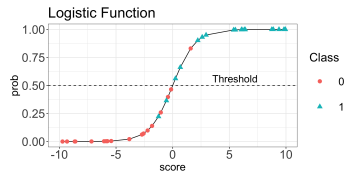
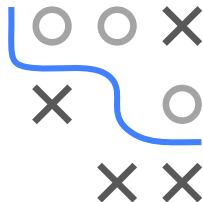


Introduction to Machine Learning

Supervised Classification In a Nutshell

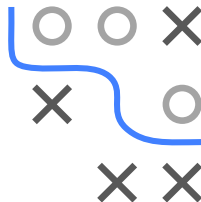


Learning goals

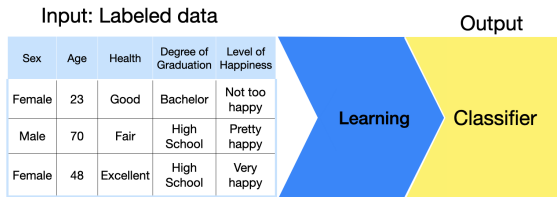
- Understand basic concept of classifiers
- Know concepts of probabilistic and scoring classifier
- Know distinction between discriminant and generative approach
- Understand ideas of logistic regression and Naive Bayes

CLASSIFICATION TASKS

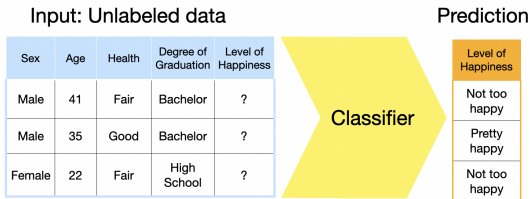
- Learn function that assigns categorical class labels to observations
- Each observation belongs to exactly one class
- The task can contain two (binary) or multiple (multi-class) classes



Training



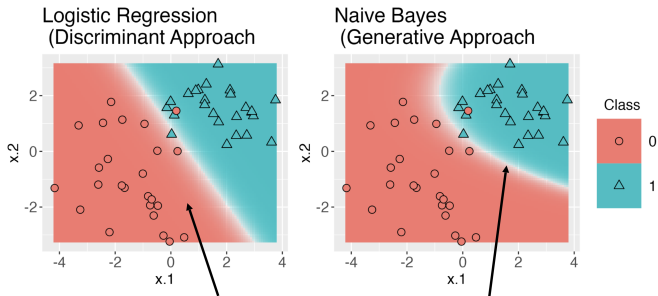
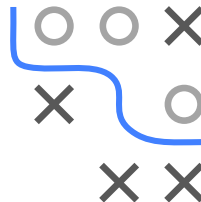
Prediction



BASIC DEFINITIONS / 2

Two fundamental approaches exist to construct a classifier:

- **Discriminant approach** asks “What is the best prediction for the class given these data?” (uses loss functions and empirical risk minimization)
- **Generative approach** asks “Which class tends to have data like these?” (models the feature distributions in each class separately)

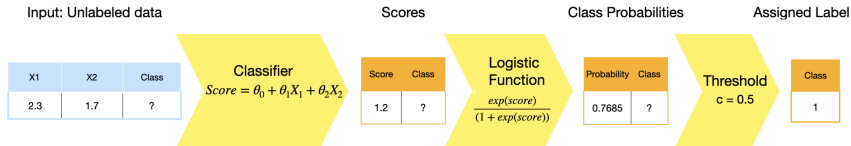
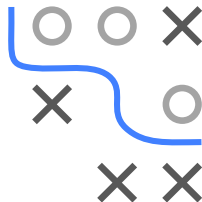


Decision Region: Region where all observations are assigned to the same class.

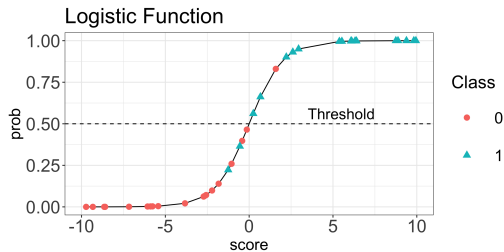
Decision Boundary: Points where all classes have the same probability/score.

LOGISTIC REGRESSION

- Logistic regression is a **discriminant approach** for binary classification. It turns scores into probabilities with the logistic function.
- We just need to compute the probability for **one** class (usually class 1).
- If the probability exceeds a threshold value **c** \Rightarrow class 1 is predicted.

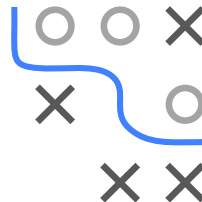
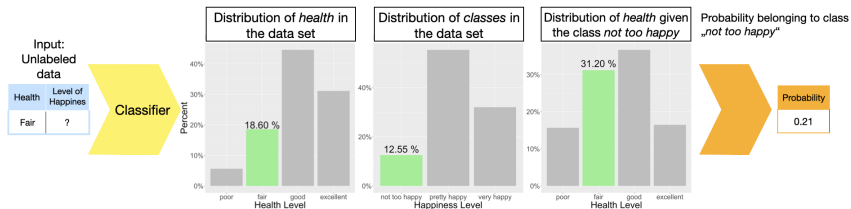


The logistic function puts all scores in order along an s-shaped line.

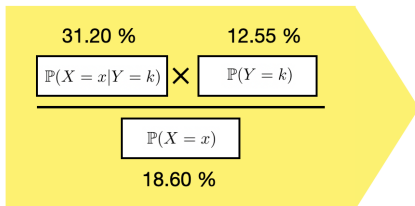


NAIVE BAYES / 2

- Example: Class probability of “not too happy” given health = “fair”:



Naive Bayes Classifier



Class probability given the data

21.00 %