



Inteligencia Artificial & Machine Learning

Aplicaciones en movilidad

Engineering 

Founded by the Royal Academy of Engineering
and Lloyd's Register Foundation

Dr. Iván S. Razo Zapata



Aprendizaje Supervisado

Redes Neuronales Artificiales

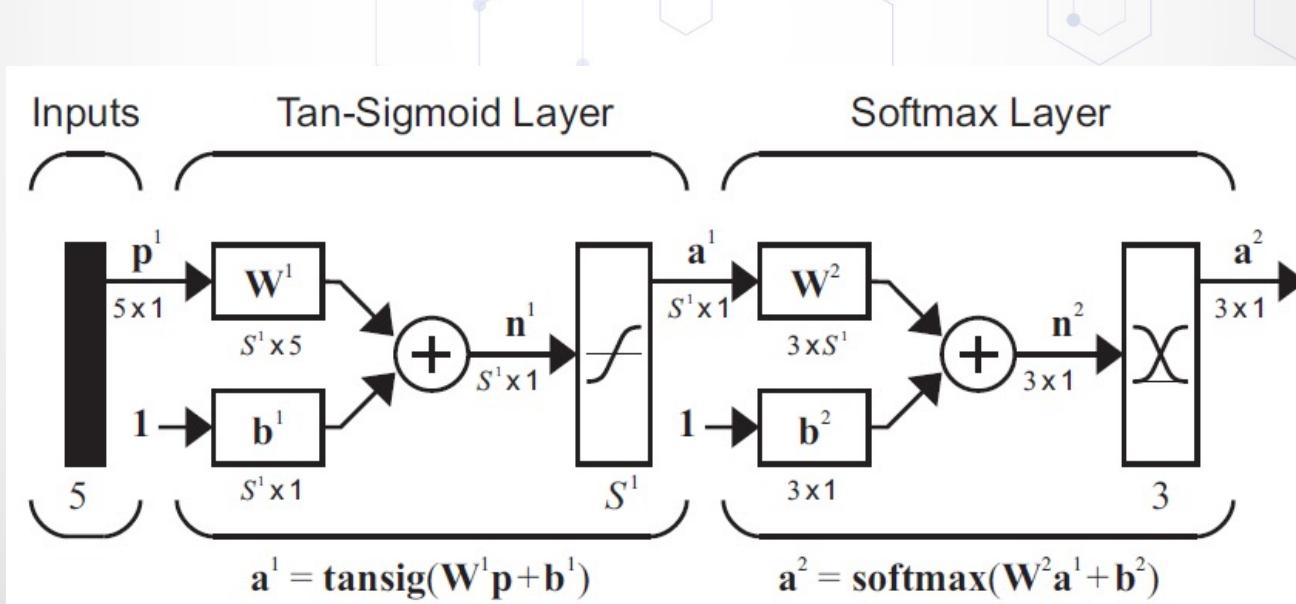


MLP para clasificación con conjunto de datos de vino

- Estos datos son el resultado de un análisis químico de vinos cultivados en la misma región de Italia pero derivados de tres variedades diferentes
- El análisis determinó las cantidades de 13 constituyentes encontrados en cada uno de los tres tipos de vino
- Los atributos son:
 - 1) Alcohol, 2) Ácido málico, 3) Ceniza, 4) Alcalinidad de la ceniza, 5) Magnesio, 6) Fenoles totales, 7) Flavonoides, 8) Fenoles no flavonoides, 9) Proantocianidinas, 10) Intensidad de color, 11) Tono, 12) OD280/OD315 de vinos diluidos, 13) Proline.
- Número de instancias:
 - clase 1: 59, clase 2: 71, clase 3: 48.

