Introduction to Machine Learning

28 04 2023

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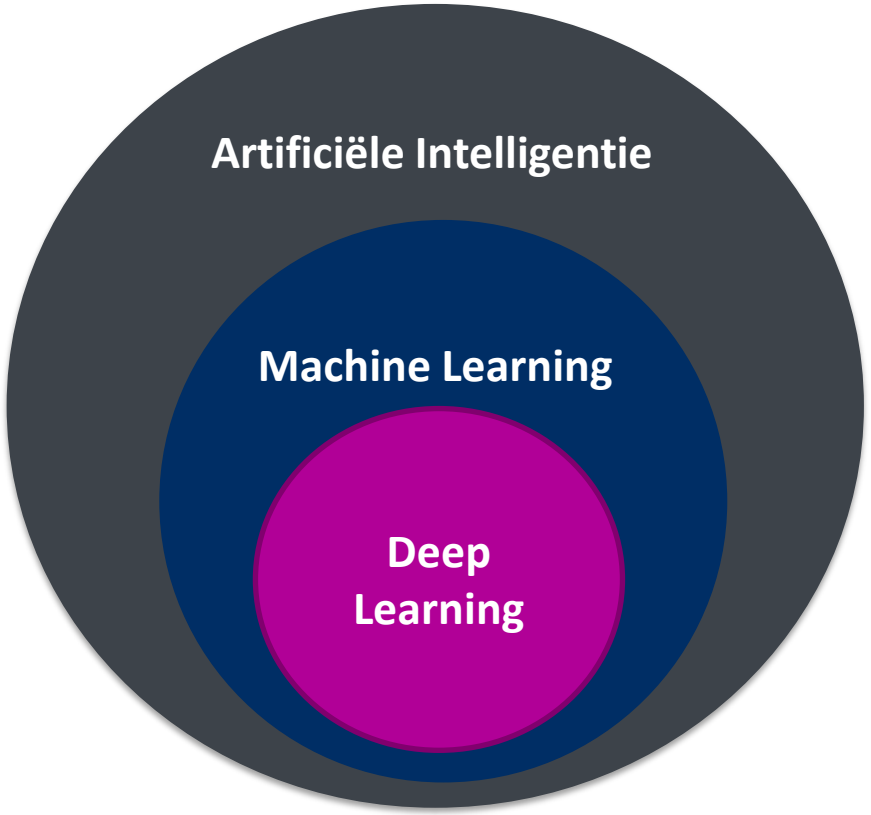
AI - Machine Learning - Deep Learning

Statistische machine learning classifiers:

- Logistische regressie
- K-nearest neighbors (KNN)
- Support Vector Machine (SVM)
- Decision Tree
- …

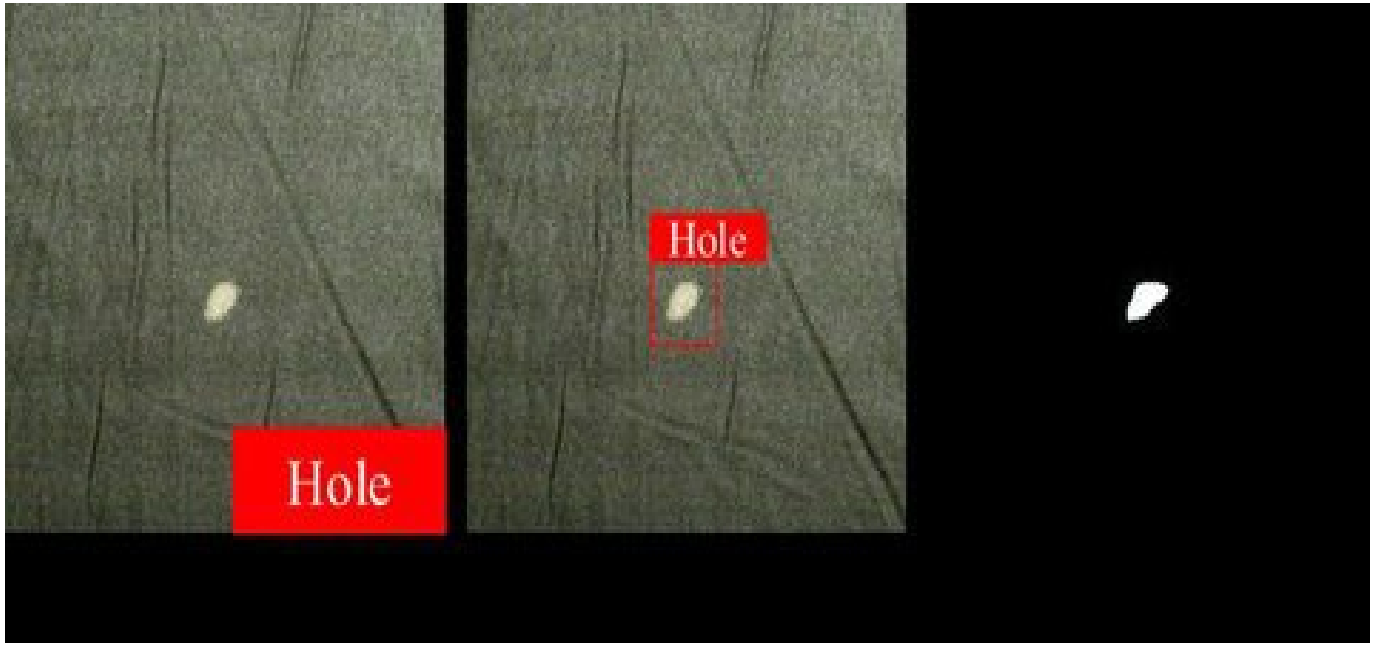
deep learning architectures:

- Convolutional Neural Networks (CNN)
- Generative Adversarial Networks (GAN)
- Autoencoder (AE)…



