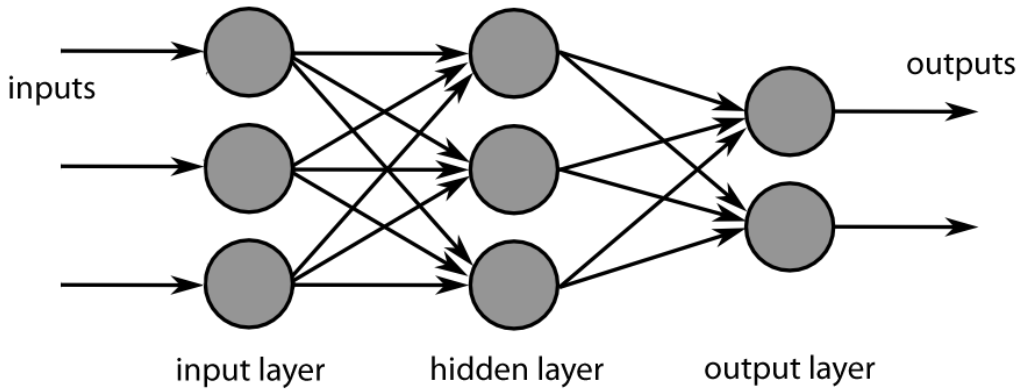
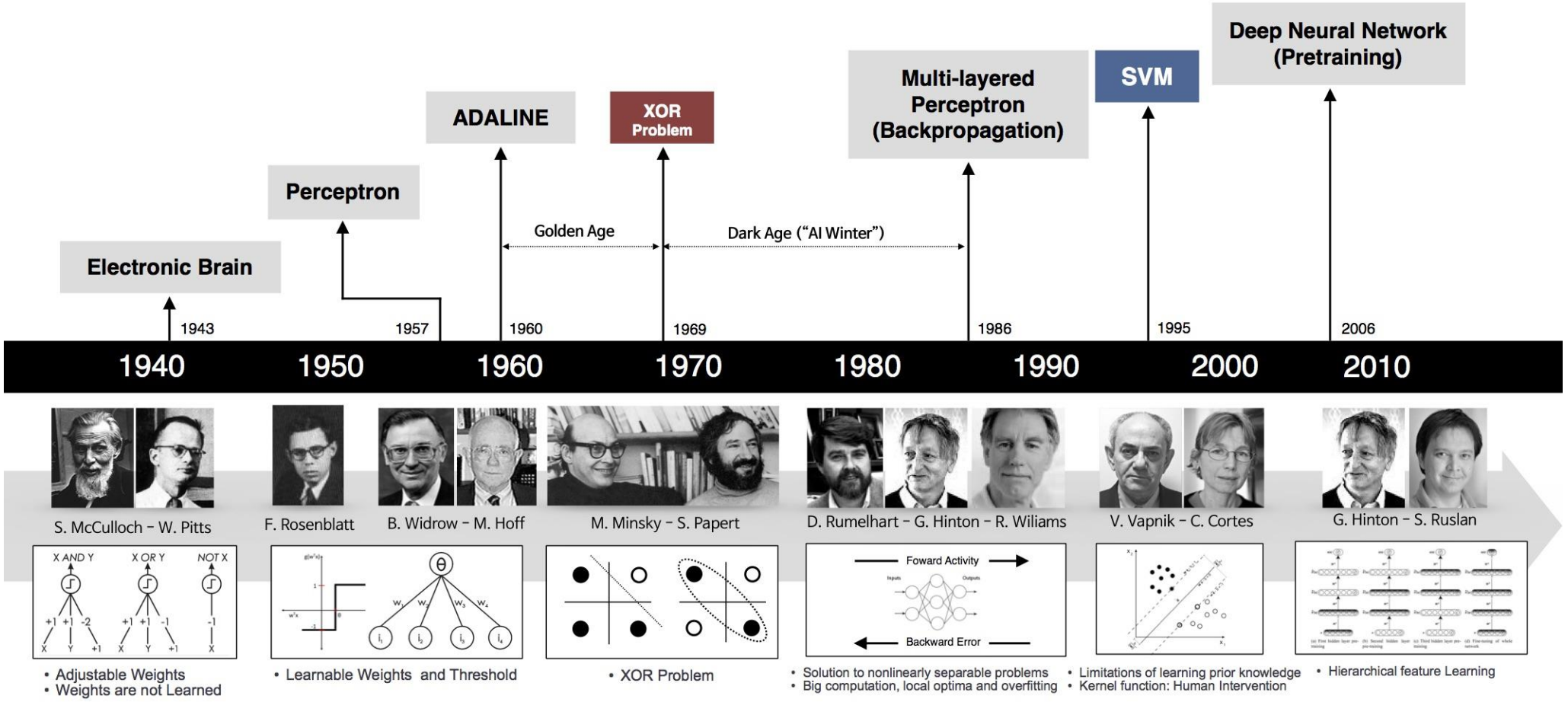