Softmax

$$a_i = f(n_i) = \exp(n_i) \div \sum_{j=1}^S \exp(n_j).$$



Softmax

```
import numpy as np

def softmax(X):
    x = np.exp(X)
    x = x / sum(x)
    return x

np.random.seed(123)

N = np.random.rand(3)
P = softmax(N)

print("---- Salidas N ----")
print(N)
print("---- Probabilidades ----")
print(P)
print("---- Suma de probabilidades ----")
print(sum(P))
```

---- Salidas N ----
[0.69646919 0.28613933 0.22685145]
---- Probabilidades ----
[0.43693449 0.28987605 0.27318946]
---- Suma de probabilidades ----
1.0

Código

MLP para clasificación con imágenes

Labeled Faces in the Wild



Menu

- LFW Home
 - Explore
 - Download
 - Train/Test
 - Results
 - Information
 - Errata
 - Reference
 - Resources
 - Contact
 - Support
 - Changes
- Part Labels
- UMass Vision

Labeled Faces in the Wild Home



On October 29th at ICCV 2019 in Seoul, the creators of LFW were **honored with the Mark Everingham Award for service to the Computer Vision Community**. Thanks to all that have participated in making LFW a success!

NEW RESULTS PAGE:

WE HAVE RECENTLY UPDATED AND CHANGED THE FORMAT AND CONTENT OF OUR **RESULTS PAGE**. PLEASE REFER TO THE **NEW TECHNICAL REPORT** FOR DETAILS OF THE CHANGES.

MLP para clasificación con imágenes

7.2.3. The Labeled Faces in the Wild face recognition dataset

This dataset is a collection of JPEG pictures of famous people collected over the internet, all details are available on the official website:

<http://vis-www.cs.umass.edu/lfw/>

Each picture is centered on a single face. The typical task is called Face Verification: given a pair of two pictures, a binary classifier must predict whether the two images are from the same person.

An alternative task, Face Recognition or Face Identification is: given the picture of the face of an unknown person, identify the name of the person by referring to a gallery of previously seen pictures of identified persons.

Both Face Verification and Face Recognition are tasks that are typically performed on the output of a model trained to perform Face Detection. The most popular model for Face Detection is called Viola-Jones and is implemented in the OpenCV library. The LFW faces were extracted by this face detector from various online websites.

Data Set Characteristics:

Classes	5749
Samples total	13233
Dimensionality	5828
Features	real, between 0 and 255

MLP para clasificación con imágenes

Modelo MLP

```
mlp = MLPClassifier(  
    hidden_layer_sizes=(100,25),  
    activation='relu',  
    learning_rate_init=0.001,  
    max_iter=300,  
    solver='sgd'  
)
```

- (Pre-)Procesamiento de imágenes

Código



Aprendizaje Profundo

Deep Learning (DL)



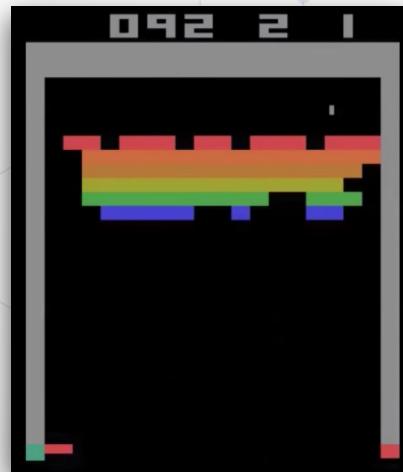
Inteligencia Artificial - Desarrollo histórico

- Nuevo regreso de redes neuronales - “deep learning”(2011- presente)
- DeepMind



DQN: Human-level control of Atari games

One of the great challenges in AI is building flexible systems that can take on a wide range of tasks. Our Deep Q-Network (DQN) surpassed the overall performance of professional players in 49 different Atari games using only raw pixels and the score as inputs.



AlphaGo defeats Lee Sedol in the game of Go

While becoming the first computer program to defeat a professional human Go player, AlphaGo taught the world new knowledge about perhaps the most studied and contemplated game in history.



Inteligencia Artificial - Desarrollo histórico

nature[Explore content](#) ▾ [Journal information](#) ▾ [Publish with us](#) ▾[nature](#) > [articles](#) > [article](#)

Article | Published: 15 July 2021

This is an unedited manuscript that has been accepted for publication. Nature Research are providing this early version of the manuscript as a service to our authors and readers. The manuscript will undergo copyediting, typesetting and a proof review before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers apply.