CNN - Convolutional Neural Netwerk

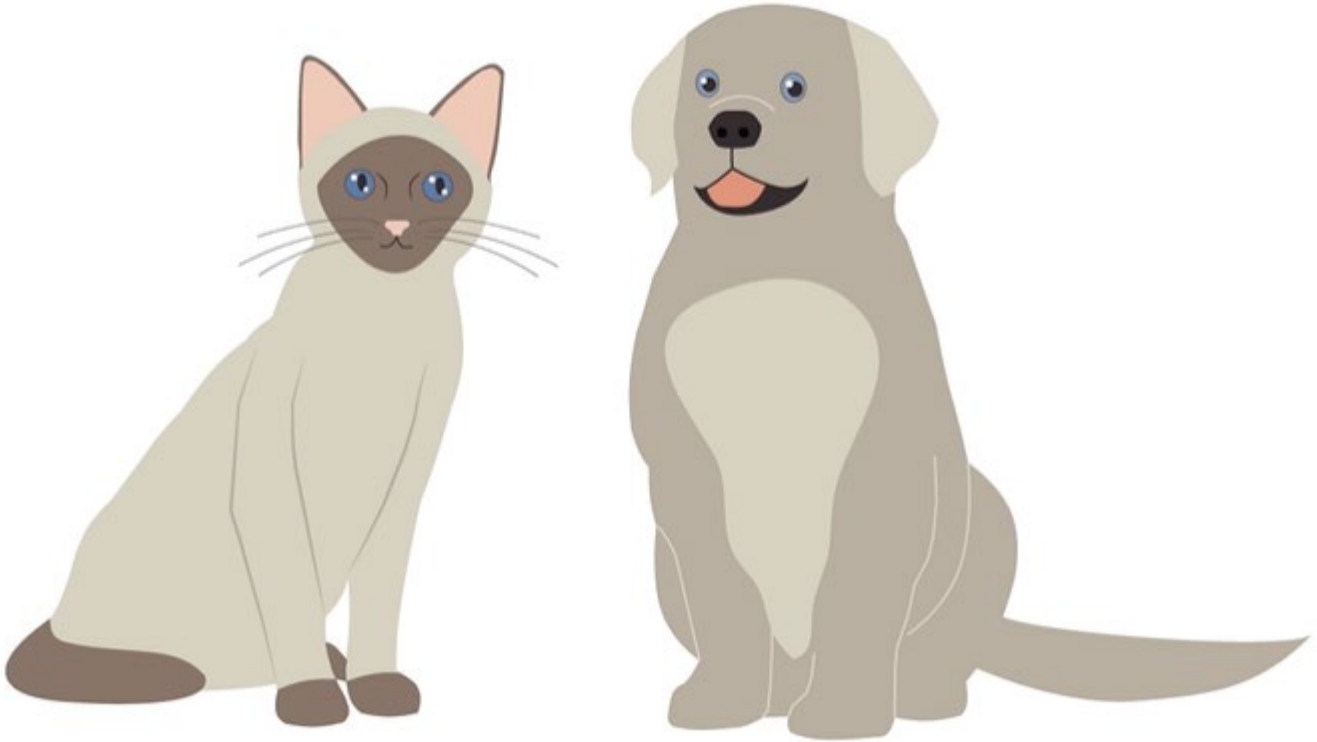
- **Doel: Analyse van afbeeldingen**



Classificatie **Lokalisatie** **Segmentatie**

Machine learning workflow

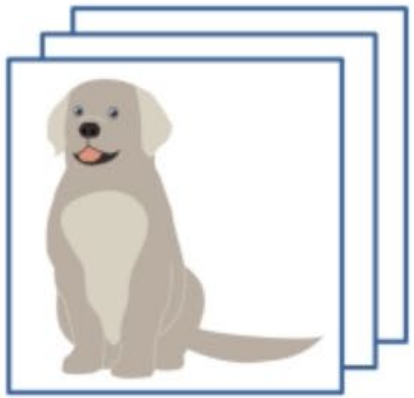
Classificatie



kat **hond**

MACHINE LEARNING WORKFLOW

TRAINING DATA

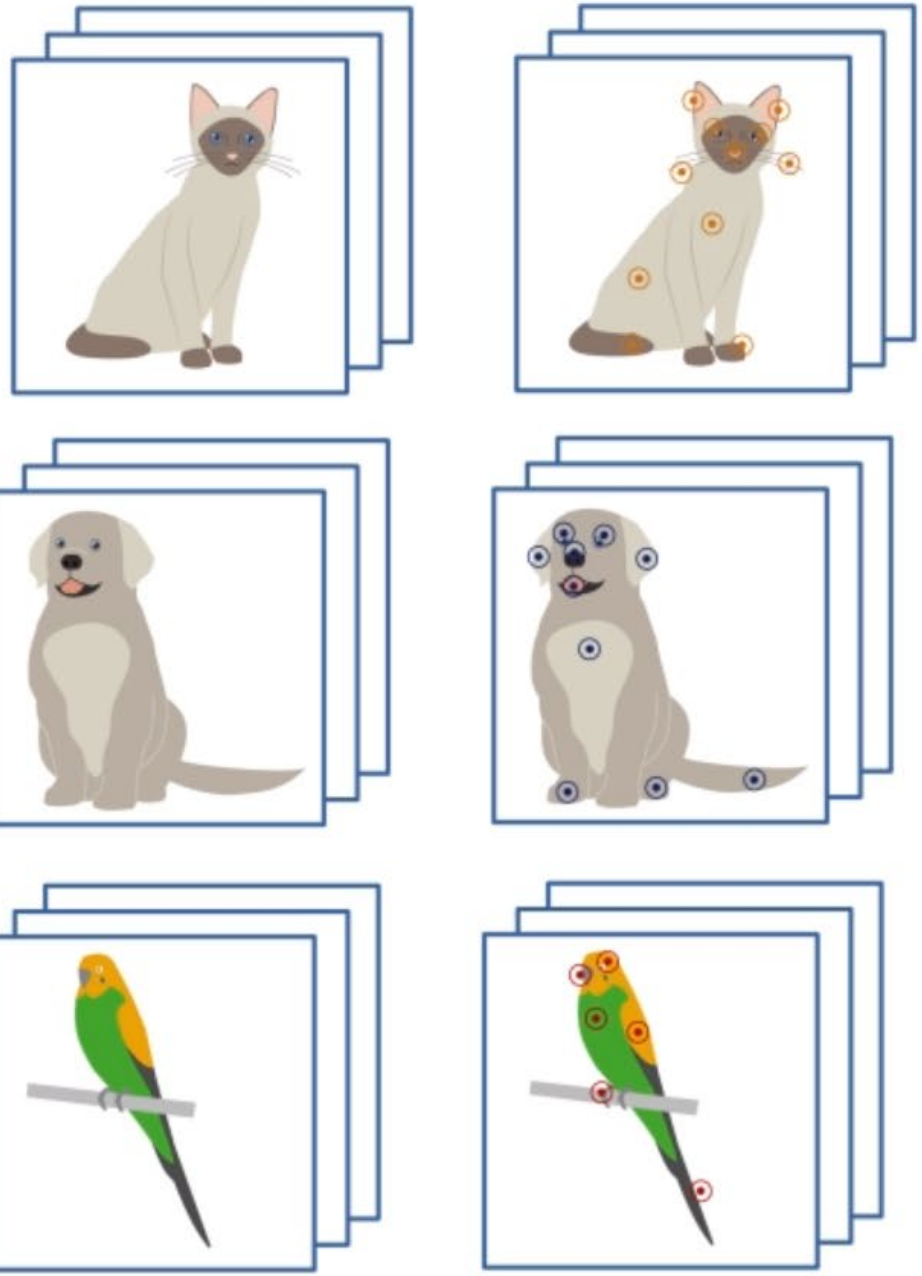


MACHINE LEARNING WORKFLOW

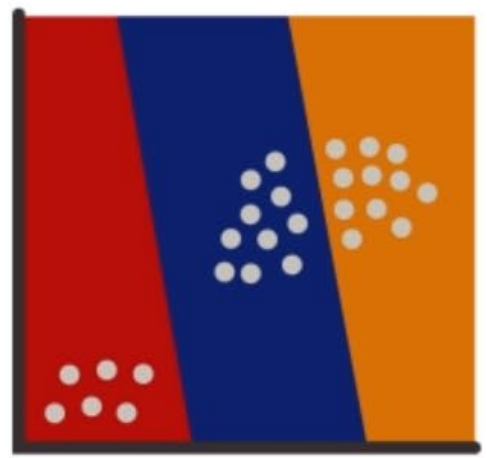
MACHINE LEARNING WORKFLOW

TRAINING DATA

FEATURE EXTRACTION



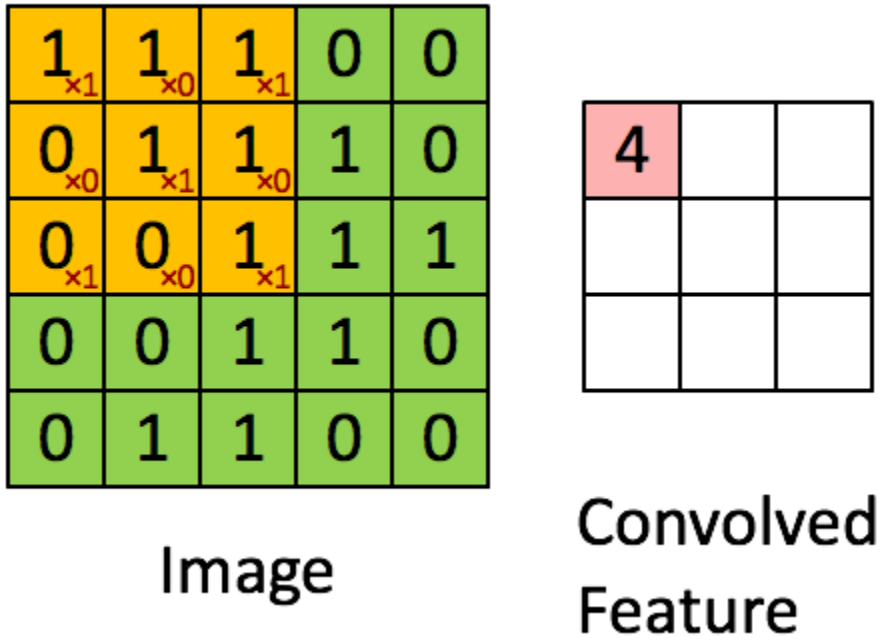
MACHINE LEARNING
MODEL CLASSIFICATION



MACHINE LEARNING WORKFLOW

CNN - Convolutional Neural Netwerk

Wat is een convolutie? Wat is het doel?

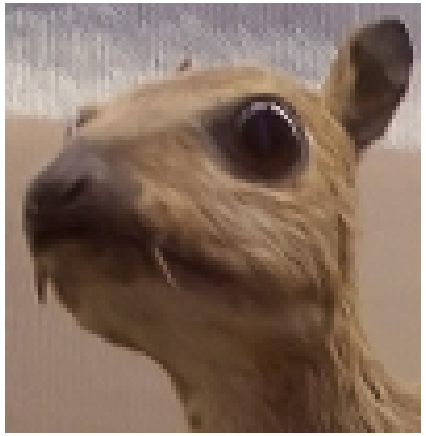


Bron: https://developer.nvidia.com/discover/convolutional-neural-network

CNN - Convolutional Neural Netwerk

Wat is een convolutie? Wat is het doel?

