Instance-based learning: Introduction

Universitat de les Illes Balears
Departament de Ciències Matemàtiques i Informàtica

11752 Aprendizaje Automático
11752 Machine Learning
Máster Universitario
en Sistemas Inteligentes

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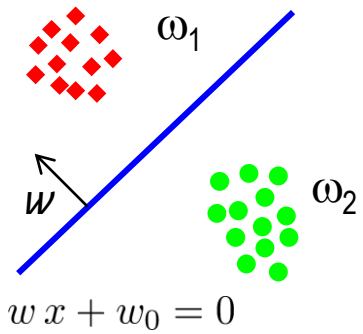
Generic description

- **Instance-based learning** (IBL) refers to a family of techniques for classification and regression, which produce a **class label** on the basis of a **subset of the training set**
  - IBL is a class of **supervised learning** (SL) algorithm
  - The entire training set is needed for training, but, contrary to other algorithms, only a **subset (of examples)** might be needed during use
    - Some IBL algorithms **do not build a complete abstraction** from all the data stored in the training set, there is **no global model**
      - an expression, e.g. the hyperplane that discriminates between two classes ω_1 and ω_2:

$$(w, w_0) \text{ such that } \begin{cases} wx_i + w_0 \geq 0 & \Rightarrow x_i \in \omega_1 \\ wx_i + w_0 \leq 0 & \Rightarrow x_i \in \omega_2 \end{cases}$$



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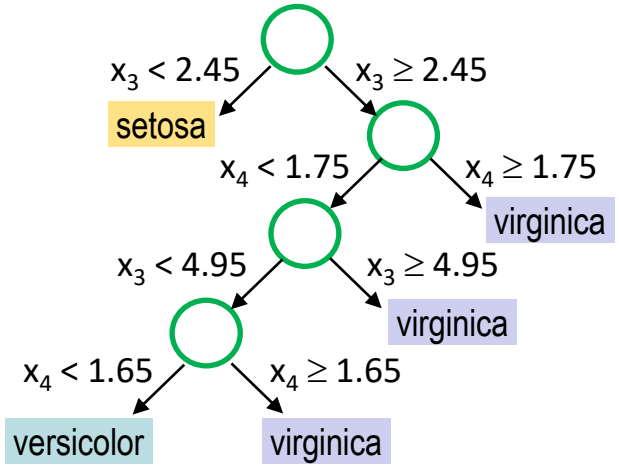
      - an algorithm, e.g. a decision tree

IRIS dataset

x_1 – sepal length
x_2 – sepal width
x_3 – petal length
x_4 – petal width



Generic description

- IBL is also known as **memory-based learning, exemplar-based learning, case-based learning** or **experience-based learning**
- When there is no abstraction, the subset of examples have to be **accessible**
  - stored in memory
  - stored in a database
- To battle the memory complexity of storing all training instances, **instance reduction algorithms** have been proposed
  - This also provides a way to counteract overfitting
- One advantage that some instance-based learners have over other methods of machine learning is its ability to **adapt its model** to new samples
  - Some instance-based learners may simply store a new instance or throw an old instance away
- **Examples** of instance-based learning algorithms are
  - The k-nearest neighbors algorithm,
  - Support Vector Machines (SVM) and in general Kernel machines,
  - Radial Basis Function network (RBF), etc.

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