Highly accurate protein structure prediction with AlphaFold

John Jumper , Richard Evans, [...] Demis Hassabis [Nature \(2021\)](#) | Cite this article

255k Accesses | 1 Citations | 2660 Altmetric | Metrics

<https://www.nature.com/articles/s41586-021-03819-2>

The recipes for those proteins - called genes - are encoded in our DNA

Proteins are comprised of chains of amino acids (also referred to as amino acid residues). But DNA only contains information about the *sequence* of amino acids - not how they fold into shape

Predicting how these chains will fold into the intricate 3D structure of a protein is what's known as the "protein folding problem" - a challenge that scientists have worked on for decades

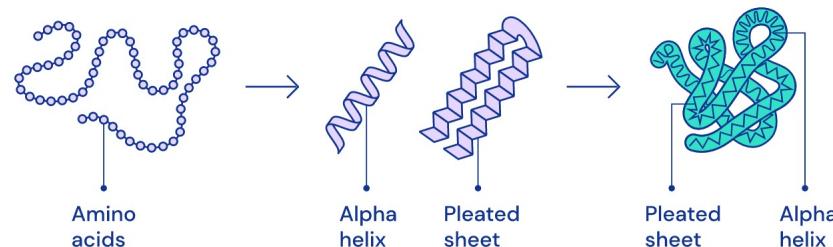


Figure 1: Complex 3D shapes emerge from a string of amino acids.

Inteligencia Artificial - Desarrollo histórico

Science

Contents ▾ News ▾ Careers ▾ Journals ▾

Read our COVID-19 research and news.

Advertisement



SHARE

RESEARCH ARTICLE

Accurate prediction of protein structures and interactions using a three-track neural network

 Minkyung Baek^{1,2},  Frank DiMaio^{1,2},  Ivan Anishchenko^{1,2},  Justas Dauparas^{1,2},  Sergey Ovchinnikov^{3,4},  Gyu Rie Lee^{1,2},  Jue Wang^{1,2},  Qian Cong^{5,6},  Lisa N. Kinch⁷,  R. Dustin Schaeffer⁶,  Claudia Millán⁸,  Hahnbeom Park^{1,2},  Carson Adams^{1,2},  Caleb R. Glassman^{9,10},  Andy DeGiovanni¹²,  Jose H. Pereira¹²,  Andria V. Rodrigues¹²,  Alberdina A. van Dijk¹³,  Ana C. Ebrecht¹³,  Diederik J. Opperman¹⁴,  Theo Sargemeister¹⁵,  Christoph Buhleller^{15,16},  Tea Pavkov-Keller^{15,17},  Manoj K. Rathinaswamy¹⁸,  Udit Dalwadi¹⁹,  Calvin K. Yip¹⁹,  John E. Burke¹⁸,  K. Christopher Garcia^{9,10,11,20},  Nick V. Grishin^{6,21,7},  Paul D. Adams^{12,22},  Randy J. Read⁸,  David Baker^{1,2,23,*}

¹Department of Biochemistry, University of Washington, Seattle, WA 98195, USA.
²Institute for Protein Design, University of Washington, Seattle, WA 98195, USA.
³Faculty of Arts and Sciences, Division of Science, Harvard University, Cambridge, MA 02138, USA.
⁴John Harvard Distinguished Science Fellowship Program, Harvard University, Cambridge, MA 02138, USA.
⁵Eugene McDermott Center for Human Growth and Development, University of Texas Southwestern Medical Center, Dallas, TX, USA.

<https://science.sciencemag.org/content/early/2021/07/19/science.abj8754>

Inteligencia Artificial - Desarrollo histórico

DALL-E 2

DALL-E 2 is an AI system that can create realistic images and art from a description in natural language.