Input image



128 x 128

Convolution Kernel

$$\begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix}$$

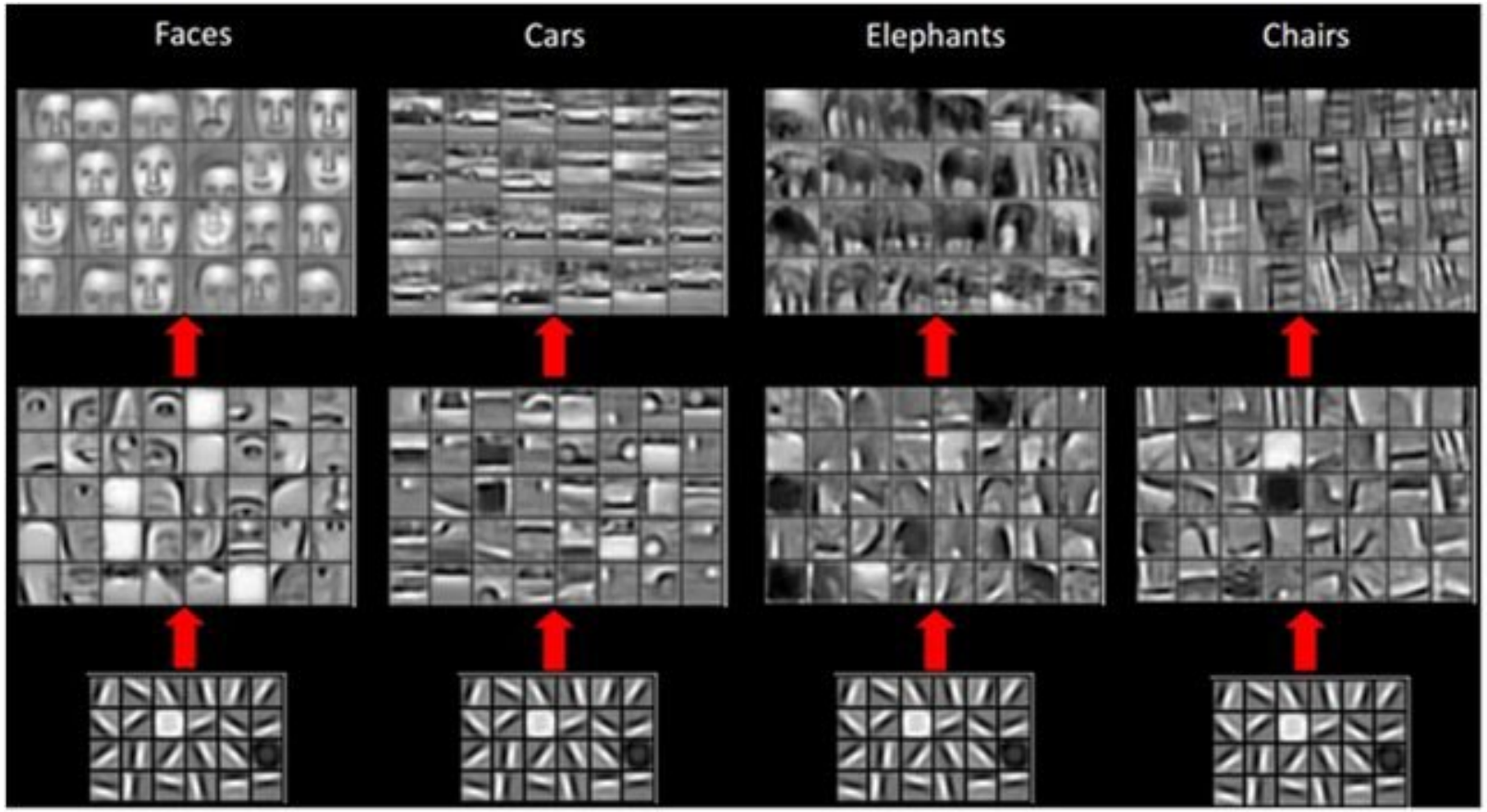
Feature map

96 x 96

Bron: https://developer.nvidia.com/discover/convolutional-neural-network

CNN - Convolutional Neural Netwerk

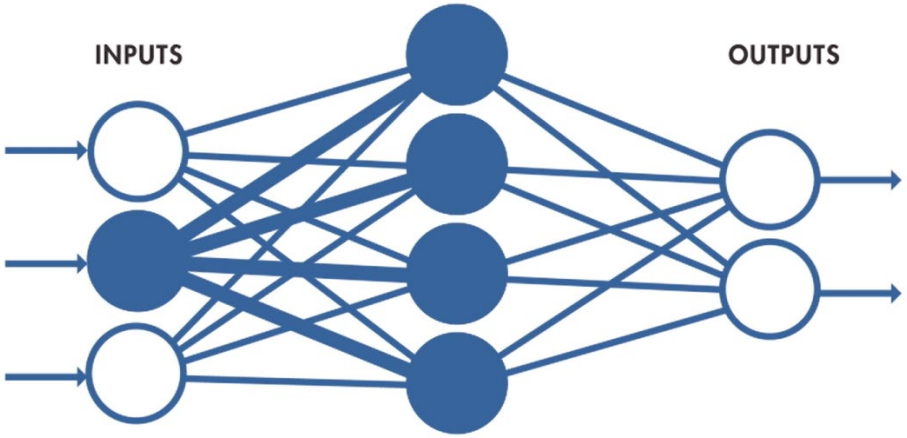
Features



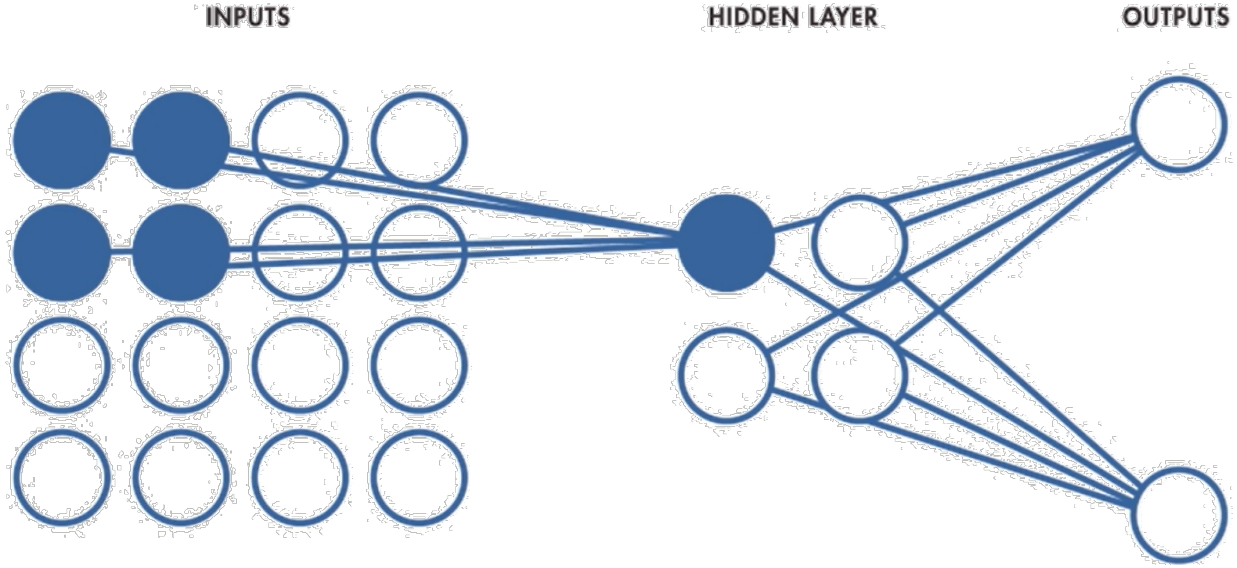
Bron:
https://www.researchgate.net/publication/308883811_Adaptive_Neuron_Apoptosis_for_Accelerating_Deep_Learning_on_Large_Scale_Systems

CNN - Convolutional Neural Netwerk

Local receptive field



Typisch Neuraal Netwerk



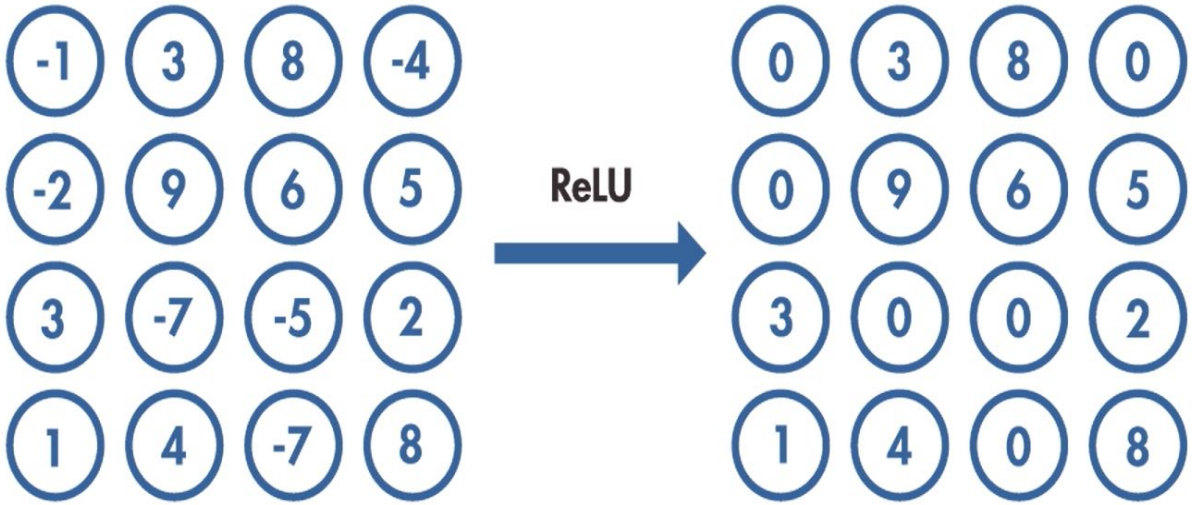
CNN

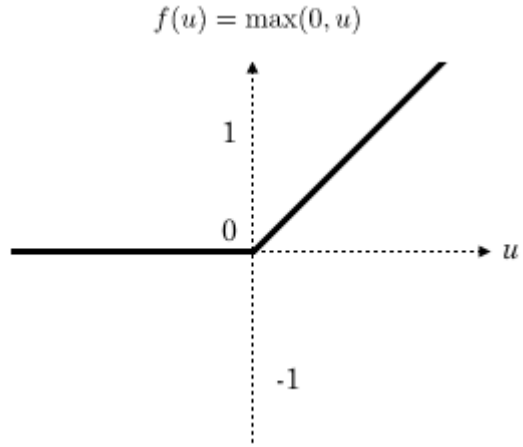
Bron: https://nl.mathworks.com/videos/introduction-to-deep-learning-what-are-convolutional-neural-networks--1489512765771.html