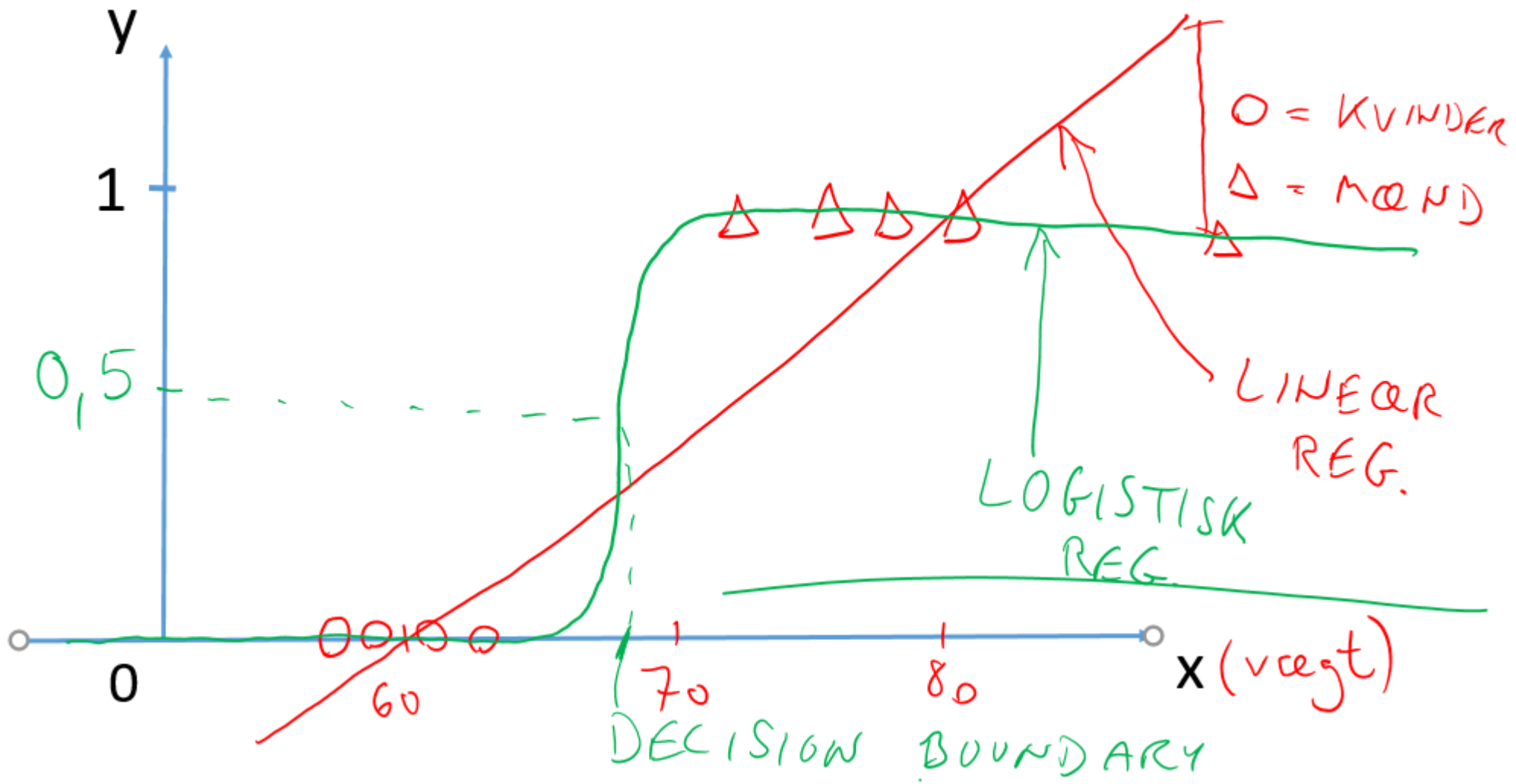
Artificial Neural Networks