Input

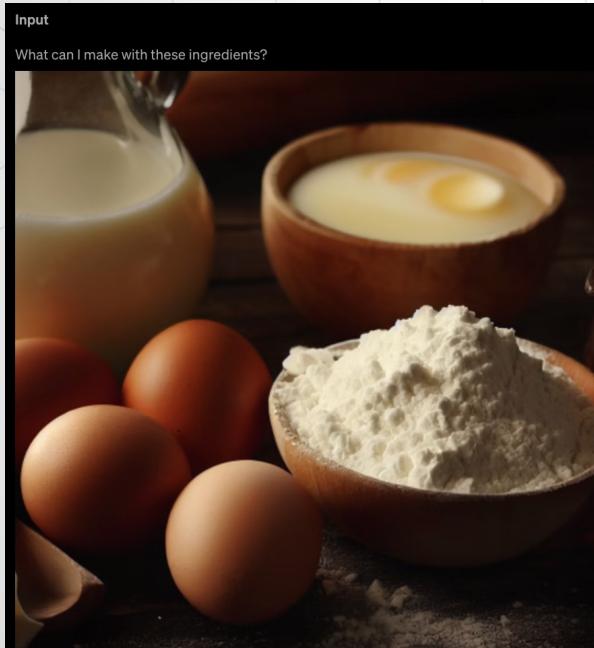
An astronaut riding a horse in photorealistic style.

Output



Inteligencia Artificial - Desarrollo histórico

GPT-4 can solve difficult problems with greater accuracy, thanks to its broader general knowledge and problem solving abilities.

**Output**

There are many options for what you can make with these ingredients! Some possibilities include:

- Pancakes or waffles
- Crepes
- French toast
- Omelette or frittata
- Quiche
- Custard or pudding
- Cake or cupcakes
- Muffins or bread- Cookies or biscuits

User What is funny about this image? Describe it panel by panel.



GPT-4 The image shows a package for a "Lightning Cable" adapter with three panels.

Panel 1: A smartphone with a VGA connector (a large, blue, 15-pin connector typically used for computer monitors) plugged into its charging port.

Panel 2: The package for the "Lightning Cable" adapter with a picture of a VGA connector on it.

Panel 3: A close-up of the VGA connector with a small Lightning connector (used for charging iPhones and other Apple devices) at the end.

The humor in this image comes from the absurdity of plugging a large, outdated VGA connector into a small, modern smartphone charging port.

Inteligencia Artificial - Desarrollo histórico



GPT-4 Developer Livestream

The stream will begin in:

00:00:03

<https://www.youtube.com/watch?v=outcGtbnMuQ>

Deep Learning

- Las ideas principales sobre las redes neuronales modernas no han cambiado mucho desde los 80's
- Los resultados recientes de DL se pueden atribuir a:
 - Gran cantidad de datos
 - Redes neuronales más grandes
 - Mayor poder de computo

Libro

- <https://www.deeplearningbook.org/>

Deep Learning

An MIT Press book

Ian Goodfellow and Yoshua Bengio and Aaron Courville

[Exercises](#) [Lectures](#) [External Links](#)

The Deep Learning textbook is a resource intended to help students and practitioners enter the field of machine learning in general and deep learning in particular. The online version of the book is now complete and will remain available online for free.

The deep learning textbook can now be ordered on [Amazon](#).

For up to date announcements, join our [mailing list](#).

Citing the book

To cite this book, please use this bibtex entry:

```
@book{Goodfellow-et-al-2016,  
    title={Deep Learning},  
    author={Ian Goodfellow and Yoshua Bengio and Aaron Courville},  
    publisher={MIT Press},  
    note={\url{http://www.deeplearningbook.org}},  
    year={2016}  
}
```

