Introduction to Deep Learning

Day 1

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Digital Skills

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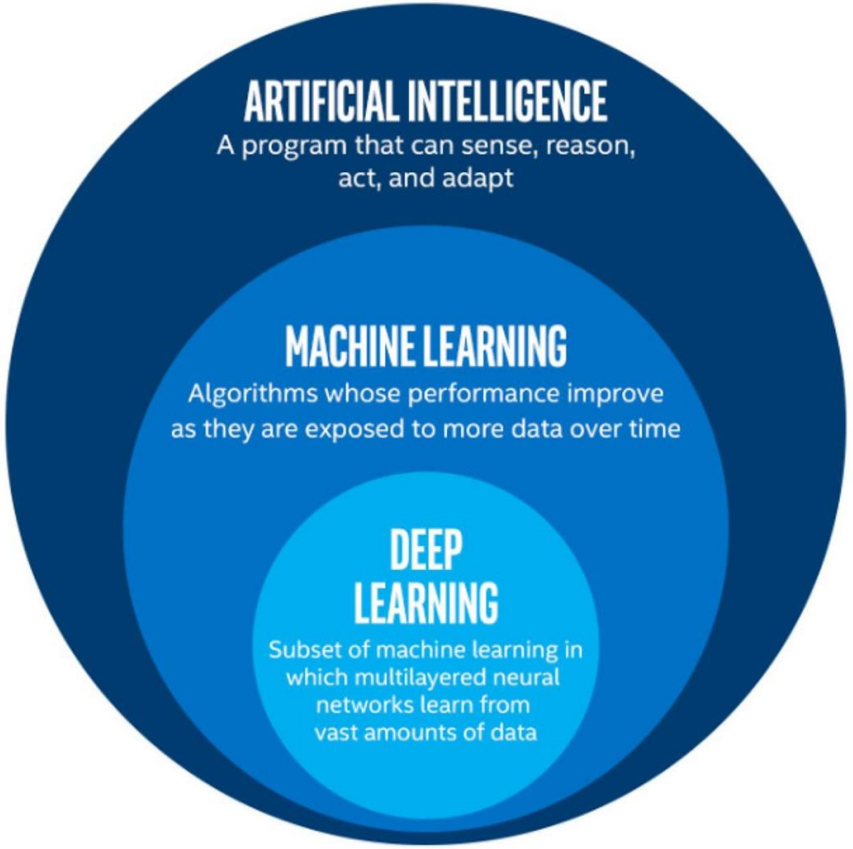
What is Deep Learning?



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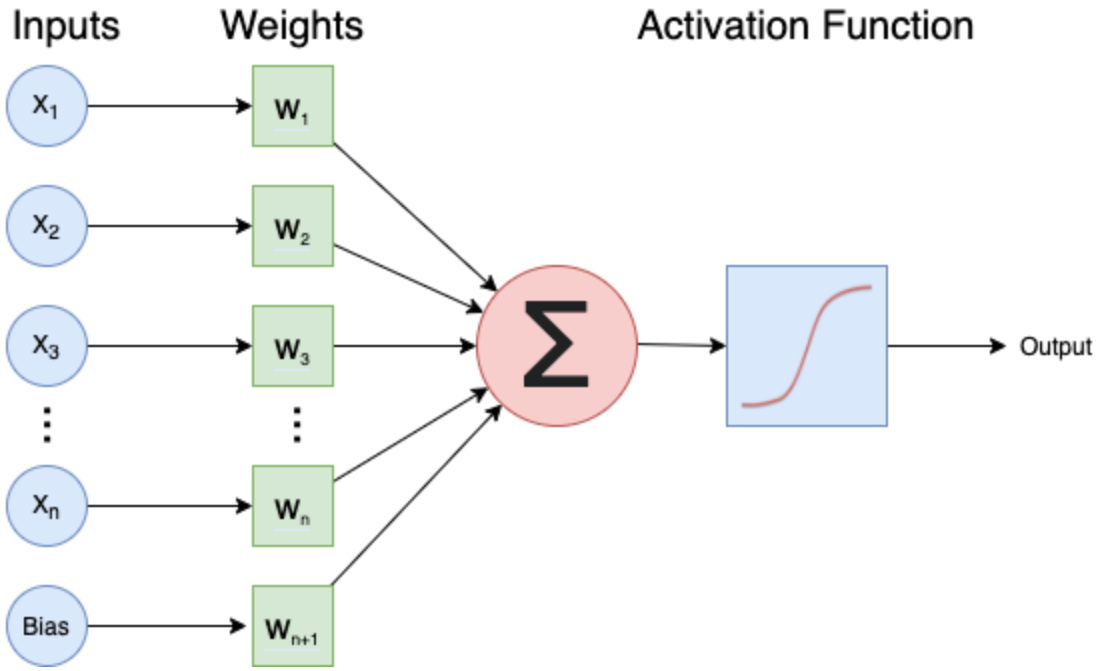
Neural Networks



$$Output = Activation\_function\left(\sum_i (x_i * w_i) + bias\right)$$

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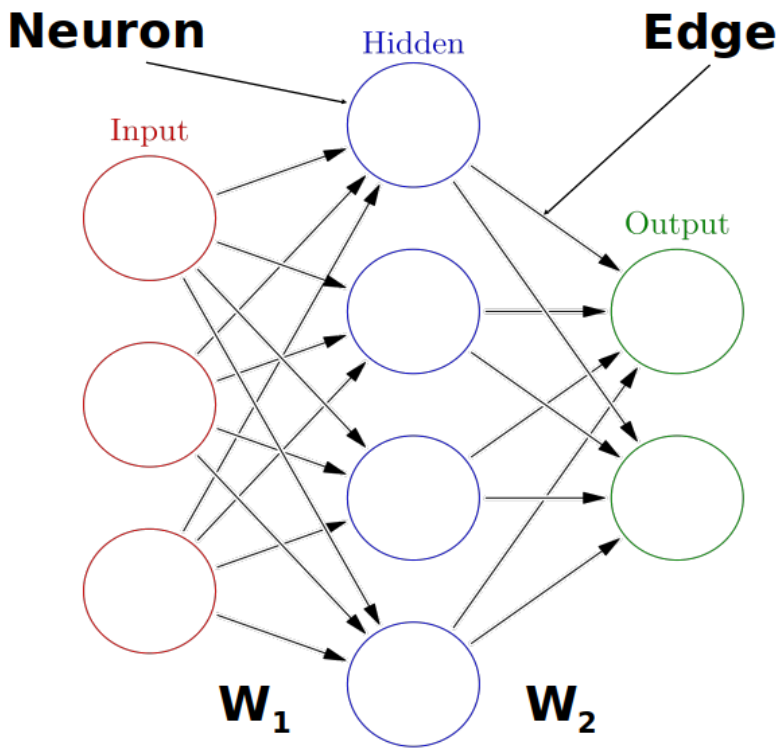
Neural Networks



https://playground.tensorflow.org/

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Exercise

- Calculate the output for one neuron

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Exercise

- Activation functions (see collaborative document)

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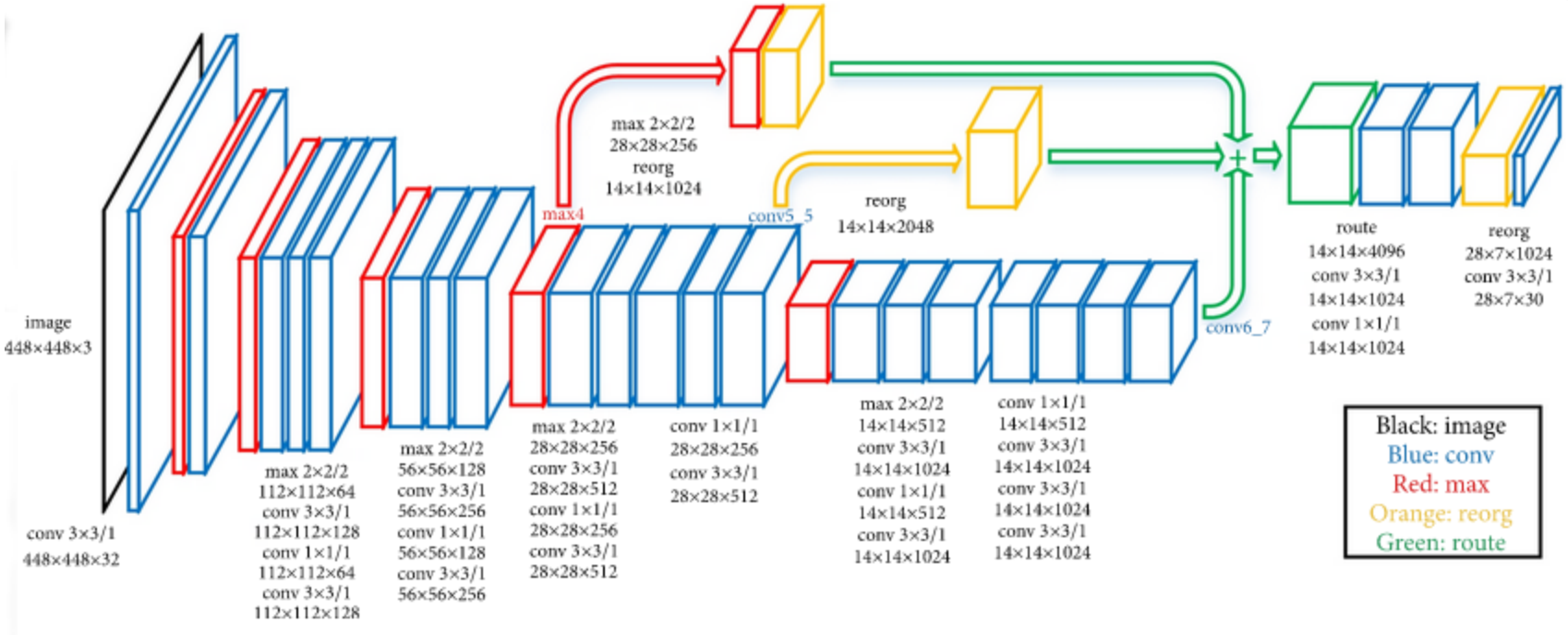
Example of a Deep Neural Network



"An Efficient Pedestrian Detection Method Based on YOLOv2" by Zhongmin Liu, Zhicai Chen, Zhanming Li, and Wenjin Hu, published in Mathematical Problems in Engineering, Volume 2018

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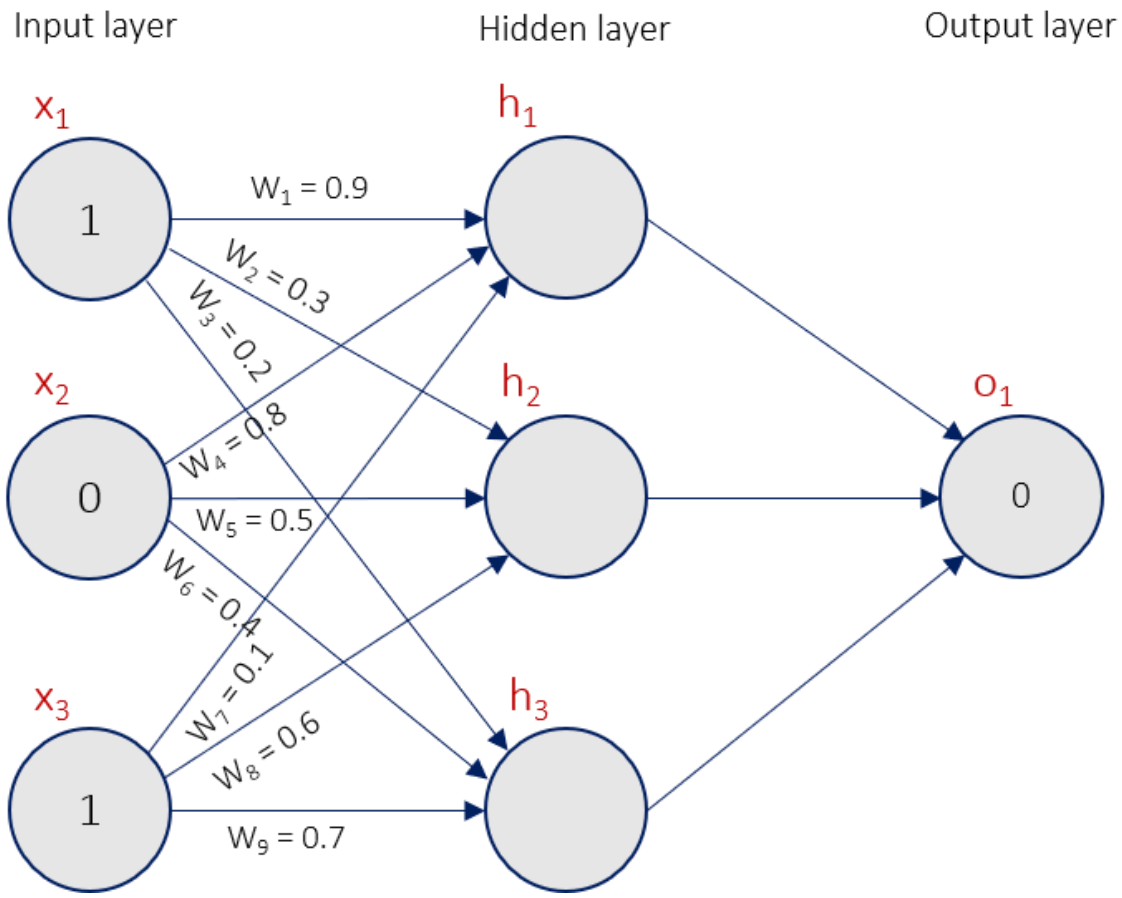
How do Neural Networks learn?



Loss Function

*Neural Network: A Complete Beginners Guide - Gadictos

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Exercise

- Loss function (see collaborative document)

DNN: What is it good for?

What sort of problems can deep learning solve?

- Pattern/object recognition

DOG

CAT

DNN: What is it good for?

What sort of problems can deep learning solve?

- Segmenting images (or any data)

DNN: What is it good for?

What sort of problems can deep learning solve?

- Translating between one set of data and another, for example natural language translation.

https://blazepress.com/2014/10/36-of-the-funniest-translation-fails-ever/

DNN: What is it good for?

What sort of problems can deep learning solve?

- Generating new data that looks similar to the training data, often used to create synthetic datasets, art or even “deepfake” videos.

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What problem *can't* it solve?

- Any case where only a small amount of training data is available.
- Tasks requiring an explanation of how the answer was arrived at.
- Classifying things which are nothing like their training data.

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When is it Overkill?

- Logic operations, such as computing totals, averages, ranges etc. (see this example applying Deep Learning to solve the “FizzBuzz” problem often used for programming interviews)
- Modelling well defined systems, where the equations governing them are known and understood.
- Basic computer vision tasks such as edge detection, decreasing colour depth or blurring an image.

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Exercise

- Deep learning problems (see collaborative document)

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How much data is enough data?

xkcd: Machine Learning

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Deep Learning Workflow

1. Formulate/ Outline the problem
2. Identify inputs and outputs
3. Prepare data
4. Choose a pre-trained model or build a new architecture from scratch
5. Choose a loss function and optimizer
6. Train the model
7. Perform a Prediction/Classification
8. Measure Performance
9. Tune Hyperparameters
10. Share Model

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DEEP LEARNING WORKFLOW EXERCISE

Think about a problem you would like to use Deep Learning to solve.

1. What do you want a Deep Learning system to be able to tell you?
2. What data inputs and outputs will you have?
3. Do you think you will need to train the network or will a pre-trained network be suitable?
4. What data do you have to train with? What preparation will your data need? Consider both the data you are going to predict/classify from and the data you will use to train the network.

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Deep Learning Libraries

TensorFlow

PyTorch

Keras

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Setup Testing