

# Instance-based learning: Introduction



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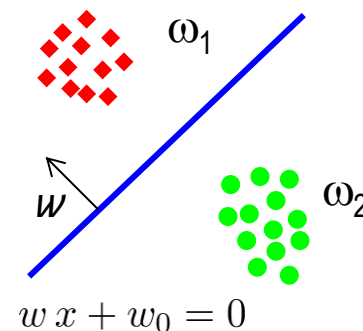
Departament  
de Ciències Matemàtiques  
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**11752 Aprendizaje Automático**  
***11752 Machine Learning***  
Máster Universitario  
en Sistemas Inteligentes

**Alberto ORTIZ RODRÍGUEZ**

- **Instance-based learning (IBL)** refers to a family of techniques for classification and regression, which produce a **class label/regressed value** 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 **generic supervised learning algorithms**, only a **subset (of examples)** might be needed during use
    - IBL algorithms **do not build a complete abstraction** from all the data stored in the training set to build a kind of **global model**, which can take the form of
      - an expression, e.g. the hyperplane that discriminates between two classes  $\omega_1$  and  $\omega_2$ :

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



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      - an algorithm, e.g. a decision tree

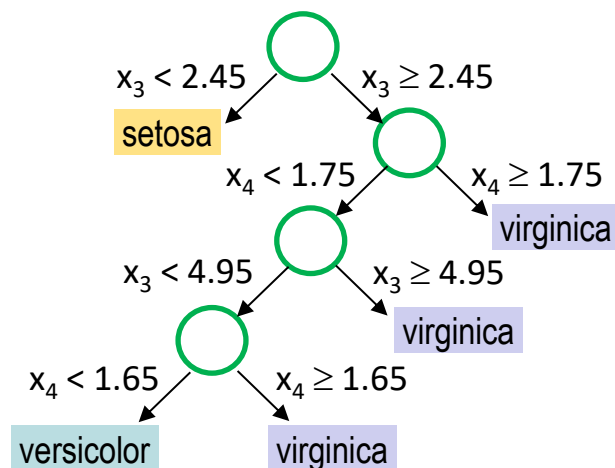
## IRIS dataset

$x_1$  – sepal length

$x_2$  – sepal width

$x_3$  – petal length

$x_4$  – petal width



- IBL is also known as **memory-based learning**, **exemplar-based learning**, **case-based learning** or **experience-based learning**
- Since 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 developed
  - 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 networks (RBFN), etc.

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