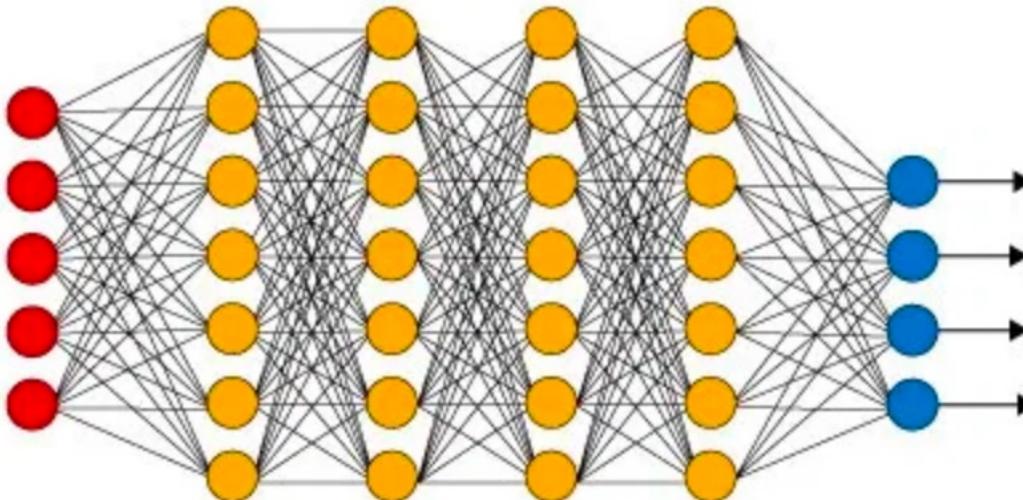
Deep Learning

- [Table of Contents](#)
- [Acknowledgements](#)
- [Notation](#)
- [1 Introduction](#)
- [Part I: Applied Math and Machine Learning Basics](#)
 - [2 Linear Algebra](#)
 - [3 Probability and Information Theory](#)
 - [4 Numerical Computation](#)
 - [5 Machine Learning Basics](#)
- [Part II: Modern Practical Deep Networks](#)
 - [6 Deep Feedforward Networks](#)
 - [7 Regularization for Deep Learning](#)
 - [8 Optimization for Training Deep Models](#)
 - [9 Convolutional Networks](#)
 - [10 Sequence Modeling: Recurrent and Recursive Nets](#)
 - [11 Practical Methodology](#)
 - [12 Applications](#)
- [Part III: Deep Learning Research](#)
 - [13 Linear Factor Models](#)
 - [14 Autoencoders](#)
 - [15 Representation Learning](#)
 - [16 Structured Probabilistic Models for Deep Learning](#)
 - [17 Monte Carlo Methods](#)
 - [18 Confronting the Partition Function](#)
 - [19 Approximate Inference](#)
 - [20 Deep Generative Models](#)
- [Bibliography](#)
- [Index](#)

Deep Learning

- Las redes neuronales de avance profundo, también llamadas redes neuronales de avance o perceptrones multicapa (MLPs), son los modelos quintesenciales de aprendizaje profundo.

