizaje de máquina

- Métodos o algoritmos que permiten “entender” la estructura estadística de un conjunto de datos con el objetivo de responder alguna pregunta en particular. Ej:
  - Diagnóstico médico: ¿cuál es la probabilidad de que este paciente tenga cierta enfermedad dados sus resultados?
  - Procesamiento de lenguaje natural: ¿qué quiere saber esta persona que se comunica con el chatbot?
  - Visión computacional: ¿qué objetos hay en esta imagen?

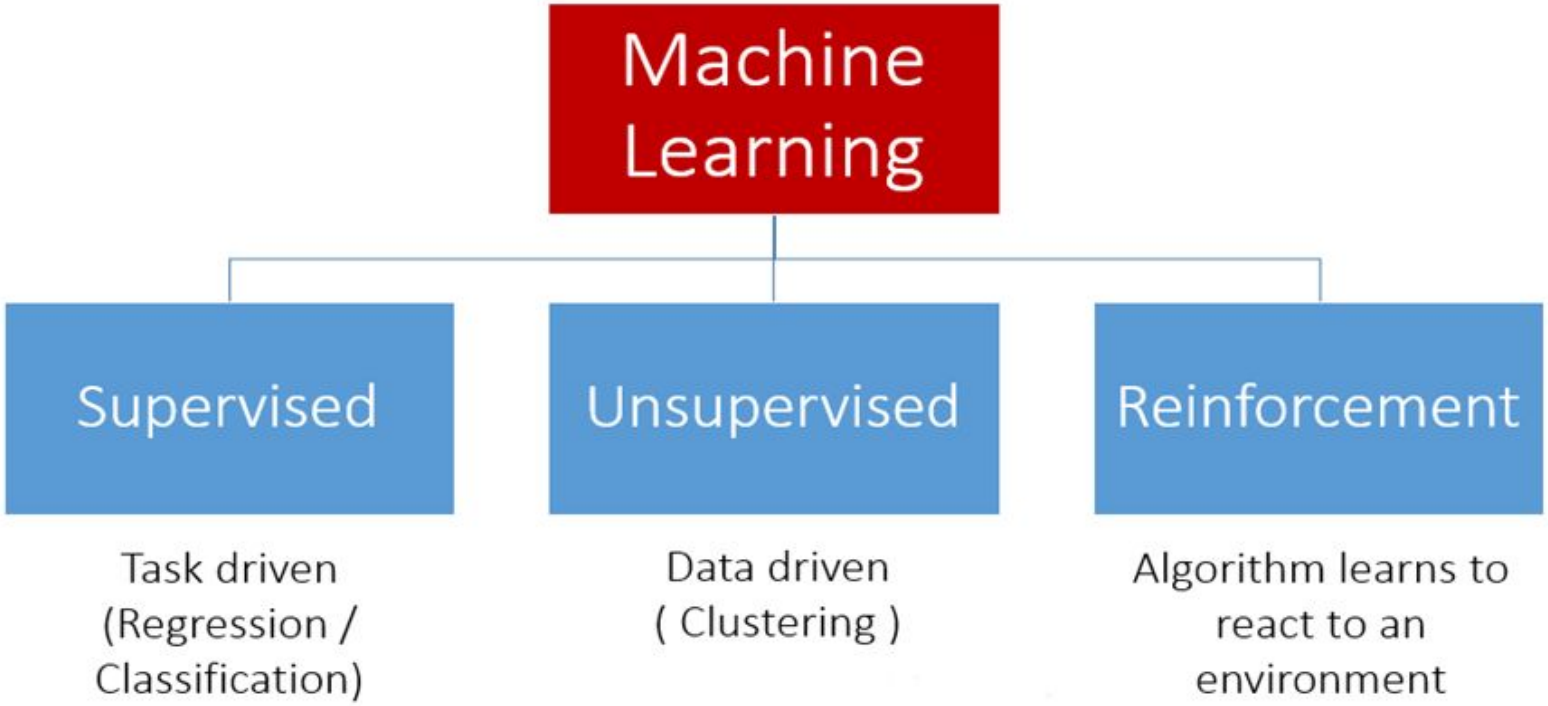
LA REPRESENTACIÓN NECESARIA SIEMPRE ES UN VECTOR NUMÉRICO

¿Qué matemáticas se necesitan?

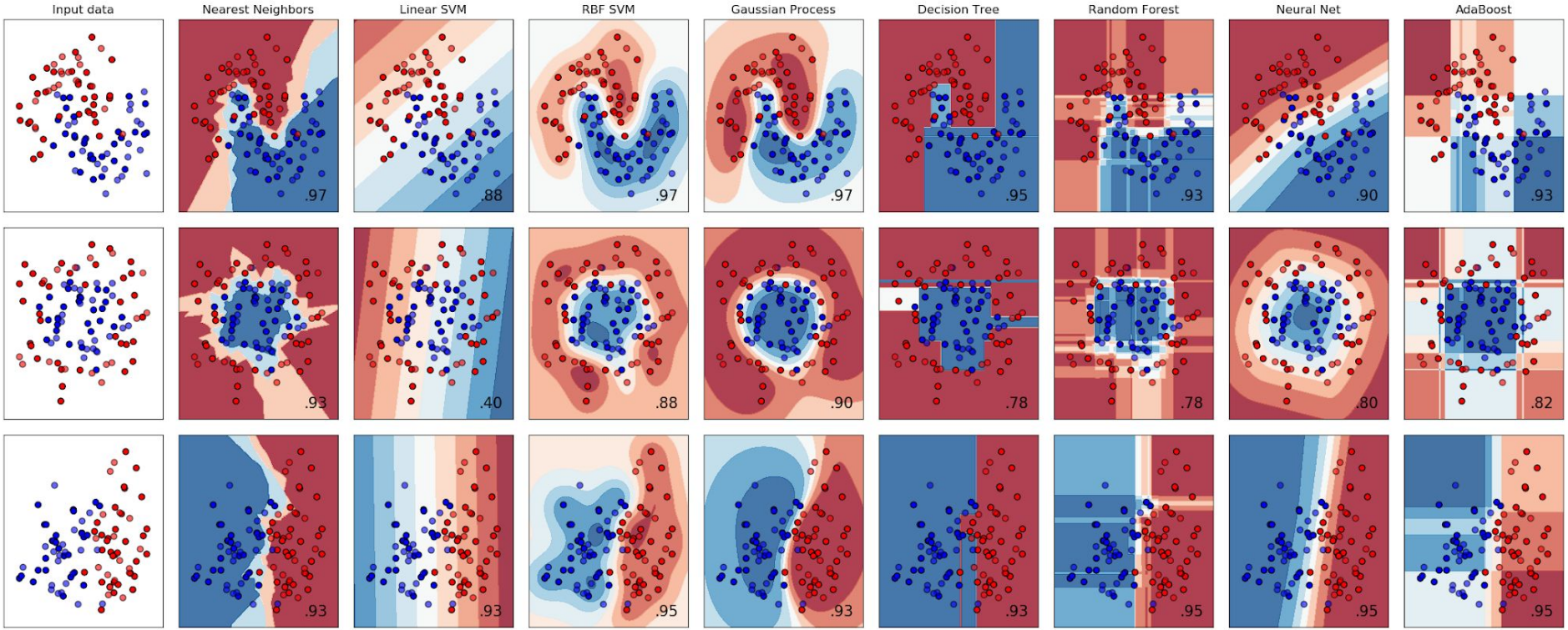
- cálculo en Rn
- álgebra lineal
- estadística
- grafos
- intuición



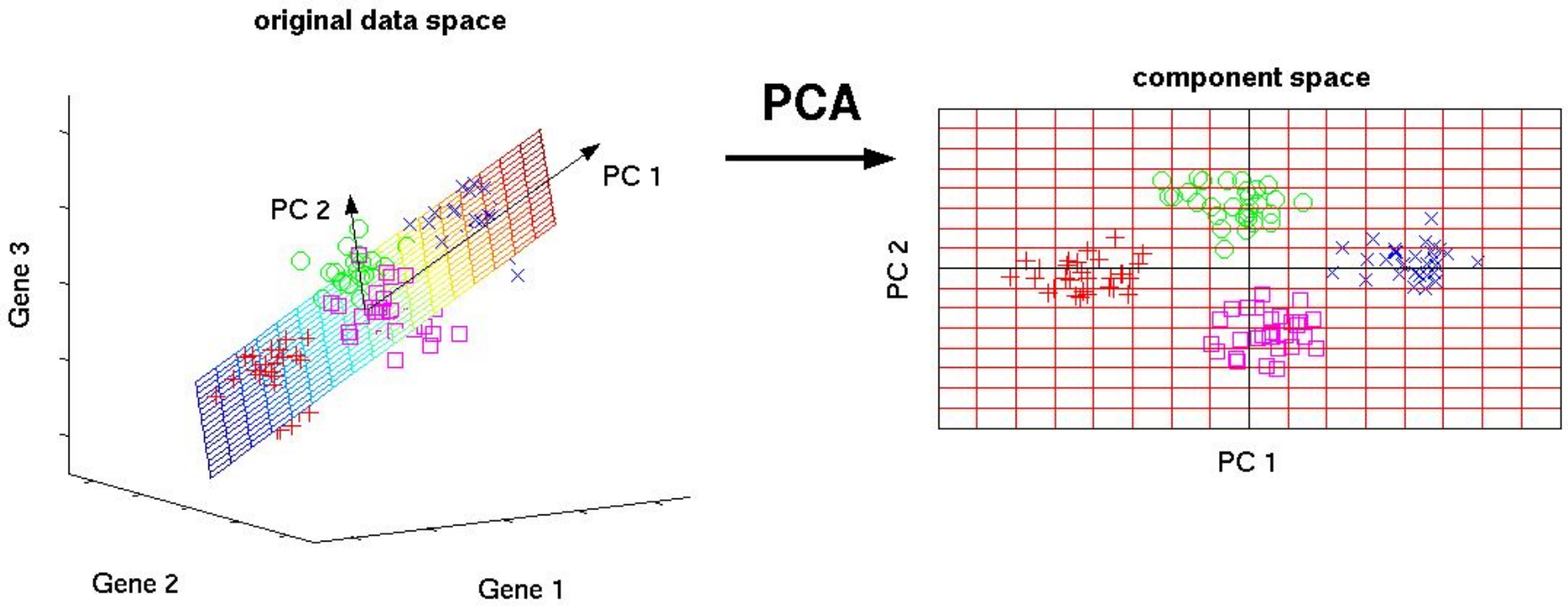
Types of Machine Learning



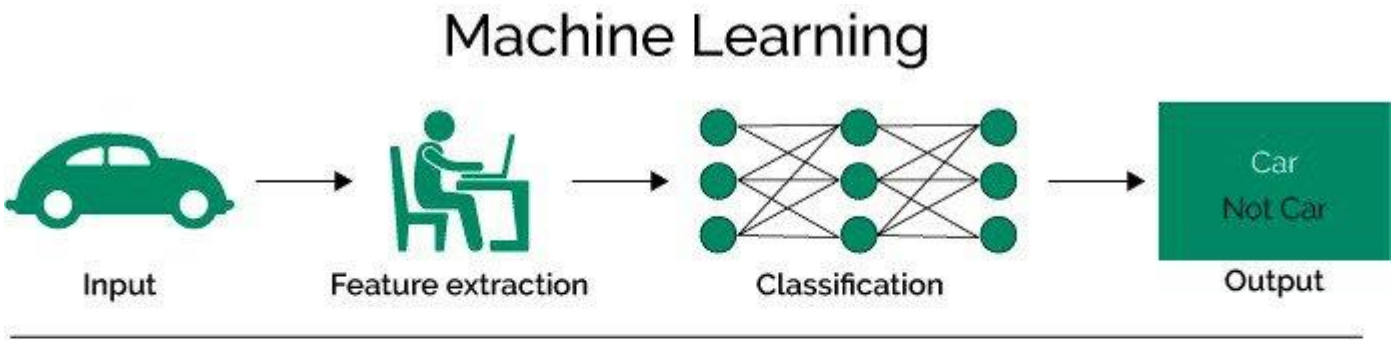
Diferencias de algoritmos de clasificación (supervisada)



