

Introduction to Machine Learning

MODULE 3

Notations



Modules for this course

1. Overview: What is Machine learning
2. Categories of machine learning
- 3. Notation**
4. Machine Learning application approach
5. Recommender Systems
6. Building a Recommender Engine

Module 3

Notation



Supervised Learning Notation

Training set: $\mathcal{D} = \{\langle \mathbf{x}^{[i]}, y^{[i]} \rangle, i = 1, \dots, n\},$

Unknown function: $f(\mathbf{x}) = y$

Hypothesis: $h(\mathbf{x}) = \hat{y}$

In classification, we define the *hypothesis* function as

$$h : \mathcal{X} \rightarrow \mathcal{Y},$$

where $\mathcal{X} = \mathbb{R}^m$ and $\mathcal{Y} = \{1, \dots, k\}$ with class labels k . in the special case of binary classification, we have $\mathcal{Y} = \{0, 1\}$ (alternatively, we may use $\mathcal{Y} = \{-1, 1\}$).

And in regression, the task is to learn a function

$$h : \mathbb{R}^m \rightarrow \mathbb{R}.$$

Data Representation

$$\mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_m \end{bmatrix}$$

Feature Vector

$$\mathbf{X} = \begin{bmatrix} \mathbf{x}_1^T \\ \mathbf{x}_2^T \\ \vdots \\ \mathbf{x}_n^T \end{bmatrix}$$

Design Matrix

$$\mathbf{X} = \begin{bmatrix} x_1^{[1]} & x_2^{[1]} & \cdots & x_m^{[1]} \\ x_1^{[2]} & x_2^{[2]} & \cdots & x_m^{[2]} \\ \vdots & \vdots & \ddots & \vdots \\ x_1^{[n]} & x_2^{[n]} & \cdots & x_m^{[n]} \end{bmatrix}$$

ML Terminology (Part 1)

- **Training example:** A row in the table representing the dataset. Synonymous to an observation, training record, training instance, training sample (in some contexts, sample refers to a collection of training examples)
- **Feature:** a column in the table representing the dataset. Synonymous to predictor, variable, input, attribute, covariate.
- **Targets:** What we want to predict. Synonymous to outcome, output, ground truth, response variable, dependent variable, (class) label (in classification).
- **Output / prediction:** use this to distinguish from targets; here, means output from the model.

Summary

- Aligned on the notations and terminologies