Notes for Machine Learning: A Probabilistic Perspective by Kevin P. Murphy

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Abstract

Notes for Kevin Murphy's Machine Learning: A Probabilistic Perspective. Note template by Pingbang Hu.

Contents

Chapter 1

Introduction

1.1 Machine Learning: An Overview

Machine learning is a set of methods that can automatically detect patterns in data. There are two types: **supervised** and **unsupervised** learning.

Definition 1.1.1 (Supervised learning). **Predictive/Supervised learning**'s goal is to learn a mapping from inputs x to outputs y, given a labeled set of input-output pairs $\mathcal{D} = \{(x_i, y_i)\}_{i=1}^N$.

Definition 1.1.2 (Unsupervised learning). **Descriptive/unsupervised learning** only consists of inputs, $\mathcal{D} = \{x_i\}_{i=1}^N$ and has the goal of finding "interesting patterns" in the data. This is sometimes called **knowledge discovery**.

Here, $\mathcal{D}$ is the **training set**, and N is the number of training examples. In the simplest setting, each x_i is a D-dimensional vector of numbers, which are called **features**. However, in general, x_i could be a complex structured object such as an image, email, etc.

The **response variable**, each y_i, can be anything, but is usually a categorical or nominal variable from some finite set, $y_i \in \{1, \dots, C\}$. When y_i is **categorical**, the problem is known as **classification** or **pattern recognition**, and when it is real-valued, the problem is known as a **regression**.

1.2 Supervised Learning

Here, the goal is to learn a mapping from inputs x to outputs y, where $y \in \{1, \dots, C\}$ with C being the number of classes. One way to formalize the problem is as a **function approximation**: we assume $y = f(x)$ for some unknown function f, and the goal of learning is to estimate the function f given a labeled training set. Then we can make predictions using $\hat{y} = \hat{f}(x)$ (where the hat symbol is used to denote an estimate).

Appendix

Appendix A

Additional Proofs

A.1 Proof of ??

We can now prove **??**.

Proof of ??. See here. ■