Reducción de dimensionalidad (no supervisada)

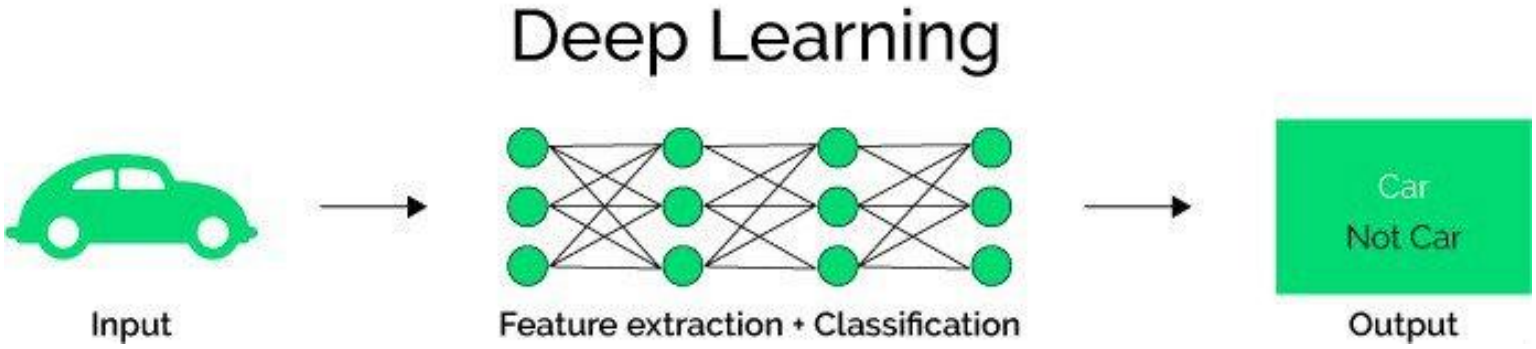


¿Quienes son las coordenadas?
¿Cuál es la representación?



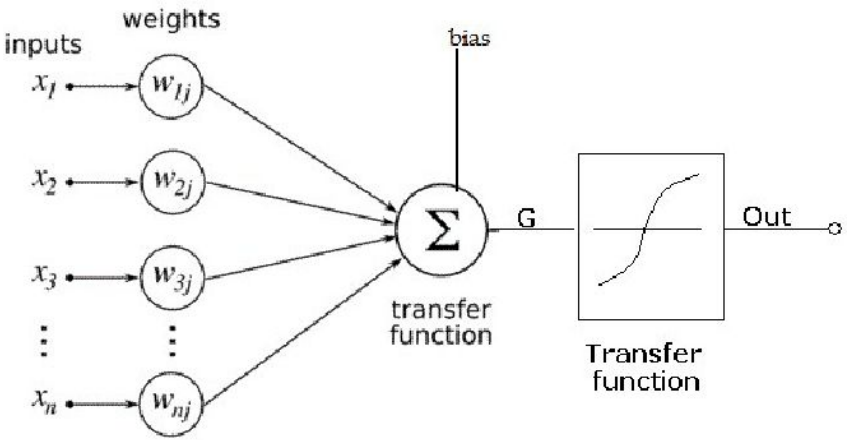
Suma, Resta, Multiplica, Divide
Dim: PCA, ICA
CV: HOG
NLP: TF-IDF

Deep Learning: Deep Neural Networks

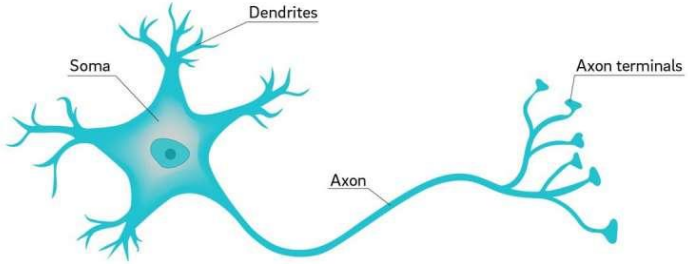


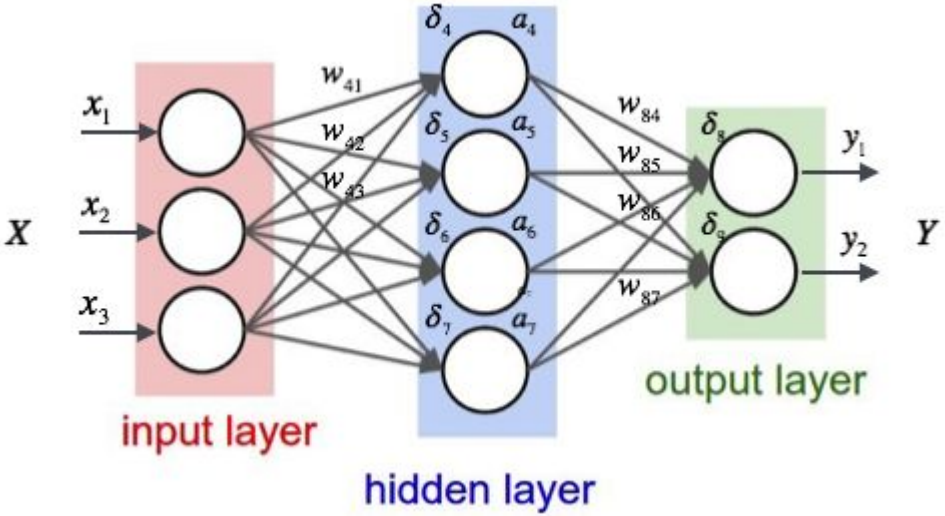
Deep Learning is Representation Learning

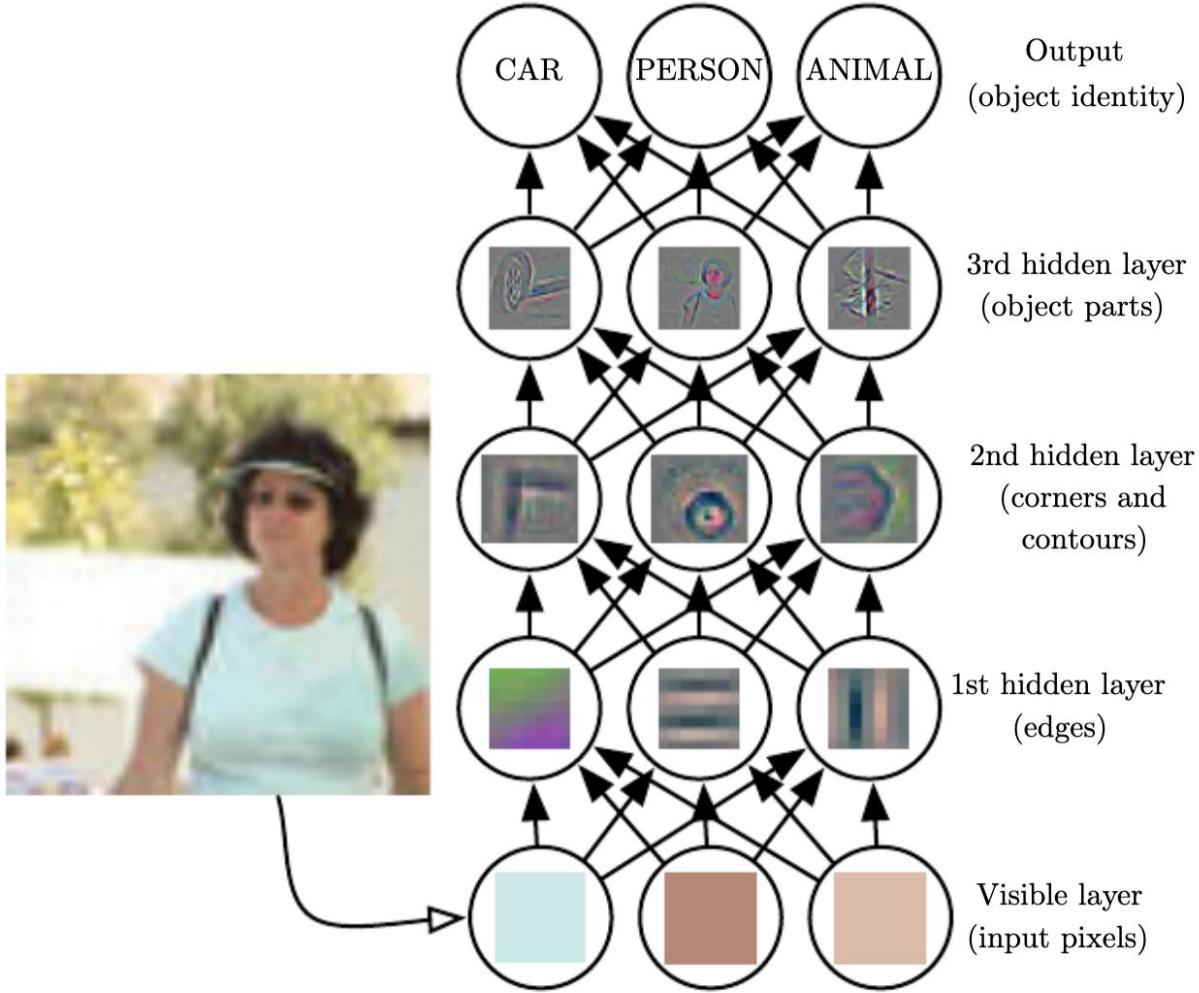
Neural Networks



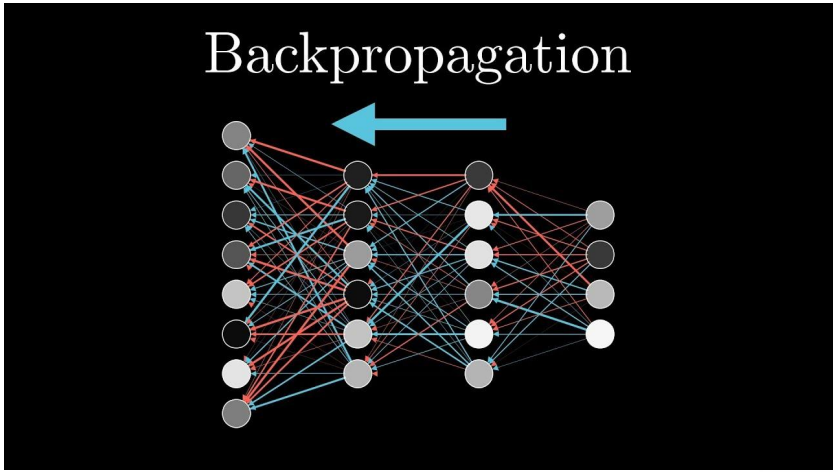
Neuron

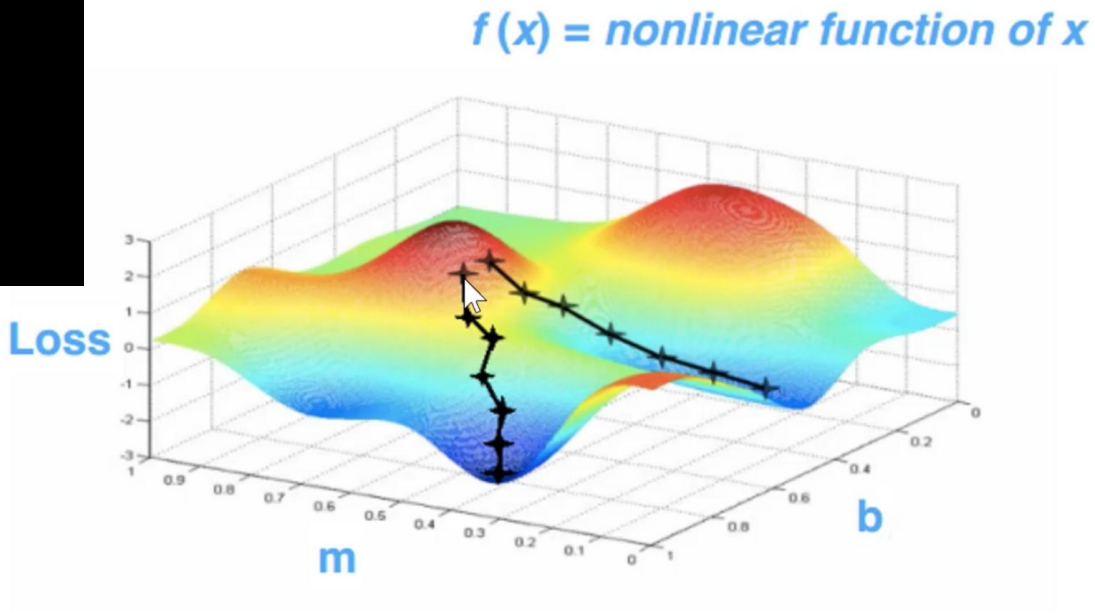





CAR
PERSON
ANIMAL
Output
(object identity)
3rd hidden layer
(object parts)
2nd hidden layer
(corners and
contours)
1st hidden layer
(edges)
Visible layer
(input pixels)