Historien..


Deep Neural Network (Pretraining)
SVM
Multi-layered Perceptron (Backpropagation)
XOR Problem
ADALINE
Perceptron
Electronic Brain
Golden Age
Dark Age ("AI Winter")
1943
1957
1960
1969
1986
1995
2006
1940
1950
1960
1970
1980
1990
2000
2010
S. McCulloch - W. Pitts
F. Rosenblatt
B. Widrow - M. Hoff
M. Minsky - S. Papert
D. Rumelhart - G. Hinton - R. Wiliams
V. Vapnik - C. Cortes
G. Hinton - S. Ruslan
X AND Y
X OR Y
NOT X
Foward Activity
Backward Error
• Adjustable Weights
• Weights are not Learned
• Learnable Weights and Threshold
• XOR Problem
• Solution to nonlinearly separable problems
• Big computation, local optima and overfitting
• Limitations of learning prior knowledge
• Kernel function: Human Intervention
• Hierarchical feature Learning

Logistisk regression - recap



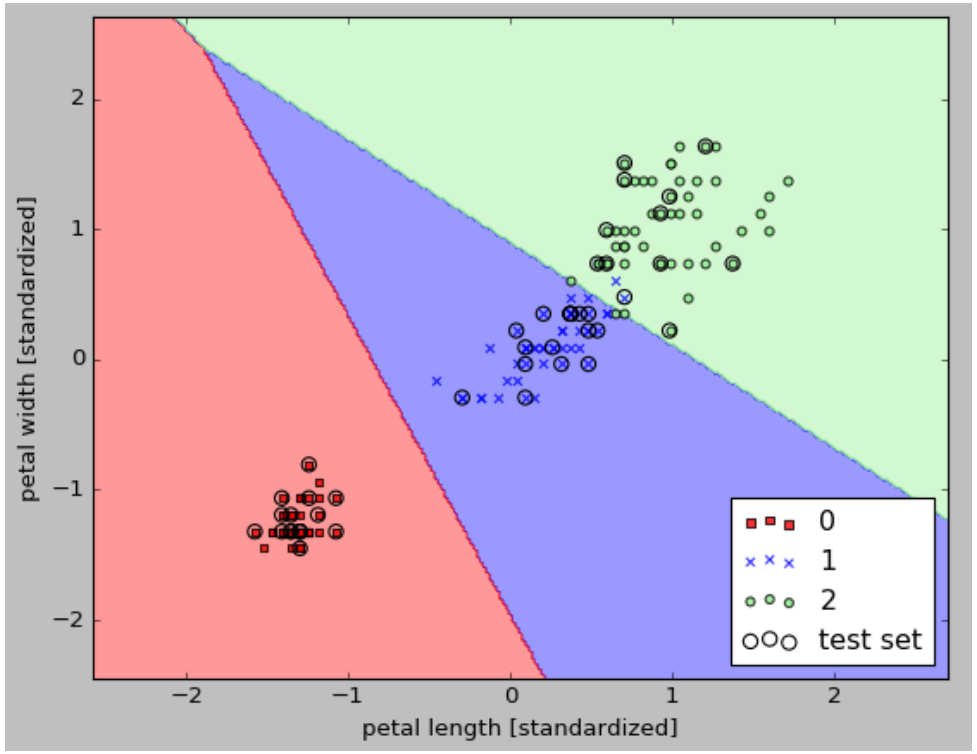
Logistisk regression - recap

Equation 4-13. Logistic Regression model estimated probability

$$\hat{p} = h_{\boldsymbol{\theta}}(\mathbf{x}) = \sigma\left(\mathbf{x}^T\boldsymbol{\theta}\right)$$