CNN - Convolutional Neural Netwerk

Activation Function en Pooling

niet-lineaire functies

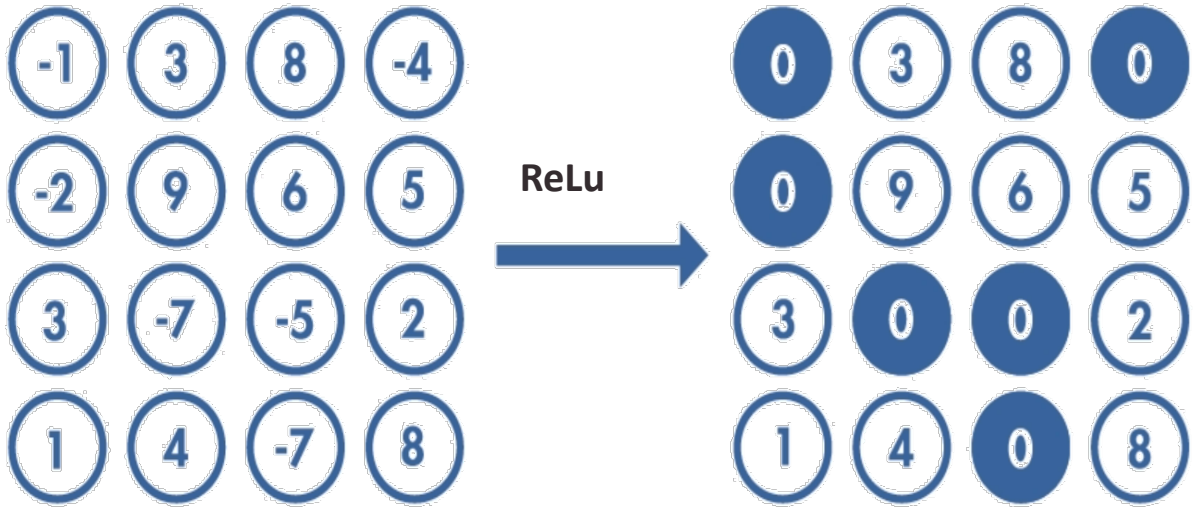


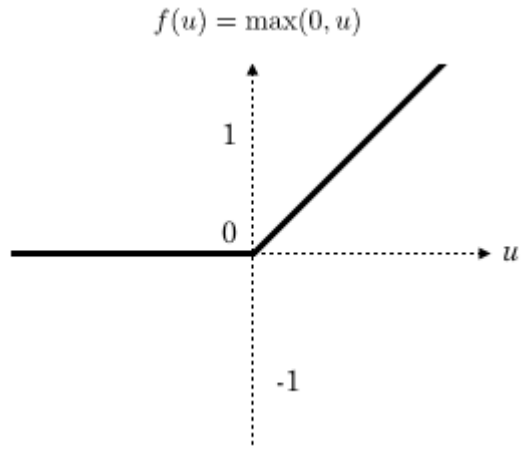


ReLU
(rectified linear unit)

CNN - Convolutional Neural Netwerk

Activation Function en Pooling





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CNN - Convolutional Neural Netwerk

