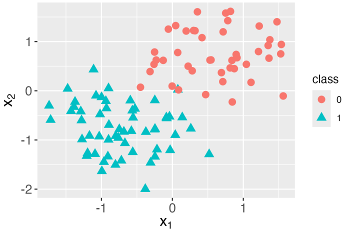
Introduction to Machine Learning

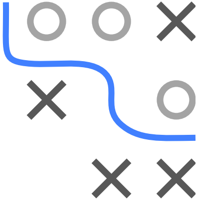
ML-Basics
Supervised Tasks



Learning goals

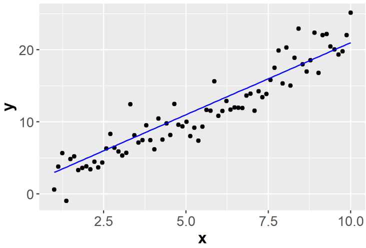
- Know definition and examples of supervised tasks
- Understand the difference between regression and classification

TASKS: REGRESSION VS CLASSIFICATION

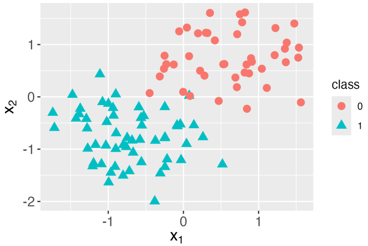


- Supervised tasks are data situations where learning the functional relationship between inputs (features) and output (target) is useful
- The two most basic tasks are regression and classification, depending on whether the target is numerical or categorical

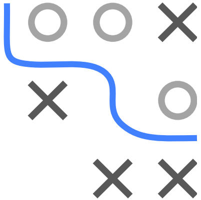
Regression: $\mathcal{Y} \subseteq \mathbb{R}$



Classification: $\mathcal{Y} = \{C_1, ..., C_g\}$



PREDICT VS. EXPLAIN



We can distinguish two main reasons to learn this relationship:

- **Learning to predict**. Here, usually, we don't care how our model is structured or whether we can understand it.
  We want an accurate predictor for new data.
- **Learning to explain**. Here, our model is only a means to a better understanding of the inherent relationship in the data.
  We might not use the learned model on new observations, but rather discuss its implications, in a scientific or social context. Of course, a model must "match" the data, we usually still measure this via predictive accuracy.

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

Features x				Target y
square footage of the house	number of bedrooms	swimming 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

▸ Click for source

Rather *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

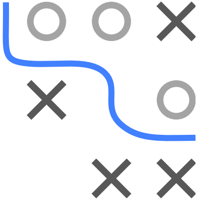
Predict days a patient has to stay in hospital at time of admission

Features x					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

▸ Click for source

Can be *learn to explain* but *learn to predict* would help practically

CLASSIFICATION EXAMPLE: RISK CATEGORY



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

Features x				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.