Equation 4-14. Logistic function

$$\sigma(t) = \frac{1}{1 + \exp\left(-t\right)}$$

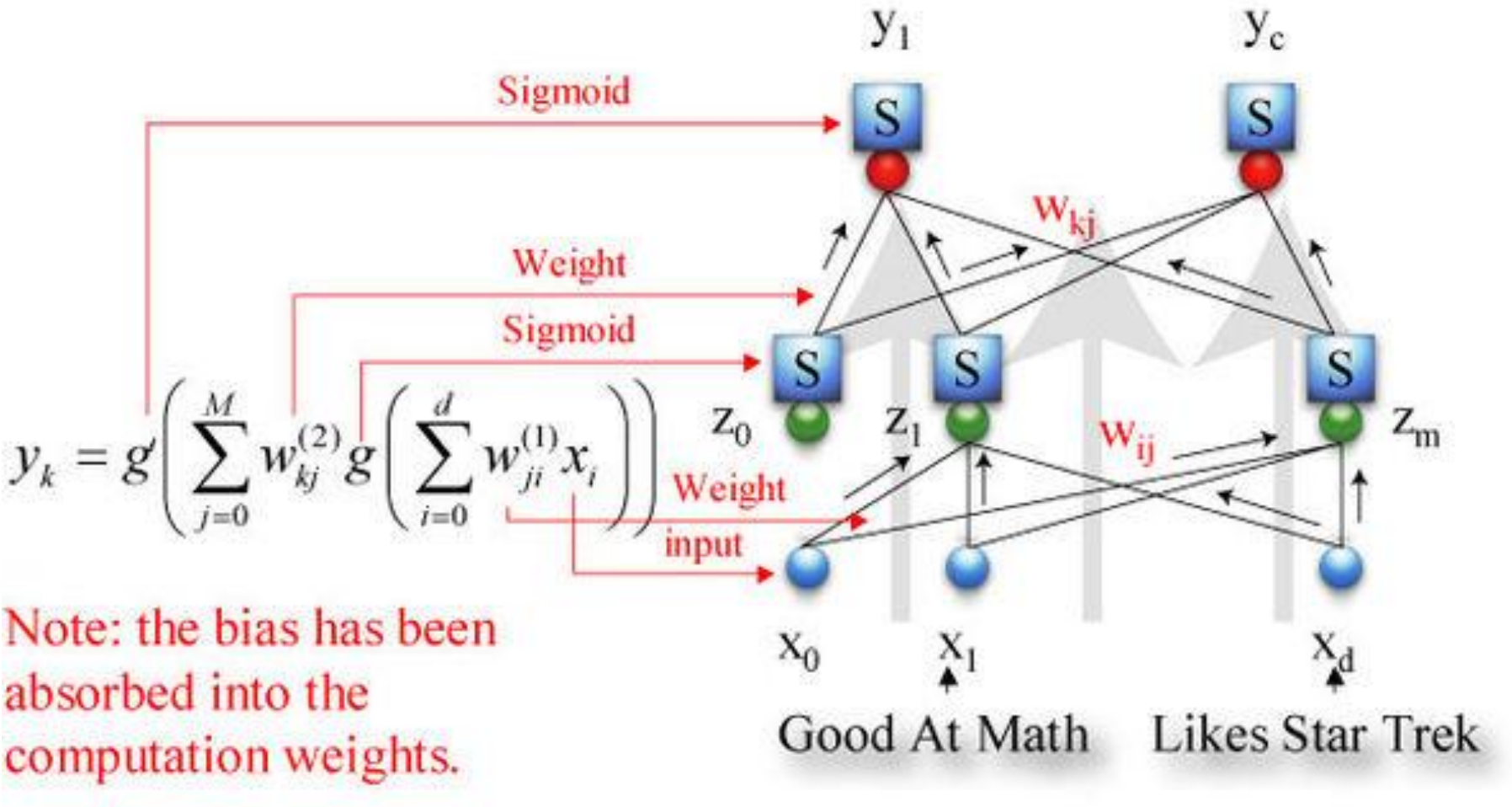


Lineær classifier

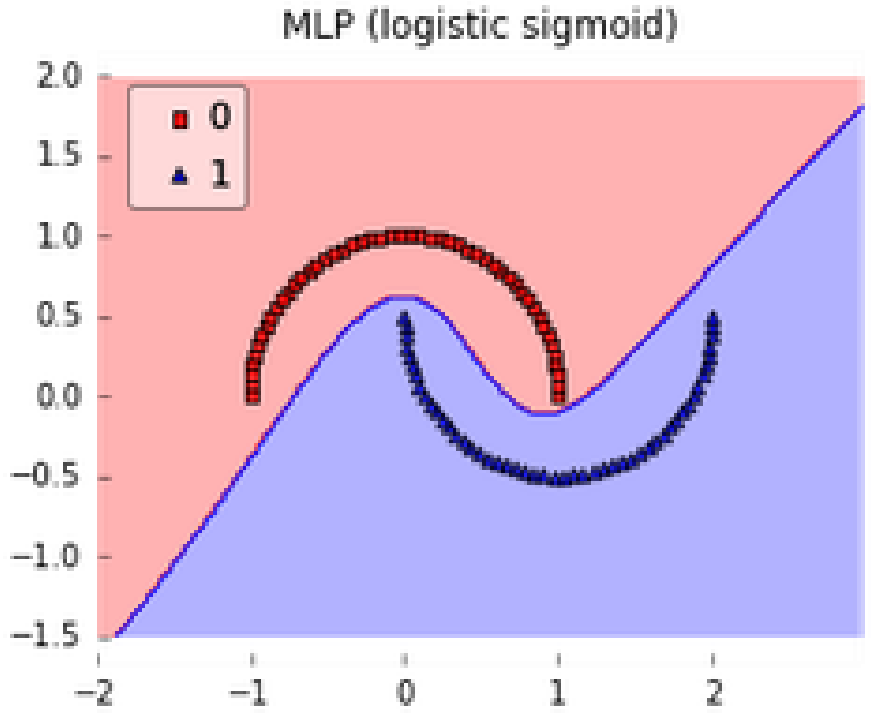