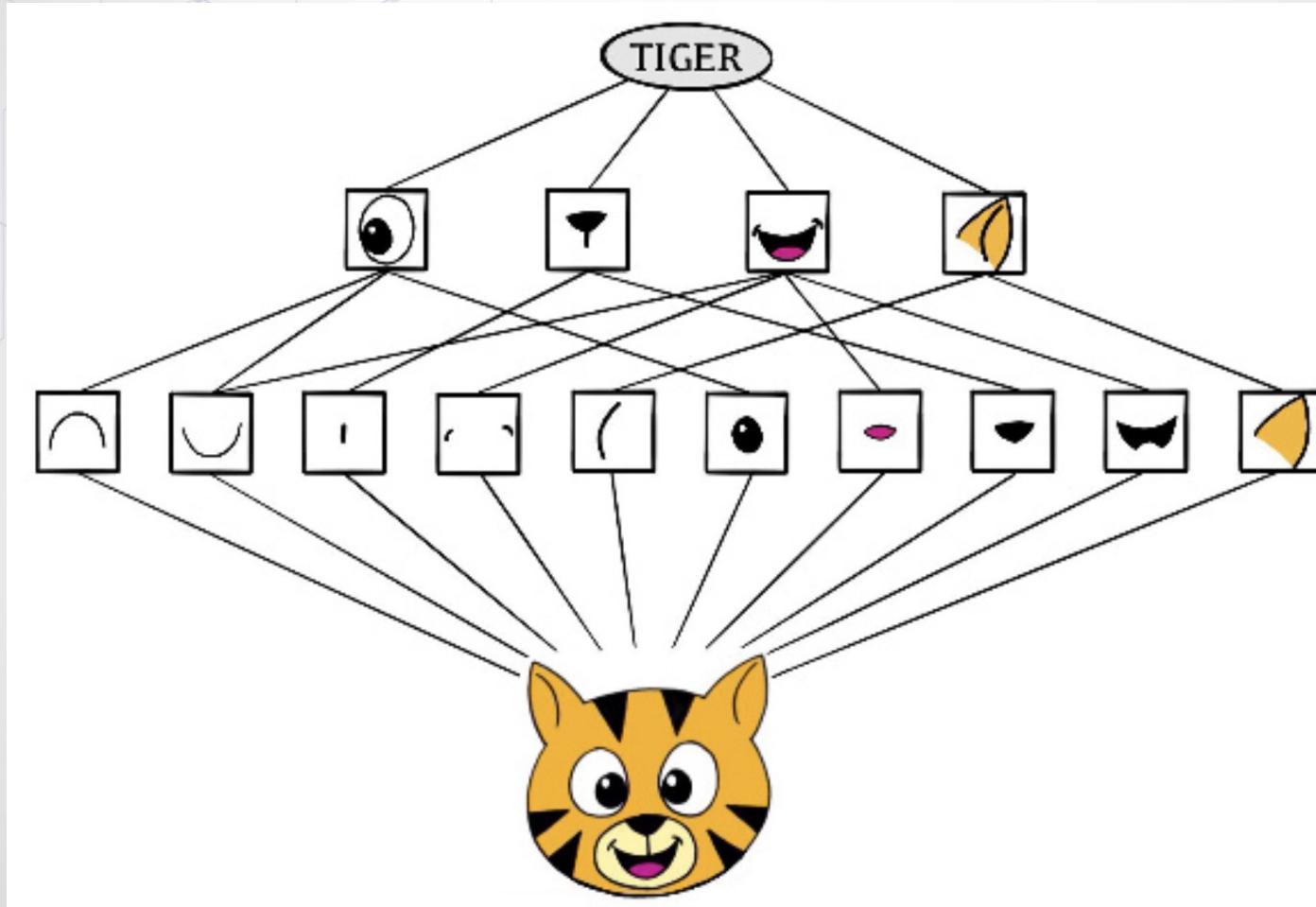
Deep Learning Neural Network



Redes Convolucionales (Convolutional Neural Networks)

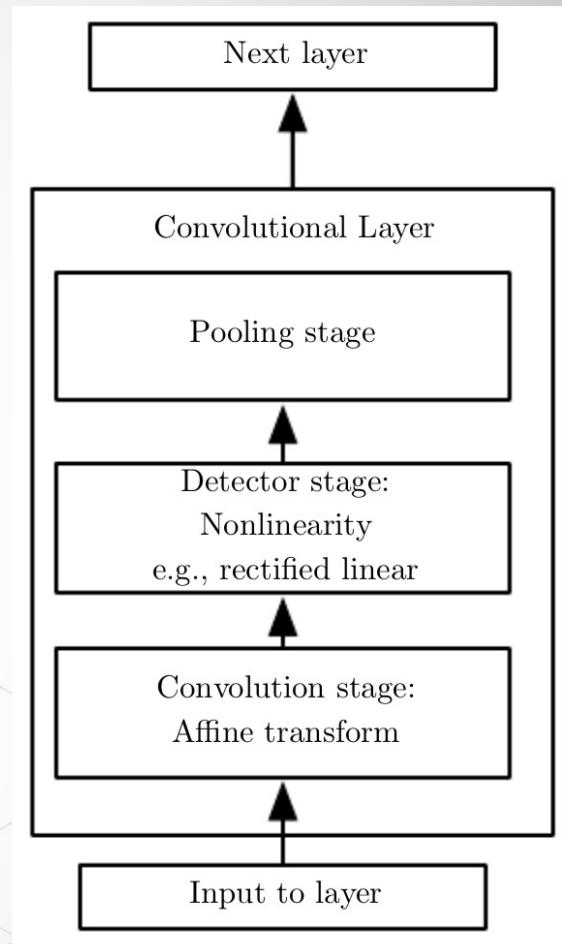
- La red utiliza una operación matemática llamada convolución
- La convolución es un tipo especializado de operación lineal
- Las redes convolucionales son simplemente redes neuronales que usan la convolución en al menos una de sus capas.