¿Cómo se entrena una red neuronal?

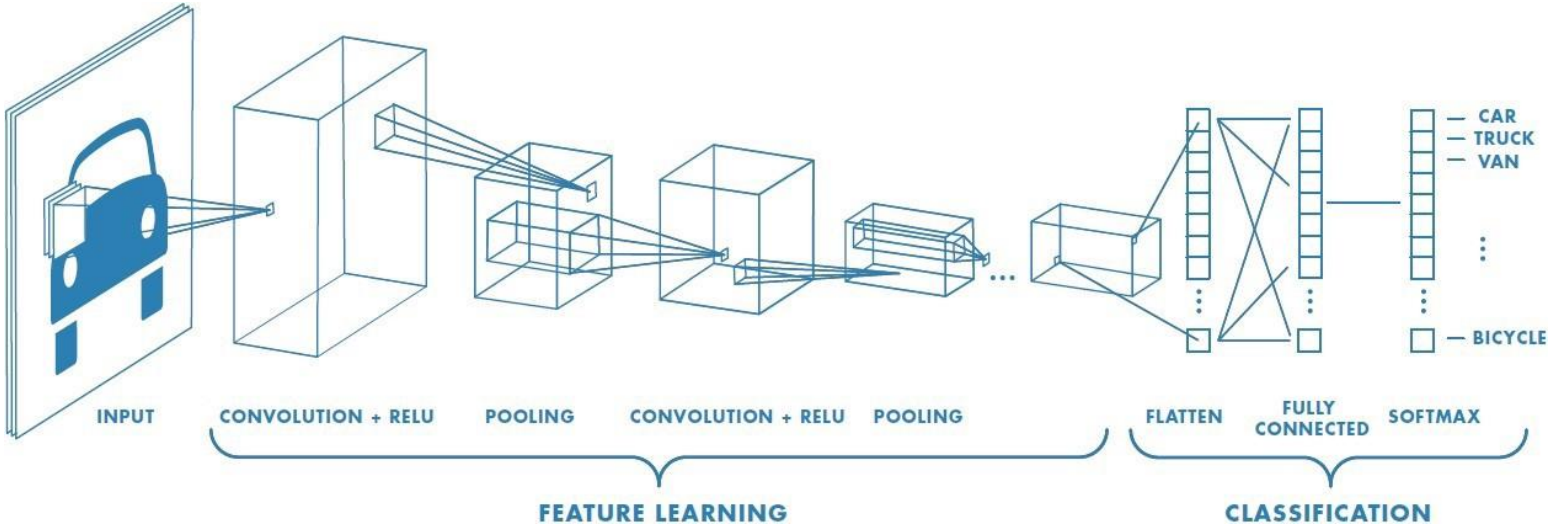


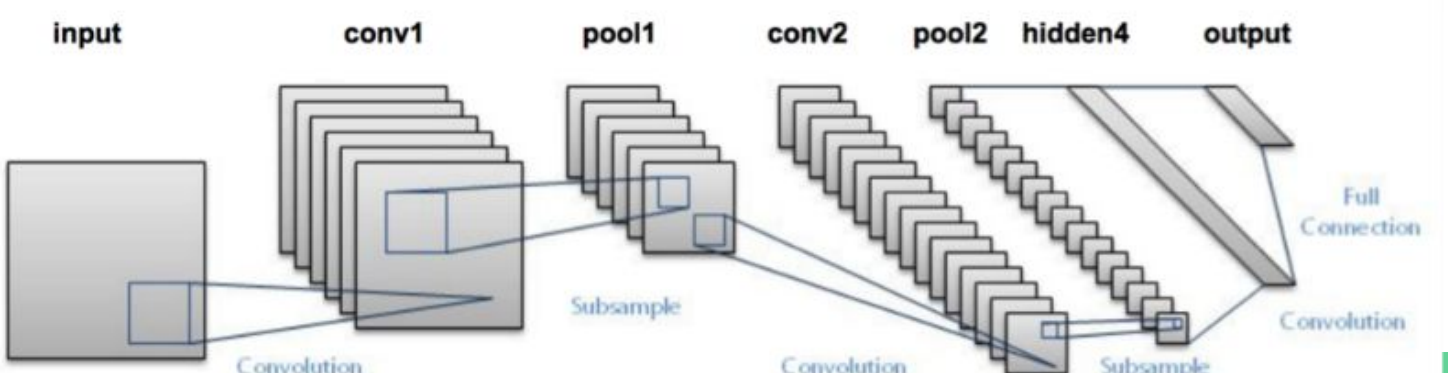


Demo sencillo de entrenamiento

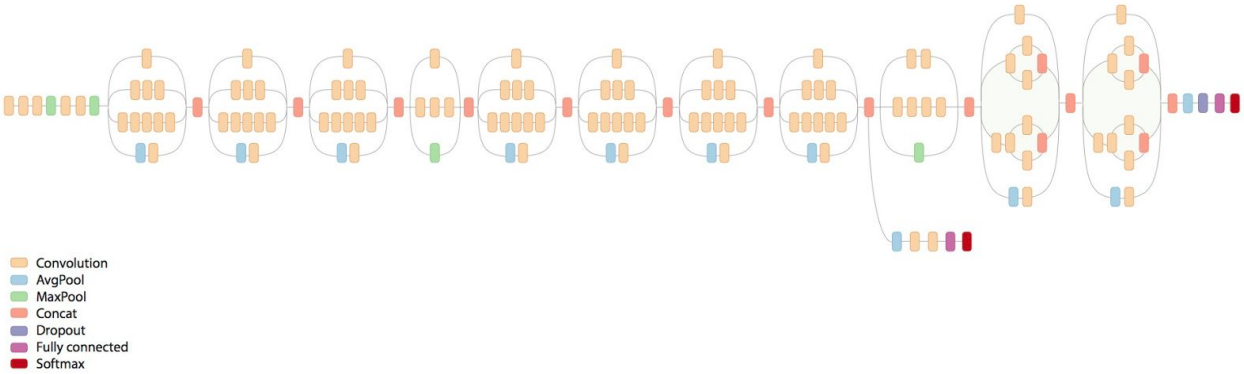
- Diferentes datasets
- Feature engineering
- Training/Test Loss
- Backpropagation
- Representations in layers
- Overfitting
- Architecture Search / Hyperparameter optimization

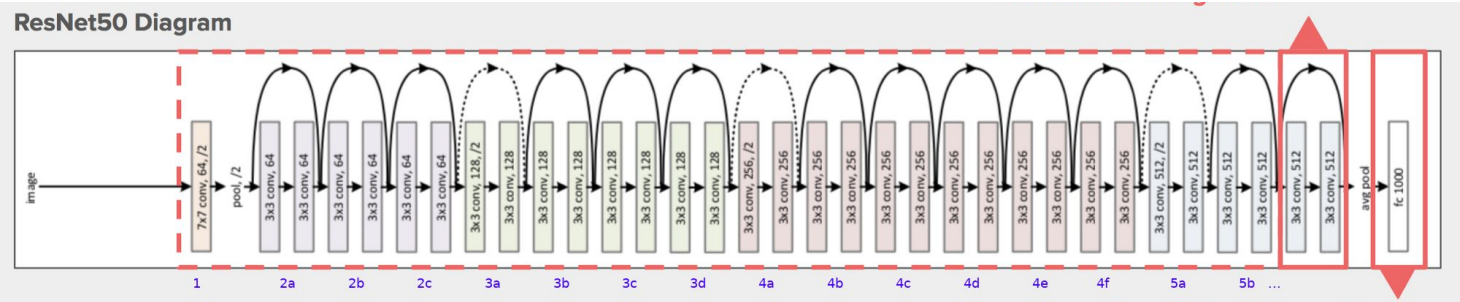
Convolutional Neural Networks for Computer Vision

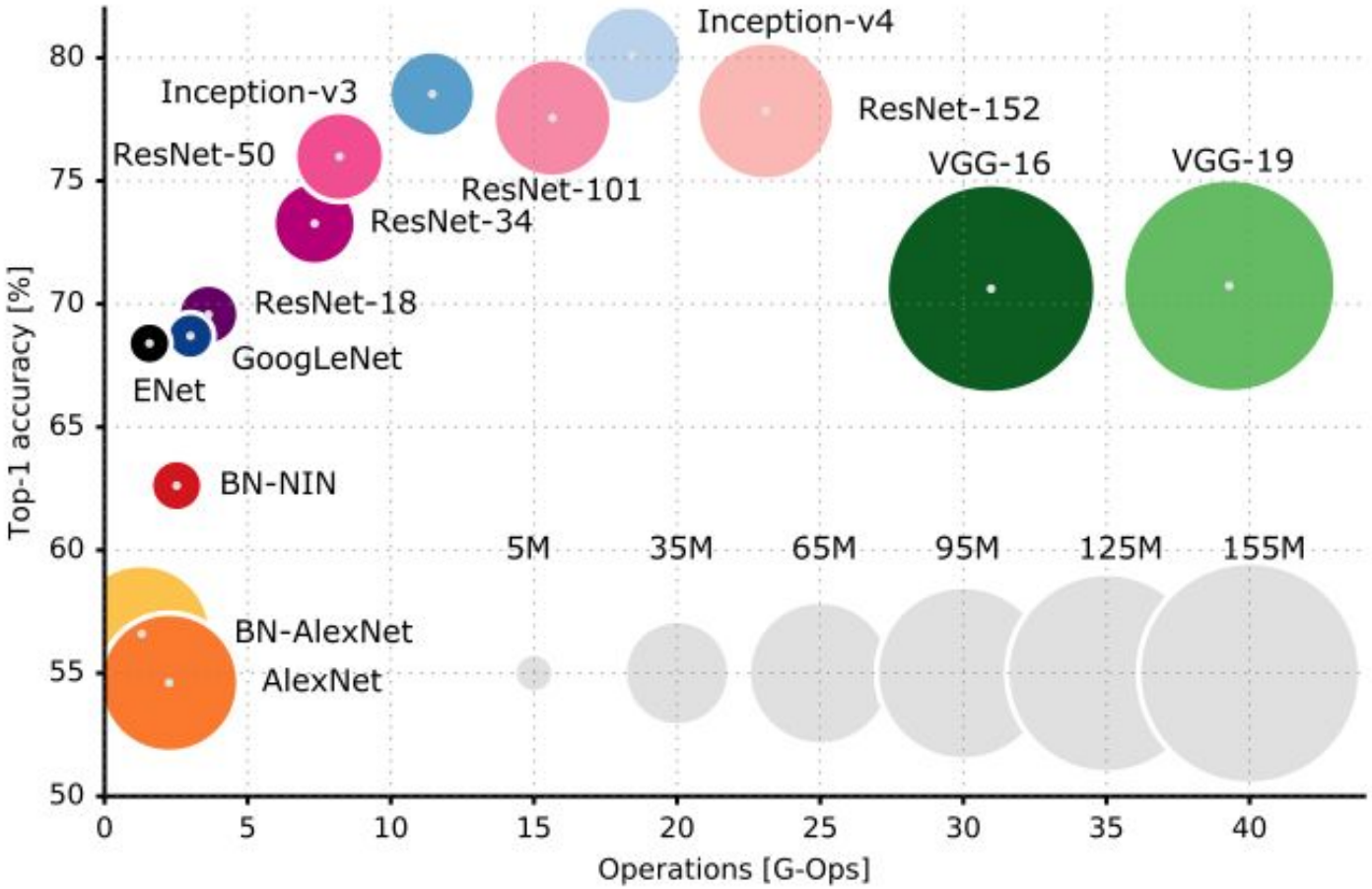




Demo MNIST, Imagenet ➔ Inception (Google), Resnet (Microsoft)