Multi-layer perceptron (="alm." neural netværk)

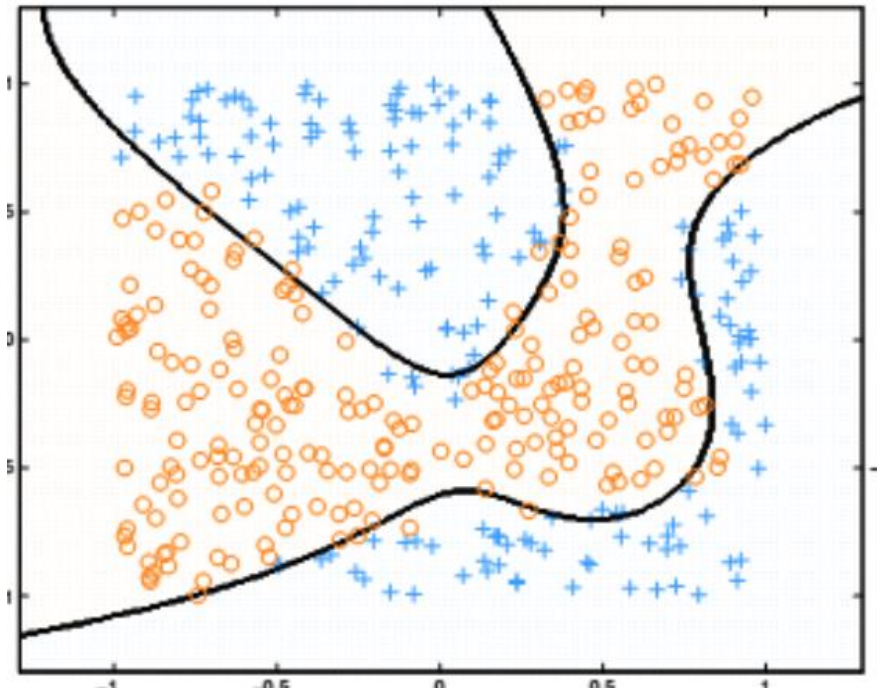
- Ide : Sum af fx. logistic function -> mere fleksibel decision boundary

Multi-layer perceptron (alm. 2 lags)

