

Introduction to Machine Learning

MODULE 4 ML Application Design Approach



Modules for this course

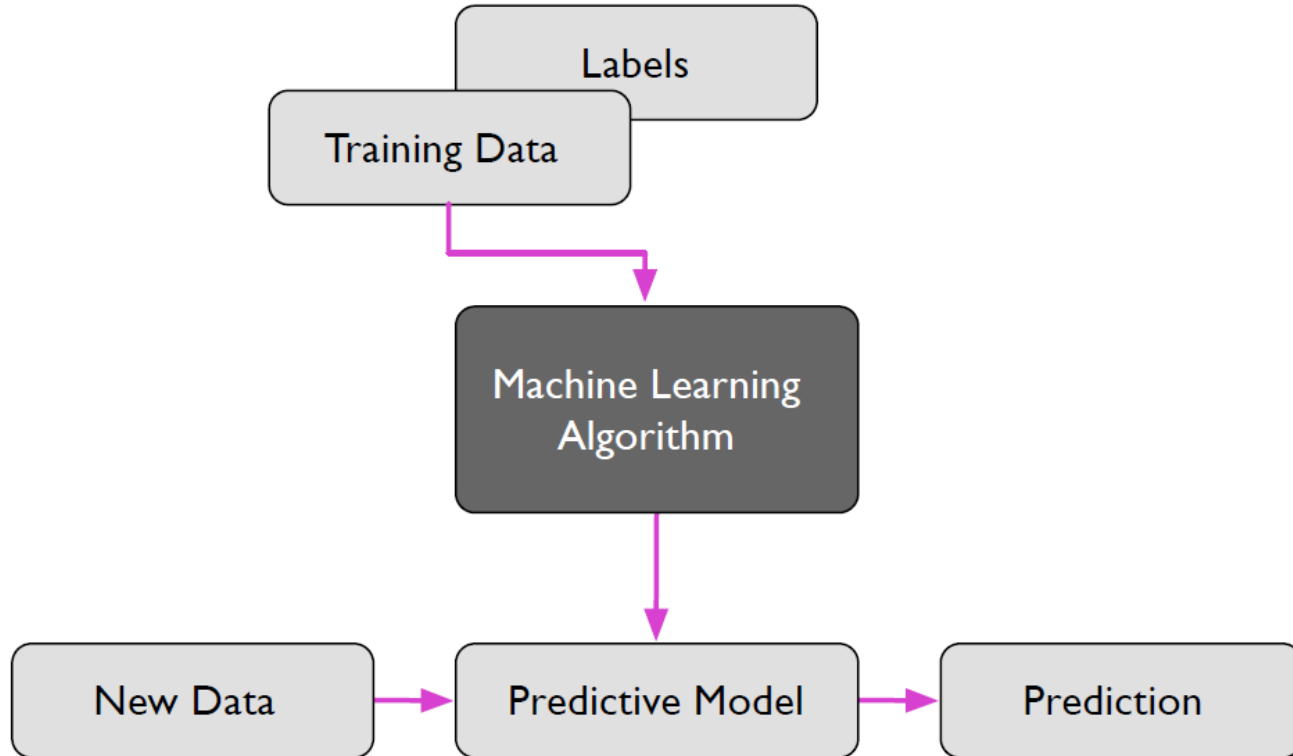
1. Overview: What is Machine learning
2. Categories of machine learning
3. Notation
- 4. Machine Learning application approach**
5. Recommender Systems
6. Building a Recommender Engine

Module 4

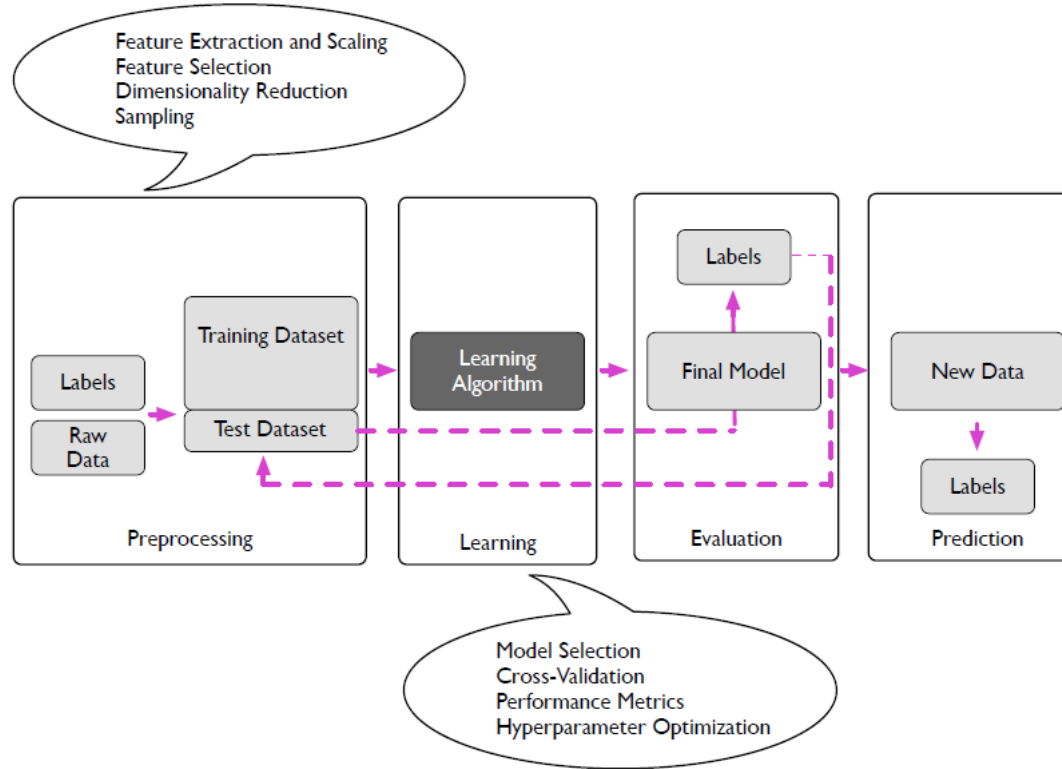
Machine Learning Application Design Approach



Supervised Learning Workflow



Supervised Learning Process



5 steps for ML Application Design

1. Define the problem to be solved.
2. Collect (labeled) data.
3. Choose an algorithm class.
4. Choose an optimization metric or measure for learning the model.
5. Choose a metric or measure for evaluating the model.

Objective Functions

- Maximize the posterior probabilities (e.g., naive Bayes)
- Maximize a fitness function (genetic programming)
- Maximize the total reward/value function (reinforcement learning)
- Maximize information gain/minimize child node impurities (CART decision tree classification)
- Minimize a mean squared error cost (or loss) function (CART, decision tree regression, linear regression, adaptive linear neurons, ...)
- Maximize log-likelihood or minimize cross-entropy loss (or cost) function
- Minimize hinge loss (support vector machine)

Evaluation – Misclassification Error

$$L(\hat{y}, y) = \begin{cases} 0 & \text{if } \hat{y} = y \\ 1 & \text{if } \hat{y} \neq y \end{cases}$$

$$ERR_{\mathcal{D} \text{ test}} = \frac{1}{n} \sum_{i=1}^n L(\hat{y}^{[i]}, y^{[i]})$$

ML Terminology (Part 2)

- **Loss Function:** Often used synonymously with cost function; sometimes also called error function. In some contexts, the loss for a single data point, whereas the cost function refers to the overall (average or summed) loss over the entire dataset. Sometimes also called empirical risk.

Summary

- We now have some basic understanding of the process to build an ML application.