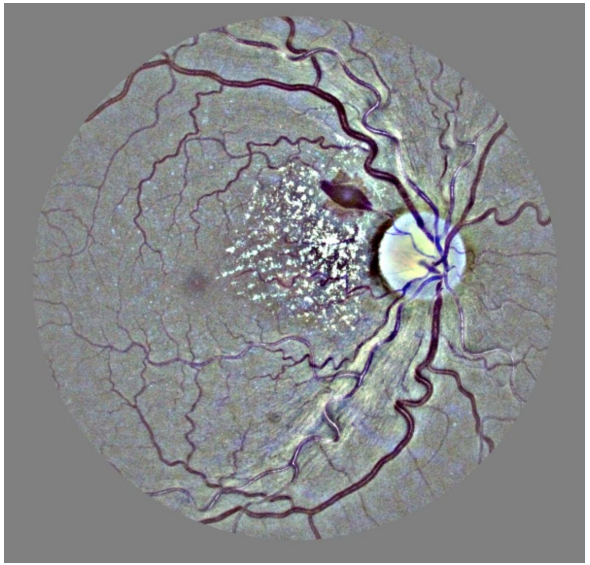


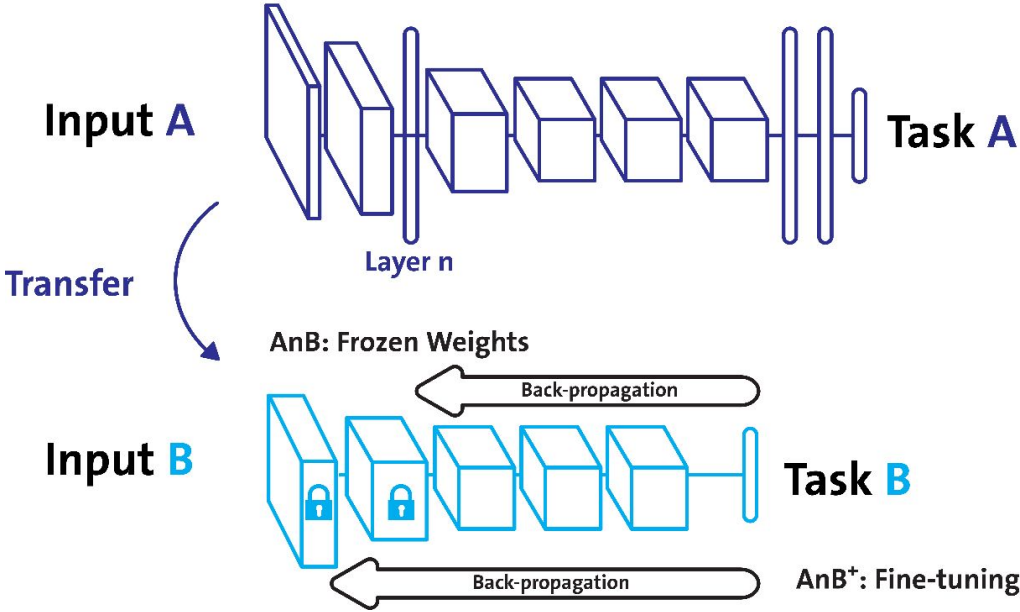

Inception-v4
Inception-v3
ResNet-152
ResNet-50
ResNet-101
VGG-16
VGG-19
ResNet-34
ResNet-18
GoogLeNet
ENet
BN-NIN
5M
35M
65M
95M
125M
155M
BN-AlexNet
AlexNet
Top-1 accuracy [%]
80
75
70
65
60
55
50
0
5
10
15
20
25
30
35
40
Operations [G-Ops]

Transfer Learning

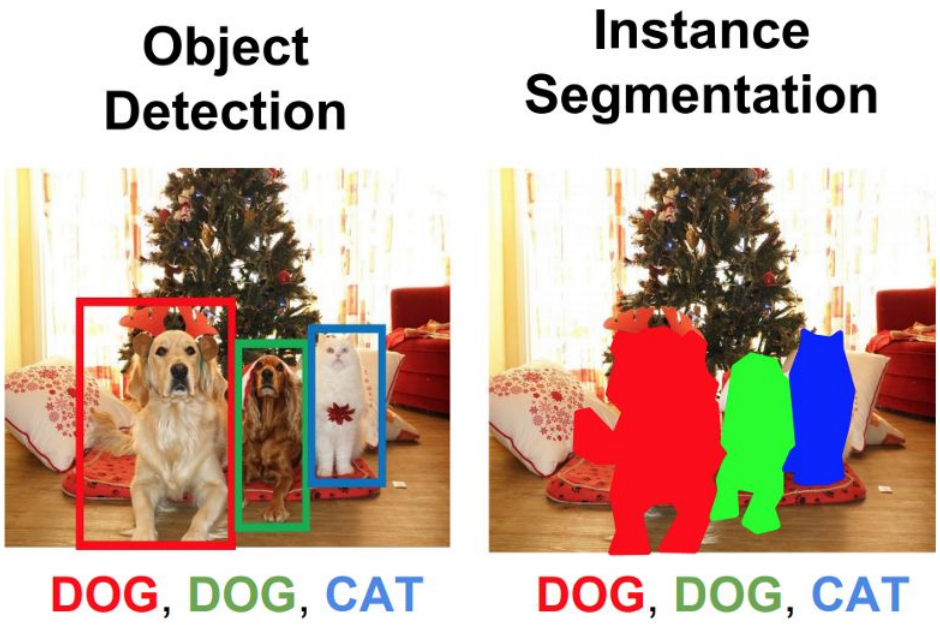
Aprovechar el poder de representación de una red ya entrenada para atacar otros problemas: transferencia de conocimiento.

Ejemplo en Synx: Retinopatía Diabética





Segmentación y Detección



Neural Style Transfer: generate samples

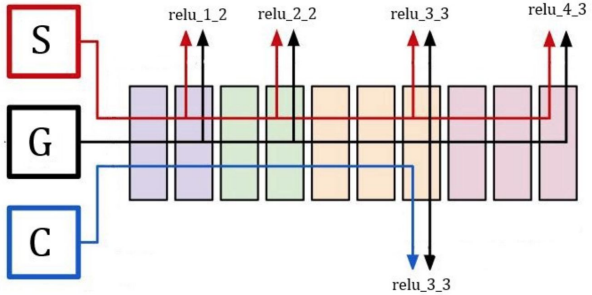
Content: Neckarfront in Tübingen, Germany

Style: The Shipwreck of the Minotaur, JMW Turner

Style: The Starry Night, Vincent van Gogh

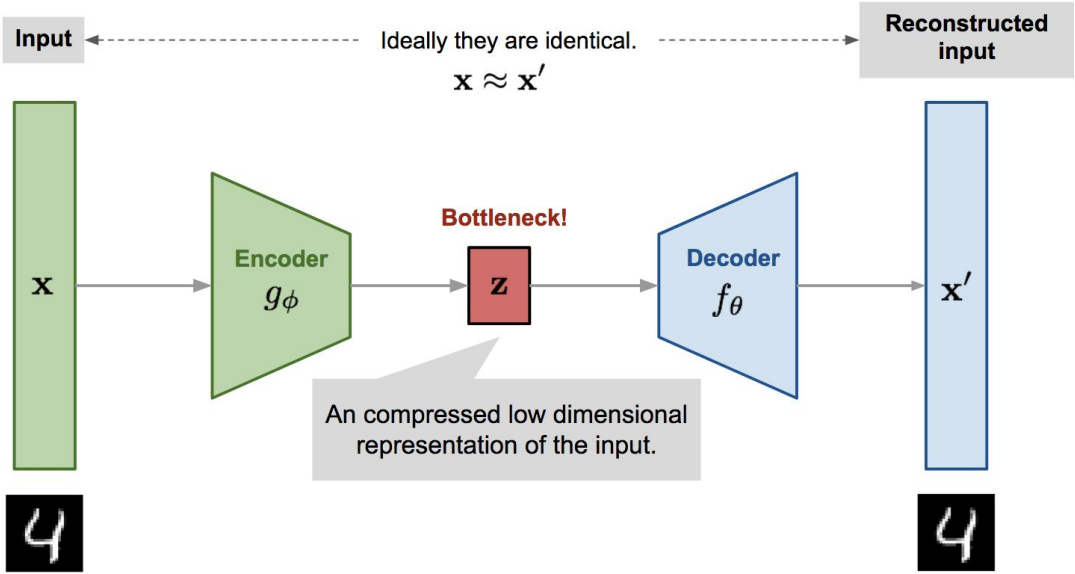
Style: Der Schrei, Edvard Munch

Input image | Reference style image | Result



Autoencoders

- Encontrar representaciones (embeddings) de baja dimensionalidad de forma no supervisada: muy útil!