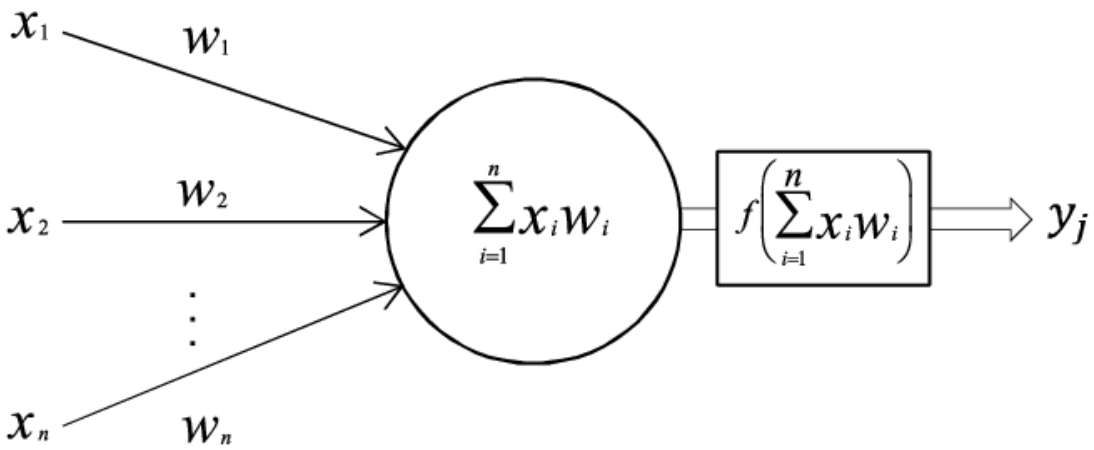


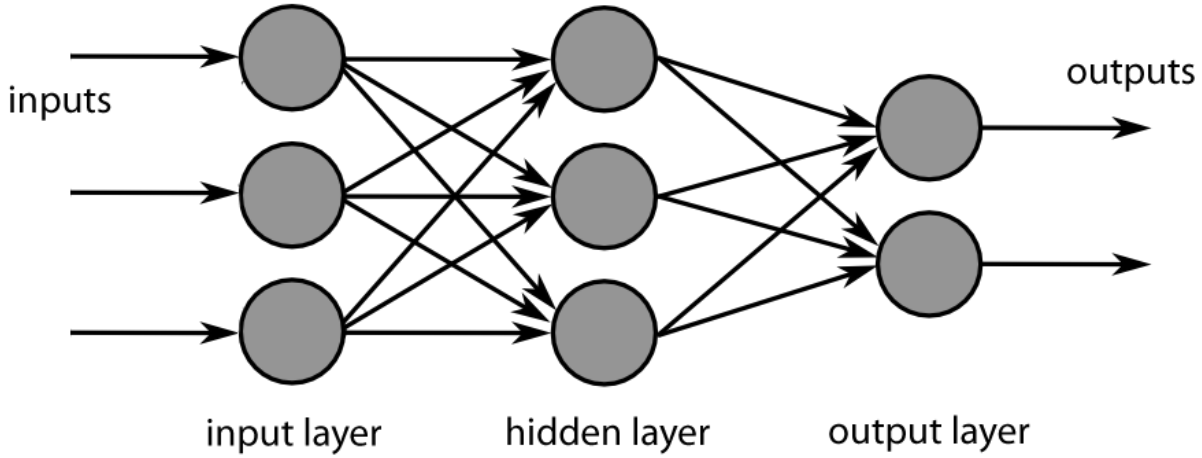
Decision boundary



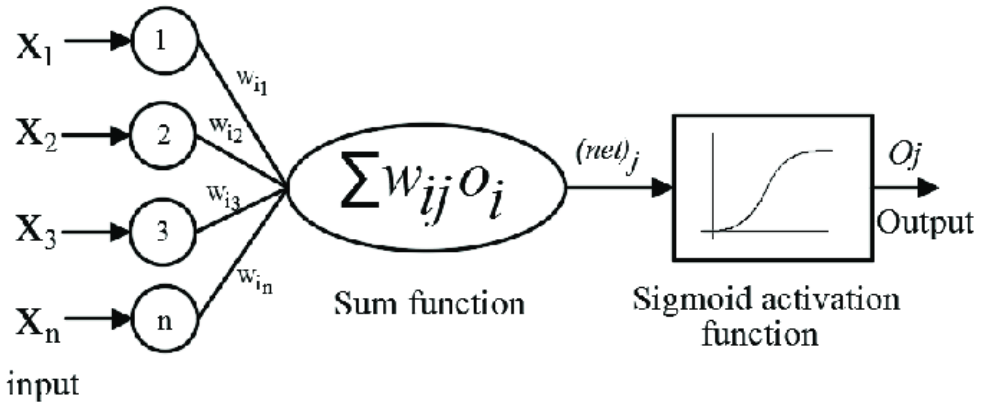


Grafisk repræsentation

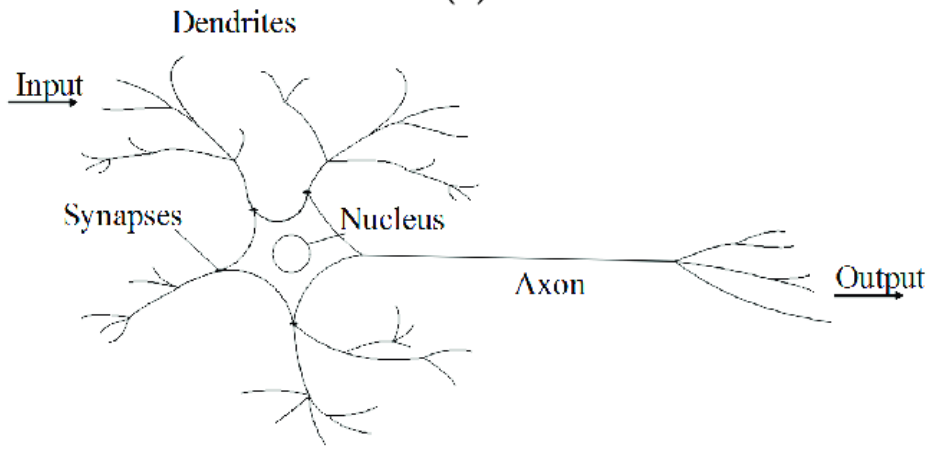




Lidt historie igen..

