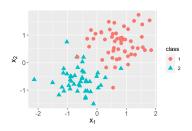
# Introduction to Machine Learning

## **ML-Basics: Supervised Tasks**



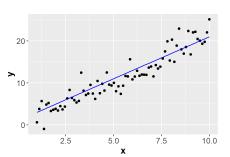
#### Learning goals

- Know definition and examples of supervised tasks
- Understand the difference between regression and classification

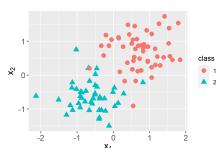
## TASKS: REGRESSION VS CLASSIFICATION

- Supervised tasks are data situations where learning the functional relationship between inputs (features) and output (target) is useful.
- The two most basic tasks are regression and classification, depending on whether the target is numerical or categorical.

**Regression**: Our observed labels come from  $\mathcal{Y} \in \mathbb{R}$ .



**Classification**: Observations are categorized:  $y \in \mathcal{Y} = \{C_1, ..., C_g\}$ .



### PREDICT VS. EXPLAIN

We can distinguish two main reasons to learn this relationship:

- Learning to predict. In such a case we potentially do not care
  how our model is structured or whether we can understand it.
  Example: predicting how a stock price will develop.
  Simply being able to use the predictor on new data is of direct
  benefit to us.
- Learning to explain. Here, our model is only a means to a better understanding of the inherent relationship in the data.
   Example: understanding which risk factors influence the probability to get a certain disease. We might not use the learned model on new observations, but rather discuss its implications, in a scientific or social context.

While ML was traditionally more interested in the former, classical statistics addressed the latter. In many tasks nowadays both are relevant – to different degrees.

#### REGRESSION EXAMPLE: HOUSE PRICES

Predict the price for a house in a certain area

	Target $y$			
square footage of the house	number of swimming bedrooms pool (yes/no)			house price in US\$
1,180	3	0		221,900
2,570	3	1		538,000
770	2	0		180,000
1,960	4	1		604,000



Probably *learn to explain.* We might want to understand what influences a house price most. But maybe we are also looking for underpriced houses and the predictor is of direct use, too.

#### REGRESSION EXAMPLE: LENGTH-OF-STAY

Predict days a patient has to stay in hospital at time of admission

	Target $y$				
diagnosis category	admission type	gender	age		Length-of-stay in the hospital in days
heart disease	elective	male	75		4.6
injury	emergency	male	22		2.6
psychosis	newborn	female	0		8
pneumonia	urgent	female	67		5.5



Can be *learn to explain*, but *learn to predict* would help a hospital's planning immensely.

### CLASSIFICATION EXAMPLE: RISK CATEGORY

Predict one of five risk categories for a life insurance customer to determine the insurance premium

	Target $y$			
job type	age	smoker		risk group
carpenter	34	1		3
stuntman	25	0		5
student	23	0		1
white-collar worker	39	0		2



Probably *learn to predict*, but the company might be required to explain its predictions to its customers.