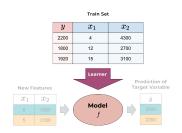
Introduction to Machine Learning

ML-Basics: Learner



Learning goals

 Understand that a supervised learner fits models automatically from training data

SUPERVISED LEARNING EXAMPLE

Imagine we want to investigate how working conditions affect productivity of employees.

- It is a **regression** task since the target *productivity* is continuous.
- We collect data about worked minutes per week (productivity), how many people work in the same office as the employee in question, and the employee's salary.

	Features x		Target y	
	People in Office (Feature 1) x_1	Salary (Feature 2) x_2	Worked Minutes W (Target Variable	
(4	4300€ 🗼	2220	
$n=3$ $\left< ight.$	y 12	2700 €	1800	
\downarrow	5	3100 €	1920	
$oxed{x_1^{(2)}}$	p =	= 2	$x_2^{(1)}$	$y^{(3)}$

SUPERVISED LEARNING EXAMPLE

How could we construct a model from these data?

We could investigate the data manually and come up with a simple, hand-crafted rule such as:

- The baseline productivity of an employee with salary 3000 and 7 people in the office is 1850 minutes
- A decrease of 1 person in the office increases productivity by 30
- An increase of the salary by 100 increases productivity by 10
- => Obviously, this is neither feasible nor leads to a good model

IDEA OF SUPERVISED LEARNING

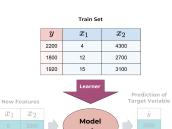
Goal: Automatically identify the fundamental functional relation in the data that maps an object's features to the target.

- Supervised learning means we make use of labeled data for which we observed the outcome.
- We use the labeled data to learn a model f.
- Ultimately, we use our model to compute predictions for new data whose target values are unknown.

	x_1	x_2	Functional Relationship	y
(4	4300 €	A C	2200
Already seen	12	2700 €		1800
Lata	15	3100 €	f	1920
New Data	6	3300 €	rico de	???
New Data	5	3100 €		???

LEARNER DEFINITION

- The algorithm for finding our *f* is called **learner**. It is also called **learning algorithm** or **inducer**.
- We prescribe a certain hypothesis space, the learner is our means of picking the best element from that space for our data set.
- Formally, it maps training data $\mathcal{D} \in \mathbb{D}$ (plus a vector of **hyperparameter** control settings $\lambda \in \Lambda$) to a model:



LEARNER DEFINITION

As pseudo-code template it would work like this:

- ullet Learner has a defined model space of parametrized functions ${\cal H}.$
- User passes data set $\mathcal{D}_{\text{train}}$ and control settings λ .
- Learner sets parameters so that model matches data best.
- Optimal parameters $\hat{\theta}$ or function \hat{f} is returned for later usage.