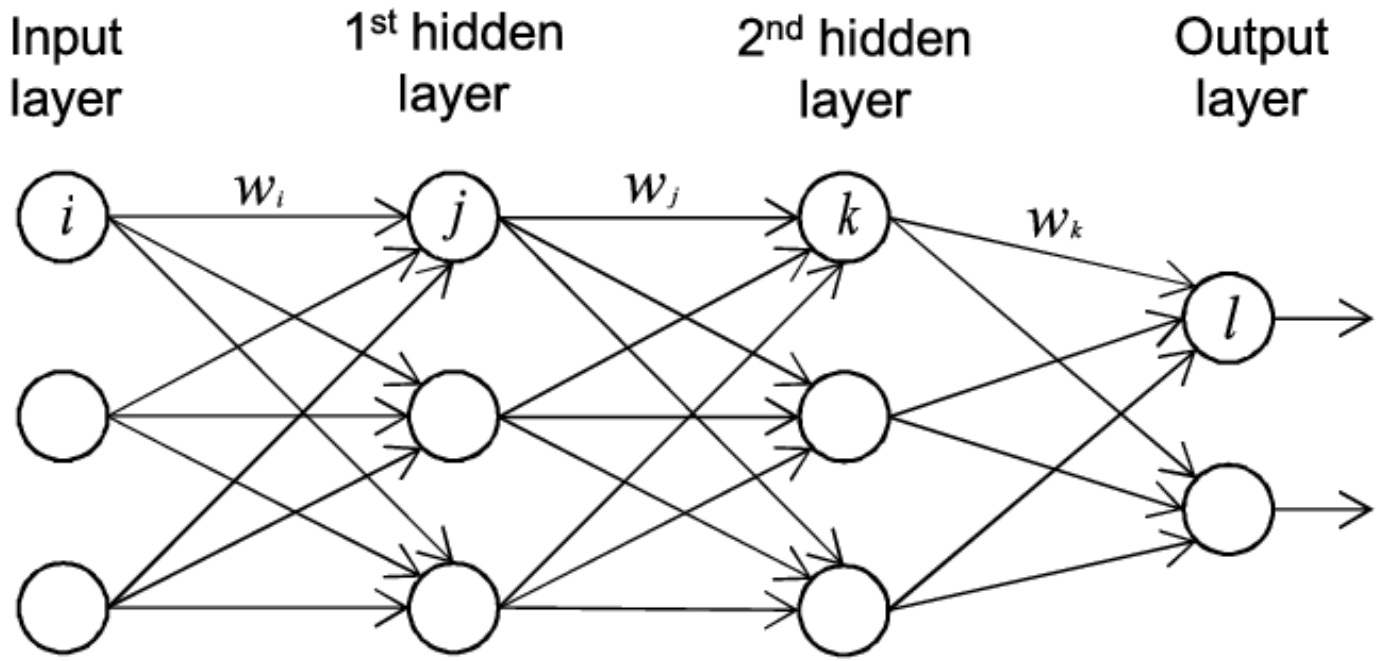


(a)



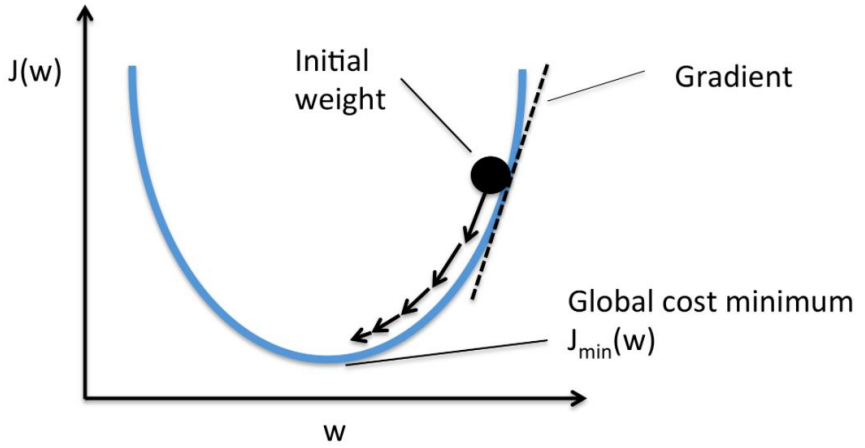
(b)

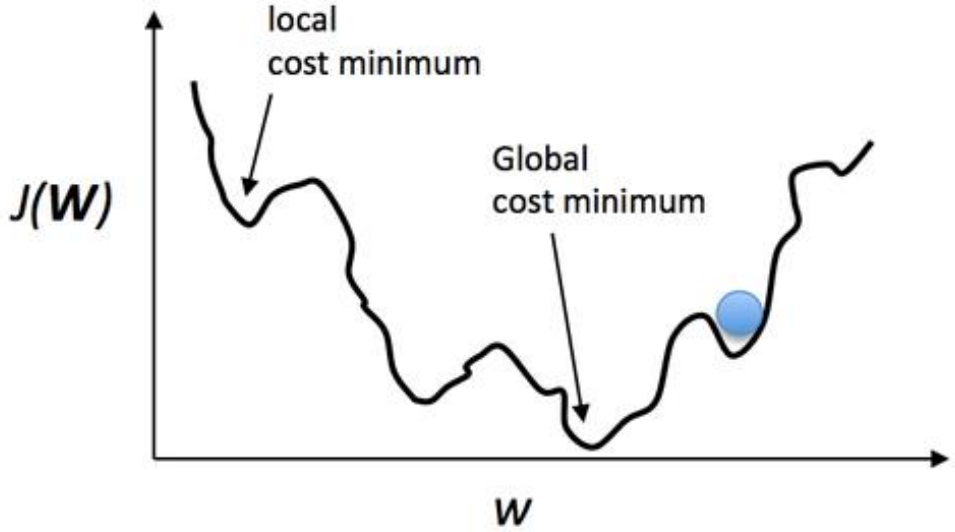
Grafisk repræsentation



Learning / training

- Regression – samme cost function som linear regression, MSE
- Klassifikation – fx. cross-entropy error function
- Samme princip med minimering af cost function som tidligere..





Backpropagation

- "Trick" til lettere at beregne gradient af cost function
- Kan sammenlignes med FFT til udregning af DFT

Keras / Tensorflow

- Neural network python libs
- Vi benytter Keras i ITMAL !
- Keras mere fleksibelt/udbygget end Scikit – især til dybe neurale net
- Keras = frontend til Tensorflow
- Keras vs tf.keras