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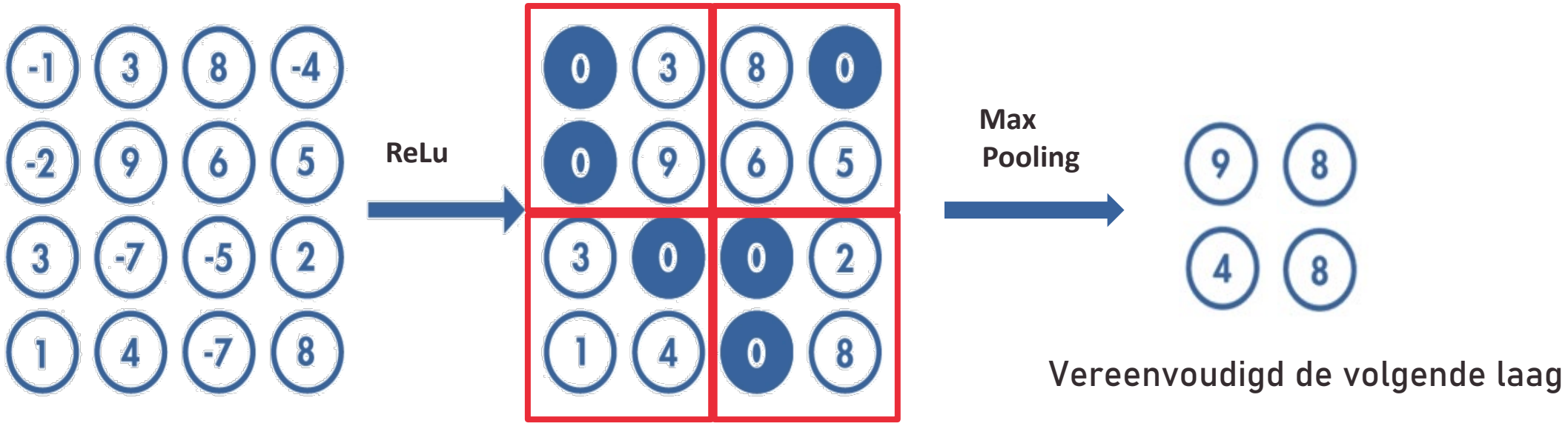
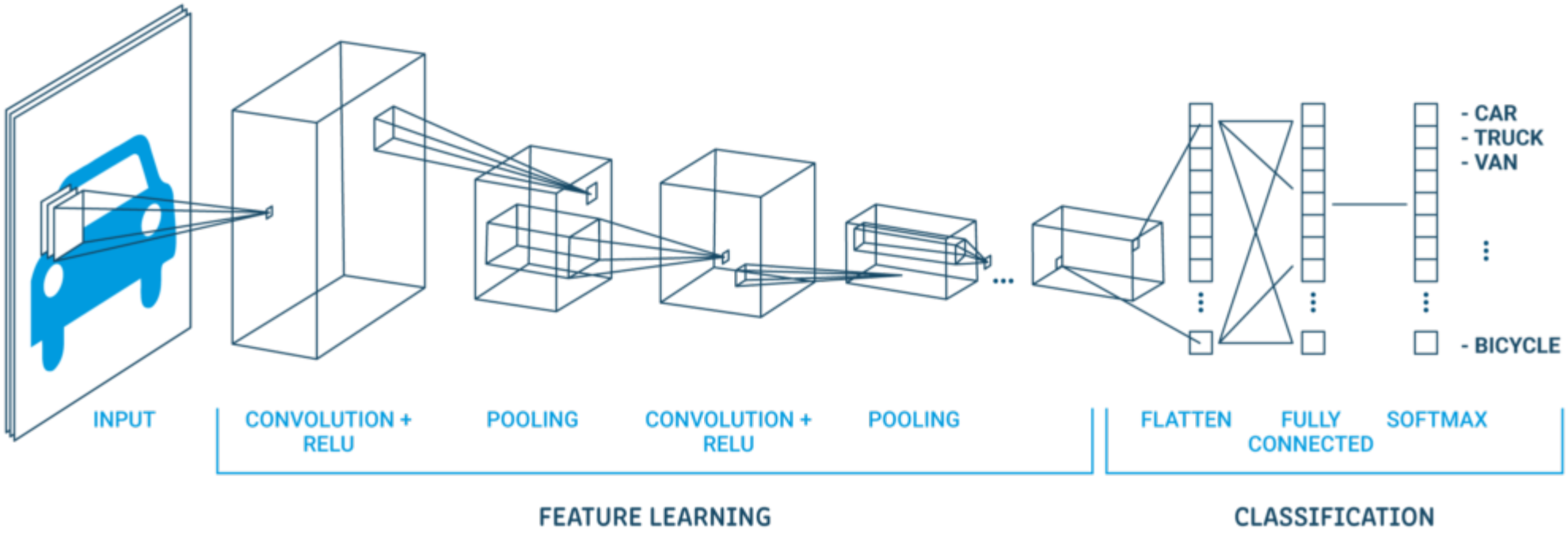
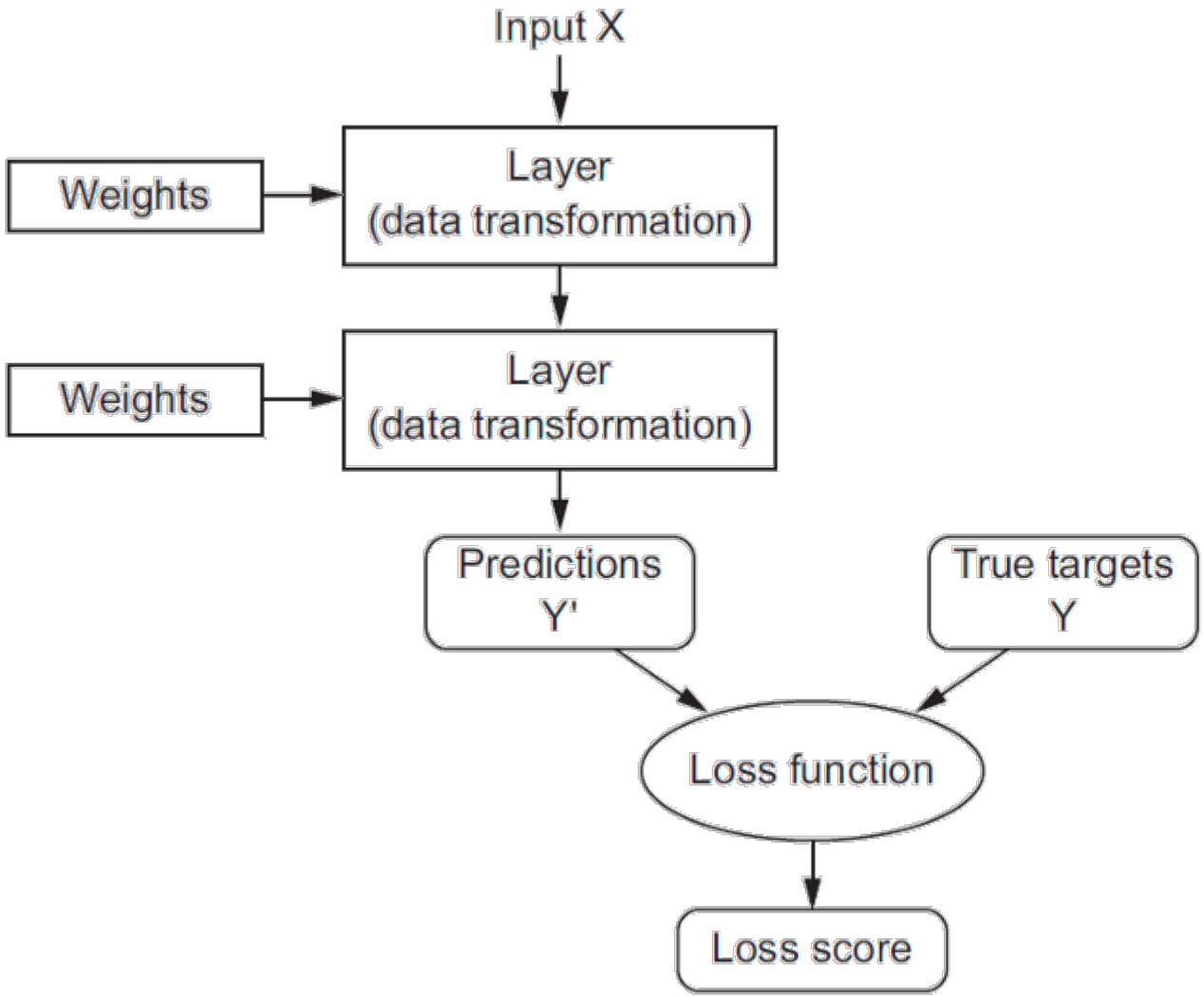
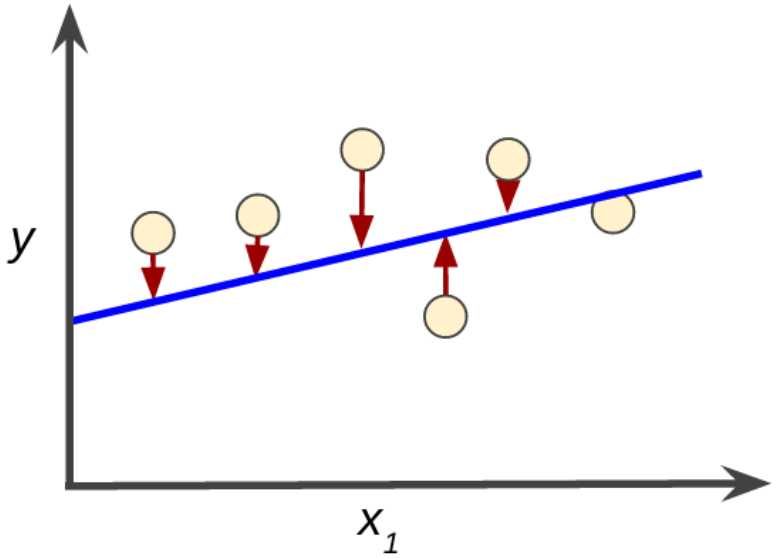


