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INTRODUCTION AND OVERVIEW

- 1.1 Overview
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All men by nature desire knowledge.
Aristotle

Man has an intense desire for assured knowledge.
Albert Einstein

This chapter describes the motivation for predictive learning from data and the connection between predictive learning, philosophy of science and various ways of handling uncertainty.

Section 1.1 informally describes multiple facets of ‘learning from data’, including statistical, philosophical and psychological aspects of learning. It also explores the connection between statistical learning and induction in philosophy.

Section 1.2 provides a historical account of handling uncertainty and risk. It is interesting to note that modern probabilistic treatment of uncertainty is very recent, even though humans had to deal with uncertainty throughout thousands of years.

Section 1.3 describes different types of human knowledge, and the growing importance of empirical knowledge in today’s data-rich society.

Section 1.4 shows how the problem of learning dependencies from data can be reduced to the problem of function estimation from noisy samples. Such a mathematical formalization allows one to quantify the notions of explanation and prediction. We also point out that the problem of learning from data is just one step in the general experimental procedure used in different fields of science and engineering. Various steps of this procedure are described, with emphasis on the importance of other steps preceding learning.

Section 1.5 presents summary and discussion. This book is mainly concerned with estimation of *predictive* data-analytic models. This framework is called Predictive Learning. The task of predictive learning is essential to many diverse fields such as pattern recognition, statistics, data mining, machine learning, signal processing etc. These data-analytic methodologies are also briefly discussed in Section 1.5.