Introduction to Machine Learning

Introduction: Models & Parameters

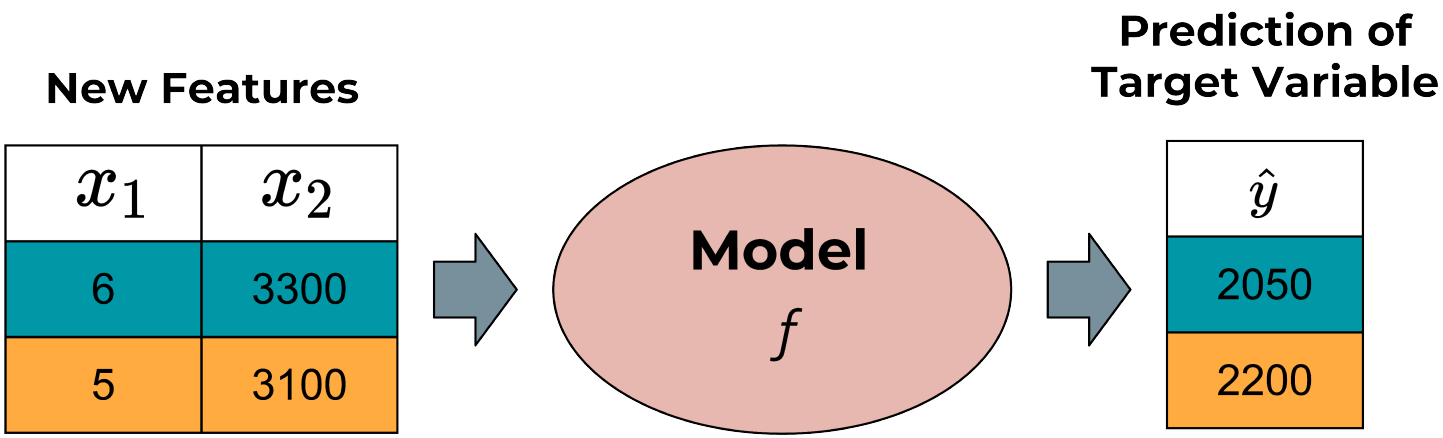
compstat-lmu.github.io/lecture_i2ml

WHAT IS A MODEL?

- A **model** (or **hypothesis**)

$$f : \mathcal{X} \to \mathbb{R}^g$$

  is a function that maps feature vectors to predicted target values.
- In conventional regression we will have $g = 1$, for classification see later.



WHAT IS A MODEL?

- We have already seen that machine learning typically requires constraining f to a certain class of functions.
- Otherwise, the task of finding a "good" model is basically impossible to solve.
- The set of functions defining a model class is called a **hypothesis space** $\mathcal{H}$.
- For example, the set of all constant functions

$$\mathcal{H} = \{f : f(\mathbf{x}) = c, c \in \mathbb{R}\}$$

  forms a specific hypothesis space.

PARAMETERS OF A MODEL

- Within one hypothesis space, models are typically all "alike" in a sense: they all share a certain structure.
  $\rightarrow$ E.g., all Gaussian density functions exhibit a bell-like shape.
- The only (!) aspects in which they differ are described by **parameters**.
  $\rightarrow$ Gaussians are solely determined by mean and variance.
- We typically subsume all parameters in a **parameter vector** $\boldsymbol{\theta} = (\theta_1, \theta_2, ...)$ from a **parameter space** Θ.
- $\boldsymbol{\theta}$ is learned during training: finding a "good" model boils down to finding a suitable combination of parameters.
- We will in the next chapter how the "goodness" of a model can be determined.