CNNs



CNNs

- Una capa típica de una red convolucional consta de tres etapas
- En la primera etapa, la capa realiza varias convoluciones en paralelo para producir un conjunto de activaciones lineales
- En la segunda etapa, cada activación lineal se ejecuta a través de una función de activación no lineal, por ejemplo, ReLU. A veces se llama etapa de detección
- En la tercera etapa, utilizamos una función de agrupación para modificar aún más la salida de la capa



Convolución



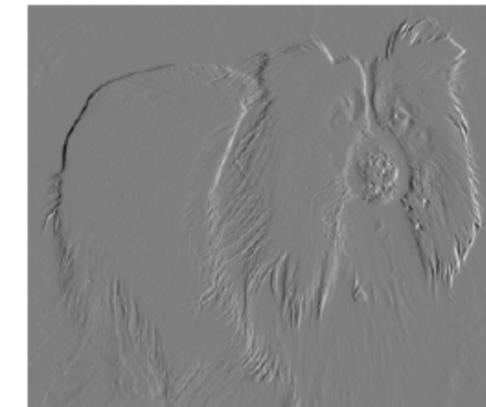
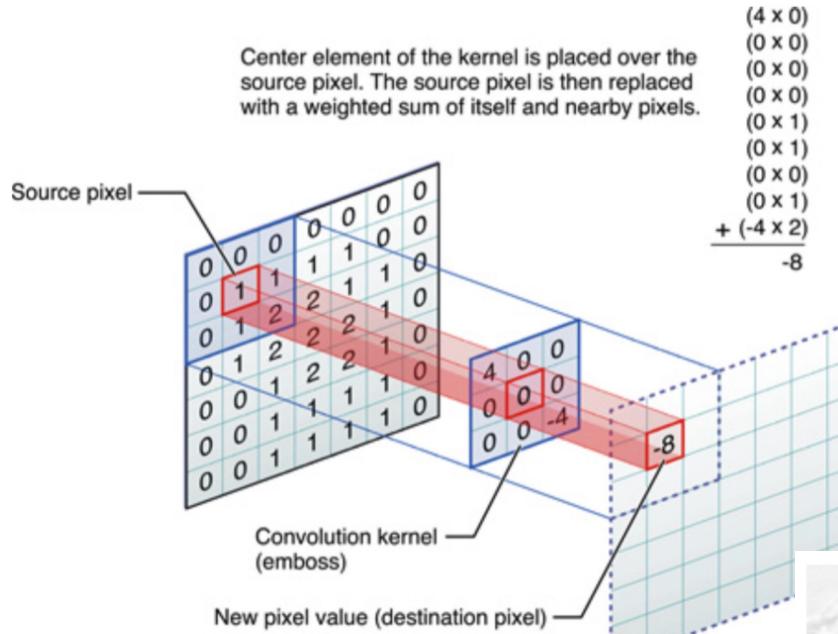
192×179

15×15



Convolución

Center element of the kernel is placed over the source pixel. The source pixel is then replaced with a weighted sum of itself and nearby pixels.