DeepFakes

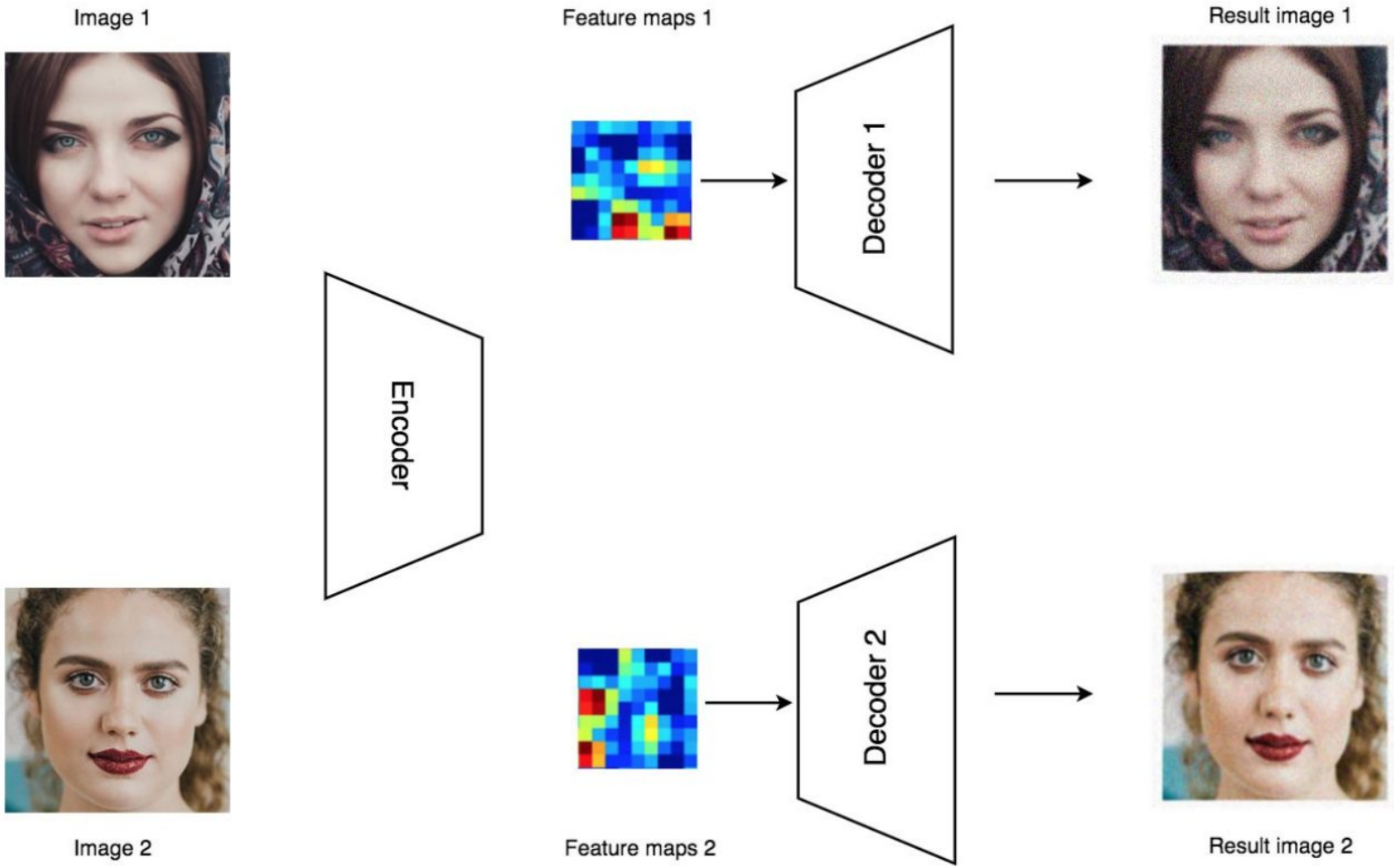
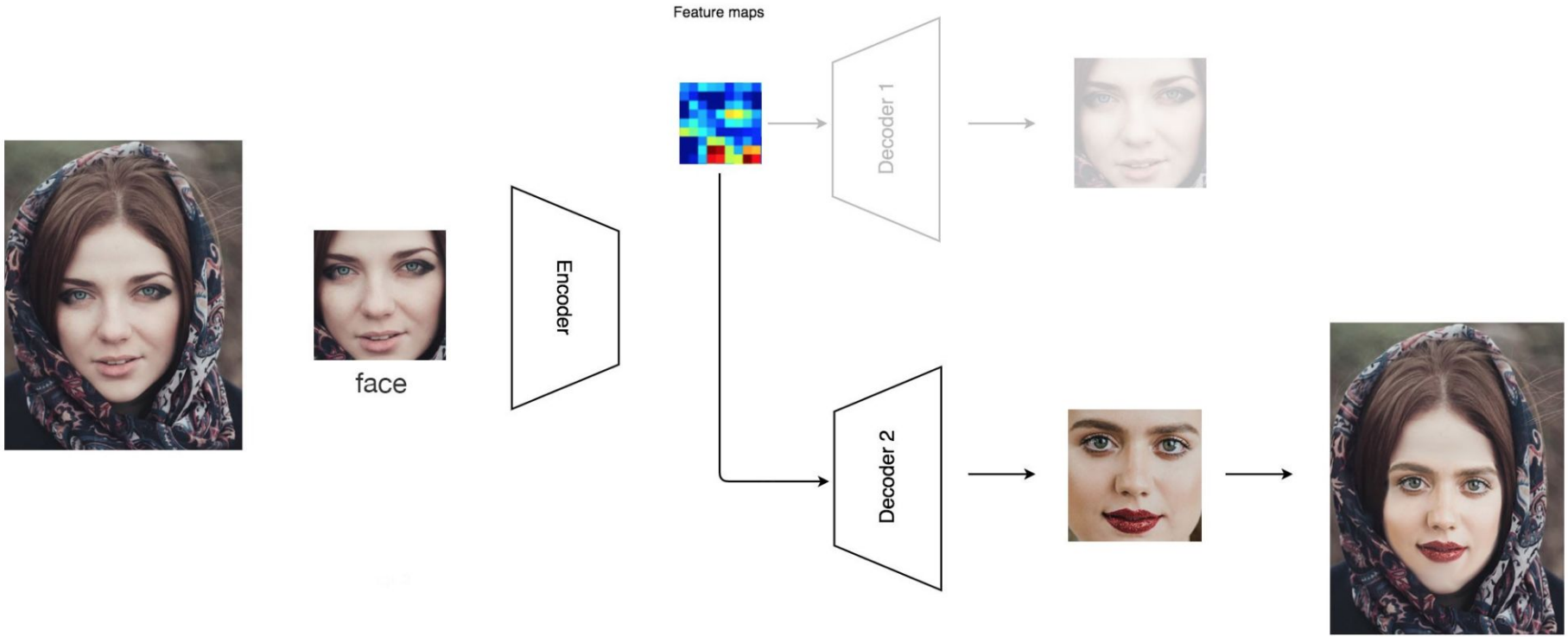
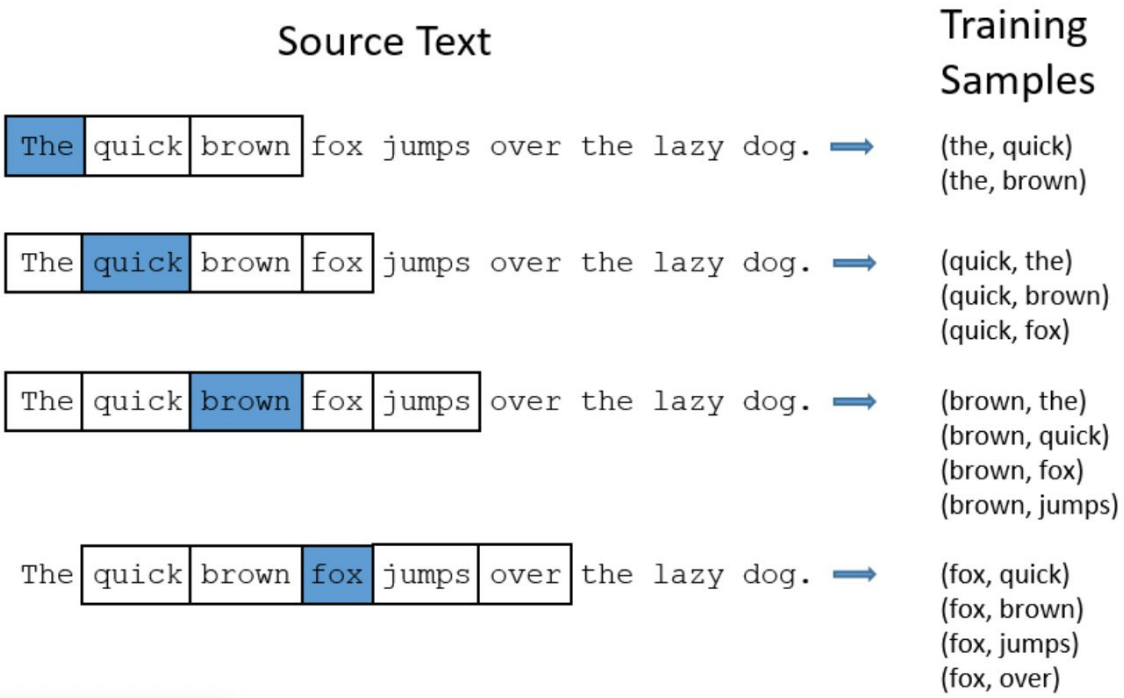


Image 1
Feature maps 1
Result image 1
Decoder 1
Encoder
Decoder 2
Image 2
Feature maps 2
Result image 2

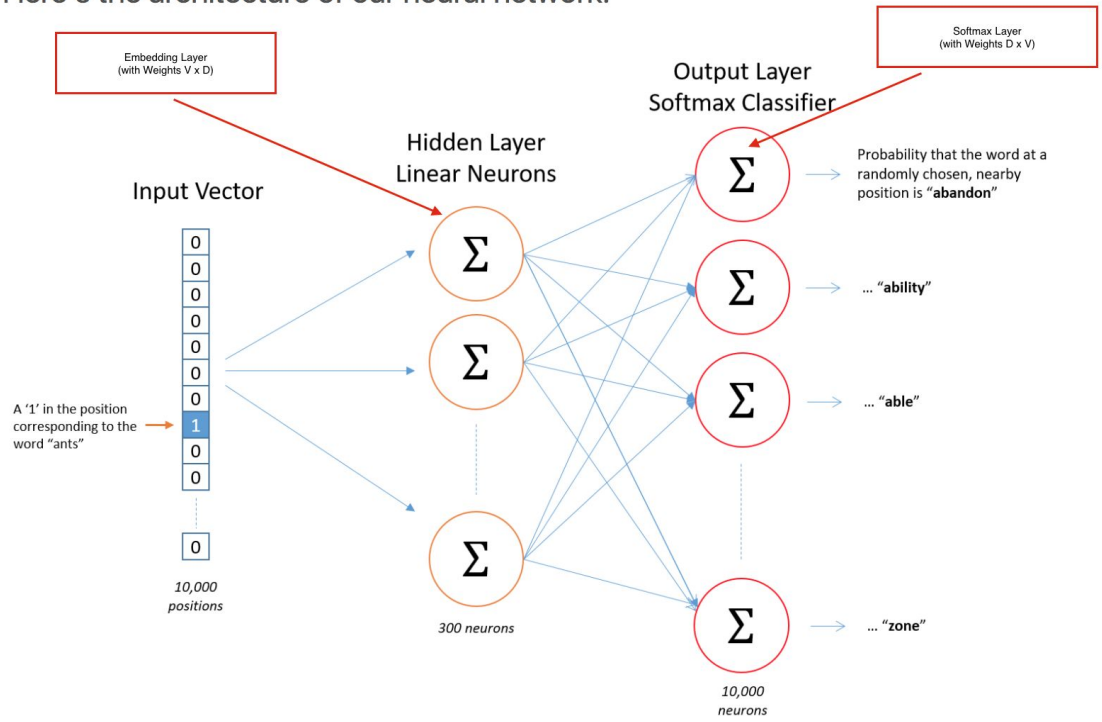

Feature maps
Decoder 1
face
Encoder
Decoder 2

Representaciones o embeddings en NLP: Word2Vec

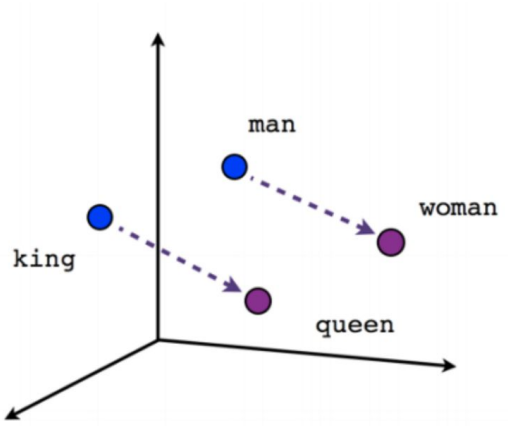


Representaciones o embeddings en NLP: Word2Vec

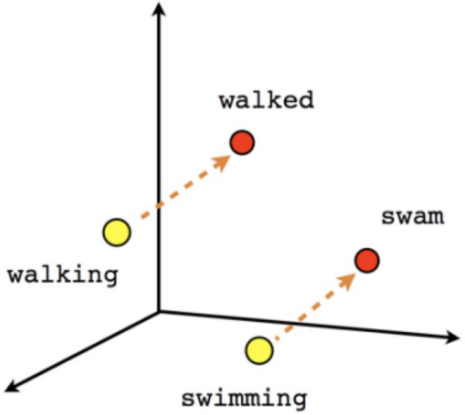
Here's the architecture of our neural network.



