Machine Learning Formulas

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Abstract

[TODO].

1. Introduction

[TODO]

2. Supervised Learning

[TODO]

Error Measures [TODO]

TODO

Experimental Strategies [TODO]

- **Holdout**: [TODO]
- **Repeated Holdout**: [TODO]
- **Cross Validation**: [TODO]
- **Repeated Cross Validation**: [TODO]

2.1. Decision Trees

[TODO]

2.2. Rule Based Systems

[TODO]

2.3. Instance Based Learning

[TODO]

2.4. Bayes Learning

[TODO]

2.5. Linear Classifiers

[TODO]

2.6. Neural Networks

Perceptron model

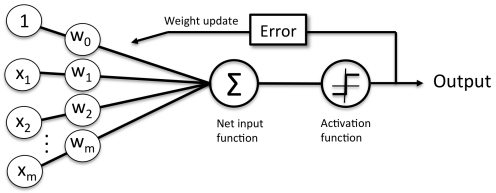

Figure 1: *General concept of perceptron*

Perceptron's structures

$$w = \begin{bmatrix} w_1 \\ \vdots \\ w_m \end{bmatrix}, x = \begin{bmatrix} x_1 \\ \vdots \\ x_m \end{bmatrix}$$

Ouput equation

$$z = w_1 x_1 + \cdots + w_m x_m = \boldsymbol{w^T x}$$

Activation function

$$\phi(z) = \begin{cases} 1 & \text{if } z \geq \theta \\ -1 & \text{otherwise} \end{cases}$$

Update of weight vector

$$w_j := w_j + \Delta w_j$$
$$\Delta w_j = \eta(y^{(i)} - \hat{y}^{(i)}) x_j^{(i)}$$

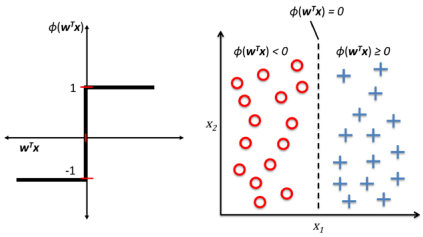

Figure 2: *Activation function*

Adaptive linear neurons (ADALINE)

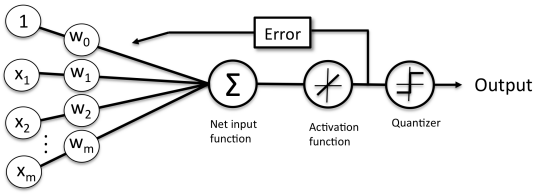

Figure 3: *General concept of adaline perceptron*

Cost function

$$J(w) = \frac{1}{2}\sum_i (y^{(i)} - \phi(z^{(i)}))^2$$

Update of weight vector

$$w_j := w_j + \Delta w_j$$
$$\Delta w_j = -\eta \nabla J(w) = \eta \sum_i (y^{(i)} - \phi(z^{(i)}))x_j^{(i)}$$

Features standarization

$$x'_j = \frac{x_j - \mu_j}{\sigma_j}$$

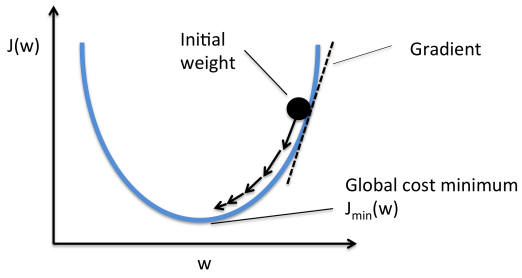

Figure 4: *Gradient descent*

3. Unsupervised Learning

[TODO]