CNN - Convolutional Neural Netwerk



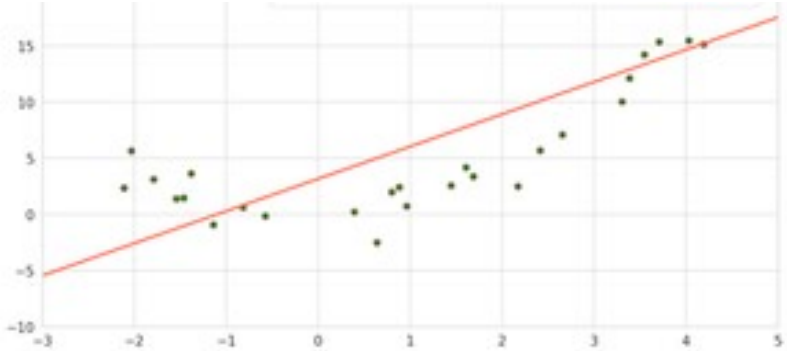
Loss functie



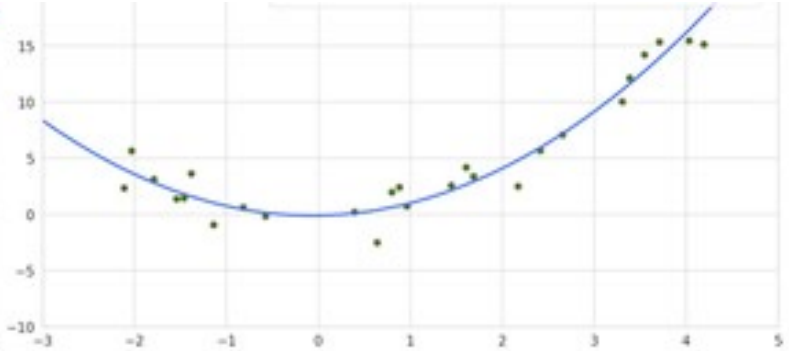


Prestatie van het model

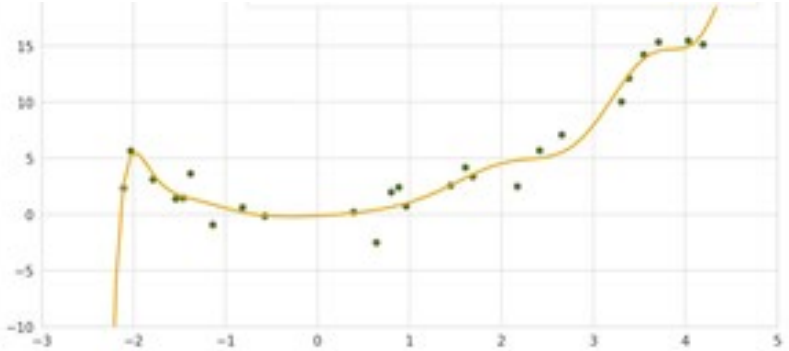
Under fit



Good fit

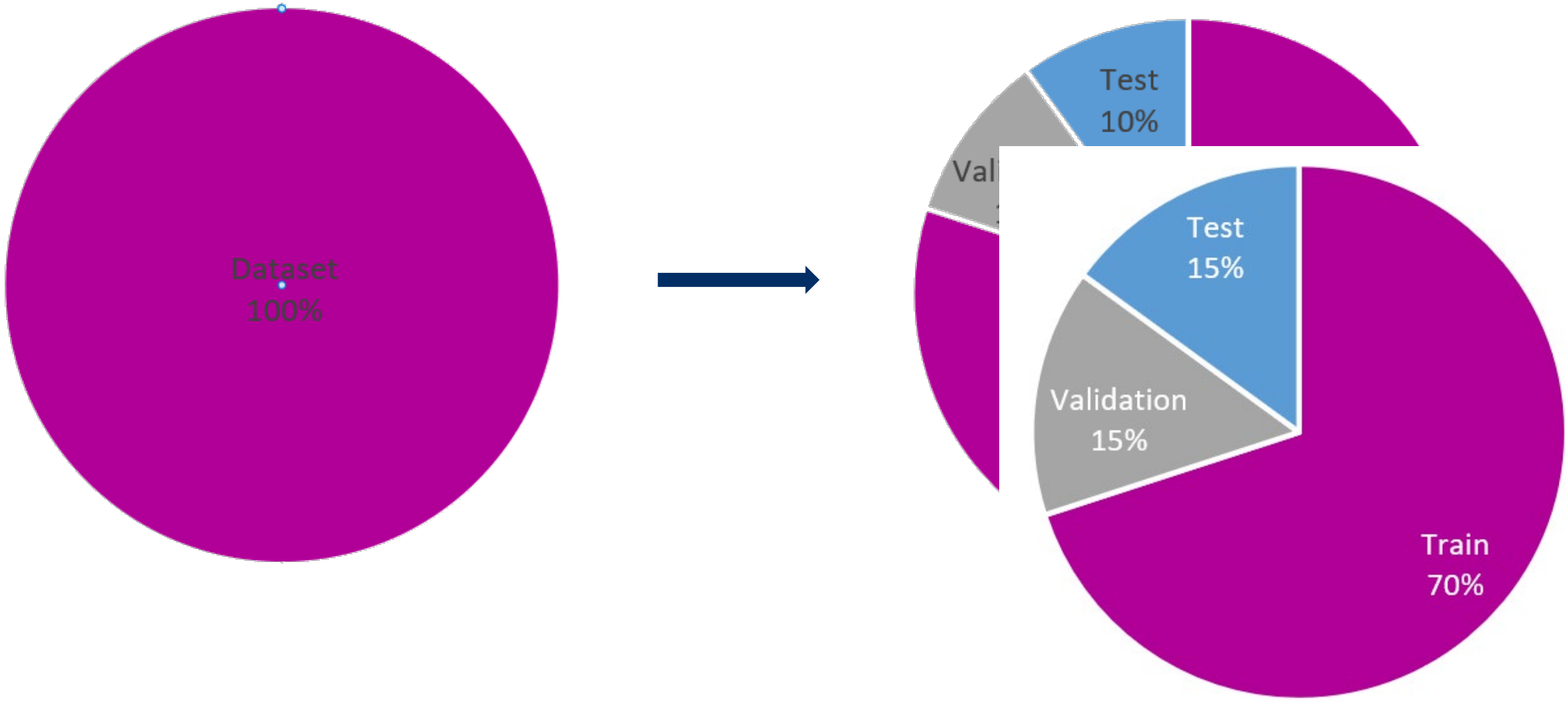


Over fit



Bron: https://www.baeldung.com/cs/ml-underfitting-overfitting

dataset splitting



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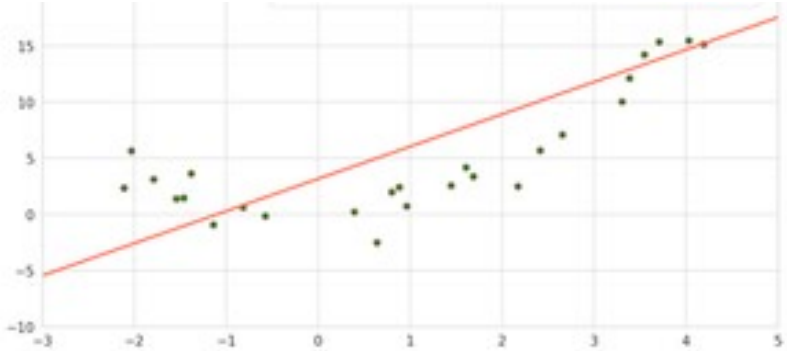

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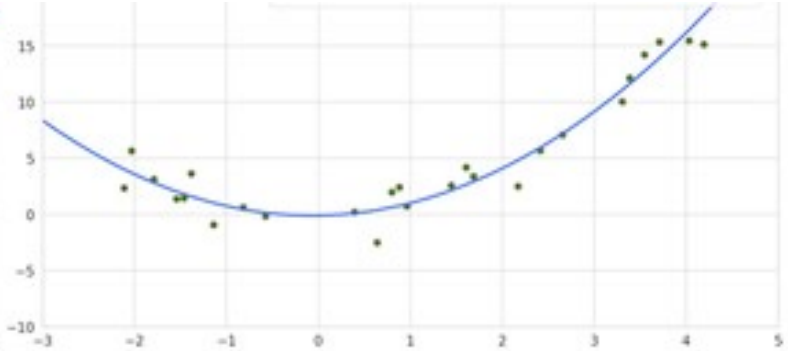

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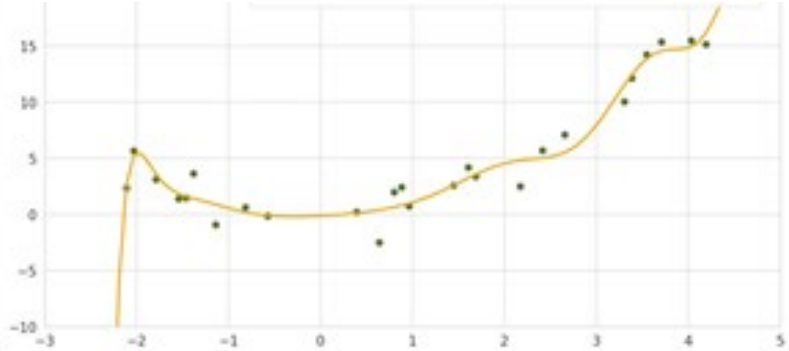

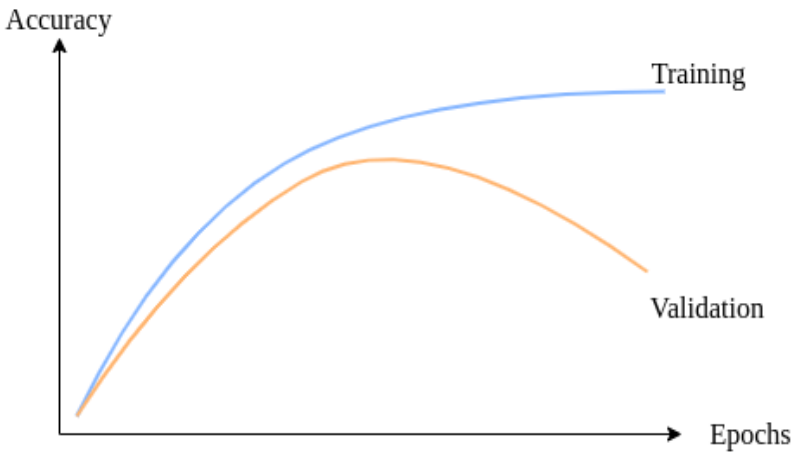

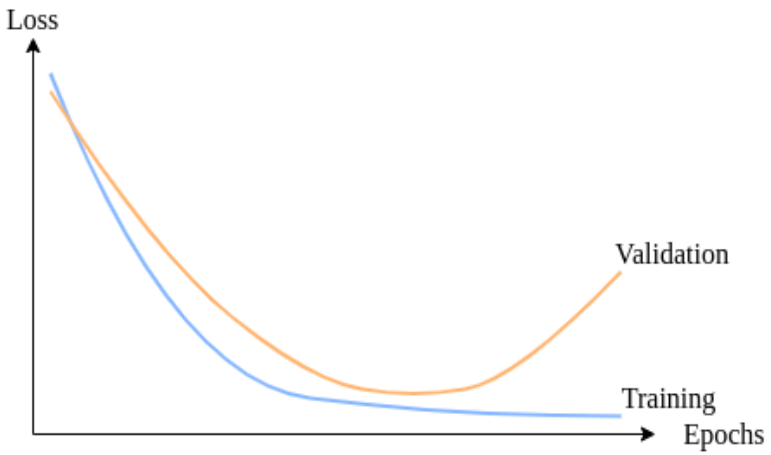

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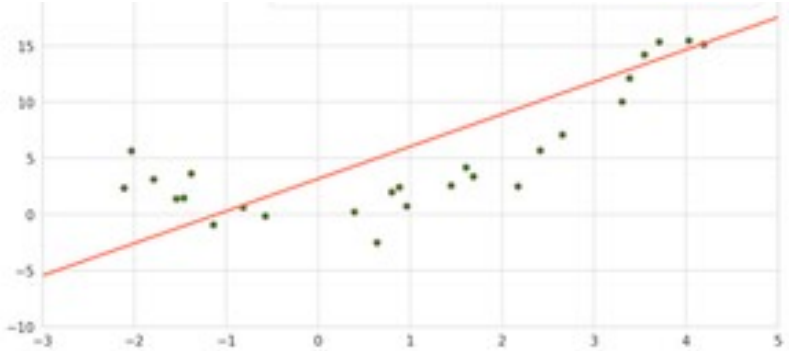