Representaciones o embeddings en NLP: Word2Vec



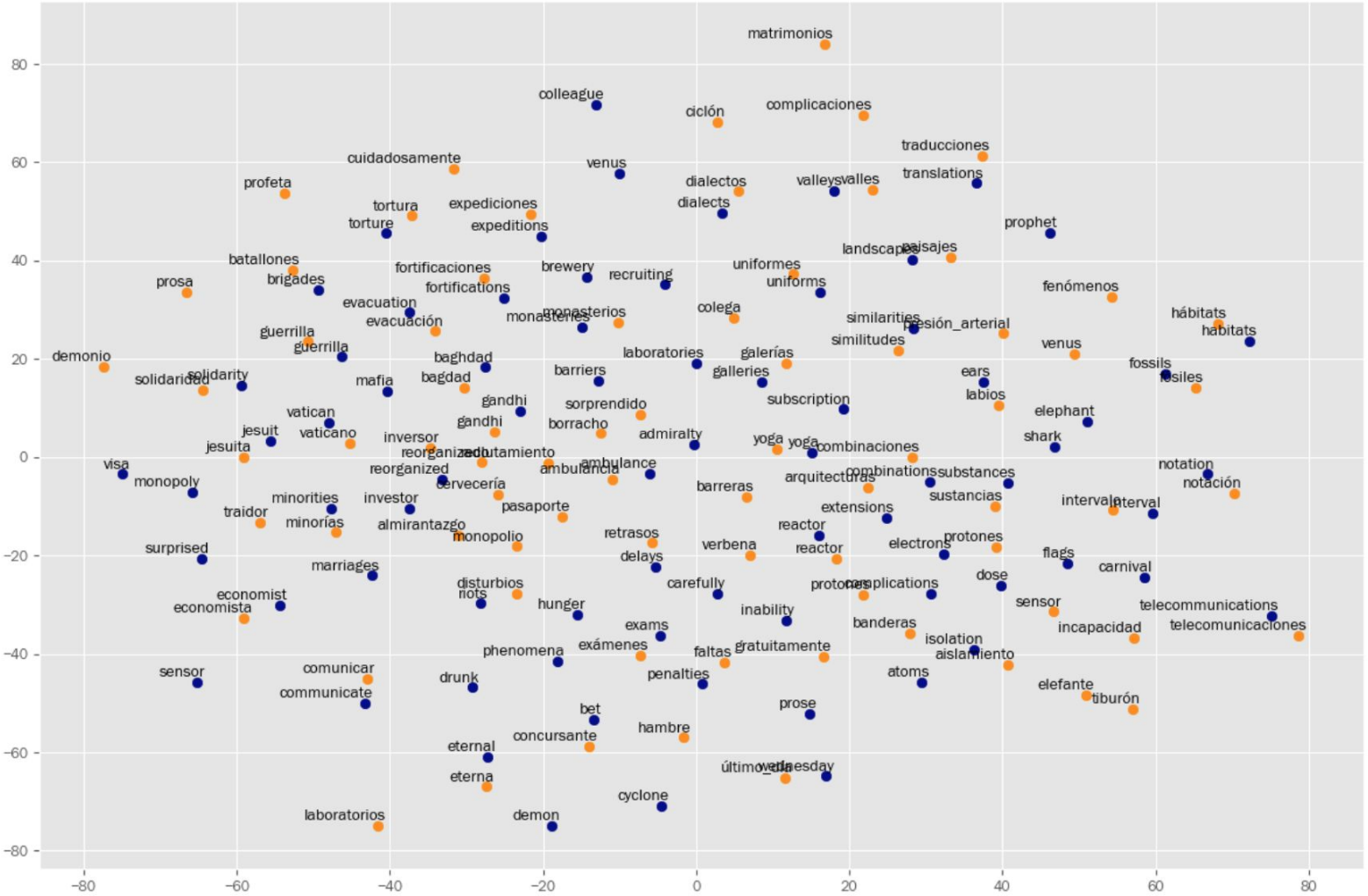
Male-Female



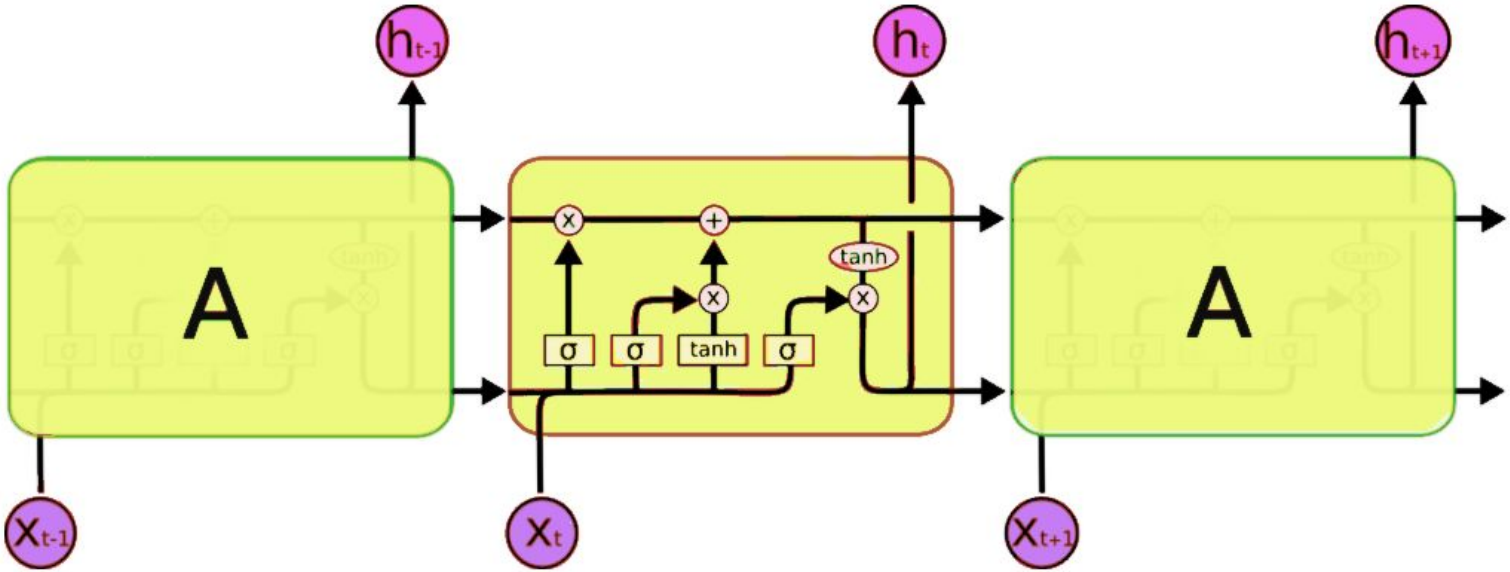
Verb tense

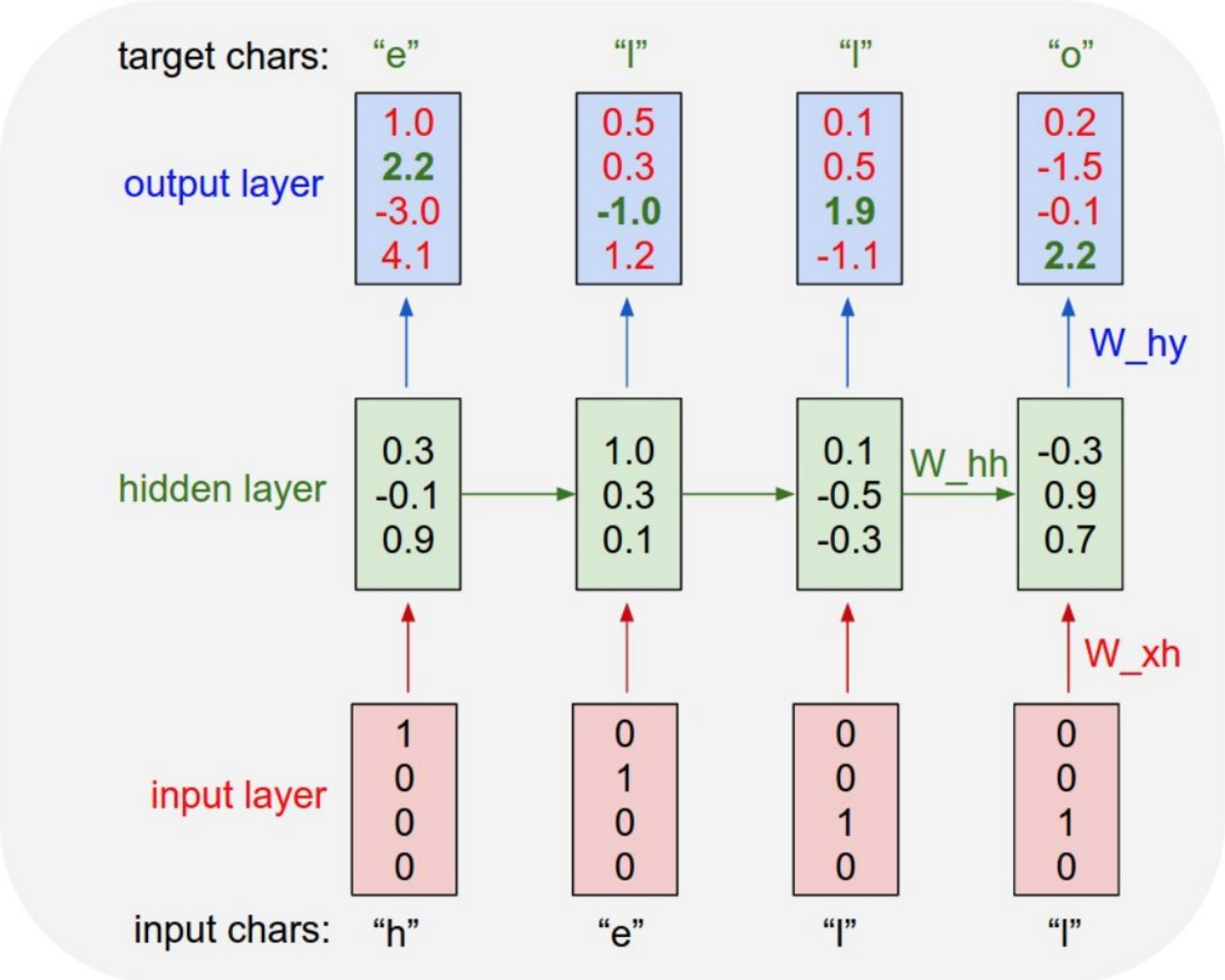
r(king)+r(woman)-r(man) = r(queen)

¡La semántica tiene representación con estructura lineal!