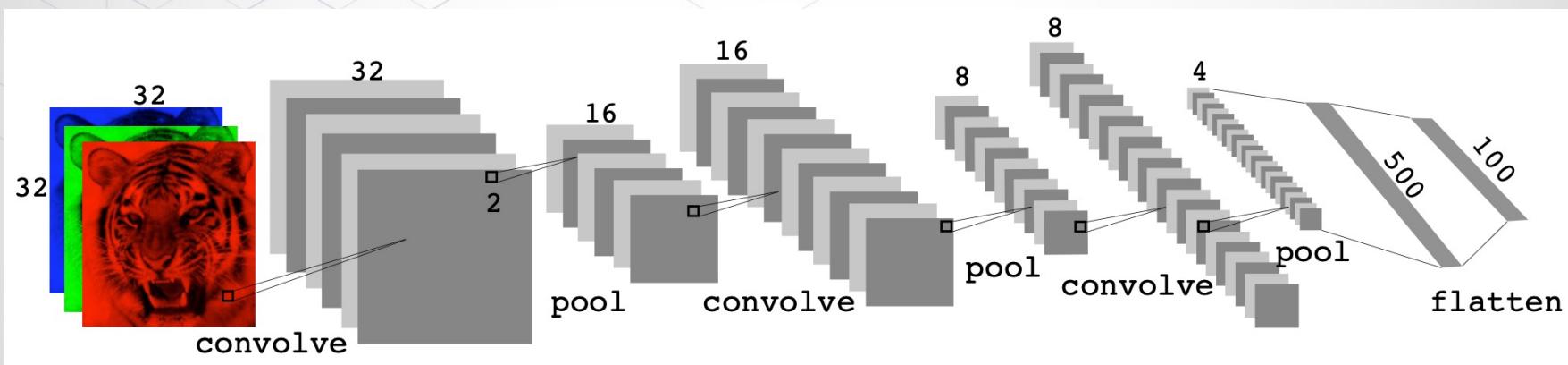
Pooling

- Una función de pooling reemplaza la salida de la red en una ubicación determinada con una estadística resumida de las salidas cercanas (por ejemplo, máx, media, suma, etc.).

Max pool

$$\begin{bmatrix} 1 & 2 & 5 & 3 \\ 3 & 0 & 1 & 2 \\ 2 & 1 & 3 & 4 \\ 1 & 1 & 2 & 0 \end{bmatrix} \rightarrow \begin{bmatrix} 3 & 5 \\ 2 & 4 \end{bmatrix}$$

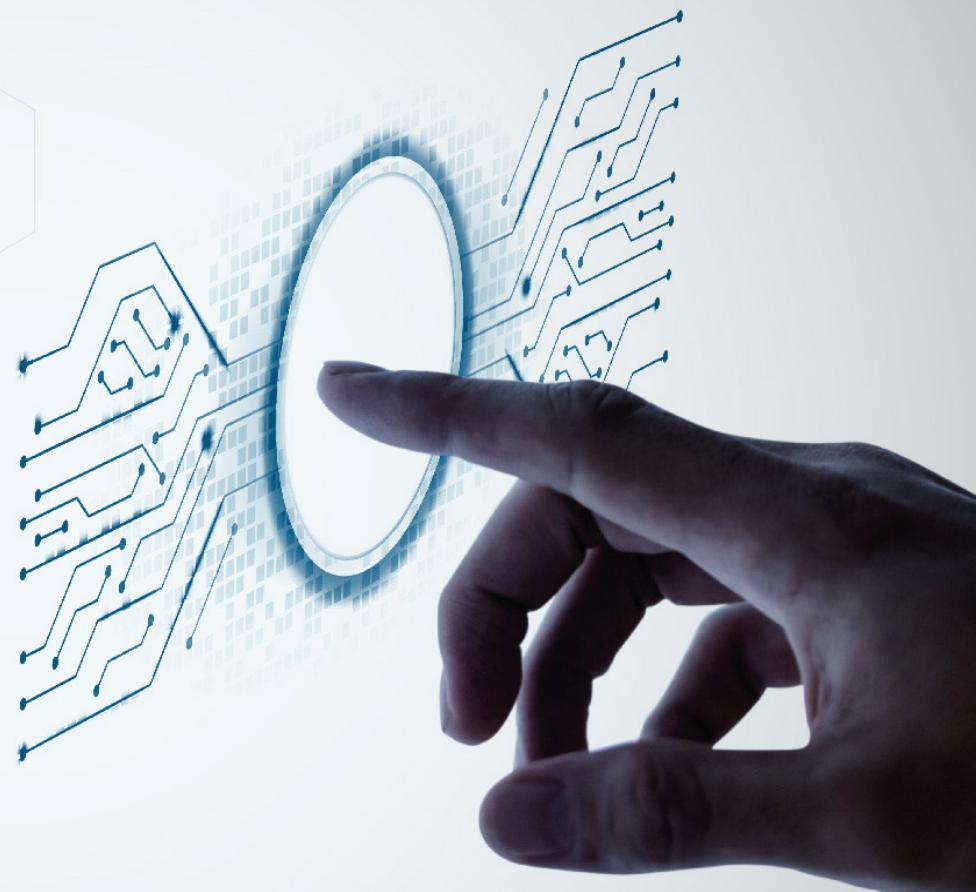
CNNs



Engineering X

Founded by the Royal Academy of Engineering
and Lloyd's Register Foundation

GRACIAS



<https://hubiq.mx/>

HUBIQ.RO HUBIQ HUBIQ.RO