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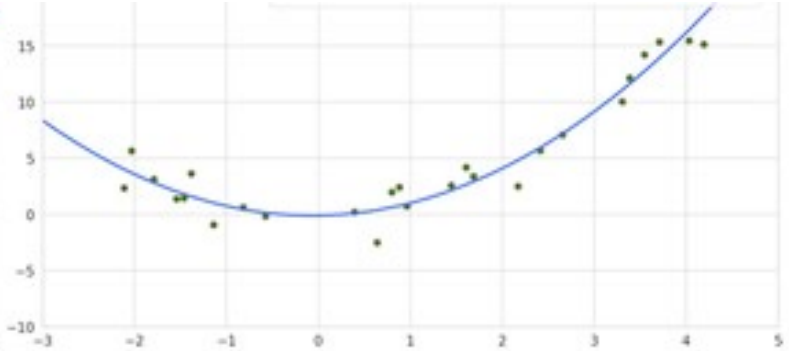

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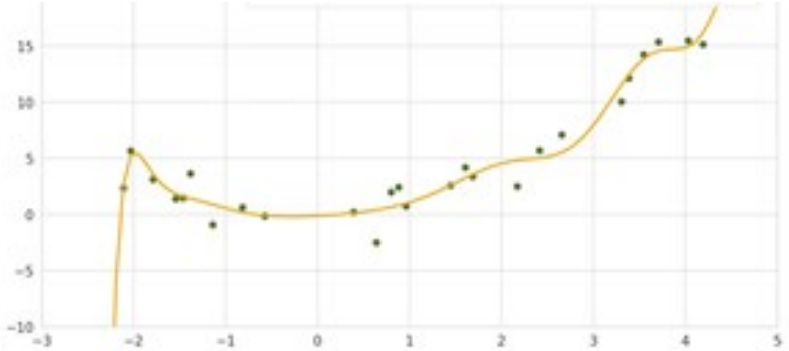

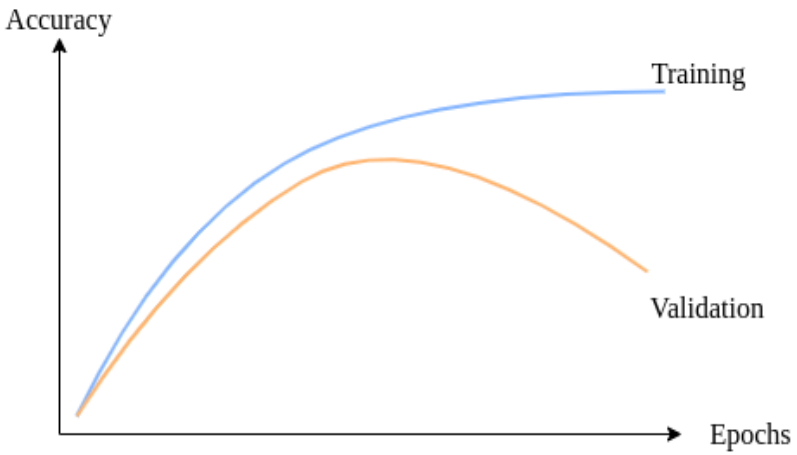

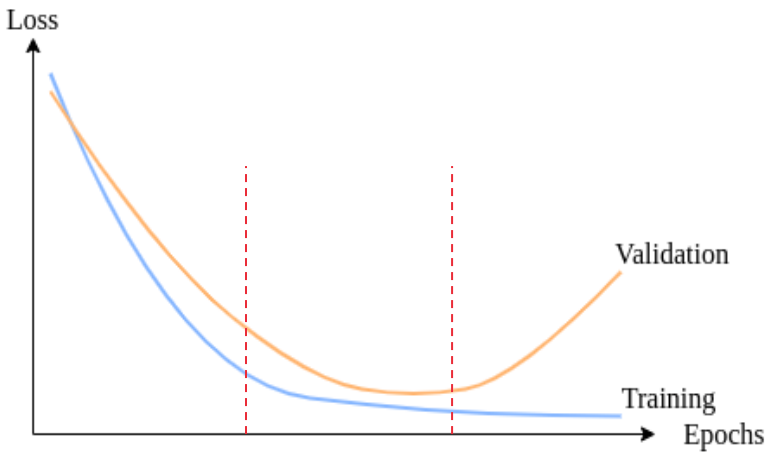

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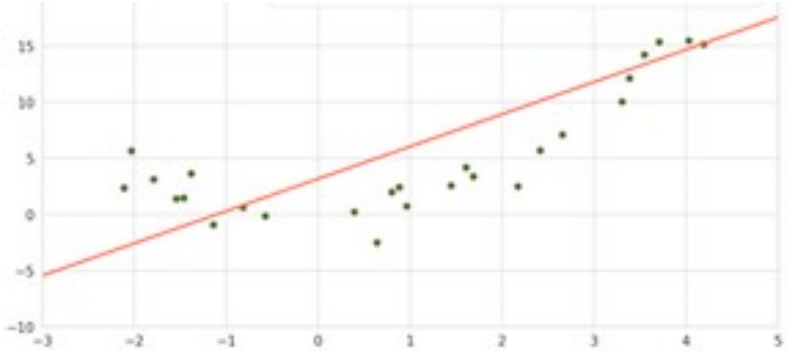

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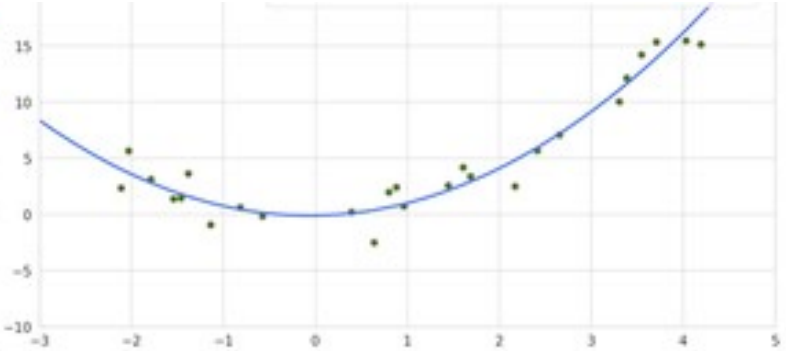

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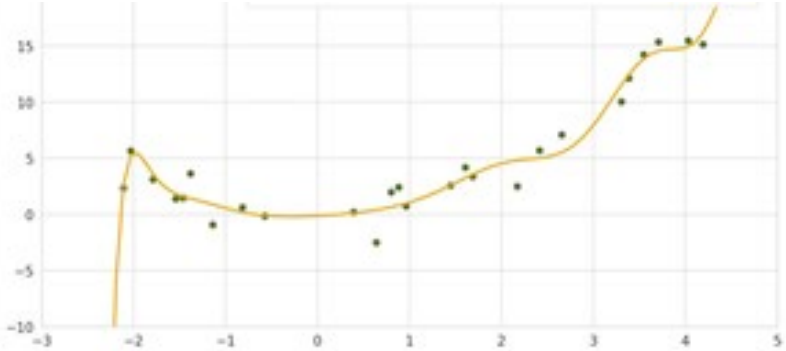