matrimonios
colleague
ciclón
complicaciones
traducciones
cuidadosamente
venus
translations
profeta
dialectos
valleys
valles
tortura
expediciones
dialects
torture
expeditions
prophet
landscapes
paisajes
batallones
fortificaciones
brewery
recruiting
uniformes
prosa
brigades
fortifications
uniforms
fenómenos
evacuation
colega
similarities
hábitats
monasterios
presión_arterial
evacuación
habitats
guerrilla
similitudes
venus
demonio
guerrilla
baghdad
laboratories
galerías
fossils
solidaridad
solidarity
mafia
bagdad
barriers
galleries
ears
fósiles
labios
vatican
gandhi
sorprendido
subscription
elephant
jesuit
vaticano
gandhi
borracho
admiralty
shark
jesuita
inversor
yoga
yoga
combinaciones
visa
reorganized
ambulancia
ambulance
notation
monopoly
cervecería
arquitectura
combinations
substances
notación
minorities
investor
barreras
sustancias
traidor
pasaporte
extensions
intervalo
interval
minorías
almirantazgo
reactor
monopolio
retrasos
electrons
protones
surprised
verbena
reactor
flags
delays
carnival
marriages
carefully
protones
complications
dose
economist
disturbios
riots
sensor
telecommunications
economista
hunger
inability
banderas
incapacidad
telecomunicaciones
exams
isolation
phenomena
exámenes
faltas
gratuitamente
aislamiento
sensor
comunicar
drunk
penalties
atoms
elefante
communicate
tiburón
bet
prose
hambre
concursante
eternal
último_día
wednesday
eterna
cyclone
laboratorios
demon
80
60
40
20
0
−20
−40
−60
−80
−80
−60
−40
−20
0
20
40
60
80

Recurrent Neural Networks (RNN) & LSTM




target chars:
"e"
"l"
"l"
"o"
output layer
1.0
2.2
-3.0
4.1
0.5
0.3
-1.0
1.2
0.1
0.5
1.9
-1.1
0.2
-1.5
-0.1
2.2
W_hy
hidden layer
0.3
-0.1
0.9
1.0
0.3
0.1
0.1
-0.5
-0.3
W_hh
-0.3
0.9
0.7
W_xh
input layer
1
0
0
0
0
1
0
0
0
0
1
0
0
0
1
0
input chars:
"h"
"e"
"l"
"l"

Fun with RNNs Demo

```
static int indicate_policy(void)
{
  int error;
  if (fd == MARN_EPT) {
    /*
     * The kernel blank will coeld it to userspace.
     */
    if (ss->segment < mem_total)
      unblock_graph_and_set_blocked();
    else
      ret = 1;
    goto bail;
  }
```

```
PANDARUS:
Alas, I think he shall be come approached and the day
When little srain would be attain'd into being never fed,
And who is but a chain and subjects of his death,
I should not sleep.

Second Senator:
They are away this miseries, produced upon my soul,
Breaking and strongly should be buried, when I perish
The earth and thoughts of many states.
```

Proof. Omitted. □

Lemma 0.1. *Let $\mathcal{C}$ be a set of the construction.*

Let $\mathcal{C}$ be a gerber covering. Let $\mathcal{F}$ be a quasi-coherent sheaves of $\mathcal{O}$-modules. We have to show that

$$\mathcal{O}_{\mathcal{O}_X} = \mathcal{O}_X(\mathcal{L})$$

.

Proof. This is an algebraic space with the composition of sheaves $\mathcal{F}$ on $X_{\acute{e}tale}$ we have

$$\mathcal{O}_X(\mathcal{F}) = \{morph_1 \times_{\mathcal{O}_X} (\mathcal{G}, \mathcal{F})\}$$

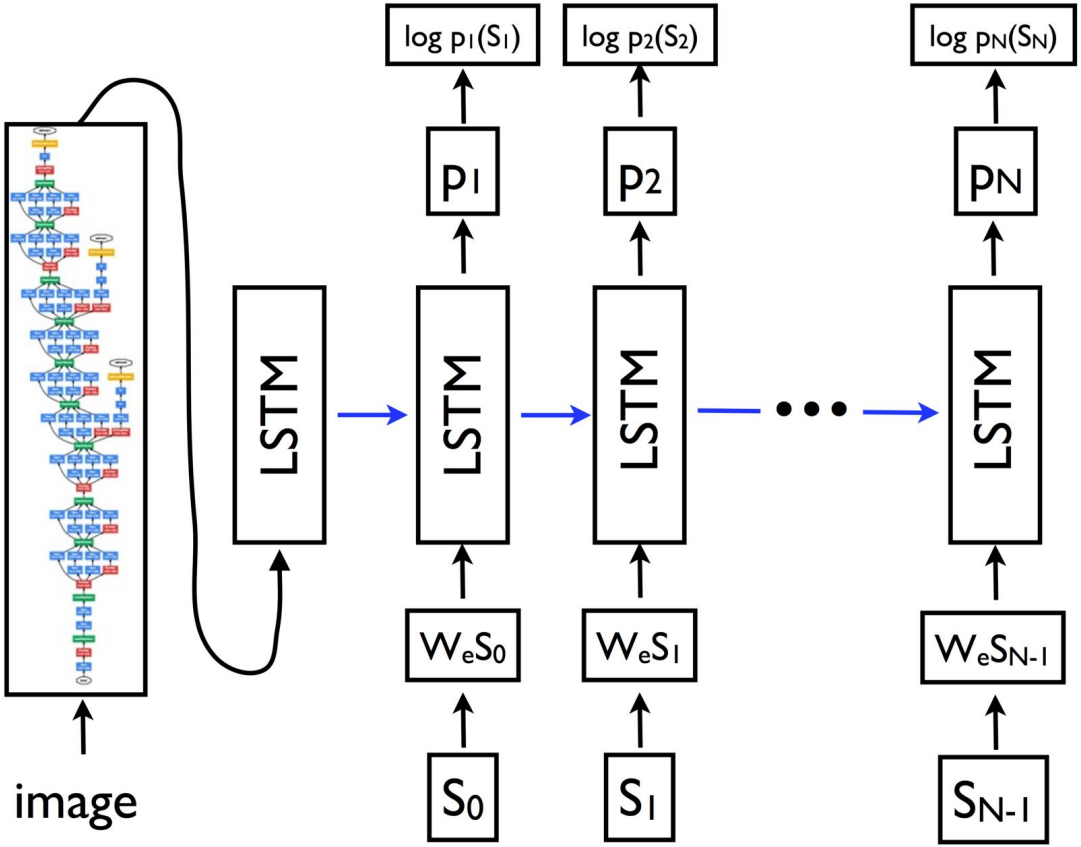
where $\mathcal{G}$ defines an isomorphism $\mathcal{F} \to \mathcal{F}$ of $\mathcal{O}$-modules. □

Lemma 0.2. *This is an integer $\mathcal{Z}$ is injective.*

Proof. See Spaces, Lemma ??. □

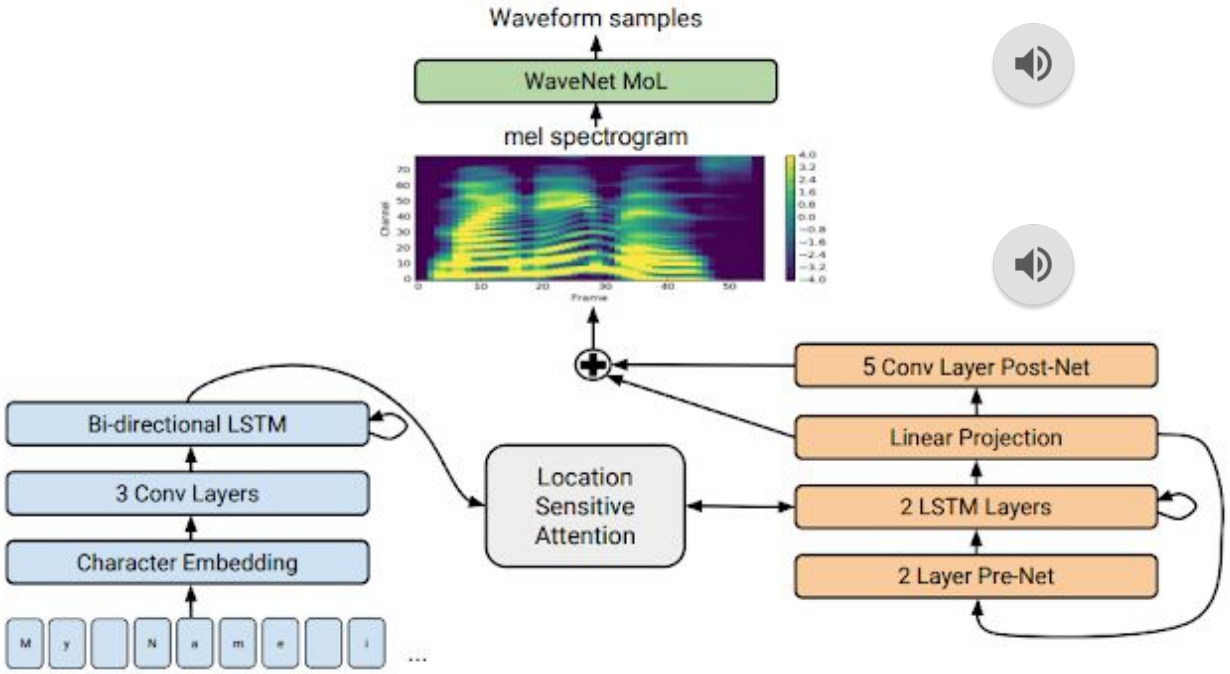
```
Naturalism and decision for the majority of Arab countries' capitalide was
by the Irish language by [[John Clair]], [[An Imperial Japanese Revolt]], a
with Guangzham's sovereignty. His generals were the powerful ruler of the E
in the [[Protestant Immineners]], which could be said to be directly in Cantonese
Communication, which followed a ceremony and set inspired prison, training. The
emperor travelled back to [[Antioch, Perth, October 25|21]] to note, the Kingdom
of Costa Rica, unsuccessful fashioned the [[Thrales]], [[Cynth's Dajoard]], known
in western [[Scotland]], near Italy to the conquest of India with the conflict.
```

Subtitulando imágenes: Inception, LSTM, Word2vec

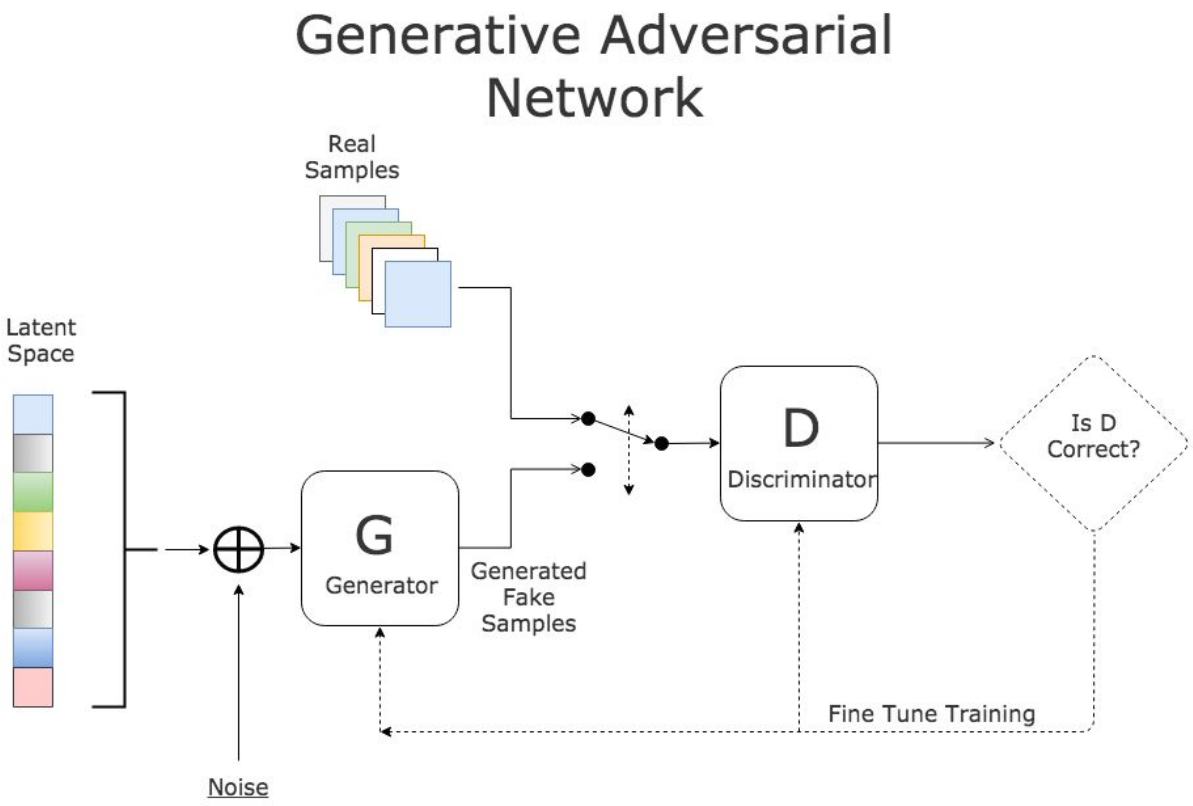


Describes without errors	Describes with minor errors	Somewhat related to the image	Unrelated to the image
A person riding a motorcycle on a dirt road.	Two dogs play in the grass.	A skateboarder does a trick on a ramp.	A dog is jumping to catch a frisbee.
A group of young people playing a game of frisbee.	Two hockey players are fighting over the puck.	A little girl in a pink hat is blowing bubbles.	A refrigerator filled with lots of food and drinks.
A herd of elephants walking across a dry grass field.	A close up of a cat laying on a couch.	A red motorcycle parked on the side of the road.	A yellow school bus parked in a parking lot.

Googe Wavenet & Duplex



Generative Adversarial Networks GANs



Style transfer allows you to blend facial characteristics from different people. | Image: Karras, Laine, Aila

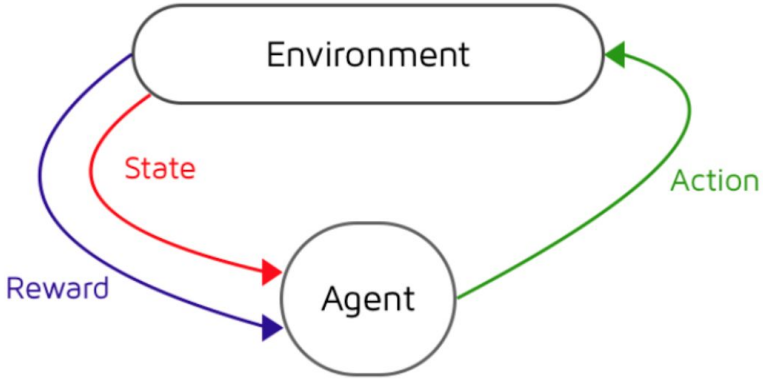
GT
this flower is white and pink in color, with petals that have veins.
these flowers have petals that start off white in color and end in a dark purple towards the tips.
bright droopy yellow petals with burgundy streaks, and a yellow stigma.
a flower with long pink petals and raised orange stamen.
the flower shown has a blue petals with a white pistil in the center
GAN
GAN - CLS
GAN - INT
GAN - INT - CLS

Synx™

Reinforcement Learning

At each step, the agent:

- Executes action
- Observe new state
- Receive reward

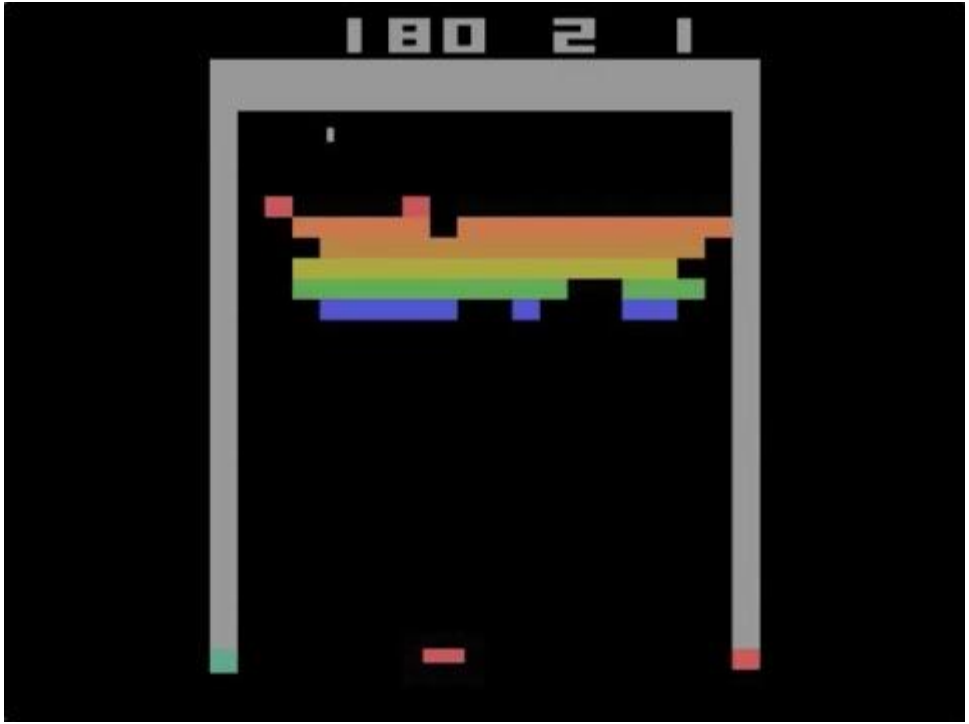


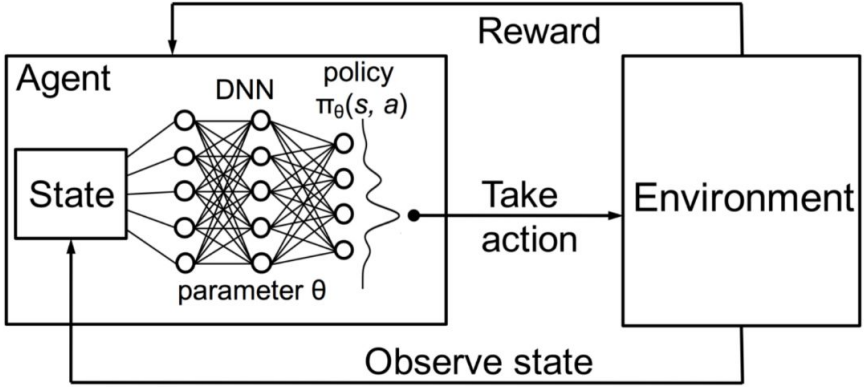
Exploration vs Exploitation

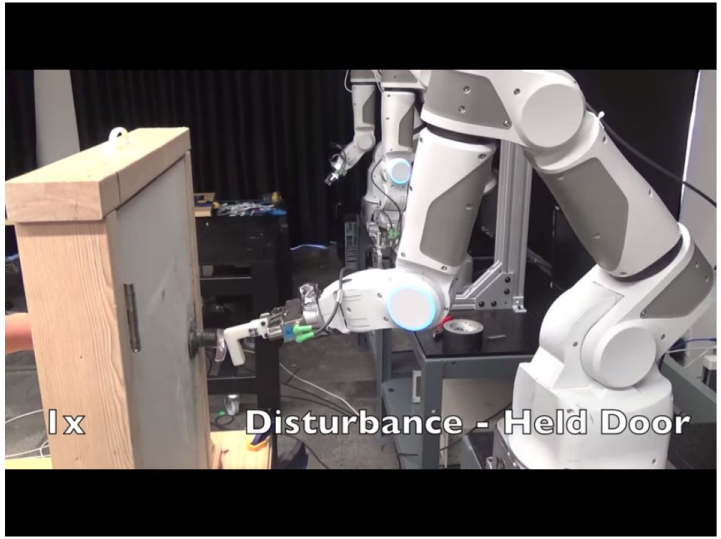
Synx™

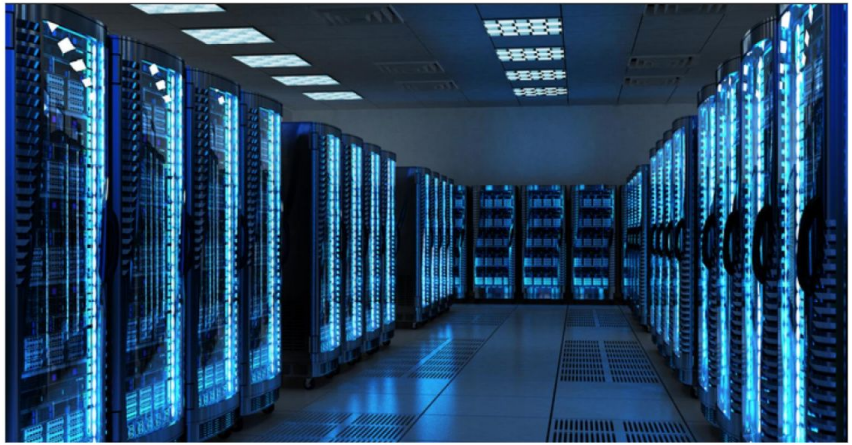
Playing Atari with Deep Reinforcement Learning

DeepMind Technologies, 2013

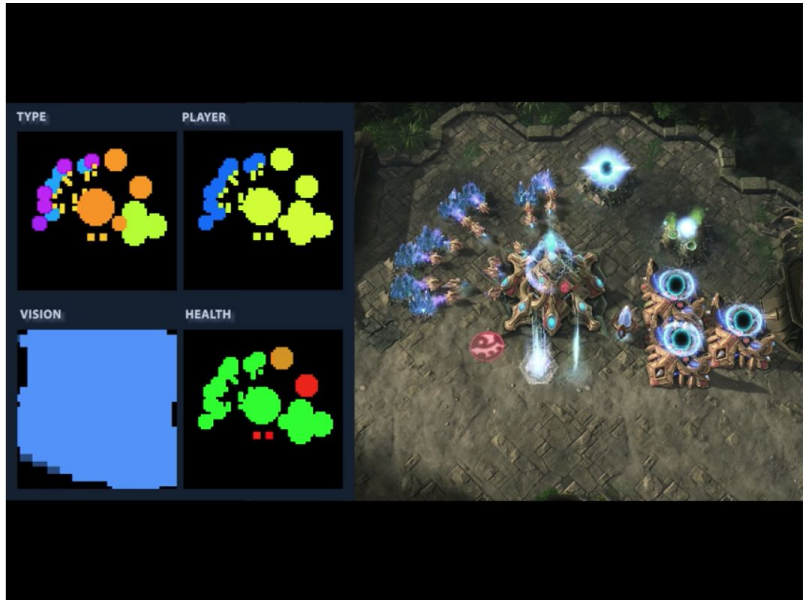





1x
Disturbance - Held Door



浙江省体育局
柯洁 KE JIE
01:14:01
ALPHAGO
02:19:19


TYPE
PLAYER
VISION
HEALTH

Reflexión

Espero haber ayudado a desmitificar la AI

¿Inteligencia artificial general?

¿Conciencia artificial?

¿Nos debe preocupar “la singularidad”, o es una distracción?

Usos irresponsables y dañinos de AI: fake news, hacking

Otros aspectos éticos: justicia

Es una tecnología revolucionando ciencias, industrias y culturas

Para aprender: Coursera, Kaggle, tutoriales, artículos e intentar no dejar temas sin entender

Gracias

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