Lecture 2

Linear Regression Models

Cat Hearts example:

Experience E

- The dataset consists of n data points
  - $((x_1, y_1), ..., (x_n, y_n) \in \mathbb{R}^d \times \mathbb{R})$
  - $x_i \in \mathbb{R}^d$ is the *"input"* for the i^{th} data point as a feature vector with d elements, d being the # of dimensions in the feature space, in this case 1.
  - $y_i \in \mathbb{R}$ is the *"output"* for the i^{th} data point, in this case the weight of the corresponding cat heart.

Learning Task, T

- In this example, our task is: **Linear Regression**
- Find a *"model"*, i.e. a function:
  - $f : \mathbb{R}^d \to \mathbb{R}$
- s.t. our future observations produce output *"close to"* the true output.

Linear Regression Model

- A linear regression model has the form:
  - $f(x) = (\sum_{i=1}^{d} w_i \cdot x_i) + b$
  - where:
    - $x \in \mathbb{R}^d$ is the input vector (feature)
    - $w \in \mathbb{R}^d$ is the weight vector (parameters)
    - $b \in \mathbb{R}$ is a bias (parameter)

- $f(x) \in \mathbb{R}$ is the predicted output