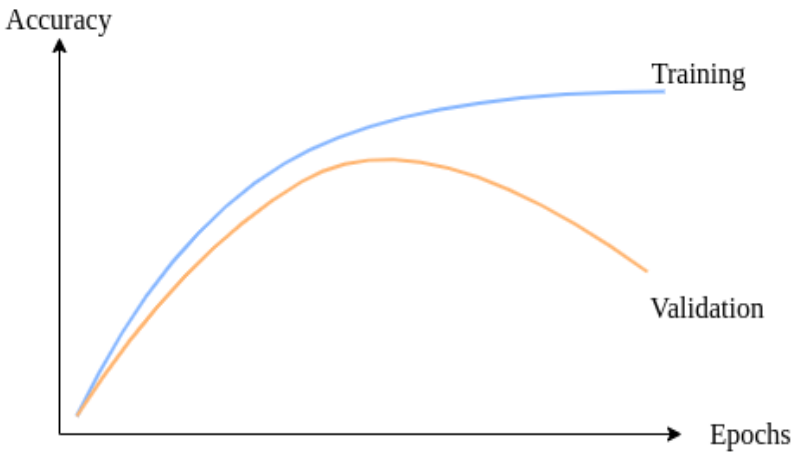

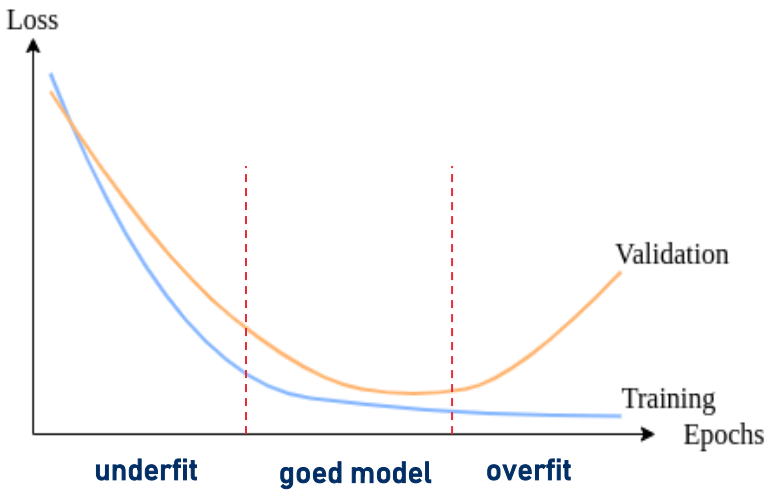

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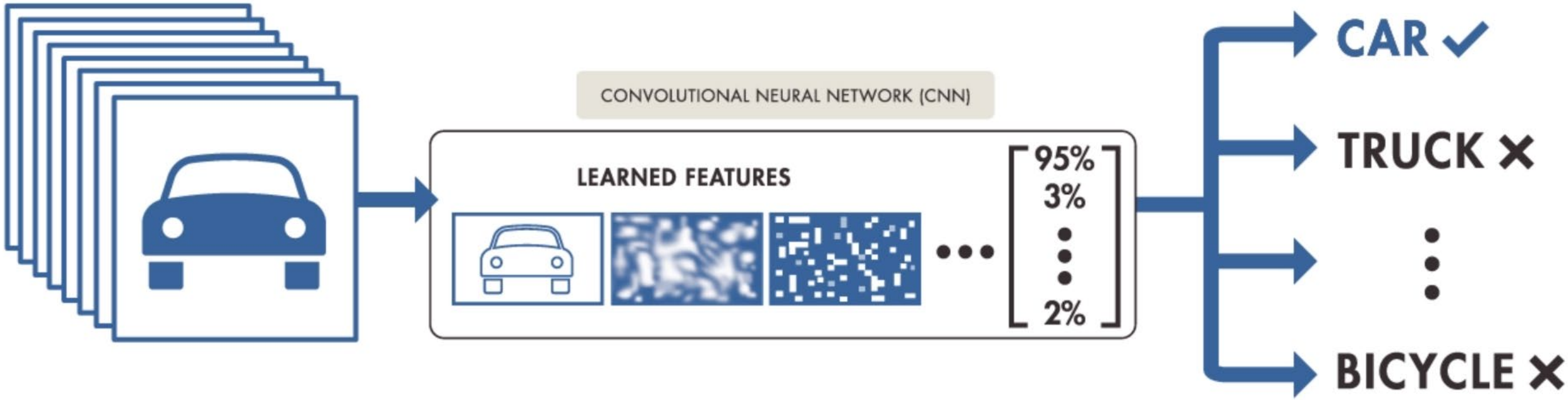
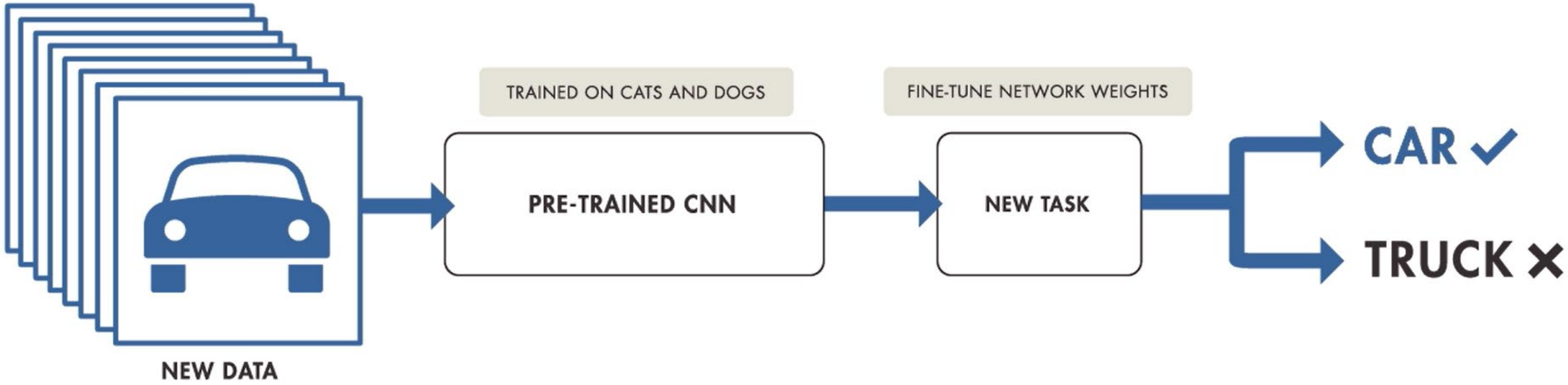
Manieren om een CNN te trainen

- **Vanaf nul**



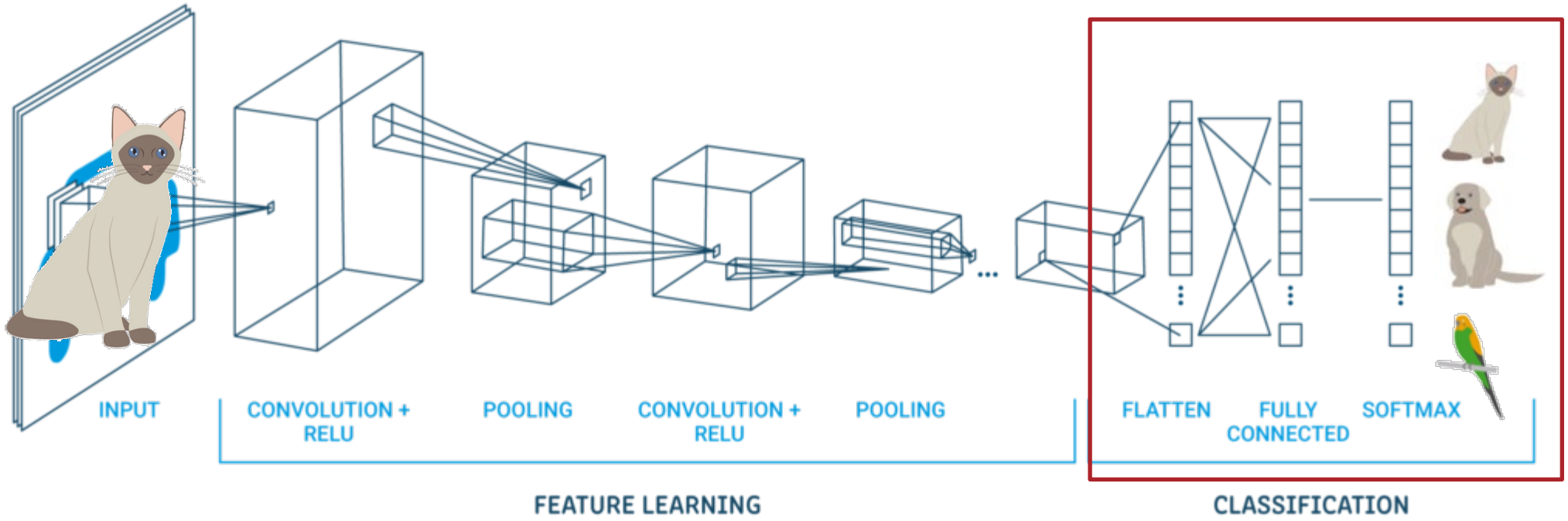
Manieren om een CNN te trainen

- **Transfer Learning**



Manieren om een CNN te trainen

- **Transfer Learning**



Aan de slag

Wat is python™

- Programeertaal
  - webontwikkeling, data-analyse, machine learning…
  - Gecompileerd tijdens uitvoering
  - natuurlijke taalconstructies
  - Start: variabelen, datatypes, loops, conditionele statements

```
a = 10
b = 5.0
if a > b:
    print("a is groter dan b")
else:
    print("b is groter dan of gelijk aan a")
```

Wat is  PyTorch

- open source machine learning-framework
- complexe en dynamische neurale netwerken
- Eenvoudige interface voor GPU's
- Eén van de belangrijkste machine learning-frameworks van dit moment.

Wat is colab

- cloudgebaseerde ontwikkelingsomgeving van Google
- virtual machine (VM) met voorgeïnstalleerde softwarepakketten:
  TensorFlow, Keras, PyTorch, Pandas, NumPy
- Google Drive en Google Cloud Storage
- **GPU's beschikbaar om training te versnellen**

Hands-on

- **Code:**

  https://github.com/Ritchie3/Invilab_4.0_Workshop

- **Dataset:**

  https://invilabworkshops.be/inspect

  - Login:
  - Paswoord: