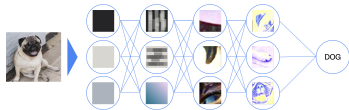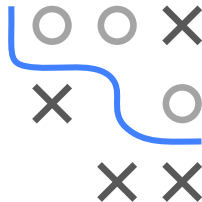# Introduction to Machine Learning
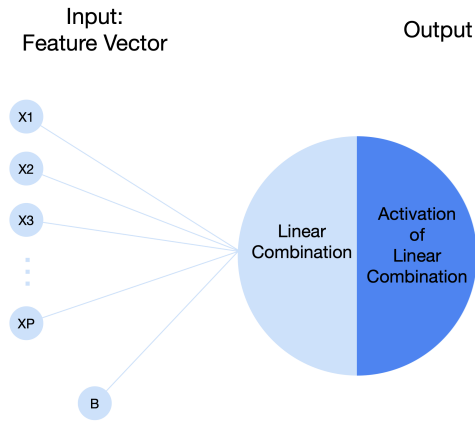
Neural Networks
In a Nutshell

Learning goals

- Know basic computational unit
- Know basic architecture
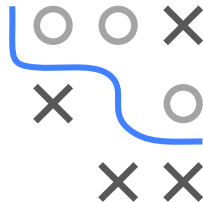- Understand Learning in NNs

BASIC COMPUTATIONAL UNIT: PERCEPTRON

Input:
Feature Vector

Output

Output differs depending on activation function:

- **Identity function**: Perceptron represents linear regression

- **Logistic function**: Perceptron represents logistic regression
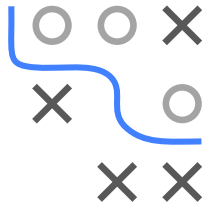
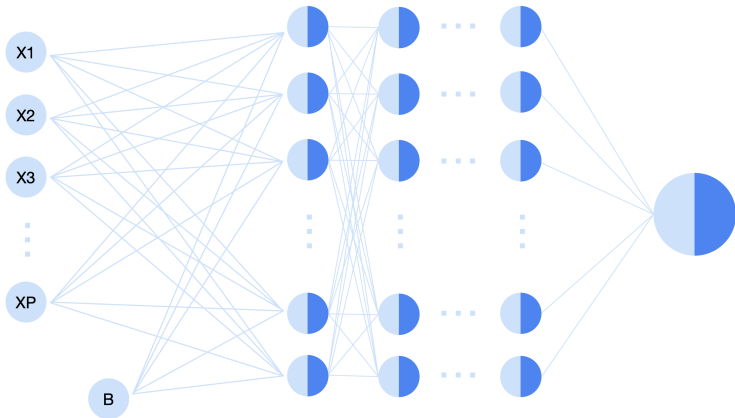- Other activation functions possible

BASIC ARCHITECTURE OF NN

A neural network is built by combination of multiple perceptrons:

Input:
Feature Vector

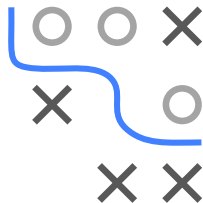Hidden Layers

Output

X1

X2

X3

XP

B

BASIC ARCHITECTURE OF NN

Hidden Layers:

- Output of hidden units serves as input for units in next layer
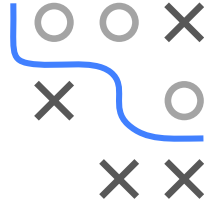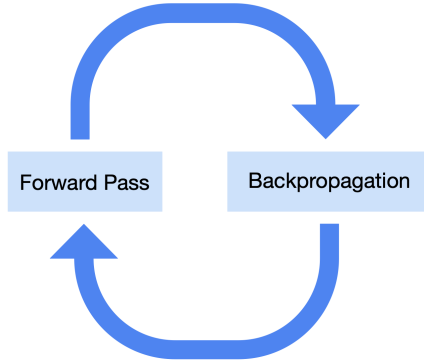- Too many hidden layers or too many units per layer can lead to overfitting

Output Layer:

- Number of output units depend on task
- Different activation functions for output layer and hidden layers possible
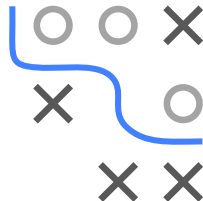
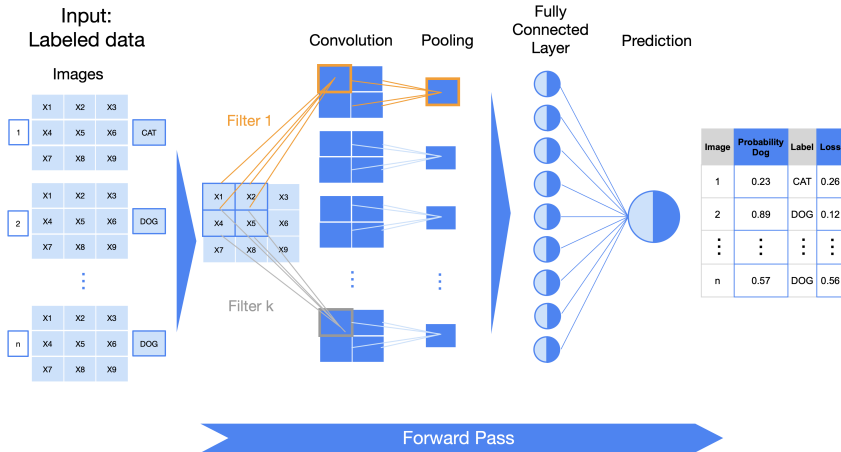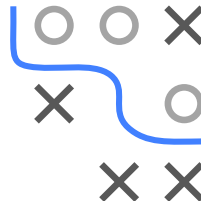# LEARNING - IMAGE CLASSIFICATION TASK
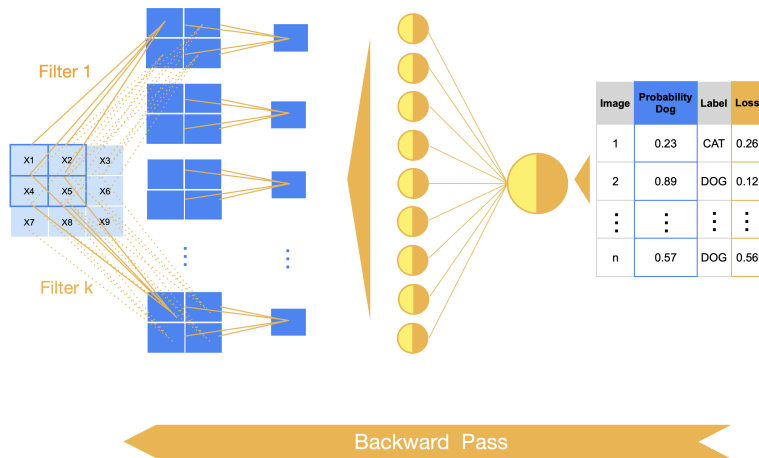
For each Training Iteration:

Forward Pass → Backpropagation

LEARNING - IMAGE CLASSIFICATION TASK

LEARNING - IMAGE CLASSIFICATION TASK

Compute update of each weight by backpropagation

PREDICTION - IMAGE CLASSIFICATION TASK

EFFECT OF HIDDEN LAYERS

- Learn more and more abstract representations
- Each layer adds degree of non-linearity